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## **Increasing GDP Relevance and Usefulness in a Changing, Globalising World – Arguments for Measuring a Unique and Complex Food - Human Milk - in GDP**

Julie P. Smith (Australian National University)

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**INCREASING GDP RELEVANCE AND USEFULNESS IN  
A CHANGING, GLOBALISING WORLD – ARGUMENTS  
FOR MEASURING A UNIQUE AND COMPLEX FOOD -  
HUMAN MILK - IN GDP**

*Associate Professor Julie P. Smith  
College of Asia and the Pacific,  
Australian National University  
Canberra, Australia*

*Lindy Ingham*

**INCREASING GDP RELEVANCE AND USEFULNESS IN A CHANGING, GLOBALISING WORLD – ARGUMENTS FOR MEASURING A UNIQUE AND COMPLEX FOOD - HUMAN MILK - IN GDP<sup>i</sup>****ABSTRACT**

This paper addresses debates about the future beyond GDP, by arguing for the usefulness of measuring breastfeeding and human milk in GDP as an alternative indicator of population well-being, through experimental estimates within the System of National Accounts (SNA) framework.

As the S-S-F Commission acknowledged, human milk epitomizes how current assessment of economic activity which excludes non market production is biased, and can distort policy. It is clearly within the SNA production boundary, is quantitatively non-trivial and has important implications for public policy including health.

Here it is shown that focussing on breastfeeding fits within a capabilities framework and facilitates exploration of objective measures of quality of life that can be integrated with several key areas of concern about existing GDP measurement practices. Key focus areas are: time inputs to unpaid household production via breastfeeding, as an indicator of gender equity in work and well-being, and of policy recognition; human milk as valuable household food production in core GDP; unpaid household inputs into human capital formation via early life nutrition and care; negative externalities of breastmilk substitutes (such as health costs and environmental depreciation and depletion).

**JEL Subject Codes: I120; J160; E100**

**Key words: Breastmilk, national accounts, health, food supply and demand analysis, childcare**

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# INCREASING GDP RELEVANCE AND USEFULNESS IN A CHANGING, GLOBALISING WORLD – ARGUMENTS FOR MEASURING A UNIQUE AND COMPLEX FOOD - HUMAN MILK - IN GDP

## 1. Introduction and background

*‘There is a serious omission in the valuation of home-produced goods – the value of breast milk. This is clearly within the System of National Accounts production boundary, is quantitatively non-trivial and also has important implications for public policy and child and maternal health.’* (1, p. 39)

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What we measure affects what we do, which is why it is so important that how we measure the economy is right. Amidst consideration of future directions for Gross Domestic Product (GDP) in measuring human well-being, this paper make the argument that a focus on breastfeeding can facilitate exploration of how to address key areas of contemporary concern. This is because human milk - as the evolved food and care system for the human infant and young child (IYC) - epitomises central issues of translating GDP into integrated indicators of well-being within the United Nations’ System of National Accounts (SNA) framework.

“W(h)ither the SNA?”

Doubts have been expressed for several decades about the relevance and usefulness of GDP as an indicator of economic progress, and as a focus for economic policy. Such concerns have included questions about the ethical and distributional basis for valuing economic activity based on market transactions and the measuring rod of money, the SNA treatment of human capital formation and non-market household production, and the appropriate incorporation of market failures and environmental asset depletion in measures of economic progress.<sup>(2-11)</sup>

Ongoing suspicions about the relevance and usefulness of the SNA framework and GDP present a continued challenge for its advocates. Critics prefer the SNA to ‘wither away’. In particular, there have been strong calls to either radically change, or even replace, GDP in order to have a measure that takes better account of social and environmental issues. Against this there have been important SNA reforms responding to widespread demands for a more inclusive and relevant framework, such as encompassing unpaid household activity, and environmental assets. Continuing to develop thinking and data collections to extending economic measurement beyond GDP is essential to maintain a place for the SNA as a credible tool for understanding contemporary social and environmental problems.

In this paper, a novel and perhaps provocative focus on breastfeeding is used to show how key criticisms of GDP might be explored and addressed - ‘beyond GDP but within the SNA’. Building on the precedent of Norway’s food accounts, we propose further SNA development work through experimental accounts of breastfeeding as a ‘canary in the coal mine’ indicator of human well-being. While the primary discussion is of human well-being, we draw connections to SNA environmental accounting which reveals potential pathways for integrating human capital and environmental accounts.

### *Reform priorities - Beyond GDP but within SNA?*

The national accounting community have made considerable progress in conceptualising and collecting data on non-market production, human capital and environment assets, as part of the program to reform the SNA to improve its relevance and usefulness. Nevertheless, amidst highly publicised claims of a global ‘crisis of care’ affecting the world's children, sick and elderly, and the intense scientific debate on the ‘climate change crisis’, public policy attention remains firmly anchored on maximising growth of the market economy as measured by GDP.

The SNA framework has become an important social institution; by measuring, it is shaping cultural norms about what is economically important. Reflecting its visibility and policy influence, as well as the priority given to market expansion, GDP is increasingly contested on social, economic and environmental grounds.

Recent public commentary on the EU implementation of SNA reforms in 2014 reflected a mix of dismay, confusion and disbelief that revisions to guidelines for the core GDP measure prioritised the inclusion of prostitution and the drug trade. The credibility of the SNA reform program for dealing with the problems facing society was severely damaged.

It is said that GDP doesn’t judge ‘bad’ or ‘good’, and that there is an established practice of including illegal activities in GDP to maintain cross country and intertemporal comparability<sup>(12)</sup>. However, similar arguments might be made for including non-market household production. It is reasonable to question the usefulness and direction of SNA reforms which require that ‘bad’ things that men do, commonly exploiting women’s economic vulnerability, must be counted in national economic performance because men can pay, whereas ‘good’ things like care work barely count because women can be coerced to do it for free.

As for the claim to moral ‘objectivity’, the underlying moral basis of GDP measurement is the measuring rod of money; market economy expansion is a policy priority because it is valued by those willing and most able to pay. This is itself is a moral position. As *The Economist* pondered on ‘the Prosperity Puzzle’ in 2015, ‘Is a nation really doing better when its sex- and drug-trades are growing more quickly?’<sup>(13)</sup>.

The contrast in reform priorities of including illegal prostitution in GDP, while not counting household production and work such as breastmilk or breastfeeding provides a useful background for exploring whether the supposed objectivity of SNA contains deep rooted gender biases and inequities, which not only reflect but also result from what is prioritised for measurement in GDP.

### *Measuring what people care about*

In its reflections on its task, the 2009 Commission on the Measurement of Economic Performance and Social Progress (‘S-S-F Commission’) observed how the continued exclusion of home production distorts measurement of economic performance and development. It warned that ‘failing to observe shifts from home production to market production may seriously bias our estimates of improvements in societal well-being’<sup>(1, p. 39)</sup>:

As countries develop, there is often a shift from home to market production. The increases in market production may thus overstate increases in well-being. By the same token, policies that encourage market over non-market production distort the economy. Those engaged in non-market production often argue that not to include it in our measure of societal well-

being is to devalue the important services provided by those who are engaged in these non-market activities.

Economic performance evaluation and public policy needs to be informed by statistics which accurately portray the economy and women's contribution to it. Feminist economic scholarship since 1970s has emphasised how mismeasurement of economic well-being disorients public policy, and entrenches gender inequity. Vigorous feminist critique of the SNA by Marylyn Waring <sup>(14)</sup> inspired strong feminist scholarship and activism on valuing women's work in economic statistics <sup>(2)</sup>, and made an important contribution to what is known as the "accounting for women's work project" <sup>(15, p. 131)</sup>. This aimed for all women's work to be counted in statistics, accounted for in the representations of how economies work, and taken into account when policy is made <sup>(16)</sup>. Nevertheless, as Valeria Esquivel foreshadowed, "producing household sector satellite accounts does not by itself change macroeconomic policy" <sup>(17)</sup>. Subsequent discourse has shifted in focus from simply "measuring" unpaid work, to the "three R's of unpaid work": recognition, reduction and redistribution. That is, to an emphasis on unpaid work as "essential to well-being", but "costly" for those who provide it, and justifying claims for strategic policy interventions to reduce unpaid work and redistribute its burden within and between households. <sup>(18)</sup> As discussed further below, 'the three R's' tie SNA guidelines and national accounting practice directly to accountabilities on universal economic and social rights.

#### *Alternative concepts of well being*

The S-S-F Commission reflected on alternative subjective and objective indicators of well-being for a reformed SNA framework. The capabilities approach, implies that GDP is just one input into development of a final product that is jointly produced by the family, the community, the market, and the state <sup>(19)</sup>. Provisioning humans rather than expanding the market sector thus becomes the main goal <sup>(20)</sup>.

Attention in feminist economics has focussed on the capabilities approach, made more gender inclusive by Nussbaum <sup>(21)</sup>, for measuring quality of life, within an economic conceptual framework which encompasses the value of unpaid household work <sup>(22)</sup>. Such a framework highlights important and under-theorised issues of unpaid work and allocation of resources to dependents, as well as of distributional justice <sup>(19)</sup>. Much unpaid household work, properly accounted for, is caring work, directed at meeting the needs of children and other dependents such as the sick or the elderly.

#### **Alternative indicators**

A number of gender inclusive measures have been inspired by the capabilities approach including initially, the Human Development Index (HDI) <sup>(22)</sup>. Such comprehensive or composite measures are important for policy analysis and call the attention of policymakers in a way that more detailed information and indicators do not <sup>(15)</sup>. Like SNA measures such as GDP, these can be also used for making comparisons in cross-country or country-level trend research, including for assessing policy effectiveness.

However, feminist economists have also pointed out the limitations of such indicators <sup>(22 p.31)</sup>. Some have been critiqued for being favourably biased towards developed countries by including income, and for failing to measure gender inequity. Different conceptual underpinnings for different indicators may make interpretation difficult, and country rankings may vary for different indices.

## **Survival and health outcomes**

A key indicator of human well-being is mortality <sup>(23)</sup>, with evidence of girl preference that results in the disappearance of over a hundred million baby girls each year <sup>(24)</sup>. Life expectancy at birth may provide a better measure of gender equity than indicators incorporating reproductive health <sup>(25)</sup>. The growing 'double burden' of infectious illness and chronic disease arising from co-existence of under-nutrition and over-nutrition in many countries has triggered concerns that future generations could have shorter life expectancy than current generations <sup>(26)</sup>. Globalisation of food and nutrition systems has driven a 'nutrition transition' to unhealthy dietary patterns <sup>(27)</sup> and an emerging 'chronic disease epidemic, with heavy cost burdens on countries' health systems <sup>(28, 29)</sup>. Because of their disproportionate role in unpaid health care, such chronic disease trends point to a unmonitored but growing family care burdens on women, exacerbated by the cost-shifting fiscal policies of the past decade <sup>(30, 31)</sup>. Some have warned of an emerging 'crisis of care' arising from lack of accounting for women's care work burdens in formulation of fiscal and employment policies <sup>(32, 33)</sup>.

## **Indicators of the influence of social institutions and norms on well being**

With growing realisation of how social institutions and cultural norms affect the potential for well-being <sup>(34, 35)</sup>, indicators of legal and institutional barriers to equality have been developed <sup>(15)</sup>. Such measures are crucial as they draw the connections to institutions and cultural norms which create and entrench gender inequality. If women have a greater disposition to care for children and other dependents, that predisposition can be considerably strengthened or weakened by economic organisation and cultural negotiation.

