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Time-use and economic activity: inputs, outputs and outcomes

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This addresses two issues within the System of National Accounts which remain unresolved in its 2025 revision. (1) The SNA excludes most final production by and intended for private households, even though technical change often involves transfer of productive tasks out of the money economy and into these, or similar, small enterprises. And (2) it fails to distinguish between final output at the General Production Boundary, and other unintended, individual or collective outcomes of economic activity. Both problems relate to the inadequate conceptualisation of final consumption, which is required to complement Reid's (1934) "3rd person" definition of production. SNA 2025 recommends the construction of "extended accounts" using prices of analogous commodities in the money economy to "shadow" those from outside the money nexus—but these do not exhaust the full range of non-money production and consumption.

Keywords: System of National Accounts (SNA), Extended accounts, Non-market production, Household production, Time-use surveys

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Time-use surveys can be deployed to construct both conventional and "extended" dual-entry economic accounts —the latter potentially yielding comprehensive coverage of all economic activity—and also "single-entry" socio-economic accounts.

Dual-entry methods rely on the identity between the value (plus "shadow value") of economic ***inputs*** (capital, materials and labour), and the value (and shadow value) of ***outputs*** which provide for populations' manifested wants as suggested by the stated purposes of the final consumption.

Single entry methods multiply time in each category of human activity by coefficients representing consequence of durations of these for various sorts of individual- (health, happiness), and collective-level ***outcomes*** (pollution, sustainability) and summing the totals of the products across all activities. They provide comprehensive measures of various latent (unintended or generally unconsidered) implications of populations' daily activity, that cannot be straightforwardly valued in money terms, but can nevertheless be relatively reliably and uncontroversially observed and measured.

Time-use and economic activity: inputs, outputs and outcomes.

1. Introduction

For all but the last three of the more than 100 centuries since the end of the last Ice Age, the great majority of all economic activity took the form of subsistence production. Perhaps a few artists, a few manufacturers of useful artifacts (pottery or knives), and brigands with their men- or women-at-arms, might be occupied otherwise, but almost all others, women and men, were engaged principally in food production and preservation, for their own consumption, or in some near-variant such as share-cropping. Commerce, production for the purpose of exchange rather than consumption by the producers or those closely associated with them, formed only a small part of the total. Early economists focussed on just part of commercial activity—initially just on agricultural production for the market. The medieval "Staple" (reflecting the state of English wool production) was the first British proxy for National Product. Adam Smith (though he criticised his French friend Quesnay for excluding manufacturing) himself excluded services from his account of the economy (these seem first to have entered economic statistics through the work of Giffen ([1887] 1904 pp.99-144). The non-marketed sector of activity was regarded as, somehow, archaic, and was quite firmly excluded by at least the pre-modern male economics establishment.

That there is economically-relevant activity that goes unmeasured by the official System of National Accounts (SNA) is well recognised, by Kuznets (1946), Mishan (1967), Hirsch (1976), Stiglitz et al (2009), Bean (2016) and Coyle (2020) among many others. We now accept that SNA estimates of national product are not adequate measures of welfare. What follows identifies three substantive issues: (1) paid work *still* accounts for substantially less than 50% of all work undertaken in developed economies, and the non-money proportion is, generally, growing over time; (2) the productivity of unpaid work is increasingly enhanced by investment in private households' capital equipment, with effects that are neither measured nor estimated in the SNA; and (3) paid and unpaid work and consumption all have some substantially important consequences ("outcomes") that are better considered outside the money-equivalent framework of an extended SNA.

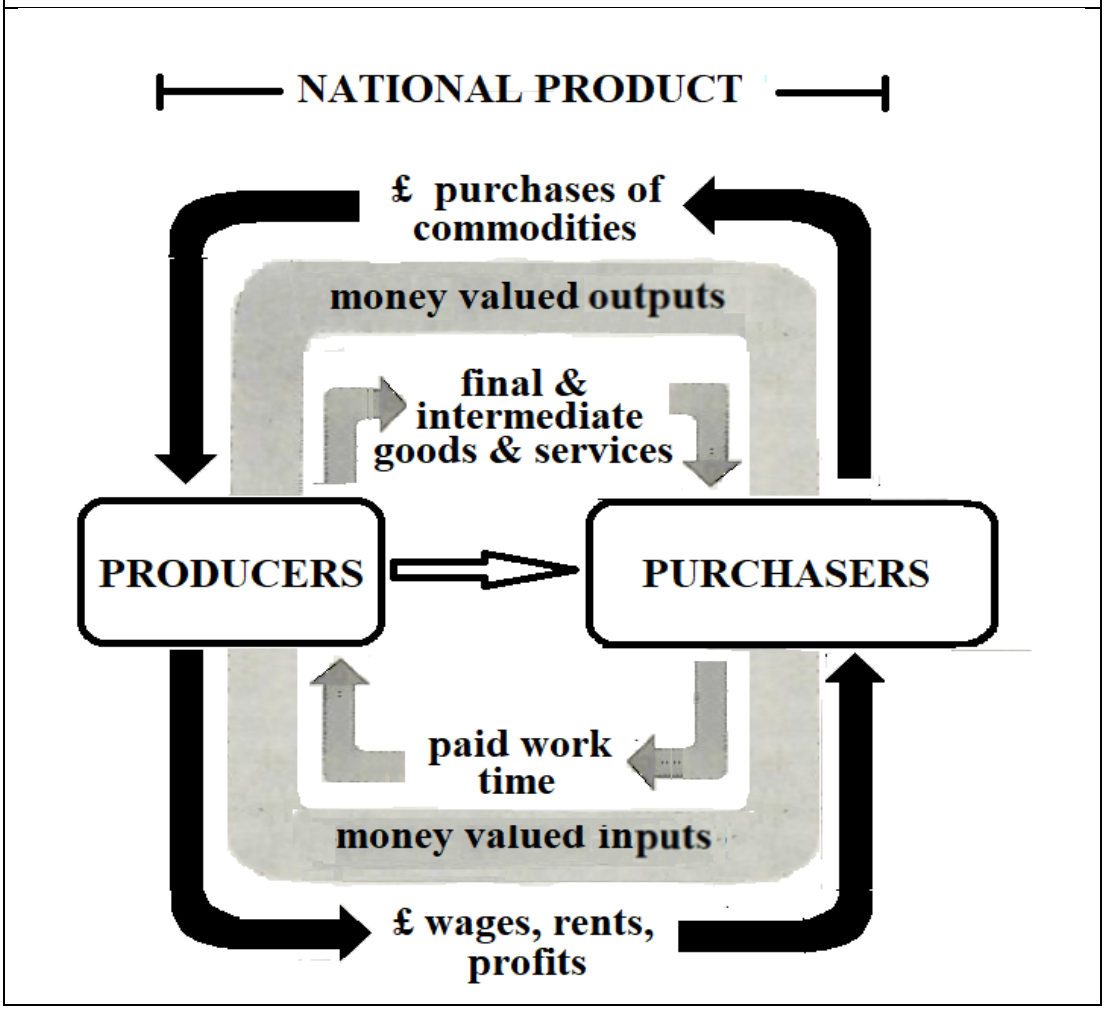
The scale of the missing elements, and the fact that they may grow or decline at rates which vary from, and may be distributed across social classes differently to, what is measured in the SNA accounts (as demonstrated most recently by Madsen et al 2025), raises the question of why we should rely so heavily on such an incomplete measure of economic activity.

What follows is intended to map and estimate the size of the missing regions in a comprehensive and systematic fashion, deploying theoretical insights from economic sociology, and empirical evidence from an until-recently underutilized source of economic statistics—nationally representative time-use diary studies—as well as clarifying the relationship of the absent elements to the core SNA.

Economic "dark matter"

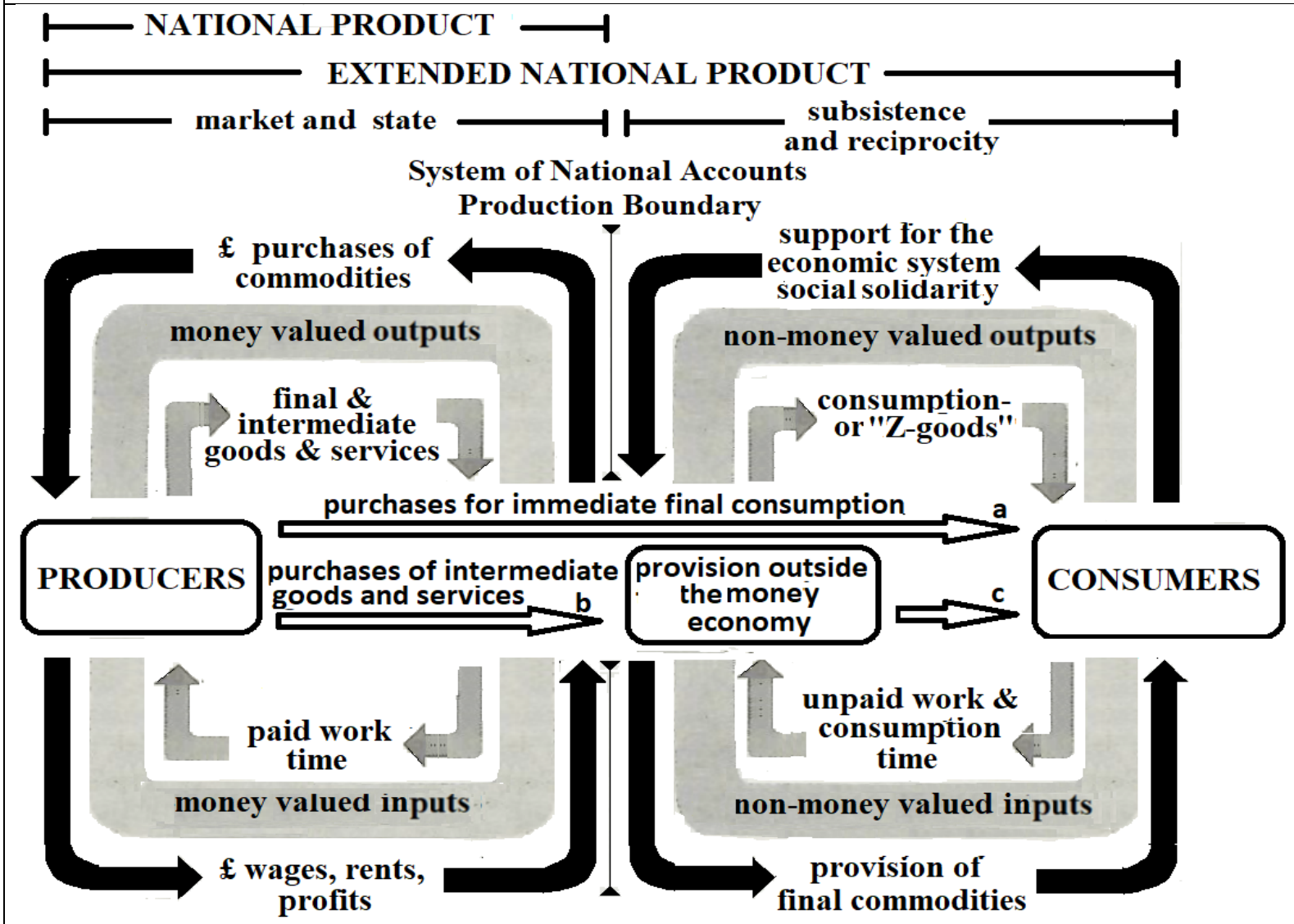
Figure 1 is the Economics 101 presentation of the constituents of economic activity. The picture is derived directly from the latest edition, but it is essentially unchanged from the 1965 textbook in which I first encountered the discipline (Samuelson and Nordhaus 20th Edition 2015 p,522).

Figure 1. Circular flow of (money) income and output.



It identifies two economic roles, ***producers*** and ***purchasers,*** which overlap, insofar as most individuals and households engage in both sorts of activity for much of their lives. And it shows two circular flows: clockwise, a flow of commodities, goods and services with money-denominated prices from producers to purchasers, and balancing them an anti-clockwise flow of waged or otherwise money-valued work time, to pay for these. These circular flows are intended to represent the whole of economic activity. But in fact they leave out a large part of some of the most important aspects of this. Figure 2 provides a more complete view of economic activity. It adds a second pair of circuits or exchanges of activity, in which the commodities purchased from the economy are used in ways that translate into flows of benefit or satisfaction—to their final ***consumers***.

Figure 2. Two circuits of economic activity



Some of the purchases made by individuals or households are indeed consumed directly, but much of what is bought is not immediately consumed (a formal definition of this process follows) but is instead ***used in further processes of provision for wants that lie outside "the (money) economy"***. These processes are, in effect, economic "dark matter", invisible to conventional measures of national product, but nevertheless just as important for understanding social conditions and social change.

A large part of economic development is driven by ***innovation in modes of provision for human wants***. The 20th century saw, for example, domestic servants—unambiguously part of the first circuit and perhaps 20% of all paid work in the UK in the 1920s)—largely replaced by a combination of privately-owned domestic machinery and unpaid self-servicing work. And we now see developments, of "robot" lawnmowers and vacuum cleaners that may even portend the disappearance of parts of that self-servicing work. Devices enabling the remote transmission and retrieval of entertainment, information and consultancy services provided access to new forms of recreational activity. The 21st century will see high-skill final services progressively replaced by household purchases of IT and AI. The dissemination of these alternative modes of provision had, and will have, profound implications for social structure, in the disappearance of entire social classes, and (consider the implications of the diffusion of radio and television in the 20th century) the transformation of the distribution of access to services across the population.

Yet for reasons that are not immediately apparent, economists are not generally at all curious about what is done with the commodities—the consumer capital items and materials—purchased by their final users. The standard instrument for estimating the volume and nature of purchases uses the United Nations' "Classification of Individual Consumption According to Purpose (COICOP). The very name of this instrument is misleading. Purchase is not consumption and COICOP fails to distinguish between purchases for immediate consumption, the arrow labelled **a** in Figure 2, and purchases of inputs to further production (arrows **b** and **c**). So we are unable to tell how the final purchases made by the ultimate consumers, are translated into the final services (Becker 1965 called these "Z-goods") which are actually ***consumed*** to satisfy human wants.

Corresponding to the flows of money-valued commodities in Figure 1, the second circuit of Figure 2 has flows of non-money-valued commodities—clockwise, flows of unpaid work time and consumption time, anti-clockwise, flows of final services to their ultimate consumers. If the latter are adequate to satisfy the wants of the population, they generate in turn public sentiments of satisfaction with, and support for, the socio-economic system as it is currently operating. But if they are insufficient, they may produce the reverse, feelings of economic deprivation among some social groups, leading to dissent and dissatisfaction, undermining support for the economic system, and encouraging political actors who wish, for whatever reason, to radically reform or overturn it. The first circuit provides information needed by financial agencies about flows of money. The second circuit provides complementary information needed by policymakers, on the consequences of economic activity for the distribution of welfare and wellbeing across the population.

Measuring dark matter: what is real, what is important?

The intention in what follows is to reveal important aspects of economic activity in realistic ways. The SNA national income estimates are both real and measurable, without (if we are content to ignore price change issues) any requirement for overly-demanding assumptions. These statistics may be needed for economic management—for example, allowing credit rating agencies to judge and grade the performance and stability of national financial systems. But nevertheless the SNA statistics only very incompletely represent economic activity as a whole. And while extensions to national income using "shadow" money values, do include some at least of the "second circuit" activities, and are as a result less unrepresentative, and allow more meaningful comparisons across different sort of people and of changes across historical time, they depend heavily on the arbitrary assumptions about the quality of unpaid productive activity, which are used as the basis for shadow wages and prices. There are no wages and prices in the second circuit, there is no market, so there is no straightforward process for establishing the value of the output it produces. We can make guesses, sometimes perhaps plausible ones, but these are guesses, nonetheless.

However, underlying these money-valued extensions, are real activities whose extent can be directly measured—not in terms of money, but of time.

With suitable definitions we can discover just how many minutes of a society's day are devoted to each sort of human activity, and how these are distributed among different groups in the population. The methods are challenging but they provide real answers, ascertainable facts about individuals' and populations' allocation of time, using approaches which are largely known and well-tried.

And once established, these totals and distributions of time provide an agreed empirical basis for further debate about more questionable statistical constructions—whether these be the extended "dual entry" estimates of flows of inputs and outputs in Figure 2, or other "single entry"-type estimates, inherently less demanding of arbitrary assumptions, of consequences of economic activity for individual health, safety, wellbeing, and of collective outcomes such as environmental sustainability. What follows has twin aims: to provide the real measures in terms of time use and its distribution and change; and then provide examples of the use of these to construct useful and interesting socioeconomic statistics which complement the System of National Accounts.

2. A first pass through the argument

Adam Smith starts The Wealth of Nations with a discussion of the means of ***production.*** What does economics look like if, instead, we work backwards, starting from the ends of economic activity***,*** in the form of ***consumption***?

While the core underlying the concept of production—***work***—is reasonably common-sensical and easy to grasp, consumption is less straightforward, and indeed raises some unexpectedly complex and unfamiliar definitional issues. This discussion starts by considering various aspects of the consequences of economic activity—foreseen and unforeseen—to arrive at a consistent idea of the nature of economic "wants". It then turns to a key empirical issue, the use of time-diary evidence (alongside money expenditure diaries), to produce comprehensive accounts of the full extent of economic activity and its consequences.

I should say immediately that the innovative aspect of this discussion is not the use of the time-diary itself. There is a substantial literature, going back around 100 years, which discusses placing monetary values on unpaid work time, as estimated from time-use diaries (to choose just three examples: Kneeland 1929, Hawrlyshn 1974, Payne 2016) and defined on the basis of the 3rd person criterion (Reid 1934). What follows, however, focuses on *another*, complementary, part of daily time-use narratives—establishing the extent of, not work, but consumption time. It makes use of the key characteristic of all ***dual entry accounting systems***: that the value of economic outputs is, by definition, identical to that of the economic inputs to them. The arguments that follow rest on the much smaller body of discussion, to my knowledge initiated by a researcher based in the ILO in the 1980s (Luisella Goldschmidt-Clermont 1987, 1999**)**, and followed by Holloway *et al* 2002, Ironmonger 2000, 2009) which focuses, not on the value-added from unpaid production alone, but on comparisons of these ("**input**") estimates, with estimates of the value of ***all*** consumption of final commodities, not just the "**outputs**" emerging from the UN System of National Accounts (SNA) activity, but also including non-marketed household and similar production.

This additional focus is what allows us to estimate the complete "chains of economic provision" which make explicit connections between economic means and the full set of economic ends. SNA accounts cover only economic activities connected directly to money payments. Among these are some items of final consumption, as defined in what follows. But much (indeed, as we shall see in a moment, *most*) of final money expenditure by consumers, most of the sales of commodities, including both access to infrastructure and purchases of consumer capital items and materials, as well as commodities made freely available by government agencies and charities, is not itself consumed, according to the definition set out below, but instead ***used*** in further production processes outside the money economy. And we will speculate, on the basis of time-diary evidence in presented in following sections, that, in most of the developed societies for which we have appropriate data, a growing part—already more than half—of all final economic output depends on unpaid labour.

Most estimations of SNA extensions involve multiplying unpaid work time measured by time-use diaries, by "shadow" valuations of this time related to "shadow" wages paid for similar work in the money economy. But the "extended product=shadow wages" approach is plainly insufficient, since it ignores the contribution of capital owned by private households and other informal-economy productive agents. In particular, all the value of extra-SNA production chains which involve—directly at least—no unpaid labour

(for example, sleep, relaxing at home, or watching television) is either ignored or accounted for by an arbitrarily estimated "household services" category. Since, as we shall see, the majority of both the population's money expenditure and its work time is associated with extra-SNA production and consumption, these are unquestionably important elements of economic activity.

Goldschmidt-Clermont's unique contribution was to identify time-use diaries as the appropriate source of direct information on both inputs and outputs to the economic system—increasingly important, including as it does all ***use*** of broad- and narrow-cast and downloaded software content within households—evidence which is absent from conventional SNA accounts. Only once we consider the complete range of consumption activity, which is described in the time-diary evidence but not registered in money expenditures, do we acquire a comprehensive classification of provisions to final consumers. This in turn allows us to construct the complete reversed-economics account in which the satisfaction of wants explains economic inputs to production.

Finally, in this unavoidably extended argument, I note that the pairing of input and output measures in the dual-entry accounts does not exhaust the full range of consequences of economic activity. In addition to the "manifest" sources and impacts of economic activity, which we might consider as likely motivators of actors' economic behaviour, are other, "latent" effects, wholly or partly unknown to, and perhaps inaccessible by, individuals' conscious selves: the psychological, physiological and environmental consequences or "**out*comes***"—in the form of health, happiness and wellbeing, and also collective phenomena such as resource depletion and pollution and their more general effects in the form of global warming. These result from specific work and consumption activities, but do not have full and directly purchasable counterparts in the money economy, and so cannot be unequivocally valued in money terms. To register these, outside the extended System of National Accounts, though they are derived from the same sequence of activities that constitutes the extended SNA, we need a parallel ***system of single-entry accounts*****,** which multiply time in each of the activities by appropriate coefficients, and sum them to estimate the full extent of their consequences.

Manifest and latent consequences of economic activity.

The distinction between the two sorts of consequences of consumption, respectively ***manifest*** (or overt) and ***latent*** (hidden or inobvious), facilitates a slight revision (set out in the next section) of the standard economic definition of "work" stemming from Reid (1934). It also helps explain the (2009) Stiglitz *et al* proposal that national production and consumption estimates should be accompanied by a battery of other non-money-based "social indicators" of the consequences of economic activity not registered by the System of National Accounts (or its extensions).