Women's propensity to care for others is argued to account for many of the economic disadvantages they experience: if women cared less, they would earn more money and enjoy more leisure time. As Folbre observes, 'current debates over the organization of care work have grown out of awareness that specialisation in care work carries significant costs and risks for women' <sup>(36, p. 606)</sup>. However, such analyses raise questions such as, what are the implications for well-being if women cared less? And would the quality of care provided decline if they did? <sup>(36, p. 597)</sup>.

## **Total work hours as a gender inclusive well-being indicator**

Most gender equity indicators focus on monitoring well-being outcomes for women. However, a focus on how time inputs to work - including for non-market production - are distributed, is also argued to be important to gender empowerment <sup>(37)</sup>. Hence, a deficiency of existing gender equality indicators is that very few include unpaid work such as care work <sup>(37)</sup>. Folbre has proposed gender sensitive indicators of 'inputs' to production which focus on time use, including who has access to leisure, to address this issue <sup>(37)</sup>. The increasing numbers of national time use studies provide data on work hours which may contribute objective indicators of well-being and gender equity within a capabilities framework. At the same time, time use studies have the advantage of being closely related to SNA concepts, including extended GDP measures of household production <sup>(37)</sup>.

## **The 'crisis of care' - measuring inputs to the care economy**

The need for better measurement of care work as an economic activity in the SNA has been central to feminist critiques of GDP. As with any new area of research, on-going efforts are



required to achieve consensus on basic definitions. Nancy Folbre has proposed definitions for unpaid care work, in the context of SNA definitions of other types of work, including the production of goods for household consumption or subsistence production. This is considered to lie within the SNA 'boundary', though it is seldom measured accurately. Furthermore, care work is located in many different areas of the economy—ranging from the family to paid employment, and is performed on behalf of a wide range of care recipients.

'The informal sector, comprised of self-employed individuals, small businesses and temporary or contingent workers, often straddles the boundary between paid and unpaid activities, as when women street merchants tend their children (including breastfeeding them) even as they sell their wares' <sup>(37)</sup>.

Folbre also observes that caring for other people's children, or other family dependents (whether sick or elderly), is commonly a form of informal reciprocity which is repaid in-kind. These examples draw attention to how such production and exchange should be conceptualised and measured in an SNA framework.

### **A human rights framework for policy relevance**

A crucial weakness of existing gender inclusive indicators is that they fail to attract the attention that GDP gets from policymakers. A human rights focus based in the Universal Declaration of Human Rights, is argued by feminist economists to have stronger practical relevance for policy assessment and evaluation, because of processes for scrutiny of governments, yet being complementary to the capabilities approach <sup>(38)</sup>.

A human rights focus also introduces provisioning criteria that are compatible with feminist economic perspectives. This can be used for evaluating the effectiveness of social institutions including markets in allocating resources and economic policies to satisfy countries' duties on essential social and economic rights, such as food, health and work. Such a focus also helps evaluate policies which make men and boys worse off, yet without improving women's capabilities. <sup>(22)</sup>

### **Asset depletion and SNA**

Measuring the value of the human capital stock is an issue of longstanding interest and increasing relevance to contemporary policymaking <sup>(39, 40)</sup>. Human knowledge, skills, competencies and attributes may be at least as important as a country's physical capital in determining a country's economic prosperity <sup>(41-44)</sup>. Cost and income based measures date back to the 19<sup>th</sup> century <sup>(41, 42)</sup>.

An important contemporary reason cited for measuring human capital is as an indicator of overall economic well-being. Some studies identify declining values of human capital stocks as population aging offsets slowing investments in education <sup>(39, 40)</sup>. Population growth is central to growth in the human capital stock, and some studies taking a cost-based approach also account for the cost of non-market inputs to human capital stock.

Feminist economists have drawn attention to aspects of children and child-raising which can be considered as public goods, with important externalities affecting parental incentives to invest in children <sup>(7, 45)</sup>. However, women's contribution to the creation of human capital is yet to be fully captured in most studies of human capital stock which generally use income, rather than costs as the basis for its valuation, and focus on working age adults rather than

including children and the elderly. As Abraham and Mackie pointed out in 2005 <sup>(46, p. 79)</sup>, household investments augment the human capital of household members, especially the investments of time that parents and other family members devote to the care and nurturing of children.

No other outputs are as quintessentially nonmarket as the production and care of children. While parents may purchase assistance with the care of their children, market care cannot fully substitute for their personal attention. Some observers appear to view family care as akin to sunlight, available without cost in effectively unlimited supply and thus of no economic interest. Given recent societal trends, however, it may not in fact be safe to assume the availability of family care.

The relationship of non-market household investments in human capital and contemporary problems of aging populations are also evident in their comment that it would be logical to treat the physical production of children as a component of the human capital produced in the home. The authors warned that;

any effort to develop more focused human capital investment accounts, such as education accounts or health accounts that we recommend in later chapters—may yield misleading conclusions if those using the accounts do not recognize the contributions made by prior and concurrent investment activities in the home <sup>(46, p. 81)</sup>.

## **Environmental resource depletion and degradation**

High profile issues of global climate change also reinforce longstanding critiques of the validity of GDP and the SNA treatment of environmental asset depletion and defensive expenditures. The predominance of GDP growth as the key indicator for assessing the health of the economy is argued to maintain socially and ecologically harmful processes, including environmental degradation. Valuing the environment's contributions in economic analysis, policy formula and assessments is a necessary acknowledgement of the benefits for human well-being from ecosystem services <sup>(22)</sup>.

Development of integrated environmental accounts within an SNA framework <sup>(47)</sup> is just one approach amidst a variety of environmental indicators being developed. For example, the OECD includes climate change indicators such as greenhouse gas emissions, and intensity of water use among key indicators for tracking progress on major environmental issues <sup>(48)</sup>. The important failures of GDP to measure the economic contribution of care work and to account for use of environment resources are linked, through its reliance on an economics paradigm that biases the use of resources towards meeting the requirements of market production <sup>(49)</sup>. To be relevant and useful to contemporary policy problems, future development of indicators within SNA will need to account not only for environmental depletion and degradation but also to understand the strong interconnections between the crisis of care and the deepening ecological crisis.

### *Overview*

This paper explores the well-being measurement issues of gender equity, unpaid household production, human capital, and accounting for market failures and resource depletion through the lens of human milk, illustrating also the implications for public policy. We address the debate about the future of the GDP by arguing for producing experimental estimates of its time input costs and human capital outputs within an SNA framework.

Firstly we discuss key issues and gaps in SNA measurement of well-being, and how each pertains to breastfeeding and human milk. We then briefly review previously published studies of the economic value of human milk production for a diverse range of countries and regions, and consider the implications for public policies and well-being of its exclusion from measures of economic activity. Finally, we propose the preparation of experimental accounts of breastfeeding and human milk, encompassing the inclusion in core GDP, satellite accounts, and human capital and environmental accounts. It is our contention that considering breastfeeding and human milk as archetypal non-market goods and services in an SNA framework helps improve understanding of how key ‘well-being’ measurement issues might be advanced ‘beyond GDP’.

## **2. The national accounting framework, non-market household production, and breastfeeding**

The S-S-F Commission acknowledged the validity and importance of recognising the value of human milk production in countries’ GDP in the context of commenting on the distortions to measurement and policy resulting from SNA exclusion of home production.

An important example may help make the point stronger. There is a serious omission in the valuation of home-produced goods – the value of breast milk. This is clearly within the System of National Accounts production boundary, is quantitatively non-trivial and also has important implications for public policy and child and maternal health.

The 2015 IARIW conference agreed that measures of social and environmental issues could be presented in a more inclusive statistical framework, and there was consensus that more attention should be paid to household related indicators. Statistical systems should be design with flexibility to allow for improved linkage of macroeconomic and micro data sources. The value of experimental work was also noted for developing and testing an extended statistical framework.

Considering breastfeeding or lactation within the discussion of production or productive work highlights an area where there are clear biological differences and physiological influences affecting preferences and underpinning what are said to be women’s tendencies towards care work <sup>(36)</sup>. Evolutionary anthropology suggests that women have more to lose in terms of reproductive fitness from the death of a child, while men have less to lose from neglecting a child and offload the costs onto others. This implies that human females will devote more energy and resources to the next generation <sup>(36, 50, 51)</sup>. However, breastfeeding practices are also biocultural behaviour. Global and historical patterns and trends since industrialisation provide a contemporary demonstration that social institutions and cultural norms such as GDP and the valorisation of market work by social institutions including by the SNA framework can shape if not coerce, care work preferences of women. Societies inculcate caring preferences which greatly amplify the impacts of biological differences between men and women. <sup>(36)</sup> A considerable feminist literature points out the phenomenon of ‘compulsory altruism’, whereby expectations that care work is unremunerated in effect compel or coerce women to provide care and empathy for low economic reward <sup>(36, 52)</sup>.

Breastfeeding is not primarily an economic activity. Breastfeeding is a central element of an mammalian evolutionary template which optimizes infant survival by providing immunological benefits and regulating fertility in a way which maximizes population success <sup>(53)</sup>. However breastfeeding practices are also shaped culturally <sup>(54)</sup>, and by the availability of resources to the mother <sup>(55)</sup>.

It has long been recognized that breastfeeding decisions and behaviors are influenced by economic factors including its time opportunity costs, and the price of market substitutes for human milk <sup>(8, 56-58)</sup>. Breastfeeding and maintaining lactation to enable human milk production ‘competes’ with women’s other paid and unpaid work activities, and with commercially marketed baby food products for maternal time and money resources. That is, at the population level, the ‘price’ of breastfeeding is economically significant, in the sense that price affects how much breastmilk women will ‘supply’ and how much they are willing to pay for it with their time or purchase with their money. Policies such as the availability of paid maternity leave and publicly funded childcare services influence the economic tradeoffs between breastfeeding, and paid maternal employment, and affect the overall economic productivity of women with children.

The level of social resources directed to infant care are in effect minimized by coercing such caring behaviors from women through exploiting women’s biological drive,<sup>(59)</sup> and the retention of deeply embedded patriarchal social institutions which maximize the surplus available to males <sup>(34, 36, 60)</sup>. It can thus be argued that breastfeeding practices are an indicator of the growing phenomenon of ‘compulsory altruism’ arising from fiscal retrenchment since the global financial crisis. Breastfeeding and producing human milk requires input of women’s time, skill and energy, but the SNA framework continues to exclude such marketable outputs from the important measures of economic activity. Folbre notes that

One salient activity that fits the SNA criteria but is nonetheless largely ignored within national income accounts is breastfeeding. This is a time and energy-intensive activity that is a quintessential example of food production for ‘own use’. If mothers do not breastfeed, they must purchase market substitutes such as infant formula to feed their children. <sup>(19)</sup>

This paper discusses not only the inclusion of human milk in the core production boundary of the SNA, but also its conceptual relevance to adjustments for defensive health and environmental expenditures within core GDP, to satellite accounts of household time inputs and nonmarket household production of childcare and healthcare services, and to human capital stock and environmental asset accounts. In line with arguments that time inputs to household production may also reveal important aspects of gender equity <sup>(37)</sup>, we propose the use of time use data on breastfeeding as an indicator of maternal investments and gender equity in care work. Our approach is summarised in Figure 1. We suggest that as national data on breastfeeding prevalence is already collected throughout the world on a consistent basis, it can be considered as a practical and easily utilised ‘canary in the coal mine’ indicator of human well-being within the SNA economic framework.

### *Well-being, capabilities and human rights*

From a ‘well-being’ perspective, breastfeeding can be argued to sit within the capabilities approach. Its importance to human health, survival and human development potential is deeply based in mammalian evolutionary history but is also situated socially <sup>(53)</sup>. Reflecting the dyadic relationship between the mother and young child, protection of breastfeeding is also woven into the complementary human rights framework, through UN Conventions defining the social and economic rights of women, as well as those defining the rights of the child <sup>(61-64)</sup>.

WHO, UNICEF and other health authorities recommend exclusive breastfeeding during the first six months of life and continued breastfeeding along with appropriate complementary foods until two years, or beyond <sup>(65)</sup>. These guidelines apply to all countries because there is

strong evidence that morbidity, mortality and child developmental impacts of infant and young child feeding are relevant in all country settings <sup>(66, 67)</sup>.

Countries' breastfeeding practices may provide a 'canary in the coalmine' signal of societal resourcing of mothers' unpaid care work (and its economic opportunity costs via maternity protection policies). Hence measuring the economics of human milk production of human milk provides a measure of maternal and child population well-being that is highly relevant to gender and social equity, nutrition and health and food system sustainability across diverse human populations. Unlike some other indicators of well-being, human milk is a commodity, production of which can be objectively measured using conventional, existing statistical collections.

### *Markets in human milk and breastfeeding*

In 2015, a company called Ambrosia Milk began exporting human milk purchased from mothers in Cambodia for \$1 an ounce to be sold to mothers in the US for around \$5 an ounce which is the current price of human milk sourced from US milk banks. <sup>(68-71)</sup>

However, markets in human milk and breastfeeding are as old as the ancient practice of wet-nursing <sup>(72)</sup>. Various forms of exchange and trade in human milk and breastfeeding have re-emerged in a variety of country settings since the 1990s. Depending on the policy response to this development, international trade in human milk is potentially large, both to meet demand during humanitarian crises, and to arbitrate between the high demand, affluence and human milk scarcity in developed countries, and the significant potential milk supply and poor economic opportunities for women in developing countries.

Contemporary markets for human milk typically involve consumers such as health services, as well as less traditional, informal users including adults. Purchasers include:

- Hospitals and health services for vulnerable new-borns, or less commonly for the specialised nutrition or care of older children or adults
- Scientific research bodies, both academic and industry
- Corporations which process human milk for specialised care of premature or ill infants in neonatal intensive care units
- Individual consumers particularly mothers with a preference to provide human milk for their own infant's nutrition when their own milk or breastfeeding is not available
- Adults pursuing improved sports nutrition
- Adults males seeking sexual gratification

There are several different markets and key participants, as well as a range of prices for human milk or breastfeeding (Table 1)<sup>ii</sup>. Trade and exchange of human milk and breastfeeding services has expanded in part as a consequence of the internet which brings buyers and sellers together, and also the marketing of personal electric breast pumps which facilitate efficient extraction of human milk by mothers separated from their infant by

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<sup>ii</sup> Not identified in this table is the market for breastfeeding and human milk for adults or for research, which has raised concerns about the diversion of milk supplies for clinical use. The market values in this adult market are beyond the scope of the present study but are a concern for policy because these consumers appear to have a greater willingness and capacity to pay compared to not for profit human milk banks.

circumstances such as employment. The market for human milk has also expanded rapidly due to advances in human milk science <sup>(73)</sup>. The only producers of human milk and breastfeeding are women. Most operate in the non-market sector. However, there is also growing formal and informal involvement of market entities acting as intermediaries in its exchange. Breastfeeding and human milk compete with markets, because of the opportunity cost of women's time, and because of the wide availability and promotion of breastmilk substitutes such as infant or toddler milk formula <sup>(8)</sup>.

### *SNA guidelines and the national accounting framework*

Substantially revised international guidelines for compiling GDP estimates, commonly referred to as SNA93, were published in 1993 (System of National Accounts 1993). Revised guidelines published in 2008 (SNA08) made few substantive changes to 1993 guidelines <sup>(74, p. 126)</sup>.

SNA93 recognized some 'non-market' work to be within the 'core' production boundary. It included a category for "own account" production of goods by households, which included subsistence production in agriculture, and other goods produced by households for their own consumption, to be included within the core production boundary. Broadly, production of goods by households even if intended for their own final consumption, such as backyard production, food gathering, or on farm consumption of agricultural production, is considered as part of core GDP in the SNA framework.

Official imputations are now routinely made such as for non-marketed agricultural production and goods produced by households for their own consumption. <sup>(75)</sup> As Ironmonger and Soupourmas <sup>(76, p. 245)</sup> pointed out, SNA93 meant that;

'growing rice and chickens for use within the household is regarded as production of goods to be included in SNA production even if not for sale. Cooking rice and chickens for use within the household is regarded a production of meals and hence services not goods and is excluded from the SNA production boundary.'

The example of Australia shows how these guidelines have been applied in practice to estimate the value of own consumption of on-farm and backyard production by households. According to the Australian Bureau of Statistics (ABS);

'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'. <sup>(75, p. 46)</sup>

### **Unpaid household services**

Like its predecessor, SNA93 (and SNA98) continued to exclude from the core accounts the economic value of "own account" production of services by households.

However, recommended for the first time in SNA93 was the incorporation of unpaid work, including household work (such as domestic chores and childcare), volunteer work, and community work in satellite accounts. Although recognizing in principle the unpaid time inputs of households, such as women caring for infants and young children, household services remained outside of 'core' GDP. However, experimental accounts have been developed building on those produced by the Australian Bureau of Statistics in the early 1990s, and Eurostat more recently <sup>(77, 78)</sup>.

## Human capital accounts

Over the past two decades, the important role of households in building human capital has been identified as an issue for national accounting. In *Beyond GDP* the role of the family in creating human capital is acknowledged in a detailed exploration of families' role in health and education of children <sup>(11)</sup>.

Experimental accounts of human capital creation were prepared in Australia as early as the 1920s. At this time Australia's national statisticians applied modern methodologies for evaluating and including the value of human capital in economic statistics, showing that the value of human capital was several times the value of 'material' capital <sup>(41)</sup>. Likewise estimates by the ABS in 2001 showed the relative value of human capital when measured against physical capital.

Nevertheless, household inputs into to human capital reproduction and formation <sup>(79)</sup>, including the crucial contributions made through women's contribution to early nutrition, health and development of children <sup>(80, 81)</sup> remain uncouned in the SNA. Important building blocks for labour income in GDP do not include balance sheet accounting for human capital, and human capital studies often exclude households' non-market investments in human capital. <sup>(79, 82)</sup>

## Environmental capital accounts

A growing literature calls attention to the adverse effects of globalised food production systems on the environment as well as human health. In 2016, the UN Food and Agricultural Organisation called for sustainability to be incorporated into food and nutrition policies, building on an expanding literature focussed on the environmental degradation arising from modern agricultural and food production systems.

Critiques of GDP treatment of the environment are well developed, focussing on resource asset depletion and defensive expenditures. Earlier work such as the seminal study by Nordhaus <sup>(83)</sup> and Peskin <sup>(84)</sup> has expanded into a vast literature critiquing the SNA treatment of environmental assets and ecosystem services. With emerging global scarcity of water resources, GDP has also been criticised for accounting poorly for environmental resource depletion and for counting the clean-up costs of pollution or environmental damage as contributing to economic growth rather than defensive expenditures.

However, experimental estimates of environmental assets were produced by the Australian Bureau of Statistics in the 1980s <sup>(3, 4)</sup>, and in 2012, key agencies published a framework for a System of Environmental-Economic Accounts (SEEA) <sup>(47)</sup>.

## 3. National accounting for human milk and breastfeeding

*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*<sup>(85, p. 166)</sup>.

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Human milk and breastfeeding represent the archetypal non-market household production of food goods and care services, which also contribute crucially to human capital quality by promoting health of mother and child over the lifecycle <sup>(66)</sup>, and to labor force productivity through reducing risks to women's health and child cognitive development <sup>(67, 86)</sup>. Notably, production capacity is available equally to all mothers and children regardless of financial wealth through biologically efficient processing of minimum additions of nutritional input to the mother.<sup>(87)</sup> Breastfeeding and human milk are shown below to provide a practical indicators of socially and economically valuable economic activity at the boundaries of markets, which usefully illustrate key issues and conceptual challenges in extending GDP within an SNA framework.

#### *Gender equity and the time costs of household production and care*

A key criticism of GDP has been its failure to measure or value the economic contributions of women in the form of labour inputs into household sector production of important non-market goods and services. These time costs have important social and gender equity implications. Just as expanded production accounts for Norway have revealed the equalising economic effects of non-market production for households <sup>(88)</sup>, studies have shown that breastfeeding contributes to child health equity by widening social access to preventative health care <sup>(89)</sup>. However, care work such as breastfeeding is time intensive, and well illustrates that the economic costs of providing care for young children fall heavily on women. This highlights the importance for gender equity of social institutions and cultural norms that reduce and redistribute the economic costs of women's time inputs in care of children, such as through paid maternity and parental leave and lactation breaks <sup>(9, 90, 91)</sup>.

Women work more unpaid hours than men, and longer overall, and much of the observed differences in men's or women's work days is associated with care of infants and young children <sup>(19)</sup>. Responsibility for providing care for family members disproportionately falls on women, a responsibility which directly reduces women's opportunities for earning, as well as limiting women and girls' access to education and other participation opportunities, and contributing to wage inequality such as through job segregation.

"In the short run, women's unpaid care work reduces the costs to other members of society of caring for dependents. In the long run, however, it may perpetuate the underutilisation of women's capabilities and discourage the development of efficient forms of social insurance and public care provision" <sup>(19)</sup>.

Many alternative indicators of well-being involve measuring outputs of unpaid care work, to enhance its visibility and recognition <sup>(37)</sup>. However, measuring inputs of unpaid work time can provide an indicator of gender equity in workloads within an SNA framework, and potentially expose cost-shifting from other sectors.



Trade-offs between public provision and unpaid family care have become increasingly evident in the last decades of the 20<sup>th</sup> century with growing demands and pressures for state spending on childcare and social services. This has led to significant fiscal stress as well as drawing attention to the importance of gender and care issues <sup>(19)</sup>.

The care economy paradigm has emerged from work by feminist economists.<sup>(19)</sup> Unpaid work was previously ignored on the logic that nature or taken for granted as it was based on cultural values not economic logic, or was too difficult to measure or value. Motivations for more attention to unpaid care also emerges from feminist critique such as that by Fraser<sup>(92)</sup> of moves to a 'universal breadwinner' model of public policy in recent decades <sup>(37)</sup>. Without accurate accounts of their work women are denied both recognition and policy attention to improving gender equality and access to decent work <sup>(93, 94)</sup>. A relevant example is the recent World Bank recognition that breastfeeding is an investment <sup>(95, 96)</sup>. Although breastfeeding was celebrated as being 'free', in the absence of supportive policies, the time needed for sustaining lactation and breastfeeding becomes yet another work burden to be juggled by mothers of young children within an already limited quota of leisure time. As illustrated by concerns at an emerging 'crisis of care',<sup>(33)</sup> depleting the Magic Pudding of Care cannot be assumed to be sustained forever by feminine altruism, which is being exhausted by the relentless demands of the modern labour market and the unfair distribution of care in the home <sup>(32)</sup>.

### **Social institutions and norms shaping caregiving behaviours create 'prisoners of love'**

The care paradigm insists that the family economy, including both the unpaid work of caring for family members and the financial support of dependents, cannot be relegated to the world of nature or the world of moral commitments—even though it is clearly influenced (as are all aspects of the economy) by both nature and morality. In particular, it examines the allocation of time between paid and unpaid work, with attention to the influence of social institutions and cultural norms, as well as relative prices <sup>(19)</sup>.