The SNA-plus-extensions reflect (and *can only* reflect) just those immediate manifest or overt consequences of economic activity which have some bearing on the motivation for consumption. The latent consequences for health and happiness at an individual

physiological and psychological level, and for stocks of resources and pollution levels at a collective societal level, though sometimes of dominating significance in the longer term, have in general (and *can* have) only very limited if any effects on the immediate motivation of final consumption—precisely because they are in general outside the active knowledge or conscious experience of the economic actors.

The manifest purposes of consumption are generally thought of as being the satisfaction of wants (for shelter, food, entertainment, health care and so on). Irrespective of whether these wants are actually or actively want***ed*** by all individuals at the instant of their consumption—they are nevertheless commonly understood by the consumer as the ultimate reasons or explanations for individual or household consumption.

But alongside the overt reasons for engaging in economic activity, are various other, quite distinct, unconsidered *consequences* of doing so.

This notion of the latent consequences of daily activity is most familiar to us in relation to paid work. Jahoda, Lazarsfeld and Zeisel's classic (1933) Marienthal study—an ethnographic investigation into the reasons for the public health breakdown that followed mass unemployment in a small factory town in Austria during the Great Depression—identified a number of "common experiences" (Jahoda's 1982 rephrasing of the original 1933 description "latent functions") of factory work: the imposition of a time structure ("clocking on"), the requirement for physical activity, the structuring of sociability via the organisation of work-roles and the geography of work-stations, the establishment of personal status through technical and supervisory roles in the production process. Employment also establishes the form of the worker's contribution to the wider society through the nature of the product of the employing organisation. The loss of any of these "experiences" appeared to have a negative physiological and psychological impact, while the loss of all simultaneously has particularly negative effects on wellbeing (a result reproduced empirically with survey data in Gallie *et al* 1995 Chapter 7).

We might parenthetically note—something that was perhaps not immediately obvious to the original researchers—that these sorts of experiences are in each instance highly specific to a particular phase of ***production technology*** at a particular point in history. Thus, with the emergence of remote and offline working, automated robotic production and so on, many of Jahoda 's once-common positive experiences of manufacturing work in the workplace have become less widespread—to be replaced, particularly under conditions of remote working, by other, sometimes negative outcomes, such as personal isolation and over-sedentary work patterns.

Similar technologically specific circumstances also result in generally unconsidered or latent consequences of particular ***modes of consumption***. Food, consumed in the form of a collective meal for all the members of a household—something technologically constrained, in earlier, less-developed societies, by the economies of scale in cooking raw provisions—provided a range of Jahoda-type functions: temporo-spatial structuration (requirement for coordination of household members all to be present at one time and one table), sociability, perhaps hierarchical stratification and sense of social purpose (arising from the cooks' satisfaction from cooking). The authors of the

influential “Middletown” study of a wealthy mid-Western US city in the mid-1920s (Lynd and Lynd 1929) identified analogous coordination and structuration effects of other sorts of (pre-war, US-style) domestic final-service provisions, for example from entire households gathering around the sole radio receiver in the home to listen to specific broadcast programmes, or children constrained in the back seat of the family car, *forced* to socialise with parents during Sunday pleasure trips.

The latent consequences of consumption are, just like those of production, transformed by technological change. The domestic microwave and freezer change the economies of scale, and hence the disciplines and organisational requirements of food consumption within households (for example, microwave ovens mean that hot food can now be more readily browsed by singleton household members). General economic growth and the reducing prices of electronics allowing multiple televisions, computers and play stations per household instead of a single radio, mean that media-use is no longer a collective household activity, as was the case in the middle part of the 20th century). New infrastructure and consumer capital items (internet and home computer) transform shopping, substituting a sedentary isolated market research activity with third-party home delivery, for the not-inconsiderable sociability and the light exercise of retail activity in shops.

These sorts of consumption-related consequences have a potentially similar scale of impact to Jahoda and colleagues’ production-related related ones. In general, these latent consequences are not reflected directly in consumption decisions—they are, on the contrary, unconsidered ***outcomes*** (perhaps “externalities”) rather than economic outputs, often unforeseen at the point of decision about a particular consumption choice. And as for latent individual consequences, so also for collective ones. Can we plausibly assume that the impact of the breakfast burger on global warming, figures naturally or substantially in its market price? Or that the consequences of internal-combustion-engined motoring for this has (at least until relatively recently) fundamentally influenced the demand for automobile industry jobs, or for motor trips through the countryside?

In short: prices and wages, the fundamental elements of national accounting systems, reflect, generally speaking, the manifest but not the latent consequences of the activities associated with them. Hence the Stiglitz Report’s (2009) recommendation for separate social indicator accounts, in principle *not* money-denominated, for these latent consequences of economic development.

Time-use studies: paid and unpaid work… and consumption

When we make the most fundamental of all economic distinctions, that between work and final consumption, we put aside the latent consequences—which often reflect the technological means of provision—and focus instead on the manifest. The crucial distinction for the understanding of consumption is that the wants that are satisfied by economic activity are directly related to the manifest but not to the latent consequences.

Work—to slightly extend Reid's original (1934) definition)— is "anything that one might pay some third party to do on our behalf, without losing the ***manifest*** consequences of the consumption that results from it".

This perspective provides a way of classifying categories of consumption. "Wants"—an alternative equivalent term might be "final service functions", corresponding to the "Z-goods" in Becker's widely used 1965 "Theory of Time Allocation"—are things that people might consciously expect and intend to obtain from their interaction with the material world that surrounds them. Wants, for food, shelter, amusement and so on, are relatively short-term phenomena, as distinct from those ultimate internal states— satisfaction with life, feelings of health and happiness—which might be considered closer to the fundamental purposes of existence but are certainly not to be derived directly from any specific economic activity or transaction. Simply: this latter group of experiential circumstances cannot be purchased "over the counter".

Define ***consumption*** as "the consequences of an individual's activities that penetrate the boundary of the self with the manifest purpose of providing for some sort of want". We can (I will return to this more fully in a moment) provide a list of these wants: for nutrition (food and drink provided through the mouth and olfactory senses), for shelter (bodily comfort obtained from clothing, furniture, and local environmental conditions), for intellectual or imaginative stimulation (music and other entertainment) through the ears and eyes, or physical stimulation from exercise or competition or collaboration with others.

Other materials and sensations may also be absorbed by the self, but as ***incidental by-products*** of specific activities and locations and co-presences. They might have negative consequences—discomfort, tension, perhaps permanent damage as from the stressful nature of work, or boredom from the lack of variety, or tiredness from its long duration. Or they might have positive consequences—physiological benefits that result from exercise in the workplace, for example, or feelings of achievement that result from overcoming difficulties ("exploit", to use Veblen's 1899 term from his "Theory of the Leisure Class") or indeed a sense of comfort or satisfaction from an awareness of having made a helpful social contribution (corresponding to Veblen's use of "industry" as an abstract noun). These longer-term, less direct, consequences undoubtedly contribute to—indeed may be fundamental to—people's overall feelings of well-being, life satisfaction or happiness. But since they are ***not the immediate and essential intent that motivates the activity***, they are not to be considered themselves as consumption, but merely as ***other outcomes*** which are absorbed by economic actors in various ways, perhaps in ignorance of their incidence, or because their effects are incorrectly assumed to have been fully compensated-for by wages or by money expenditures.

The extended 3rd person criterion together with the definition of consumption, provide two different categories of production, depending on whether a third party ***is*** or ***is not*** paid. The resulting three categories of time-use—consumption, paid work and unpaid work—exhaust the range of activities: all human life is made up of one of those three.

(Aas, 1978, further distinguishes "necessary" from "discretionary" consumption, but this is not required in or appropriate for what follows.)

We can measure the prevalence of the three categories of activity in a society, by asking representative samples of national populations to record exactly what they do at each point of time throughout randomly chosen days. Time-use diary survey evidence of this sort already exists for most rich countries and many poor ones—in what follows I deploy information culled from several million randomly sampled days from 23 countries over many decades, providing nationally-representative samples describing more than 10 million consumption events.

We can, from the foregoing definitions, distinguish two sorts of ***consequences*** or ***routes of influence*** from populations' daily activities to individual life-outcomes.

First are those that derive from final consumption as defined—from the final service functions. These are analogous to the economic outputs in conventional national product, but broader, extending to include non-money related (household and community) activity in addition to money-related (market) consumption.

Second are the consequences resulting from those other materials and sensations that penetrate the boundaries of the self, not in a manner directly or consciously intended to satisfy wants, but instead incidental to, or independent of, the end-purpose of the activity—for example absorption of stress or pollutants in the workplace, or the benefits of physical exercise acquired as an incidental consequence of childcare, or indeed, in Granovetter's 1978 example, acquiring new economic information ("human or social capital") from casual conversation while drinking in a previously unvisited bar.

These two categories, "consumption consequences" (or "economic out***puts***"), and "other consequences" (or "incidental out***comes***") require different accounting methods.

3. Out*puts* and out*comes*

The money value of the first of these two categories is estimated using "double-entry" accounting statistics. Conventionally: all money-value-added labour and capital ***inputs*** sum to the monetary value of National Product which is, by definition, identical to the money value of all ***outputs***, the total of National Expenditure. We can deploy something like the same identity when we extend the accounting to include the non-money economic activity.

We can add-in a valuation for activity outside the money nexus, by putting "shadow" values on time devoted to these. For ***unpaid work*** we use "shadow wage rates"—notionally equivalent to the wages actually paid to people doing analogous tasks in the money economy—cooks' wage-rates for domestic cooking, nursery teachers' for childcare, gardeners' for gardening, and so on. (Some economists prefer to use "opportunity costs"—the unpaid workers' own expected wages per hour, which are foregone by instead working unpaid at some other task.)

For ***unpurchased consumption***, we use "shadow prices", linked to the specific consumption items—hotel prices for nights' sleep at home, taxi or uber prices for a trip in a private car, restaurant meals for meals at home and so on—all adjusted for quality using methods discussed in a later section. From this perspective private households and other groups undertaking unpaid work (such as volunteering agencies providing final consumption services) are economic enterprises, entirely equivalent to firms in the money economy, and *produce **surpluses** for their members equivalent to the **profits** of commercial enterprises*.

One benefit from adopting the double-entry perspective on non-money consumption, is the provision of a certain sort of reality check (Holloway *et al* 2002) on shadow costings. Inputs from the money economy provide a lower bound, and the price of equivalent consumption purchased directly from the money economy provide some approximate sense of an appropriate upper bound of valuation (discussed in more detail in a later section). This sort of check is particularly revealing in relation to the opportunity-cost approach to valuations. The entire point of estimating extensions to National Product including non-money production, is to represent the full range of consumption values ***in a realistic manner***. Can it be realistic to value the cake baked at home by a dentist as twelve times that baked at home by a pastry chef, simply in line with their relative hourly wage rates, as might be required by the opportunity-cost approach? It is, at least potentially, the same cake, and the chef would also probably spend less time-per-cake than the dentist. Readers might also usefully consider which cake they would themselves prefer to eat.