Unpaid care activities may be increasingly substituted for market care services during economic development. For example, extended measures of GDP which include the value of household production such as in the United States, Norway, Korea, Australia, and China, reveal that conventional GDP measurement of growth may mask declines in unpaid household production <sup>(88, 97-100)</sup>.

Social institutions reinforce women's intrinsic motivations to care. However, specialisation in care work increases their economic vulnerability because it has high opportunity costs and is risky. Caring preferences also encourage occupational segregation. These factor helps explain lower earnings due to time out for care work and lower earnings in caring occupations <sup>(36)</sup>. The invisibility, unequal distribution, and excessive burden of this work on women alongside paid work responsibilities risks adverse implications for the health and well-being those they are caring for as well as for their own wellbeing. Folbre suggests that "Women may not be able to get the freedom to care less, unless they can persuade men to care more" <sup>(36)</sup>. They are, she says, 'prisoners of love' <sup>(36)</sup>.

For example, labour markets may systematically deprecate the value of women's care work <sup>(101)</sup>.

'In an economy characterised by discrimination, where markets are imperfect' and exchange is governed by power relations as well as purely 'economic factors', imputations of the value of care work based on observed wages are likely to be biased downwards.<sup>(97)</sup>

Other authors have referred similarly to ‘compulsory altruism’ to describe the social institutions and ideologies of altruism which continue to demand ongoing contributions to care work of women without economic reward<sup>(52)</sup>. Indeed, the objectivity of market prices separate from their social institutional and cultural attitudes and values has been fundamentally contested by social anthropologists<sup>(102, 103)</sup>. Economic thinking on ‘market design’ and ‘repugnant’ markets<sup>(104)</sup> increasingly acknowledges the pervasive influence of cultural and social factors on market prices of certain goods and services.

The market value placed on breastfeeding illustrates how social institutions and cultural norms can differ over time and place regarding the acceptability of market exchanges (such as wet-nursing) and its appropriate remuneration<sup>(105)</sup>. An example of how social norms stigmatise well-paid employment of this kind is the ongoing criticism of women seeking work as wet-nurses in China<sup>(106, 107)</sup>, notwithstanding the long historical traditions of wet-nursing in China and many other countries.

### **Breastfeeding as a health care service**

Health care is a household economic activity which has a particularly high potential market value<sup>(108)</sup>. Household health care services may complement or substitute for public services or for market sector services. It has been argued that measuring health services provided in households has high potential for developing indicators that can be integrated into an SNA framework.<sup>(108)</sup>

On the other hand, the absence of indicators of household health services from the macroeconomic aggregates of national accounts prevents public policies from duly recognising the economic value of such services within the framework of either public and private health care<sup>(108)</sup>. Displacement between sectors can result, for example, as health care costs and time pressures are shifted to households and women’s unpaid care work through cutbacks to government services.

Despite its relative magnitude, the unpaid health services contribution of women is systematically excluded from coverage in the SNA, including in health sector accounts<sup>(30)</sup>. Health sector accounts reinforce the exclusion of health care services provided by the household sector, and further valorise market institutions and health care providers versus traditional medical knowledge and health care practices. This is despite the fact that women working unpaid in the household sector are crucial providers of health care services. A recent study led by Langer in *The Lancet* showed the scale of this contribution to health care provision, both in the household sector as well as in the market sector<sup>(30)</sup>. The large financial value of unpaid health care related duties that women undertake in their homes and communities was identified as a hidden subsidy to health systems and society.

Breastfeeding can be conceived as a valuable preventative health care service provided by households. Supplying human milk to infants and young children through feeding at the breast provides preventative health care and development benefits in addition to those arising simply from infants or young children’s consumption of a uniquely tailored and biologically complex<sup>(109, 110)</sup> milk. These accrue in separate ways to the lactating woman and to children.

For women, producing milk gives rise to child-spacing and reproductive health benefits<sup>(66, 111-113)</sup>. For example, recent epidemiological research published in *The Lancet* identified that at least 20,000 women die annually from breast cancer that is attributable to a truncated durations of breastfeeding. Most of these maternal deaths are in high income countries where

breastfeeding duration is short <sup>(66)</sup>. The health system costs of treating breast cancers attributable to premature weaning from breastfeeding have been demonstrated to be substantial for the US and the UK, as well as countries in South East Asia <sup>(114-118)</sup>. For children, suckling at the breast rather than receiving milk in a bottle or other implement reduces risks such as bacterial contamination and infectious illness, as well as contributing to normal jaw and speech development <sup>(119-126)</sup>.

The contribution of time spent breastfeeding to child mental development has been well established including in large, high quality randomized controlled trials <sup>(127, 128)</sup>, and after adjusting for maternal and socioeconomic factors <sup>(129-131)</sup>. The effect on child cognition of introducing milk formula during an infant's first six months of life is comparable to low level pre-natal lead exposure <sup>(67)</sup>. Whether such effects arise from the biochemical composition of breastmilk or from the interactions with the mother is unclear <sup>(132)</sup>. However, animal studies suggest that lactation hormones drive mothering behaviours <sup>(133)</sup>. Recent large cohort studies suggest important role in developing maternal attachment and care <sup>(134)</sup>.

Breastfeeding is a service that is clearly marketable, its market counterpart represented by wet-nurse employment. As evident in Table 1, prices differ somewhat in different market segments, but range through prices based on 'cost-compensation' or 'quid pro quo' exchanges, to altruistic milk sharing (sometimes described as 'cross-nursing' or milk 'donation') with friends, relatives or at 'arms-length'. Despite the growing marketization of breastfeeding, time expended on it by women providing important preventative health and nutrition services within households are ignored in existing SNA frameworks for non-market or household production.

This has real world implications for public policy and women's well-being. For example, health promotion of breastfeeding has been identified in feminist critiques as a gender inequitable cost shifting strategy of governments in North America <sup>(135)</sup>, while the failure to account for excessive demands on women's time has been shown to undermine the effectiveness of health programs promoting breastfeeding and other health behaviours in lower income countries <sup>(136)</sup>.

There are challenges in developing a comprehensive frame of reference for all activities that can be considered health promotion and distinguishing the activities that are uniquely health related. However, Ferran has proposed a conceptual framework and guidelines to measure unpaid work in health care within the SNA framework through satellite accounts, which would naturally encompass breastfeeding and lactation work <sup>(108)</sup>.

### **Breastfeeding and childcare services**

Similarly, women are also predominant providers of childcare for young children in both the household and market sector. As Ironmonger showed for Australia, measured by hours, childcare is larger than any other industry sector <sup>(137)</sup>. Replacing household sector childcare services with market provision also highlights important affordability and quality issues, especially where some or part of the cost becomes a transfer or cost to the public sector. This draws attention to the need for fundamental reconsideration of how childcare work, both paid and unpaid, is conceptualised and measured <sup>(37)</sup>.

Care of children makes heavy demands on household time, especially when accurately measured, in all its dimensions. Care of infants and young children including breastfeeding is

particularly time intensive, involves frequent interruption and multitasking, and continued presence or proximity to supervise or respond to the child's needs <sup>(138)</sup>.

Because such unpaid time inputs into nonmarket production of households are not valued in GDP, and shifts from the unpaid to the market economy are unobserved, it has been argued that health care and other policymaking is distorted in ways which exacerbate time pressures for women, and which further entrench gender inequity and disparities in women's and men's well-being <sup>(22)</sup>. Also, the quality of market services may be inferior to home care, in particular because of productivity pressures in the market <sup>(37)</sup>, with implications for child wellbeing.

Time devoted to unpaid care is assessed to decline with economic development, although time devoted to family care increases with family income <sup>(19, 139)</sup>. This may indicate that the process of economic development may place unsustainable but unmeasured demands on household's time, reducing well-being, resulting in policy concerns related to unintended fertility decline and population aging <sup>(140)</sup>. With rare exceptions, <sup>(141)</sup> macroeconomic models do not explicitly account for how unpaid labour produces and maintains the human and social capital that market economies rely on <sup>(19)</sup>. Identifying the short run cost shifting to households (and increased care penalty) of policies of reducing public services provides better indicators to motivate and guide provision of more universal and sustainable public services, and greater attention to the long run pay off to investing in development of human capabilities, including women's <sup>(31, 32)</sup>.

Again, the extent of breastfeeding and the time devoted to it might be viewed as a sensitive indicator of unmeasured household sector time inputs into non-market production, and excessive burdens on household's capacity during economic development. A number of studies of the time costs of breastfeeding exist for both developed and developing countries, and virtually all illustrate its time intensive demands on mothers of infants <sup>(9, 142)</sup>.

Breastfeeding is a form of care by households which epitomises the importance of unpaid care inputs as a measure of well-being. Breastfeeding exemplifies these issues because good nutrition and care of infants and young children is crucial to their survival and health, yet is highly time intensive, and almost exclusively done by women. Social institutions such as inadequate paid maternity leave, or employment and childcare arrangements which fail to accommodate family care responsibilities for infants and young children such as lactation work and breastfeeding contribute importantly to gender pay inequalities <sup>(143)</sup>. As these time inputs to the care economy are not measured, public policy gives disproportionate attention to what is measured, and relevant policy measures can lack a suitable evidence base. Economic progress will be misleadingly measured by GDP, which fails to notice the displacement of equivalent non-marketed production and investment in human nutrition, health, and well-being – and early human capital formation - when market childcare and health care services expand. By contrast, policies which enable women to integrate social biological and occupational roles and function to their full capacity and realise their human rights will increase their contribution to economic progress without depleting women's capacity to care.

It is necessary to better understand the costs and rewards of care work, including by measures and indicators of how increased market income affects women's well-being and inequality. Failure to account for this work in labour force and health care policies has the potential to undermine the quality of care and nutritional well-being of dependent children, as well as women's health and well-being <sup>(30)</sup>. Women may even be worse off, with more financial responsibility, and increased sole parenthood revealed as a factor behind 'feminisation of poverty' in recent decades. As Folbre has written,

“We know little about the interactions between the unpaid care economy and the market economy, making it difficult to assess the impact of unpaid care on living standards, human capital or economic growth. As a result it is difficult to project the impact of demographic change such as population aging or falling fertility or possible defamilialisation on future economic trajectories<sup>(19)</sup>

Measuring time inputs to breastfeeding provide a simple indicator of such interactions and impacts, and the gender equity impacts and sustainability of care demands placed on the household sector. This also measures the provision of nutrition, care and preventative healthcare services to all countries’ most vulnerable humans, infants and young children. Such an indicator based on national time use surveys could be extended within an SNA framework by using national accounting methodologies for its valuation.

### **Breastfeeding and women’s leisure time**

The above relates to indicators of work time as an input to economic output. Another indicator beyond the scope of SNA is leisure, which is conceptually related to work time, and is an important focus of time use studies into gender inequalities and work. It is not clear how leisure is affected; again women may be worse off despite conventional indicators showing economic gains. For example, Folbre has argued that an important aspect of gender inequalities in well-being are those that affect capacity to buy in or otherwise access help with care work in order to achieve more leisure. Inequality in access to leisure due to care responsibilities and time demands may also affect opportunities for women’s education, and for education of their children. Alternatively, women may seek to minimise the unacceptable burden of care and reduction in leisure by remaining childless.<sup>(37)</sup>

Time use studies including those directed at measuring non market household production have been an important development within the SNA framework. Better data and modelling is needed to better predict the effects on economic development including on relative bargaining power in households and on costs of caring for dependents as a whole. As time use diaries fail to fully capture supervisory and on call time, they underestimate the temporal dimensions of care for dependents.<sup>(19, 37)</sup> A stronger empirical accounts framework in measuring women’s time inputs into care work, and their true number of leisure hours, could help reveal linkages between micro studies of care economy for example of time use, and estimates of financial flows within and between households.

Breastfeeding of infants is a good example where supervisory responsibility is very high and constraints adult allocation of time even when no direct care activity is being undertaken.<sup>(138)</sup> In an Australian study conducted in 2006, many mothers of infants were found to have almost no leisure time that was not constrained by having the main responsibility for the infant’s nutrition and care.<sup>(142)</sup>

### **Satellite accounting for time inputs into breastfeeding**

The distinction between a good and a service in some areas is controversial among national accountants. However, breastfeeding is both a good and a service: the process of lactation produces a good, and nursing an infant is providing a service. Viewed as a service, production and consumption occur simultaneously. Valuing breastfeeding as own account household production of a service for own consumption would result in its inclusion in a satellite account of household production. Such an approach would value breastfeeding



mothers' time and give visibility to breastfeeding in the same way as other childcare activities. Experimental estimates involving breastfeeding could provide valuable practical experience with developing an extended statistical framework.

An illustration of the policy relevance of measuring time inputs into non-market household production is provided by considering the effects of economic reform on unpaid care work and well-being in China. Despite the value of essential unpaid care work in China being between a quarter and a third of GDP, as the authors observe,

.. the overriding concern of the Chinese government in the post-reform period has been to improve the productivity of paid work and maximize growth of per capita GDP, assuming that the provision of domestic and care services will adjust itself accordingly<sup>(144)</sup>. As a result, the role of the state and the employers as a provider of social goods and services has been eroded; responsibility for social reproduction and “care”—a domain principally of the state in the urban sector under the planned economy—has returned to the household. This process has considerable implications for the work and status of women in both the home and the marketplace (p. 19).

The policy focus on the new market economy masked important unaddressed tensions between paid employment and unpaid care work for women in China<sup>(145)</sup>. Ignoring unpaid work burdens during China's economic transition has generated inequality in women's access to earnings and leisure<sup>(10)</sup>. A recent study in China identified the importance of indicators of unpaid work burdens which include the frequency of interruptions and shifts between paid and unpaid work, as well as the number of hours of unpaid work<sup>(10, 145)</sup>. Furthermore, unpaid work burdens have been shown in China to disrupt women's paid work productivity and directly account for around a third of the gender disparity in wages. Globally, the lack of policy infrastructure to support combining care and paid work commitments is said to be an important reason behind a worldwide ‘motherhood pay gap’<sup>(143)</sup>.

The non-accounting for women's unpaid lactation work during China's rapid market development likewise exemplifies how public policies informed by gender-biased economic statistical frameworks prioritize market development over broader economic development at women's expense due to their unpaid care work burden. Despite the importance of breastfeeding demonstrated by the 2008 melamine crisis, in which hundreds of thousands of infants were hospitalized and six infants died, public policy in China has prioritized development of the commercial milk formula industry<sup>(146, 147)</sup>. The market for breastmilk substitutes has expanded dramatically in the past decade, but breastfeeding and human milk production declined. Health, labor market and market regulatory policies failed to recognize or respond to the economic importance these trends<sup>(148)</sup>. Only in 2014<sup>(149-154)</sup> did the national government initiate policies to stem the dramatic declines in breastfeeding that had occurred<sup>(155)</sup>. A recent study estimated that health treatment costs of around \$224 million a year could be saved by even a small return to breastfeeding in China, while the economic loss from cognitive deficits associated with current feeding practices results in an ongoing annual productivity loss equal to 0.33% of China's GDP<sup>(86)</sup>.

#### *GDP and household outputs of human milk*

Deregulatory policies and technical change have expanded the acceptable boundaries of the market to include conceptually challenging and sometimes ‘repugnant’ or even illegal commodities and services. This includes national and international trade in human tissues and body organs, sexual services, and birth surrogacy. In some countries it includes sales of human blood, semen, and human egg cells, or products and services with commerciality derived from these.

Unlike some other indicators of well-being, human milk is a commodity, production of which can be objectively measured using conventional, existing statistical collections within the SNA framework. Also unusually, human milk production and breastfeeding involves the female body as the production unit and the main resource costs are for maternal nutrition and time inputs.

It has been already been demonstrated that human milk production not only can be satisfactorily valued in GDP, and that its value is substantial enough to impact economic statistics and public policymaking.

Despite the SNA changes which bring human milk within the scope of the core production boundary, and evidence that its magnitude is substantial, national accounting practice is to continue to exclude human milk production from national economic accounts. By contrast, GDP includes on-farm cow's milk production, milk formula sales, and the health expenditures attributable to giving infants and young children breastmilk substitutes rather than breastfeeding. This results in GDP misleadingly measuring a rise in economic activity when breastfeeding declines and milk formula sales rise, and a decline in productivity when breastfeeding increases <sup>(156)</sup>.

### **Estimated values of human milk and breastfeeding within an SNA framework**

There are a number of estimates of the economic value of human milk output. The focus of these studies has been on measuring the economic value of breastfeeding by estimating losses in the volume and value of national food production due to declining breastfeeding. The method used in these studies is broadly consistent with the preferred national accounting 'output approach' to measuring GDP.

As identified in an FAO study in the late 1970s, estimating the production and consumption of human milk 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). The main variables in such estimates of human milk production are:

- the number of infants of the relevant age;
- estimated daily volumes of breastmilk production;
- breastfeeding prevalence;
- cost of inputs to human milk production, and;
- the value or 'price' of human milk.

In the early 1970s, Alan Berg documented the expanding economic loss associated with formula feeding replacing breastfeeding in developing countries such as Chile, Kenya, Singapore and the Philippines <sup>(157)</sup>. Likewise, nutritionist Jon Rohde <sup>(85, 158)</sup> calculated the quantities of human milk production for infants and young children in Indonesia during the 1970s and 1980s. Several studies showed the macroeconomic value of mother's milk for parts of Latin America, Sub-Saharan Africa, and India during the 1990s <sup>(159-163)</sup>. An unpublished study using a model developed by the Academy for Educational Development & UNICEF to estimate economic benefits of breastfeeding for policymakers in developing

countries<sup>(164)</sup> was used to estimate the volume of human milk produced in China at around 4 billion liters in 2001.

### *Valuing human milk in GDP*

These earlier studies used the cost of replacing breastmilk with cows' milk or formula as the market price with which to infer its economic value. National accounting principles suggest that production should be valued at market prices, as reflected in market transactions. This may involve using either using an 'input cost' based approach, or the market value of the output.

As most human milk production is not supplied to the market, and most human milk consumed is not acquired in the market, an important methodological question is therefore how non-market production and exchange of breastmilk should be valued or priced. This is not a problem unique to valuing human milk production, as for example, most meals are supplied by households in the home, and not acquired in the market, even if meal inputs are purchased. However, it is possible to value meals at home using market values. Likewise growing markets in human blood, tissues and organs present some comparable issues of valuation for national accounting purposes. Nevertheless, where markets exist, the preferred national accounting approach is to use the market price of an analogous product, or if a market price is not available, to infer its value by measuring the cost of inputs to its production, even if some production is not sold<sup>(156, 165) (166)</sup>.

Arguments for retaining the national accounting status quo have included questioning whether or not there is a true 'market' in human milk which characterized by 'economic pricing'. As documented earlier, breastmilk is now actively traded and exchanged across national borders<sup>(156, 166)</sup>, and there is a large literature showing that breastfeeding is reduced by early maternal employment and vice versa<sup>(167)</sup>. This supports the argument that human milk production is an economic activity where both producers and consumers are influenced by economic rewards including market incentives<sup>(8)</sup>. The existence of commercial markets in human milk products means there are prices of a closely related or 'analogous product' - a shadow price - from which to impute its economic value for experimental accounts purposes.

It may be argued that the price of formula, which is lower, should be used to value the lost economic value when human milk production is replaced by formula feeding, as the mothers who formula feed may not value breastmilk as highly as breastfeeding mothers. However, market prices for formula only show that consumers value bovine-based milk or plant-derived formula milk products at this price, not how much they may be willing to pay for human milk. The price of formula may be low because women consider breastmilk substitutes to have a lower economic worth. At present, some formula-feeding mothers may not be able to purchase breastmilk. Previous studies discuss methodological issues of valuing human milk within an SNA framework in more detail<sup>(156, 168, 169)</sup>.

The validity of milk bank prices as a value for human milk output has been tested by examining the prices resulting from other valuation methods<sup>(156, 169)</sup> and considered in its application to the US, Australia and Norway<sup>(168)</sup>. If market prices are not suitable, then national accounting practice allows measurement of its value through the input costs of producing it. The amount of time it takes to express milk can be estimated and an appropriate wage rate applied to value the opportunity cost of time. A common approach in national accounting is the 'replacement cost' method (Australian Bureau of Statistics 1990). This approach, for example, values the milk producing functions of the mother by estimating the



cost of employing a wet nurse, which is a form of professionalized employment at breastfeeding that has long been a commercial activity <sup>(72, 170)</sup>. The opportunity cost method is another, more contentious approach to valuing time inputs to production of non-marketed goods. This input cost approach is used to value 'difficult to price' products such as human blood or sperm at the time cost people pay to obtain it. An estimate of the input cost of human milk can be derived by estimating the time it takes to express breastmilk, including transportation or traveling costs. Difficulties nevertheless arise in determining whether a general wage or a specific wage is most appropriate for valuing the time of mothers, who may not be employed. Using the price of milk exchanged by milk banks has therefore been argued to be the most consistent with national accounting practice, and with accurately measuring the value of human milk as a food/medicine. <sup>(56, 162, 169)</sup>.

Several studies since the 1990s have shown the practicability of this approach for estimating the economic value of human milk production, and its substantial value in relation to GDP using market prices <sup>(56, 156, 159-163, 165, 166, 169, 171)</sup>. Data on mothers' milk consumption has been included since the 1970s in Norway's Food Balance Sheets, alongside estimates of consumption of meat, eggs, and other food which are important in the local diet <sup>(172)</sup> and Norway still routinely enumerates human milk production in with its national food statistics. <sup>(172)</sup> Official Norwegian estimates show that in 2011, Norwegian infants up to 2 years old consumed an estimated 10.5 million liters of mothers' milk. In a 1994 study by Oshaug and Botten <sup>(162)</sup> the authors calculated that in 1992 production of human milk in Norway was 8.2 million liters, with an approximate value of \$US400 million per annum. Production of human milk was valued using a market price for human milk — the cost of banked human milk traded by Norwegian hospitals, 344 Norwegian kroner (\$US50) per liter in 1992. A subsequent study of human milk production in countries in sub-Saharan Africa <sup>(163)</sup> used a 'very conservative and very low price' of \$1 per liter to concluded that the GDP of Mali and Senegal would have been increased by 2-5 per cent if the value of human milk were included in GDP.

This same valuation approach was adopted within a national accounting framework in research evaluating human milk production in Australia for the same year <sup>(56, 169)</sup>. Our Australian study estimated human milk production for infants and young children up to two years of age at around 33 million kilograms per annum in 1992. This had a value of A\$2.2 billion at a 'market alternative' shadow price of A\$67 (US\$50) per liter.<sup>iii</sup> This was equivalent to around 0.5% of GDP, or 15% of public spending on health. It was also equal to around 6% of private final consumption expenditure on food at that time. By comparison, retail sales of commercial formula milk were estimated to be around A\$135 million in that year.