Accounting for incidental out*comes*

At the heart of the "third party" definition of work is the proposition that work is ***entirely instrumental***, that it has no consequences other than enabling access to some set of consumption experiences. This is appropriate in relation to the dual-entry accounting system, since wages are assumed to *completely* compensate (or charge) the workers, not just for the human capital they employ, and the discomforts of the workplace, but also for any other costs (or compensating benefits) of the work. But as a result, all the material consequences of economic activity other than the intended consumption are suppressed in the valuation.

Nevertheless the same time-use information that is used to estimate the economic outputs can also be used to estimate the incidental outcomes. There are two classes of mechanism for this estimation: one internal to the time use diaries, the other external to them.

The diaries themselves can be used to collect impact information—for example, as suggested by Kahneman and colleagues in 2004, by asking diarists to record their affectual responses to their current activities as a basis for estimating "instantaneous utility". In fact, preferable to the sampling procedure (randomly selecting just 2-4 specific episodes through the diary day for the "instantaneous utility" report recommended by Kahneman and colleagues), is a (substantial, but unacknowledged in Kahneman's

accounts) prior literature (starting from Juster *et al* (1985), Juster (1990), with implementations by Erlich 1987, Robinson and Godbey 1997), collecting a 24-hour instantaneous utility sequence throughout the day diary (allowing, *inter alia,* the empirical estimation of marginal utility effects related to duration: Gershuny and Halpin 1996, Gershuny 2013).

Alternatively, diaries may be combined with external evidence. For example: all daily activities have some implications for levels of physical exertion. Ainsworth's compendium of physical activities (Ainsworth *et al* 2011) provides a comprehensive set of laboratory-based and externally validated estimates of the metabolic loads (METs) experienced as a consequence of various daily activities. Night-time sleep is estimated at 0.8 METs, sedentary work at 1.0 to 1.5 METS, and physical workouts at 7 to 10 METs. These can be directly applied to activities captured by time-use diaries (Tudor-Lock *et al* 2009), to estimate the distribution of physical activity levels across populations (Harms et al 2019). A second example, in the context of the recent COVID pandemic: the activity, location and co-presence information in a time use diary—perhaps combined with an additional "physical contact" field—can be combined to estimate the risk of infection arising from daily activities (Sullivan *et al* 2021).

Some of these outcome measures are experienced at an individual level. There are also examples related to the collective consequences of activities. Daily activity patterns have environmental "footprints"; each activity at a particular place and time requires inputs of energy and other materials resources, and has waste products that may be experienced collectively as pollution. Multiplying time devoted by populations to each activity throughout the day by specific coefficients estimating the sizes of these effects, produces straightforward estimates of environmental impacts (Schipper et al 1989, Longhi 2015).

This is the general form of the mechanism for accounting for "incidental outcomes". Durations in activities are multiplied by coefficients representing, not monetary values, but the various specific sorts of impacts. Dual entry estimates of National Product separately calculate the input values and the output values for economic activity, and then adjust these to ensure they provide identical values. By contrast, the single-entry accounting procedure sums the impacts of each moment, irrespective of whether the economic evaluation considers them work or leisure-consumption. The 2009 Stiglitz report called for wider use of these sorts of social indicators to parallel the economic. The procedures outlined here—the combination of dual- and single-entry approaches—produce the economic and the social indicators in an integrated way, starting from the same time-denominated evidence base.

4. Final service functions and extended accounting time budgets

The discussion of economic outputs directly suggests the principles that might underline calculations of extended National Product (eNP). The most fundamental requirement is for an appropriate classification of consumption. The arguments surrounding Figure 2

established that we need to distinguish between expenditures on services which are ***consumed directly*** (the economists' phrasing "consumed at the instant of production" conveys the same general idea), and on the other hand intermediate commodities, **goods or services *used in further processes of provision***. Also the observation that some final services provided directly by the money economy are at least partially substitutes for, or capable of being substituted by, non-money-based household provisions, means that we need a separate classification, of ***categories of want***, or distinct ***final service functions*** relating to different sorts of provision such as sleep and shelter, food and drink, leisure services, education and medicine.

The discussion implies the need for a complex classification of household money expenditure, crossing the directly- *versus* indirectly-consumed dimension (intermediate commodities versus final services), with the service-functional classification. This same service-functional classification can also be crossed with time-expenditure data, and used to organise evidence on unpaid work and consumption (which are respectively, unmeasured and only-partly-measured in the money expenditure data).

Combined, the money- and the time-expenditure materials provide a complete coverage of all economic activity. Table 1 is an example of such a paired classification system. It combines money expenditure activities as estimated by representative national surveys using the categories of the so-named UN Classification of Individual Consumption by Purpose (COICOP). It identifies eight final service functions, chosen for expositional convenience (travel expenditures are discussed in the next paragraph), though a much longer list may be needed for a full implementation of these concepts (see Appendix Tables A1 and A2). The cell-entries involve dividing some of the money expenditure categories between functions, (since for example some of the same expenditure categories span both the shelter and the food-provision expenditure categories).

Table 1. Spending time and money by Final Service Functions: examples of assignment categories					
	money expenditure categories			time expenditure categories	
Final service functions (Z-goods)	**Materials, inter-mediate services.**	**Capital items**	**Final services**	**Work time**	**Consumption**
(1) basic services sleep. Shelter	fuel, clothes, soap, repair services	Housing, furniture, clothes, domestic equipment	Cooking, housekeeping,, hotel stays, laundry	Unpaid clean, tidy, laundry, mend-ing, maintaining, diy, IT, shopping	sleep, rest, personal toilet
(2) eating and drinking in private spaces	Food, drink, power supplies	domestic equipment, "white goods"	Au-pairs, gardeners, cooks, cleaners	Unpaid prepare & cook, clean, tidy, laundry, mending, IT, shopping	eating at home or other private spaces
(3) childcare	Nappies	Prams, toys	Paid care provisions for young	Unpaid care for own & other children	(children's consumption time)
(4) other personal care services			Paid care provisions for old, differently abled	voluntary work, unpaid care for coresident & non-coresident elderly	Adults consuming personal care services
(5) leisure activities in private spaces		Tv, radios, computers, tablets, books, games		unpaid clean, tidy, clothes wash, mend, maintenance, diy, IT	Tv, video, reading, computer games, chats, hobbies
(6) physical exercise in public and private spaces		Specialised sports clothing and kit	Purchased training services, gym access etc.		playing sport, walking (including walking dog etc)
(7) leisure activities in public spaces	Leisure consumables games, fireworks, toys, books	Leisure equipment, boats, caravans, skis etc	Cinemas, theatres, concerts, sports events, restaurants, hotels		Eat and drink out, cinema, theatre, concert, sport event, museums, libraries
(8) High-end services, edu-cation, medicine, religion	Education materials,soft-ware, pharmaceuticals	medical kit (eg wheel-chairs, IT equipment).	Purchased medical and educational services		medicine, education, religious practices,
transport	Purchase of fuel, driver educ., garage services	Purchases & hire of cars, vans m/cycles	Purchase tickets for bus, train ,taxi, air transport	Driving vehicles unpaid	leisure trips
paid work				Paid work	

Table 2 provides a summary of mean time allocation by a representative sample of all UK adults (in 2014-15) .

Travel time, with one small exception, is treated as instrumental rather than as an end-purpose in itself. This is appropriate in the light of the substitutability, in most though not all cases, of travel by telecommunications, which enable "remote presence" in meetings and other activities. Similarly shopping is treated as instrumental rather than an end in itself—as a part of unpaid work—on the basis that (with a few exceptions) this is time devoted to the acquisition of goods and services which are subsequently inputs (as equipment, or semi-finished materials) to further production. There are small exceptions: trips where the travel is an end in itself (operationalised as ">=20 minutes' continuous travel both starting and finishing at home") which is treated as out-of-home leisure. This approach, of course, ignores the pure-recreational aspect of shopping ("hanging out at the mall", "window shopping,", and also unmotivated internet browsing); we can in necessary supplement the dual entry time budget by single entry measures that reflect these sorts of benefits

We can associate both final consumption time and non-work-related travel time to the consumption of specific categories of want. In latter case the diary format is helpful since it allows the algorithmic allocation of purpose (for example, set the trip purpose to equal immediately following non-travel activity, ***unless*** this is located at home, in which case e the purpose is assumed to be the immediately prior activity. Roughly 1085 minutes of the 1440 are associated with these two broad activity categories, leaving a total of 172 minutes of paid work time and 183 minutes of unpaid work time (both in row 21 of Table 2) to be distributed across the various categories of want

Allocating unpaid work time is more complex. On one hand some sorts of unpaid work (for example "cleaning" or "tidying") is generic, with consequences that spill across all home-based consumption, though some other categories ("bedmaking") are more specific. Different surveys have different systems of classification. Once needs for this kind of more detailed data have been clearly established, it is relatively unproblematical to construct time-use surveys which can provide this more finely-grained classification (Ironmonger and Soupourmas, 2009, for example, provide a time-diary instrument designed to capture some of this sort of detail). Alternatively and without too-much loss of information, this may be allocated among service function on the basis of analyst-defined rules related to consumption time differentials (Madsen et al 2025 Table 2).

Table 2 is read directly from the 2014-15 UK contribution to the Harmonised European Time Use Study (HETUS) data, which provides the time budget information needed for extended national accounts, The bold figures provide all the information that can be drawn directly from the diary evidence alone. In column 5, consumption time is classified by the category of want that is being satisfied. The totals of paid work, unpaid work and work-related travel time are also read directly from the time diary data. The Time Budget total (column 6 row 21) is the 1440 minutes of the society's Great Day.

Table 2: UK Time Budget for extended National Accounting 2014-15

Information from time diaries alone

	Minutes per day, Adults aged 18+	1 paid work	2 unpaid work	3 work related travel	4 travel for consum-ption	5 consum-ption	6 all UK time	7 imported worktime
	non-SNA ACCOUNTED ACTIVITIES							
1	sleep, rest, personal care	?	?	?	**4**	**590**	?	
2	eat drink @ home	?	**50**	?		**65**	?	
3	sociable activity @ home	?	?	?		**51**	?	
4	Childcare	?	**25**	?		**6**	?	
5	adult care, volunteering etc.	?	**8**	?		**2**	?	
6	video, audio, read	?	?	?		**170**	?	
7	using computer	?	?	?		**14**	?	
8	hobbies, games @ home	?	?	?	**1**	**18**	?	
9	extra-SNA accounts-related time	?	**183**	?	**5**	**916**	?	
10	SNA-ACCOUNTED ACTIVITIES							
11	doctor, hairdresser etc	?		?	**2**	**4**	?	
12	out to eat, drink	?		?	**13**	**31**	?	
13	cinema, public events	?		?	**4**	**8**	?	
14	meetings, religious practise	?		?	**9**	**5**	?	
15	education etc	?		?	**1**	**8**	?	
16	sport, physical exercise	?		?	**4**	**26**	?	
17	UK SNA accounts-related	?		?	**33**	**82**	?	
18	exported time	?					?	
19	all SNA accounts-related time					**82**	**82**	
20	non-exported paid // unassigned time	?					?	
21	All UK time use	**172**	**183**	**45**	**39**	**998**	**1440**	

For the next step we must turn to the classification of expenditure, not of time but of money. The purchase of household equipment, motorcars, and expenditure on private houses is, straightforwardly, capital investment, not consumption. Similarly, some sorts of purchased services (such as garage, home repair and decoration) are intermediates, in effect maintaining or otherwise complementing the capital equipment used in further non-money production activity. Households' purchases of materials such as foodstuffs or fuel are not themselves directly consumed, but rather, *used* in various sorts of further non-money-based production in private households and similar institutions.