Most recently, estimates of the economic value of human milk production for a selection of countries show the large economic losses from low breastfeeding rates, and the overall economic impact of displacement of breastfeeding during market development (Tables 2 and 3). These estimates, drawn from three recent studies <sup>(171, 173, 174)</sup> illustrate that the value of human milk even in developed countries, with small populations, or where breastfeeding is low, is qualitatively important compared to other goods produced for own consumption by households. It is also of a magnitude comparable with illegal activity such as prostitution, has

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<sup>iii</sup>This study took the price of expressed human milk traded by milk banks in Norway (344 Norwegian kroner (\$US50 or A\$67 per litre) as the 'market alternative' price for breastmilk in Australia, there being no human milk banks operating in Australia at that time. Exchange conversions for 1992 were at \$A1 = \$US.75.

been included, albeit controversially, in UK and other European Community national accounts <sup>(175, 176)</sup>.

Breastfeeding prevalence in most countries is well below its biologically feasible potential. As shown in a previous study, if breastfeeding had been at biologically feasible levels in Australia in 1992, the value of human milk production would have been A\$3.4 billion higher, with a potential volume of production estimated of 84 million kg p.a. This was potentially worth around 1.3% of GDP, or 40% of public sector spending on health. Alternatively, it represented around 17% of private final consumption expenditure on food in Australia <sup>(56, 169)</sup>.

Table 2 compares potential production of human milk in 2010 with actual production for that year for selected countries. This comparison with the biological potential gives some indication of the scale of the gross economic loss from substituting commercial IYC milk formulas for non-market household provision of human milk. Worldwide, production in 2010 was just over half of the biological capacity, with losses of around \$1,397 billion. The United Kingdom utilized only a fifth of its households' capacity to produce US\$3.9 billion of human milk, foregoing over US\$15 billion of its potential output due to very low breastfeeding rates. The Philippines, on the other hand (producing US\$ 39.7 billion of output) utilized two thirds of its capacity by practices favoring continued breastfeeding of older babies and toddlers.

As shown in Table 3, (which uses more standardized WHO indicators of breastfeeding practice and an updated market price of US\$100 per liter), mothers in India produce over 7 billion liters a year of human milk. This has an estimated value of US\$741 billion a year. Potential production from increasing breastfeeding to biologically optimal levels is US\$335 million a year.

Because of lower breastfeeding rates, the value of human milk produced in China, a comparable sized middle income nation, was much lower, at around 2.3 billion liters in 2012. This had an estimated market value of some US\$248 billion, but with over \$526 billion of foregone human milk production. Of particular interest in the present context is that the decline in breastfeeding in China since 1999 has resulted in a dramatic but unmeasured deterioration in unpaid household production, with a loss of around 700 million liters of breastmilk per year, because of the dramatic declines in exclusive breastfeeding of infants (0-6 months) from 67% to 28% since 2008 <sup>(177)</sup>. Replacement of breastmilk in the diet of infants amounts to a loss of economic production in China of around US\$77 billion p.a. The overall annual loss of production represented by declining breastfeeding of infants and toddlers in China since the 1990s is of the order of US\$335 billion a year.

#### *Defensive expenditures – the food and health care cost externalities of breastmilk substitutes*

Expenditures on breastmilk substitutes such as milk formula are included in GDP, with some estimated country retail sales presented in Table 4. GDP considerably overstates the gain in economic production from such products because these products substitute for breastfeeding and human milk production. GDP also overstates the gain to economic well-being by including 'defensive expenditures' on healthcare services for illness and disease attributable to replacement feeding with milk formula. Human milk and breastfeeding exemplifies the issue of health cost externalities of globalized food systems, because the rapidly increasing global displacement of breastfeeding with processed milk products <sup>(86, 178)</sup> results in increased population health and disease and higher health system costs, whilst also creating health cost externalities for families, employers, and public health systems.

A number of studies have shown the substantial national health system and other treatment costs associated with milk formula use. These studies include morbidity or mortality from acute conditions such as gastrointestinal illness or chronic disease such as diabetes or maternal breast cancer and have been shown for a diversity of countries high, middle and low income settings including in North America, Europe and Asia <sup>(66, 86, 114, 117, 118, 179, 180)</sup>.

There are also financial burdens on families due to health expenses of nutrition related chronic disease, and important social equity issues due to the financial burden of out of pocket health care expenditures in impoverished populations lacking access to publicly funded health care <sup>(181)</sup>. A further unmeasured economic burden falls on unpaid family caregivers, disproportionately women, for whom the added time pressures of caregiving compound existing financial and other disadvantage. This been cited as ‘a potential burden and threat to women’s health and well-being: little time is left for rest and leisure’ <sup>(30)</sup>.

Similar issues arise regarding the environmental cost externalities of replacing breastfeeding with milk formula products. These environmental impacts are discussed in relation to environmental assets though some may be more properly accounted for in the SNA framework as defensive expenditures.

### *Capital accounts*

#### **Human capital formation**

Household time inputs into unpaid care work provide important resources for development of human capabilities. Measuring care contributions to social capital and human capital is argued to be crucial to economic development <sup>(37)</sup>. Breastfeeding was recently identified by the World Bank as a key investment in population health <sup>(95, 96)</sup>.

Breastfeeding therefore has potentially important long term economic consequences for the quality of human capital, through its effects on population health and child development.

Early life nutrition and feeding practices affect child cognitive development, with consequences for educational attainment and future labour force productivity. Iron insufficiency among children was estimated in 2001 to cost China 3 per cent of GNP annually in lost labour productivity via an 8 percentage points reduction in cognitive performance <sup>(182)</sup>. There are now several well conducted cohort and experimental studies <sup>(131, 132, 183-185)</sup> and a recent systematic review <sup>(128)</sup> representing strong evidence that children deprived of optimal breastfeeding in infancy have lower cognitive and academic achievement and mental health in later life. In particular, a major cluster randomized trial sponsored by the WHO involving more than 17,000 children found that weaning from exclusive breastfeeding before 4 months was associated with an average IQ disadvantage of around 3–7 percent at age 6 <sup>(127)</sup>. Lack of adequate breastfeeding compares with low level prenatal lead exposure or several months of lost schooling as a risk factor for child cognitive development <sup>(67)</sup>. A major study recently published in The Lancet estimated global losses of more than \$300 billion annually due to current suboptimal feeding practices, with estimates for 80 individual countries including the US, UK, Australia, Norway, India, and China <sup>(86, 186)</sup> of \$84.2 billion, \$16.5 billion, \$6 billion, \$1.5 billion, \$0.6 billion, and \$26 billion a year respectively for 2012. The annual productivity gains from increasing low US breastfeeding rates were recently estimated in a separate study at \$40 billion <sup>(186)</sup>.

Chronic disease arising from nutrition related factors is increasingly recognised to affect work productivity and capabilities in later life, and therefore on the economic quality of a country's human capital stock. Replacement of breastfeeding with breastmilk substitutes also increases later life chronic disease risk for both mother (reproductive cancers such as breast cancer risk)<sup>(66, 111)</sup> and child (obesity, diabetes, etc.)<sup>(187)</sup> so affecting labour force productivity at the population level.

The cultural healthcare knowledge and skills of women about breastfeeding also represents an important capacity for food production and health care provision. Our own study estimated the rate of return on this capacity to represent a significant national asset<sup>(156)</sup>. The potentially significant costs of rebuilding this capacity where it has been lost are noted in the recent *Lancet* study<sup>(188)</sup>.

### **Environmental assets**

Human milk exemplifies the issue of environmental resource depletion because milk formula manufacture and use contributes significantly to environmental damage and resource depletion, whereas the environmental consequences of breastfeeding are minimal.<sup>(189, 190)</sup> This environmental impact occurs throughout the product life cycle, and includes dairy industry related land clearing and water use, greenhouse gas emissions (GHG) from livestock production, energy and water use during manufacture and consumption phases, and waste disposal. Estimates of the implications for GHG emission are now available based on Euromonitor International industry datasets on retail sales.<sup>(179)</sup> Based on results of life cycle assessments (LCA) of milk formula ingredients, GHG emissions for milk formula were estimated to be four times higher per kilogram than raw cows milk, which is well established as having a concerning high GHG impact. A recent study of high, middle and lower income countries in Asia showed that greenhouse gas emissions of 2.2 million tonnes CO<sub>2</sub> eq. were generated in China as a consequence of formula sold in that country in 2012<sup>(179)</sup>.

## **4. Discussion: Including human milk and breastfeeding in experimental accounts**

The contribution of this paper is to show how SNA concepts and indicators may be extended and integrated with frameworks for alternative indicators (such as the capabilities approach or a human rights framework), through consideration of human milk and breastfeeding as a microcosm of an unmeasured system of non-market food production, and care provision, which sustains infants and young children and human capital formation, yet competes with breastmilk substitutes the production and sale of which are inaccurately measured in GDP as the only component of this 'IYC food economy'. It brings together a substantial economic literature discussing how to improve GDP measurement – incorporating feminist economic critiques - with evidence from the nutrition and health research fields on economic costs and benefits of breastfeeding.

Above we have illustrated how experimental accounts could be constructed, to include human milk production and consumption in core GDP, adding women's time cost inputs to breastfeeding into satellite accounts for childcare and health care services, and developing a capital account measure of its contribution to the human capital stock. We note how such an approach highlights the implications for equity of unaddressed time stresses on women through increasing the 'double burdens' of care work associated with the global nutrition transition and rising epidemic of chronic disease. We also identify how such accounting could incorporate adjustments for relevant health and environmental cost externalities, whereby increased sales of breastmilk substitutes and associated higher health expenditures

are counted as defensive expenditures and the greenhouse gas emissions and other environmental harms associated with milk formula production are appropriately accounted for in environmental accounts as resource depletion and/or decline in ecosystem services.

Since changes to SNA guidelines in 1993, women's production of breastmilk (though not breastfeeding) has come within the scope of GDP measurement. Breastfeeding is a time consuming childcare activity classified as an unpaid household service, to be included in 'satellite accounts'. Human milk is a good, which can be stored, exchanged and traded, and is exchanged in markets which provides suitable prices for valuing household sector output. A range of markets and market prices for human milk exist that provide a basis for valuing this production of human milk in GDP on an output basis. Even putting aside the separate additional value of breastfeeding as a service, the value of human milk is 'quantitatively important'. Indeed as shown in the above review, it is of a magnitude that is comparable with other production for which values are already imputed such as households' 'backyard production' of food, or on-farm consumption of farm product in Australia.

Recent research has demonstrated the magnitude of actual and potential human milk production for a range of countries using standard national accounting concepts and guidelines. Building on studies on the economic value of human milk in Norway in the 1990s, it is already demonstrated within an SNA framework that human milk has a potentially significant economic value in relation to GDP in high income countries<sup>(171)</sup>. Even valued at a much lower price of \$1 per ounce, the economic value of human milk production also adds significantly to the value of GDP in African countries<sup>(163)</sup>.

The value of human milk production in both developed and developing country economies is large relative to that of market production, and also emphasizes the extent of the production loss implicit in present practices of early weaning from exclusive breastfeeding. Human milk production in many countries is presently only around a fraction of its biologically feasible production level.<sup>(173)</sup>

Such estimates of gross output within an SNA framework for a representative selection of countries illustrate that;

- The volume of human milk output can be measured through a simple methodology that is available for most countries
- A reasonably satisfactory basis for the valuation of human milk output is available from existing markets in human milk. While the data presented on the value of human milk has some uncertainties, national accounts and GDP estimates already incorporate a range of economic statistics with varying reliability but still prove useful. Under SNA93 and subsequent revisions, GDP should incorporate this substantial production of human milk by households for their own and for others consumption. It is practical to do so using the preferred output measurement method. The volume of human milk production can readily be estimated from regular collections of reliable national survey data on breastfeeding in many countries.
- Production of human milk is quantitatively important and of significant economic value, including in relation to total market production of commercial infant formula and foods. For example, alongside human milk production estimated here around \$US45 billion in the United States, the commercial baby food/formula market in that country is reported to be \$US1.5 billion a year. Likewise, in China the market for



commercial baby milk/food is reportedly around \$US3-6 billion p.a., versus a current production of human milk worth \$US304 billion (see Table X).

Human milk meets the criteria for inclusion within the SNA93 core (GDP) production boundary, while established methods including time use surveys provide the basis for also measuring and valuing household time cost inputs to breastfeeding. Nutritional input requirements have been shown in previous studies to generally be minimal.

Here we have shown that examining breastfeeding and human milk production as a microcosmic non-market economic activity reinforces findings of previous macroeconomic analyses <sup>(14, 191-194)</sup> concluding that non-measurement of women's productivity biases public policies, and leads to disadvantage and economic injustice for women.

Economic output as currently measured in GDP is an incomplete and biased measure of national economic output. For example, not to include human milk in GDP considerably distorts cross country and intertemporal comparisons of national food output, including for lower and middle income developing countries such as India or China, where breastmilk production remains a much larger share of IYC food production than in the US, the UK, Australia or Norway.

The S-S-F Commission pointed out that excluding household production biased measurement of economic progress during development, as economic activity which is not counted in GDP shifts to the market sector where it is counted <sup>(1)</sup>. The importance for public policy priorities was also noted. The implications for gender equity of ignoring the time expenditures/investments of women, and how policy failures resulting from this contribute to 'maternal depletion' were not explored in detail by S-S-F.

#### *Experimental accounts*

Experimental estimates are a well-established practice for exploring how to adapting the SNA framework to a changing world, and have been a central strategy for maintaining relevance particularly since the conceptual and political challenges to the SNA since the 1980s.

The arguments for the inclusion of human milk output in core national accounts, and the implications of breastfeeding and human milk for the capital accounts have been expanded on elsewhere <sup>(156)</sup>. Briefly summarized, experimental accounts would;

- **add** to measured GDP the annual market value of human milk produced, after
- **deduct** 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
- **deduct** from GDP an amount reflecting any reduction in market productivity by mothers which is necessary because they are breastfeeding. This highlights that workplace or other barriers to employment by breastfeeding mothers may be economically inefficient, even if the benefit to employers of removing such barriers is small or if it is costly.

There should also in principle be adjustment for the negative externalities of artificial formula manufacture, distribution, and use, including **deducting** from measured GDP the public and

private health expenditures associated with increased relative risks of infant and maternal ill health and later life chronic disease from current levels of milk formula feeding.

Lactation and breastfeeding is also relevant to measuring a nation's capital stock. As noted above, current national accounting practice fail to properly value the unpaid household nutrition, health and education activities contributing to human capital creation <sup>(11, 195)</sup>. The unique biological capacity and culturally acquired skills of women to breastfeed and lactate can also be conceived of as a natural capital asset with a health care value equal to the capitalized value of its future net income stream. The actual and potential value of this asset is large <sup>(156)</sup>.<sup>iv</sup> 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 breastfeeding and human milk production is determined by whether there is a supportive breastfeeding culture and social institutions, including variables such as adequate maternity protection for women participating in the labor market, as well as suitable childcare and maternity care services, regulation of marketing of breastmilk substitutions and other elements prioritized in the WHO/UNICEF *Global Strategy on Infant and Young Child Feeding* and related WHO guidance <sup>(86)</sup>.

Environmental accounts and defensive environmental expenditures should also be adjusted to account for dairy industry and formula manufacture and consumer stage depletion and degradation impacts of impacts of milk formula production, processing, and transportation and consumer use externalities on land, water and air.

#### *Arguments against including human milk and breastfeeding in GDP*

A variety of practical and conceptual barriers have been put forward by statistical agencies against including household work in GDP <sup>(17, 18, 194, 196, 197)</sup>. Objections might include a) that its production is not related to market activity or economic pricing, and b) that its inclusion would disrupt conventional measures of output, as the large size of household production swamps the value of market production in the total economy. Including household services in GDP may be said to detract from its usefulness to policymakers <sup>(197, 95)</sup>. Accounting for household services through 'satellite accounts' allows analysis to be expanded without 'overburdening or disrupting the central system' <sup>(198, para. 21.4)</sup>. For example, when considering in 1990 whether unpaid work should be included in the SNA, the ABS advised the Australian Government that unpaid work of households was not capable of being marketed, and was not related to market forces as directly as goods. Although the ABS acknowledged that institutional and labor market changes could result in activities shifting into and out of the market sector over time, creating artificial changes in measured GDP, the Government was advised that unpaid work should be measured instead in separate but consistent accounts because the market sector was the primary concern for macroeconomic policy considerations <sup>(77, 6-7)</sup>.

It is incorrect to apply this argument to human milk production. Production levels of human milk are closely related to market activity, with direct competition to breastfeeding from

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<sup>iv</sup> For example, for a 50 year time horizon and at a 5 per cent discount rate, the present value of this human capital asset in 1992 was comparable to the value of Australia's public telecommunications company, then around A\$30 billion, and greatly exceeds the value of Australia's livestock (A\$17.9 billion) and plantation forests (A\$4.5 billion) (Australian Bureau of Statistics 2000a). At BFPO levels of breastfeeding, the capitalized value of human milk production in Australia would be around A\$100 billion, nearly three times its current level and comparable to the country's subsoil mineral assets.

companies selling and profiting from sale of infant feeding products. Labor market participation and breastmilk production compete directly <sup>(8)</sup>. Also, its production, delivery and exchange for money or as a gift should be of considerable concern to health economic policymakers and regulators despite not being in the market sector.

It is also questionable as to whether other conventional arguments for excluding unpaid work from GDP apply to lactation work and human milk production. For example, Collas-Monsad <sup>(197, 95)</sup> has identified arguments that excluding unpaid work is necessary to maintain the usefulness of the accounts to policymakers. It is said to avoid “overburdening or disrupting the central system” <sup>(198, para. 21.4)</sup>. However, it is difficult to see why ‘disrupting’ the system by comparing these values is undesirable, or why it ‘overburdens’ policy analysis to show the large magnitude of non-market production of infant food. Exclusion of the economic value of human milk production from GDP measures means in Australia for example, that concerns at the viability of commercial firms producing less than \$500 mill of market output per year dominate policy at the expense of the unpaid producers of \$2 billion or more of household production. In the United States, public funds underpin the profitability of distributing free or low cost formula to around many households with children. WIC has recently provided between 57% and 68% of all infant formula sold in the United States <sup>(199)</sup>, a market estimated to be around \$US1.5 billion a year (Table 7). This raises questions about the economic efficiency and productivity cost of allowing sales of commercial infant formula to undermine breastfeeding and production of human milk that is potentially worth US\$108 billion annually.

Likewise, it is difficult to see why overburdening policy analysis with data showing the magnitude of the related non market production is so disturbing to policy perspectives. Including breastfeeding in GDP would surely enhance monitoring and analysis of long term productivity trends and patterns in the food, nutrition and health sectors because of the long term consequences for maternal health and well-being, as well as longer term human capital quality including cognitive performance, and chronic disease risk.

Another reason that women’s work is still not measured in key economic statistics is said to be the costs involved in changing the collection and use of national accounts <sup>(195, 30)</sup>. In a sharp contrast to the lack of resources devoted to better measuring the very large household production sector, national accounting standards in Europe now require sexual services to be included in GDP <sup>(200)</sup>, even this is extremely difficult to measure accurately and relatively small compared to household production.<sup>v</sup> In Britain, this added 0.7% to GDP, these calculations used crude proxies to value illegal sex services, based on the male population, and prices at strip clubs. The importance of international and temporal comparability is cited by the OECD to justify including illegal activities such as prostitution in GDP to make it ‘robust’, by using ‘emerging best practice’ to make ‘reasonable best estimates’ even where the practical difficulties are ‘non-trivial’, and especially where the magnitudes are ‘more substantial’. <sup>(12)</sup>

Nevertheless, it has been pointed out that valuation of non-market work is on especially solid methodological ground compared to these recent revisions. <sup>(201)</sup>

The current System of National Accounts that guides most national statistical offices stipulates that the value of household services is beyond the ‘production boundary’. The value of goods produced for own consumption, however—including grains, vegetables, milk, water and firewood collected for own consumption—lies within that boundary. In

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<sup>v</sup> National accounting rules in the European Union now include estimating the value of national trade in sexual services of women, though not their trafficking.



principle, the value of what is often termed ‘subsistence production’ should be included in measures of household and national income. Yet it is by no means clear that all countries do an adequate job of estimating the value of such goods. Further, virtually all ignore the value of a good with medically proven benefits for infants—breast milk, even though its value can be estimated rather easily from health survey data on the number of nursing mothers in a population. Detailed calculations for Australia, for instance, suggest that it amounts to almost 1 percent of conventionally measured GDP (Smith and Ingham 2005). The policy implications are disturbing: Increased purchases of infant formula increase a nation’s GDP even as they displace the nutritionally superior alternative. Another problematic imputation, mandated by the European Economic Community, requires national statistical offices to estimate the value of illegal transactions involving drugs and prostitution, even though very little reliable data on such transactions is available.

There is also a growing awareness on the need for SNA measurement of care work to include breastfeeding<sup>(37)</sup>. For example;

One important care service that theoretically falls within the purview of the SNA but is not explicitly listed there is breastfeeding. This service results in the creation of a product, breast milk, which is an important component of total subsistence production. If breast milk is not provided, market substitutes for it must be purchased. Indeed, breast milk itself is bought and sold in many countries, albeit in small amounts, making it possible to impute its value using a direct market price. Efforts to calculate its value within a national income accounts framework are underway in some countries and should be extended to others<sup>(156)</sup>. The current economic invisibility of breastfeeding has important policy implications. The premature weaning of children onto formula or solid food increases children’s vulnerability to malnutrition and disease, and increases aggregate health costs. Because these costs are diffuse and spread over a long period of time, it is difficult to link cause and effect.

Folbre also observes that;

"Unpaid care work represents a subset of all paid work, and is not perfectly synonymous with ‘non-market work’ or work that does not yield a direct monetary reward. Many censuses and labour force surveys in developing countries enumerate ‘unpaid family workers’ who contribute to a family farm or enterprise without receiving direct payment. Many of these workers are engaging in activities that are indistinguishable in most respects from paid employment. SNA considers some forms of ‘non-market’ work within the ‘production boundary’, and recommends inclusion of estimates of their value within national income accounts—primarily production of food for own consumption, but also gathering of fuel wood and collection of water. These activities are generally not considered forms of unpaid care.

## 6. Conclusions and implications

SNA is a social institutional framework which contributes to globalizing cultural norms, policies and practices which deprecate the economically valuable but unpaid household production such as breastfeeding, and depletes women through the unequal sharing of the double burden, and inflexible institutions of paid and unpaid work. Countries’ continued exclusion of unpaid household work reinforces concerns that the important reform agenda laid out by Waring’s critique of national accounting as ‘applied patriarchy’ remains largely unimplemented<sup>(202)</sup>.

The fundamental importance of human milk in national food systems has long been recognised in Norway, which includes human milk produced by Norwegian women in its

national food consumption statistics.<sup>(162, 203)</sup> This practice could be extended to include the worldwide production of food balance sheets.