Indeed, strictly considered, the same status applies even to take-away foods delivered to the home—since they are normally consumed in domestic circumstances which

deploy the household's material capital (housing, heating, furniture) to present the final meal, in much the same way that a restaurant combines foodstuffs and paid labour for cooking and serving, with tables, chairs, napery and crockery in a comfortable physical environment—which, indeed, corresponds to the treatment of manufacturers' deployment of plant and equipment alongside labour. If commercial output is to be understood as combining capital and materials to add value, part of which is distributed as profits to the providers, so too should the value pf the output of the private household—when considered as a productive enterprise—include a "surplus" value corresponding to profit (or rent) accruing to household members.

As the foregoing makes clear, the extended economy perspective implies that the misleadingly-named COICOP categories must be reclassified into two distinct components, respectively intermediate and final provisions—with only the latter constitutin consumption as defined here. Also for these purposes, as Stiglitz and co-authors (2009) remind us, we must add, to individual or household COICOP expenditures, the other intermediate services provided, by the state or other agencies, free at the point of consumption. This includes, not just, or even principally, physical infrastructure (such as roads or the plant for electricity transmission grids), but also background services including human-rights-type service provisions (such as health care and educational provisions) as well as law-and-order and national security provisions (which correspond to Adam Smith's "fleets and magistracy"),

The largest component of final money expenditure comes from households. Table 3 is calculated from the standard source of evidence, the UK Food and Household Expenditure Survey. The 14 row-categories in Table 3 are the 2-digit codes from the UK version of COICOP. The percentage columns of Table 3 are calculated by allocating each of the 400-odd 4-digit codes of the UK COICOP by the nature of the contribution of the expenditure to its end-use (details available on application). So, to focus again on COICOP category 7 "expenditures on transport", capital equipment (eg automobiles), infrastructure (public expenditure on roads), intermediate (garage) services or materials (petrol) are all more properly classified as intermediates, *means* for the provision of transport services. Only expenditures directly on the final service categories (train, bus, air travel, also located in the same COICOP category 7) are counted in the "consumed when purchased" column, which denotes the satisfaction of some final human *end*, *want* or *purpose*. Equivalent attributions for all the other categories, provide us with an overall total distribution of 64% of all expenditure falling into the intermediate category and 36% of expenditure as relating to final consumption.

A rather more detailed version of Appendix Table A3 would allow us to associate money expenditures (by private households and the other agencies, and by the state in the form of provisions free at the point of use) with each of the rows of time expenditures in Table 2 (an example is provided by Madsen *et al* 2025). In turn, these money expenditures might be traced back, via the standard input-output tables, to production from the originating industries. Investment expenditures may be re-attributed to the receiving industries, and annualized (treated in the same way as semi-finished, and stocks of finished products).

Table 3 Components of household spending, UK 2018 (Household Expenditure Survey)

	COICOP Expenditure categories	% consumed when purchased	% input to further production	average weekly spending, all households (£)
1-13	**All expenditure (excluding "other recorded")**	34.1%	65.9%	**£512**
1	**Food & non-alcoholic drinks**	0.0%	100.0%	£61
2	**Alcoholic drink, tobacco & narcotics**	0.0%	100.0%	£13
3	**Clothing & footwear**	0.0%	100.0%	£25
4	**Housing, fuel & power**	0.0%	100.0%	£76
5	**Household goods & services**	0.0%	100.0%	£41
6	**Health**	52.0%	48.0%	£7
7	**Transport**	25.6%	74.4%	£81
8	**Communication**	100.0%	0.0%	£18
9	**Recreation & culture**	54.1%	45.9%	£75
10	**Education**	100.0%	0.0%	£9
11	**Restaurants & hotels**	79.3%	20.7%	£50
12	**Miscellaneous goods and services**	70.8%	29.2%	£44
13	**Other expenditure items (holiday expenditure)**	100.0%	0.0%	£12
14	***Other recorded*** *(tax, pension, saving, insurance, gambling, windfalls, addnl. free services)*	*100.0%*	*0.0%*	*£150*

[SOURCE: HETUS_ELIDDI inte4rcode 2.xlsx=> <economics backwards\cons and prod3.sps>]

And finally the Labour Force Survey, whose respondents, classified by both industry and occupation, provide estimates of the time spent in paid work, allows this vector of money expenditures by purpose and originating industry, to be substituted by time in paid employment, replacing the queries in column 1 of Table 2, with equivalents to column 1 in Table 4.

The input-output tables allow us to re-allocate investment expenditures to the investing industries. And, particularly helpful, they also allow us to account for paid labour time embodied in exports. We can also (though these are not strictly necessary for the

accounting process) make guesses (perhaps based on UK labour productivity levels) about the extent of labour time embodied in imports (though of course these do not contribute to National Product) .

In fact Table 4 does not deploy the involved and demanding methods set out in the previous paragraphs. Instead I have subtracted 29 minutes of exported paid work in the UK Great Day—estimated on the basis of 2018 UK annual exports and UK labour productivity (and roughly balanced by the net 25 minutes of imported work time in column 10, also estimated from UK labour productivity rates)—from the 172 minute of paid work found in the time diary study and then (with the simplifying assumption that both have the same mean labour productivity) divided the resulting total of 145 minutes per day of non-exported paid work in the 66/34 percentage proportions for SNA and extra-SNA-related work time(calculated from Table 3. This produces the totals of 92 minutes of paid work-related to further production outside the SNA, and 54 minutes of paid work devoted to enabling final consumption of SNA output. For the moment the more general categories of unpaid work (cleaning, tidying, maintenance, gardening and pet care) are distributed to column 2 rows 1 to 8 of on a similar *ad hoc* basis.

Travel—following the sense of the discussion in previous sections—is treated for these purposes as entirely ***instrumental***, as ***enabling*** final consumption (a similar logic should perhaps also apply to the row category "computer use"). The "travel for consumption" column 4 assigns all trips in the time-use diary to specific purposes (to categories of want) according to the procedure use by the UK National Travel Survey: purpose is assigned to be the non-travel activity that immediately *follows* each diary travel episode, except where that activity is located at the diarist's home—in which case the trip purpose is taken to be the last non-travel activity *before* the start of the trip. So the sequence "at home, travel, at work, travel, home" is correctly identified as "travel related to paid work".

However we need not, for the moment, be distracted by the detailed calculations underlying Table 4. The most important general message of the present argument relates to column 5 of Table 2, which emerges directly from the time diary data and remains unchanged in Table 4. This vector, of time devoted to each of the various categories of final consumption, identifies the final purposes of all the society's economic activity. This vector is unique to time diary evidence, and the evidence of consumption it contains is not available from any other source whatsoever in conventional economic statistics. The money-equivalent value of all paid plus unpaid production must, according to dual-entry accounting rules, exactly balance the money value of this consumption. So the time budget in Table 4, provides, in principle, a complete and exhaustive representation of the economic activity of the UK—a representation that is not available from any other of the data sources in the economists' arsenal of evidence. And, crucially, the fact that consumption is observed comprehensively—all consumption activities are registered by time diary instruments—means that it provides a clear and unambiguous estimate of the time equivalent of that otherwise entirely elusive concept, the General Production Frontier.

Table 4: UK time budget for extended National Accounting 2014-15 (Deploying time-diary, money expenditure-diary and other information)

	Minutes per day, Adults aged 18+	1 paid work	2 unpaid work	3 work related travel	4 travel for consum-ption	5 consum-ption	6 all UK time	7 imported worktime
	non-SNA accounted activities							
1	sleep, rest, personal care	*20*	*26*	*6*	**4**	**590**	*646*	*4*
2	eat drink @ home	*14*	*83*	*4*		**65**	*167*	*3*
3	sociable activity @ home	*11*	*26*	*3*		**51**	*92*	*2*
4	Childcare	*1*	*29*	*0*		**6**	*37*	*0*
5	adult care, volunteering etc.	*0*	*9*	*0*		**2**	*12*	*0*
6	video, audio, read	*37*	*9*	*12*		**170**	*227*	*7*
7	using computer	*3*	*1*	*1*		**14**	*19*	*0*
8	hobbies, games @ home	*4*	*1*	*1*	**1**	**18**	*25*	*1*
9	extra-SNA accounts-related time	*92*	**183**	*28*	**5**	**916**	1224	*16*
10	**SNA- accounted activities**							
11	doctor, hairdresser etc	*3*		*1*	**2**	**4**	9	*0*
12	out to eat, drink	*20*		*6*	**13**	**31**	71	*4*
13	cinema, public events	*5*		*2*	**4**	**8**	20	*1*
14	meetings, religious practise	*3*		*1*	**9**	**5**	18	*1*
15	education etc	*5*		*2*	**1**	**8**	17	*1*
16	sport, physical exercise	*17*		*5*	**4**	**26**	52	*2*
17	UK SNA accounts-related	*54*		*17*	**33**	**82**	186	*10*
18	exported time	*29*					*29*	*15*
19	all SNA accounts-related time					**82**	**82**	
20	non-exported and unassigned time	*145*					3	
21	All UK time use	**172**	**183**	**45**	**39**	**998**	**1440**	*41*

5. Out*puts*: episodes and durations

The alternative ways of accounting for time allocation are particularly relevant for valuation of outputs. Sample or population mean times in activities (as in the cells of Tables 2 and 4) can be deconstructed into "*episodes*" (occasions on which individuals participate in each activity) and "*durations*" (elapsed time devoted to the activity by those who participate in it on the diary day). If all episodes are assumed to last less than 24 hours, and multiple episodes of the same activity during a single day are amalgamated, then, as in Table 5, the product of the participation rate and the mean duration of

participants' episodes, is equal to the mean time devoted to each type of activity as part of the society's Great Day.

Table 5 Consumption episodes: mean times, participation and duration

(UK 2014-5 adults >.=18)	Minutes per day	Participation rate	Participants' mean minutes	N of participants
Non-SNA related final consumption				
sleep, rest, personal care	590	1.000	590	12428
eat drink at home	65	0.914	71	11358
Social communication at home	51	0.594	86	7378
Childcare	6	0.028	228	343
adult care	2	0.006	291	80
video, audio, reading	170	0.877	193	10905
using computer	14	0.223	64	2767
hobbies, games at home	18	0.185	97	2303
SNA-related final consumption				
consume final services	4	0.061	64	757
out to eat, drink	31	0.386	81	4800
attending cinema, public events	8	0.069	120	854
meetings, religion	5	0.058	91	716
education etc	8	0.041	204	505
play sport, physical exercise	26	0.301	85	3746
N of diary days				12431

Table 5 is the final consumption vector from Table 4—Column 5—now disaggregated into these two components. We can see that for example just three of the 12,431 days accounted for in these tables, included no time in sleeping or personal toilet, whereas only 6% of the days involved any religious practise, but those who did participate in this sort of activity, devoted, on average just over an hour and a half to this.

Alternatively, rather than amalgamating daily episodes to produce a binary diurnal participation rate as in Table 5, we can calculate a daily frequency of participation—for example the count of three meals in a day—in which case the simple equation $T=p.T'$ (sample mean time/day equals participation rate multiplied by mean daily elapsed time per participant), is replaced by $T=f.t$ (mean time/day equals diarists' daily frequency of participation in the activity, multiplied by the mean duration of each episode). This episode-related representation of the time-use diary information is the most useful for *estimation of the values of final outputs*.

Valuing outputs

We are accustomed to relying on valuations of unpaid labour inputs to estimate the scale of the extended non-SNA National Product. The procedure for identifying "shadow wages", using jobs in the money economy, might involve finding near-equivalents to the unpaid work tasks: nursery nurses for infant care, paid cooks for home cookery, transport workers for driving private domestic cars, paid gardeners for gardening in private houses, paid care workers for adult care tasks, accountancy assistants for domestic administration task, and so on. Or as an alternative to the specialist task, we might use a generalist covering a wide range of tasks—a "housekeeper wage" for example to represent the of employing an individual to cover the full range of these tasks.

In a similar way, we might (following Holloway *et al* 2002) estimate "shadow costs" on the basis of final service outputs sold to their consumers directly from the money economy, which are analogous to commodities produced by private households and voluntary agencies. So, rather than valuing households' input of cooking-type labour to the production of meals, we look to their ***outputs*** of meals, valuing these as equivalent to similar meals sold by cafes or restaurants. Instead of care workers' wages, we use the costs/prices of stays in a care home. Not, in the output valuation case, the wage of the accountant or the cook, but instead the fee paid by the client for an item of accountancy services, or the price paid for a dish of restaurant food.

In some cases we might value the service as ***the "shadow price" of a discrete episode***: a family meal, for example. We can use evidence from the time-use survey about the physical equipment of the household and the capabilities of its members, to provide adjustments for the quality of household outputs. So the value of a meal provided by a skilled cook in a large well-furnished and -equipped house approach the price that would be charged by a Michelin-listed restaurant, while a meal in an ill-furnished over-crowded flat might be the cost of a meal in a neighbourhood café. The shadow price of a night's sleep might similarly be valued differentially for variously equipped households by prices in a five-star hotel at one end of the scale, and a back-packers hostel at the other. In other cases, rather than a one-off episode-price we might instead use the ***time duration in the consumption episode multiplied by a shadow price-per-minute*** for an equivalent activity; an episode of consumption of adult care, for example, might be valued as the product of the elapsed minutes in the episode, and the per-minute cost of a day in an adult care home.

One advantage of the shadow-price-based output approach over the shadow wage input approach, is that the former includes all the non-labour costs (capital, infrastructure, materials) embodied in the final service as it is ultimately consumed. The non-labour inputs can be assessed on an *a priori* basis, by allocating COICOP expenditures to each of their specific purposes.

But what of those aspects of final consumption of household products that have no associated labour inputs? The consumption of passive entertainment, for example (television, streamed music or films) has a real value that goes beyond the cost of

electricity and the depreciation of the household equipment. The usefulness of input-valued statistics ***in combination with*** output-valued statistics, is that together they provide floor and ceiling values for ***all*** the extra-SNP activities. The household expenditures (substituting depreciation of household equipment for expenditure on it) plus the value of final services provided without cost at the point of production, plus the shadow wage cost of the labour inputs, provides the floor, while the shadow output price provides something like a ceiling (though in some circumstances the extra convenience of a service provided within the home might produce a value that exceeds this ceiling).

Perhaps the most important aspect of the output approach is its application to valuing the effects of domestic capital in combination with the labour and other inputs. Enterprises operating within the money-based SNA economy produce profits by combining capital, labour and materials. Similarly, households-as-enterprises also produce surpluses for their members. After all, just as the quality and value of purchases of a restaurant's or a hotel's services are increased by the particular combination of location, design and furnishing, as well as by the skills of the employed labour, so the efficacy of a meal, of a night's sleep, or of a session of passive entertainment at home, is enhanced by the quality and appropriateness of the housing and of the household's equipment, in addition to the productive skills of the household members.

6. Chains of provision

Having established a categorisation of economic wants, we can return to consider the Adam-Smith-like questions of alternative modes of organization to satisfy them.

In the very broadest sense, "technologies" can be thought of as including all the technical and organisational characteristics of the processes which go to satisfy wants. We might presume that virtually all societies, from the simplest to the most complex, afford multiple alternative "modes of provision" for each broad category of want. The very simplest "modal split" (to borrow a term from transport modellers, who have good reasons for understanding this concept) involves the binary alternatives of self-provision for wants by individuals or members of primary groupings, as opposed to provision by servitors or slaves (who might be enforced junior or partial members of larger and richer households). As technologies advance, and with the emergence of productive surpluses beyond the requirements for survival and reproduction, new specific tasks emerge, related to gathering, producing, preserving and storing food (eg pot-making), or indeed artistic production—the earliest known sculpture is found amongst other human remains in Ice Age settlements from 26,000 years ago (British Museum 2025). These presumably allow in turn the development of a more complex ecology of primary groups of various sizes, which contribute to the increasing separation of task and what we might think of as occupational specialisation in an emerging division of labour.

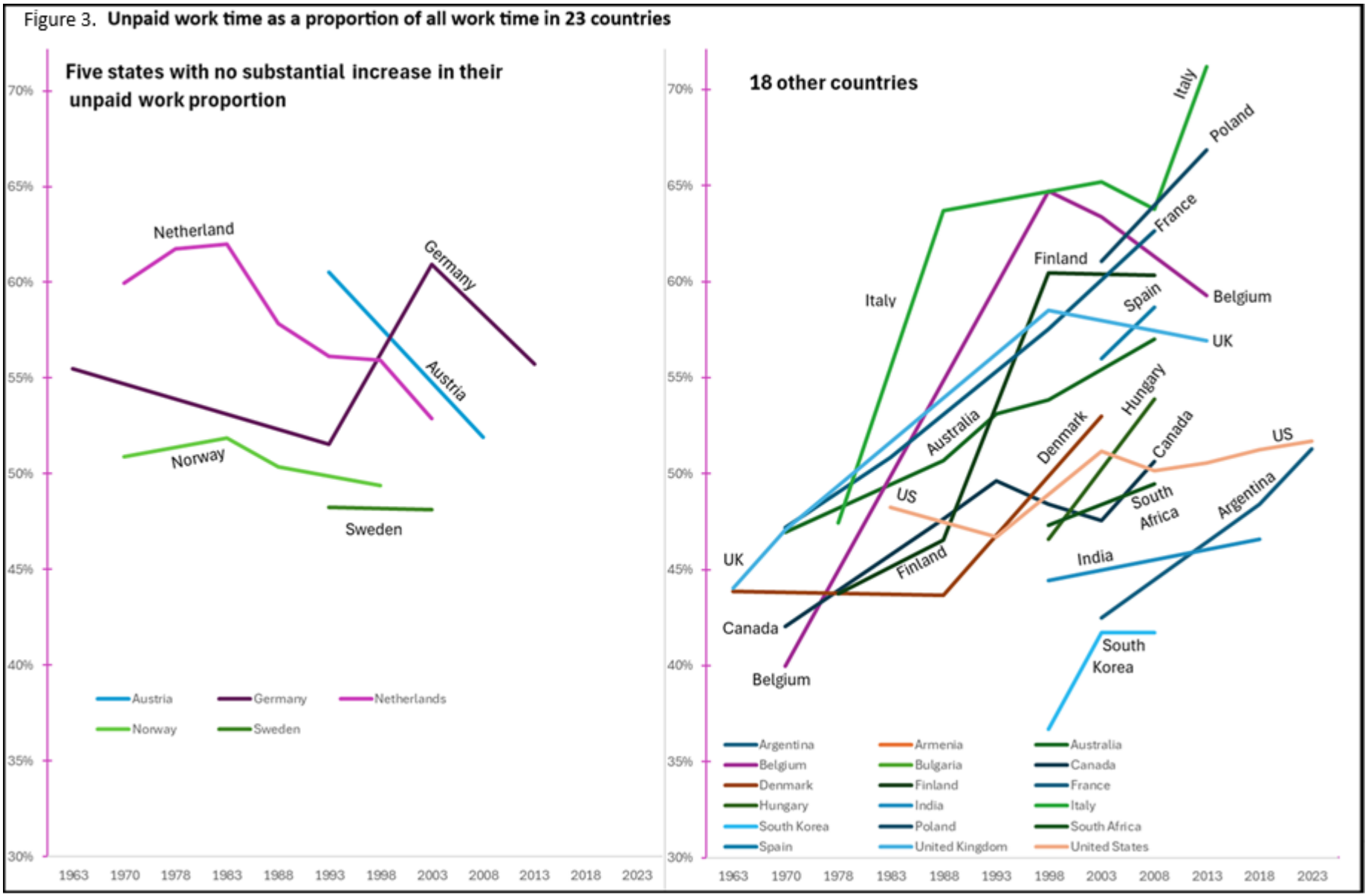
There is, at least to the economic sociologist, a puzzling rift between this conceptualisation of economic activity and that of economists of Quesnay's or Adam Smith's generation. Smith's (surely fictional) account of innovation in the control of a

beam engine (as the automatic opening of a steam valve pioneered by the child previously tasked with opening it manually as the piston stroke reached its maximum), and his certainly-borrowed example of the pin factory (Taylor 2022), both seem curiously impoverished or blinkered by their exclusive focus on money exchange as the defining characteristic of economic activity. Indeed Quesnay's exclusion of manufacturing and Smith's exclusion of services from their respective accounts of economic activity, presumably reflects the absence of any even rudimentary empirical evidence of what may be happening outside the realm of exchange. Maybe these reflect in addition some aspects of eighteenth-century sexism and class-prejudice—the disparagement of women's economic contribution and the subservience of lower orders engaged in trade or of service workers "servants"). This consideration provides the opportunity to introduce a second tranche of time-use evidence.