Current SNA provides for inclusion of human milk (though not breastfeeding which as a service is counted only in the satellite accounts), however, only commercial milk formula is presently counted<sup>(156)</sup>. The ongoing practice of ignoring human milk production in GDP measurement results in the paradoxical observation of GDP rising when breastfeeding declines and commercial formula consumption rises, and GDP falling when breastfeeding increases.

A highly relevant example of the pervasive policy impact of this invisibility in economic statistics is the recent dramatic rise in global milk formula sales in the Asia Pacific region led by China<sup>(86, 178)</sup>. High demand from working mothers is contributing to dramatic declines in breastfeeding. Time use studies show that economic development is exacerbating the time poverty of working mothers in China who often lack adequate access to maternity protection measures and suitable work settings, in a context of inequitable sharing of unpaid household work burdens<sup>(10, 144)</sup>.

The example of breastfeeding also illustrates the importance of the accurate measurement of the demands of unpaid care work for public policy regarding women's labor force participation, and the health and well-being of mothers and children. As Folbre pointed out;

... it is clear that increased pressure on mothers to enter paid employment without flexibility can have negative consequences. For instance, a statistical analysis of the impact of welfare reforms implemented in the United States in 1996 shows a small but significant negative effect on average levels of breastfeeding among low-income mothers<sup>(204)</sup>.

To make GDP more relevant and useful to collective human decision-making, this paper has argued for urgent priority to be given to developing measures which include the care economy and account for depletion of human and environmental capital. It has used the example of breastfeeding and human milk to illustrate the deep links between human health and human capital, these crises of care and environmental depletion. It suggests that this mismeasurement of the economic system results in the misdirection of nations' leadership efforts. It concludes that these critical problems of crisis for global human well-being arise from the self-reinforcing, century long preoccupation with better measuring growth in the market - an artificial construct - rather than expanding a total economic system which can sustainably resource human life and well-being.

The invisibility of this household food production seriously distorts public policy priorities. This works to the disadvantage of women and children because it means fewer economic and financial resources are allocated to important economic outcomes such as protecting and supporting breastfeeding, through for example, financing adequate quality maternity care services and mother and child health programs, and to regulating and funding labor market measures such as unpaid and paid maternity leave and breastfeeding accommodations in the workplaces. It also means that public funds continue to underpin the profitability of the commercial baby food industry through programs distributing free formula, despite this displacing women's economically valuable production of human milk through breastfeeding which is worth much more to the economy.

As well as illustrating that GDP overstates the extent of economic growth in some emerging economies compared to others where policy and other variables better maintain households'

production levels of human milk and breastfeeding, it can be argued that because of the non-measurement of these goods and services in GDP, the dramatic shift in infant and young child food production activity from the household to the market sector during the past half century in both developed and developing countries has passed unobserved, and its negative externalities unrecorded. It can be expected that the invisibility of such a shift and the economic production value being lost has resulted in policy inaction and bias <sup>(191)</sup>, which adversely affects gender equity and well-being of mothers and children, as well as the quality of the human capital stock and future economic productivity <sup>(10, 145, 196)</sup>.

There are furthermore, important environmental issues that are archetypally represented in the exclusion of human milk from national accounts. Greenhouse gas emission, land clearing and biodiversity and water use are key elements of contemporary discussions on how globalized agricultural and food systems are degrading the environment, and undercounting the crucial contribution of ecological services to human health and well-being. In the case of infant feeding, recent studies have identified the large carbon footprint of infant formula, which is not measured with the core SNA, whilst replacement of breastfeeding in the global food system by milk formula is counted in GDP as an economic gain without any adjustment for the environmental costs.

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## FIGURES

**Figure 1: Breastfeeding, human milk and the SNA Framework**

<i><b>Domains of impact</b></i>	<i><b>Effects of infant and young child feeding</b></i>	<i><b>Relevant SNA impact</b></i>	<i><b>SNA framework</b></i>
<b>Social and Gender equity</b>	Unpaid time inputs to household production and consumption of IYC nutrition and care including health care	Childcare and preventative healthcare	Satellite accounts of non-market household production
<b>Food system</b>	IYC feeding and nutrition – undernutrition and overnutrition	IYC food production and consumption	Core production boundary/GDP
<b>Health cost externalities</b>	Preventative health care and avoided attributable health costs of premature breastfeeding cessation	Health care costs and defensive health expenditures	Core production boundary/GDP
<b>Environmental cost externalities</b>	Environmental asset degradation of milk formula production eg GHG emissions, pollution, packaging and waste generation	Defensive environmental expenditures	Core production boundary/GDP
<b>Human capital</b>	Avoided acute infectious illness (respiratory, gastrointestinal); maternal survival and fertility regulation; avoided later life chronic disease child and mother (obesity, diabetes, reproductive cancers eg breast cancer), cognitive development	Increased labour productivity and human capital stock via lower chronic disease risk, child cognitive development and educational attainment	Human capital accounts – income and cost methods
<b>Environmental assets</b>	Avoided land clearing, biodiversity, water use and other avoided impacts of breastmilk substitutes	Environmental asset depletion	Environmental accounts – depletion of land, water, air, energy resources due to milk formula production and use

**TABLES**<sub>[JPS1]</sub>

**Table 1: Market values for human milk**

Market	Price (\$US per oz.)	Location	Comment/source
<b>Human milk banks</b>			
<i>HMBANA</i>	\$3-\$4.5 <sup>(1)</sup>	USA	Currently there are 12 HMBANA member milk banks providing donor human milk in the United States and Canada. HMBANA milk banks charge no fee for the actual milk, but charge a processing fee to offset the milk bank's overhead costs. This fee ranges from US\$3 to US\$4.50 per ounce, plus shipping costs. Each milk bank has the authority to determine the processing fee for its facility, which is the reason for the wide variation in price.
<i>Norwegian milk banks</i>	\$3.42 (US\$100 per litre) <sup>(2)</sup>	Norway	13 milk banks were operating in Norway in 2009, all located in hospitals with level 111 NICUs. All preterm infants are offered donor milk if mothers' milk is unavailable or insufficient, and all infants who need milk from the milk bank are offered it. Donors are given a free hospital grade breast pump, and US\$20 per litre to cover electricity and travel expenses, and donate for 6 months. At the main Oslo hospital where 2000 of the country's 60,000 annual births occur, the milk bank collects around 1000-1100 litres of human milk p.a. There is a charge of US\$100 for milk transferred to other hospitals.
<i>Standardised human milk formulations</i>	US\$35 (US\$1183 per litre) <sup>(3)</sup>		Prolacta products are for in hospital use only and the company does not supply or charge directly to parents for Prolacta products. The cost is absorbed by the hospital or covered by medical insurance, where the infant is prescribed human milk products. <sup>(4)</sup> The company's website explains its 'co-promotion' arrangement with a major formula manufacturer, Abbott Ross, which is involved in promoting and distributing these human milk products to hospitals.
<i>Human milk fortifier</i>	US\$6.25/mL (US\$6250 per litre) <sup>(3)</sup>	USA	
<b>Internet milk exchange</b> <i>Only the Breast</i>	US\$1-\$3 <sup>(5)</sup> UK\$2-8 <sup>(5)</sup>	Online	Milk can be bought and sold, as well as shared (donated). Exchange is organised into various categories, including by age of the infant, fresh (rather than shipped frozen), milk bank certified mother, milk bank screened mother, bulk sales, local sales, fat babies, special diet (vegan etc). Site offers donor

<b>Wet-nurse employment</b>			blood testing at US\$219.45. Also has trading from Canada, United Kingdom and elsewhere
<b><i>Wet-nursing</i></b>	Daily rate between US\$50 and US\$200 (2012 prices). <sup>(5)</sup> US\$1,000/week (2007 prices) <sup>(6)</sup>	USA	Offered at between US\$50 and US\$200 per day. Also has trading from Canada, United Kingdom and elsewhere. Equivalent to US\$71-286 per litre at 700 ml daily intake.
<b><i>Wet-nursing</i></b>	US\$2585/month <sup>(7)</sup>	China	Chinese wet nurses earned up to 18,000 Yuan/month in 2008. Exchange to USD is based on 2008 exchange rates. Equivalent to US\$121 per litre at 700 ml daily intake

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**Table 2: Annual production of human milk – selected countries and aggregates, 2006-2010**

Country	Actual human milk production volume (million liters) <sup>a)</sup>	Market value of human milk production, US\$ million <sup>b)</sup>	Biologically feasible potential volume of production (million liters) <sup>b)c)</sup>	'Lost' production US\$ million <sup>b)</sup>
<i>Norway</i>	11	907	18	598
<i>Australia</i>	41	3,466	89	4,134
<i>United Kingdom</i>	47	3,980	223	15,009
<i>Philippines</i>	467	39,701	691	19,096
<i>United States</i>	525	44,649	1,269	63,238
<i>China 2010</i>	3,574	303,961	4,862	109,577
<b><i>World 2010</i></b>	<b>23,315</b>	<b>1,982,942</b>	<b>39,744</b>	<b>1,397,251</b>

Source: Smith (2012)

a) Production volume calculated as sum of total infants breastfeeding each month from age 0 to 24 months, times monthly milk intake for each age

b) 2012 prices, valued at US\$85.05 per litre (US\$3 per oz.), assuming 1 ml is equivalent to 1 gram.

c) as in a), assuming optimal breastfeeding prevalence of 95% from 0-24 months. WHO estimates that fewer than 5% of mothers or infants cannot breastfeed. The medical contraindications for human milk feeding of infants as advised by the US Center for Disease Control are rare. See <https://www.cdc.gov/breastfeeding/disease/>, accessed 11-4-2017.

**Table 3: Annual production of human milk for infants, 0-24 months, India and China, 2005-2012**

<b>Country</b>	<b>Actual human milk production volume (million liters)<sup>a)</sup></b>	<b>Market value of human milk production, US\$ million<sup>b)</sup></b>	<b>Biologically feasible potential volume of production (million liters)<sup>b)c)</sup></b>	<b>‘Lost’ production US\$ million<sup>b)</sup></b>
<i><b>India</b></i>	7,003	741,123	1,076,155	335,033
<i><b>China</b></i>	2,344	248,030	774,509	526,479

a) Production volume calculated as sum of total infants breastfeeding each month from age 0 to 24 months, times monthly milk intake for each age

b) 2012 prices, valued at US\$100 per litre (US\$3.50 per oz.), assuming 1 ml is equivalent to 1 gram.

c) as in a), assuming optimal breastfeeding prevalence of 95% from 0-24 months



**Table 4: Infant formula and baby food market — estimated size**

Country	Formula (baby food) market, \$US
<i>Norway</i>	n.a
<i>Australia</i>	132 million (formula only) in 1992 <sup>(8)</sup>
<i>United Kingdom</i>	n.a.
<i>Philippines</i>	260 million (formula only) in 2003 <sup>(9)</sup> 420 million in 2006 <sup>(10)</sup>
<i>United States</i>	1.5 billion (formula only) in 2010 <sup>(11)</sup>
<i>India</i>	224 million in 2012 <sup>(12)</sup>
<i>China</i>	3.3 in 2007 <sup>(13)</sup> 12.3 billion in 2012 <sup>(12)</sup> (formula only) 17.8 billion <sup>(14)</sup> (formula only)
<i>The World</i>	9 billion in 2009 <sup>(15)</sup> (formula only) 31 billion in 2010 <sup>(16)</sup> 44.8 billion in 2014 <sup>(14)</sup> (formula only)

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