The *continuing* growth of economic activity outside the money nexus

Figure 3 shows the ratio of unpaid labour time to the total of paid and unpaid work time in a range of countries at various points in recent history. These are calculated from a collection of large-scale, nationally representative time-diary surveys, brought together as the Multinational Time Use Study (MTUS: Lamote et al 2023). The most recent estimates for 18 of the 23 countries represented in Figure 3 have more than 50% of their total work time (paid plus unpaid) located outside the System of National Accounts Production Boundary (SNAPB)—and the 18 countries in the right-hand panel exhibit a long-term historical trend of quite substantial growth in this proportion. Of the five cases shown in the left-hand panel, three (Germany, Austria and the Netherlands come from Esping Andersen's (1990) socially conservative "Corporatist" grouping of national regimes, and two (Sweden, Denmark) from his progressive "Nordic" group. Sullivan and Gershuny (2003), and Kan et al (2011) provide a discussion of how extra-SNA economic activity is differentially reflected in the time-use patterns associated with these regime-types. We might speculate that the corporatist group have maintained, at least until recently, a traditionally gendered division of paid and unpaid work, while the Nordic have tended to provide high levels of paid childcare—resulting, in both cases, though for diametrically opposite reasons, in a limit on the growth of households' unpaid work.

Figure 3. **Unpaid work time as a proportion of all work time in 23 countries**



The evidence for this continuing and mainly increasing importance of extra-SNA economic activity (first predicted speculatively in Gershuny 1977) runs directly contrary to the widespread perception that " informal economic production" (so-named by Hart 1973) is chiefly a phenomenon of less developed countries and perhaps to be regarded as an archaic form of production. Note, for example that the least economically-developed of the 24 countries represented here, India, has a lower unpaid work proportion than all but one of the other, much richer, countries.

Much of the growth in the unpaid work proportion during the last half of the 20th century reflects the mainly post-WW2 "self-servicing" industrial pattern, in which final mass-services, transport (trains and buses), entertainment (cinema), laundry and similar services, neighbourhood shopping and other facilities, were progressively replaced by a combination of manufactured, increasingly automated, and ever-cheaper household equipment (cars, televisions, washing machines refrigerator) which could be combined with unpaid household labour to produce the sorts of final consumer services discussed in preceding sections. These innovative technologies (deploying fractional horsepower electric motors, electronic valves and then transistors, pressed steel and plastics for casings and assembly, with their associated infrastructures (road networks, electricity grids, broadcasting facilities, water and sewage provisions, supermarkets) together promoted or enabled a "Kondratieff Wave" of innovation-related economic growth through the middle and later decades of the century (Freeman 1982).

A subsequent Kondratieff wave of innovations, based on microelectronics, with terrestrial telecommunications networks and communications satellites combined with local network facilities, and ancillary equipment (home computers and laptops, closed circuit video monitors and alarms), allows the domestic production of an ever-wider range of services ranging from downloaded or "narrowcast" entertainment, via remote security services, to distance-provision of personal medical and other advice, teleshopping and browsing. 1980s forecasts of the internet revolution (from Gershuny 1984 among others (which led directly to the start of the MTUS dataset) was both over-optimistically premature (predicted to take off in the 1990s) and then initially (with the failure of the 2000 "dotcom bubble") unsuccessful. But nevertheless the economic impact of these developments—and particularly of the most recent wave of telecoms-related innovations, which involve artificial intelligence and minimal unpaid work inputs, but nevertheless occupy a substantial and increasing part of all consumption time, and are, as previously noted, not observed by any other regularly collected statistical instrument—provide the strongest possible argument, both for the collection of time-use datasets, and for the extension of the standard dual-entry SNA-type statistics using these data.

7. Single-entry estimates: outcomes

Finally I return to the arguments set out previously, to the effect that dual-entry statistics cover only the manifest consequences of economic activity, and not those, arguably

more fundamental, latent consequences, for health, life satisfactions and perceptions of happiness or wellbeing. Time-use diary survey evidence is uniquely well placed for the provision of statistics relating to these. I provide just three examples from a growing literature.

The most direct, is the measurement of instantaneous enjoyment of daily activity. Kahneman's only partly ironical (1999) use of the term "objective happiness" refers to measurements within a diary instrument and related to specific activities close to the time of their occurrence. Dolan and Kahneman 2008 (p. 229) provide a balanced discussion of the advantages of this methodology. However Kahneman's 2004 proposal (with others) of the "Day Reconstruction Method" is at once more complex (with multiple affect indicators) and less comprehensive (being collected very discontinuously through the diary day) than the instrument he alludes to in his 1999 Introduction to Hedonic Psychology. In its original 1980s form, first suggested by Juster, Stafford and Robinson (1985) from the University of Michigan, and by the British psychologist Alma Erlich (1987), it consists simply of an additional field in a standard time-use diary in which respondents record, continuously, episode by episode throughout the day, how much they enjoyed the currently listed main activity. This approach has recently (Krekel and MacKerron 2034) been compared to a conceptual device "the hedonometer" proposed by Edgeworth in the 1880s, recording enjoyment in the same continuous manner that a barograph records barometric pressure during the day. Total national enjoyment (or, Kahneman's 1999 term "instantaneous utility") statistics can be derived directly from diary instruments collecting this data, as the whole-day-sum of the products of the enjoyment levels and elapsed time in the concurrent main activity.

Figure 4 (with mean daily enjoyment levels and their 95% confidence intervals for 9 broad activity groupings) illustrates the remarkable convergence of this sort of enjoyment estimate from the 1980s US and the UK datasets cited above. The left half of the figure shows US results, the right UK; we see, in the two countries, first a strongly similar overall pattern of preferences, with out-of-hole leisure strongly and significantly the most favoured activities followed by sleep and other home leisure, then tv and finally paid and unpaid work and shopping; men's and women's preferences are generally quite similar (though with significant exceptions—British men for example expressing substantially higher preferences for unpaid work).

Figure 4. US and UK men's and women's mean enjoyment and 90% CIs, broad activities mid-1980s

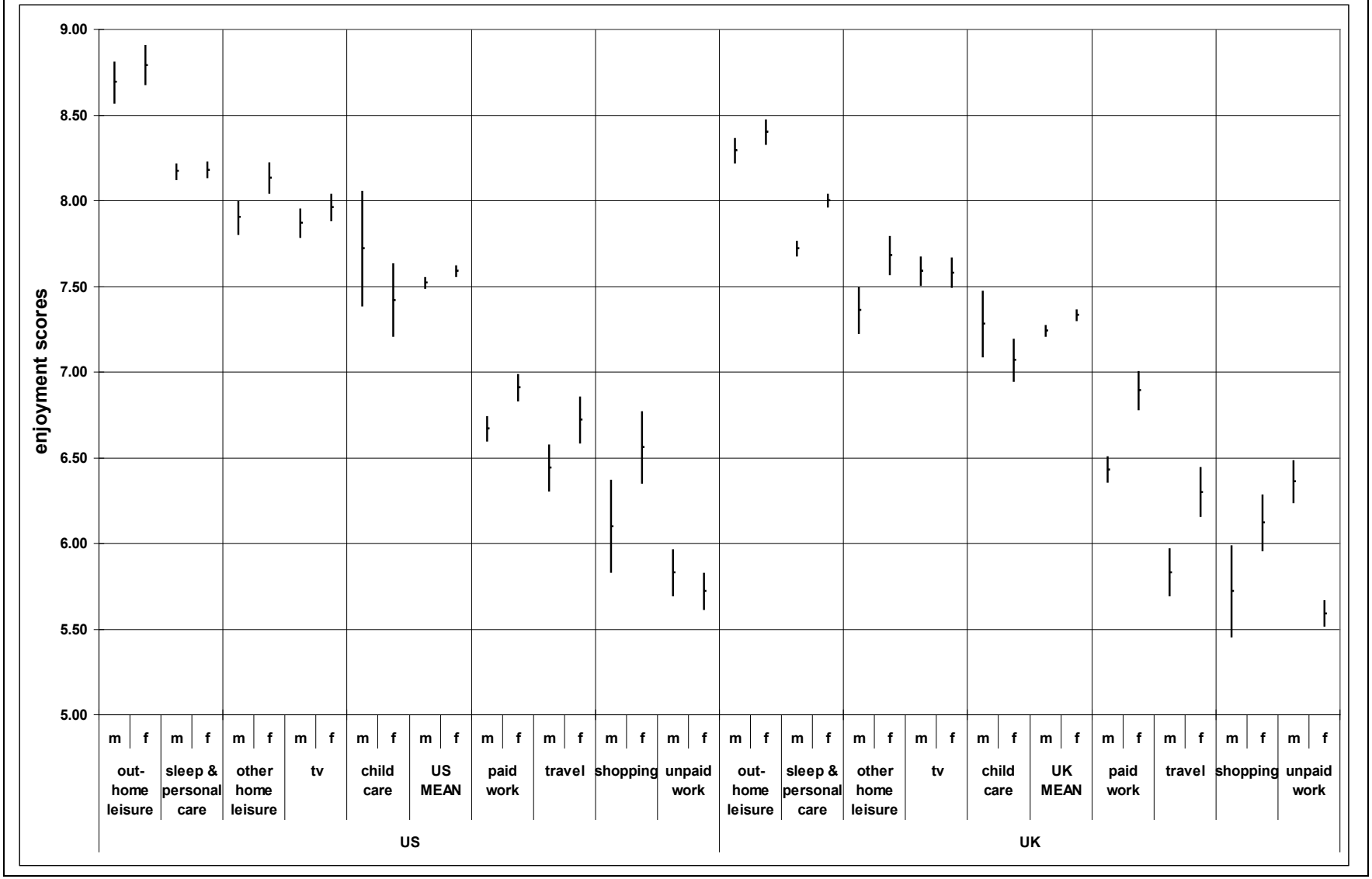
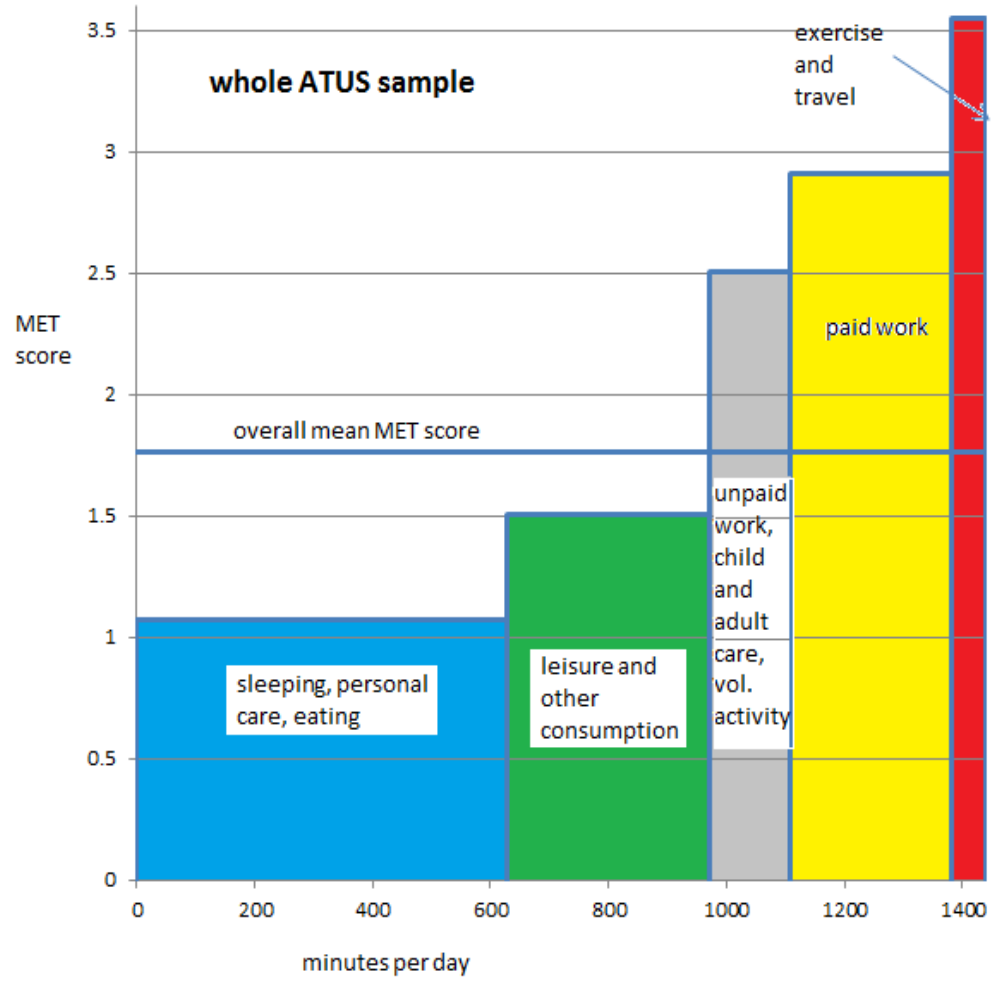
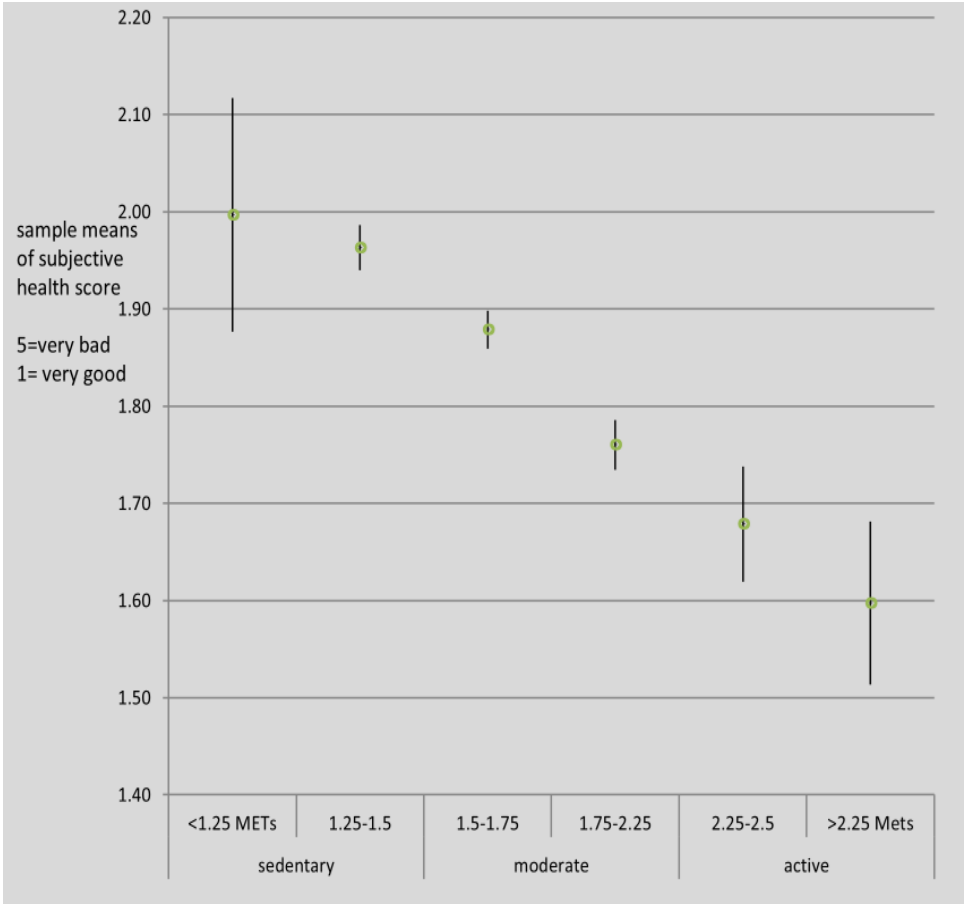


Figure 5 METs from all sources, and the relationship of total daily METs to subjectively scored health status



UK 2015 Subjective health by whole day exercise levels
(Adults daily means METs and 95% confidence intervals)



Appendix Figures A1 and A2 are the basis for a separate chapter, currently in preparation, on direct measures of instantaneous enjoyment of activities. Figure A1 shows estimates of instantaneous enjoyment levels for 63 daily activity categories, drawn from the UK 2014-5 contribution to the Harmonised European Time-Use Study; the generally non-overlapping confidence intervals demonstrate that that the 15,000-day sample size is sufficient to provide useful detailed hedonic indicators. Figure A2 shows results from OLS modelling of marginal utility plots drawn from a smaller (6,000-day 2016-2022 diary dataset) from the UK. It show clearly the characteristic shapes that would be expected of hedonic data. The five consumption categories (sleep, eating, exercise, media use and other leisure) display clearly diminishing marginal utility, with marginal enjoyment turning negative at plausible activity durations—sleep, for example, doing so around the 8-hour level. The paid and unpaid work categories show negative marginal enjoyment throughout their range. The travel category shows negative marginal utility at low levels, but then increasing beyond the two-hour mark, where the nature of the travel shifts progressively from instrumental (commuting, shopping) towards travel-for-pleasure.

A second type of single-entry accounting makes use of external referents, providing some form of valuation for the various activities recorded in the diaries. For example individual metabolic load statistics (MET scores) initially estimating the level of exercise associated with each of approximately 500 daily tasks—ranging from childcare and shopping via gym exercise to nights' sleep—are collected in the Ainsworth Compendium (Ainsworth et al 2011). These were subsequently attached to time-diary activity categories (Tudor-Locke 2009), which can in turn be attached to the activities recorded in time diary records (as in Harms et al 2019). The left-hand panel of Figure 5 shows the make-up of the mean daily METs score for a 2015 American Time Use Study (ATUS) sample. We see that, though, unquestionably, the very highest instantaneous metabolic loads are associated with purposive exercise (eg in gymnasiums) and with active travel (walking and cycling), only a very small proportion of the daily metabolic load is associated with these. Averaged across the adult sample, activities associated with paid work provide, something like five times this load, while time devoted to housework and child-care accounts for about twice as much as intentional exercise on the average day.

The right-hand panel of Figure 5 shows the cross-sectional relationship between the diary respondents' mean daily METs, and their self-reported health status (see also Appendix Figure A2, modelled by a simple OLS regression; Harms et al 2019). There is clearly no implication of a unique causal link in either direction, but nevertheless the highly plausible shape of the association makes it apparent that the METs indicator is working in the expected way.

A third example was developed by the UCL Centre for Time Use Research during the COVID period to estimate the infection risk of daily activity patterns—simply allocating an infection-risk level to each activity category (ranging from zero-risk attached to activities at home with no copresence, and a maximum score 7, attached to travelling in crowded public transport) and then assessing an overall riskiness level for the day (Sullivan *et al* 2021). Again, the same technique for estimating the population risk level as the product of each duration in an activity and its riskiness rate, summed across the diary day.

The common point across these three examples, and for many other similar ones, is that, instead of balancing money-valued inputs against outputs as in double entry accounting, we calculate a single sum, using the diary to estimate the prevalence of every activity throughout the diary day, and multiplying each of these durations by a set of corresponding non-money weights—hence, "single entry" accounts.

8. Conclusions and Limitations.

It will prove to be possible to reverse the accepted order of economic accounts—starting, not from production, but from the full range of final consumption activities, as discoverable from time diary surveys, working backwards through unpaid labour and paid work and other inputs—based on two different sorts of contribution, one broadly theoretical or definitional, the other empirical.

The definitional component of this turns on a conceptualisation of consumption as ***the transition of the manifest consequences of (economic) activities from an individual's environment, across some sensory boundary (mouth, eyes, ears, skin) to enter and change the state of that individual's self***. This definition in turn relies on a distinction between manifest consequences in the form of some intended or desired end, and latent or unintended consequences which may not be explicitly or comprehensively recognised nor fully understood by the actor. We can then say that the particular means which are adopted to achieve the ends are, in the most general terms, ***work***, as defined by the 3rd person criterion (combined with the travel necessary to undertake the work or the consumption).

This approach also encourages us to differentiate between, on one hand, those ***manifest*** consequences, which are sufficiently well-understood by the actor to allow an explicit calculation of the balance or equalisation of advantage between the means and the end, and on the other, ***latent*** consequences which are not included in this calculation—and therefore not implicated in any monetary or analogous transaction. The former are the subject of dual entry accounting—which, if all episodes of consumption registered in the time-use diary are included, exhausts the full range of all human activity, and provides an empirical referent for the society's General Production Boundary. Since the latter are not traded—and even though various tendentious arguments might be advanced to provide monetary equivalents—they can have no straightforwardly meaningful market-based

(and hence consumer-choice-derived) money prices, and their consequences cannot (or perhaps ***should not***) therefor be added in to National Product.

But the absence of market or similar prices does not make these unexpected consequences negligible. On the contrary: while for example the tiredness resulting from a period of paid work may be to some degree figured into the wages paid and received for it, the for-the-most-part ill-understood secondary consequences—for instance Jahoda *et al* latent consequences such as time structuration, the metabolic load resulting from physical activity, the sense of societal purpose and so on—may be of more importance, in the longer term, for the individual's health, happiness and well-being. Hence the importance of the single-entry accounts to run in parallel with the dual-entry. The single-entry accounts use the same data as the dual, but directly register consequences that would be disguised, and perhaps become unrecognisable, if translated with whatever justification into money values.

And the use of a "dashboard", multiple metrics—extended dual-entry National Product alongside single-entry social indicators—as proposed by Stiglitz, raises no insuperable problems for the formulation of public policy. On the contrary, the fact that the same data is used for the two sorts of accounts, means that forecasts based on extended National Product may be set against their associated implications for material wellbeing without the obfuscatory intervention of imposed monetary valuations. To continue one of the examples discussed in the previous section, it is surely preferable that we should observe that some particular line of economic development has some specific material consequence for change in the level of self-assessed health, rather than discussing some perhaps questionable indirectly-estimated money value of that change.

Representing both work and consumption in terms of a population's time use seems straightforward—and indeed unavoidable, insofar as much economic activity, which may be substituting for, or substituted by, money-denominated activity, disappears altogether if we rely on money-expenditure measures alone. Perhaps the most dramatic empirical finding in the foregoing discussion is, throughout the richest nations. the high overall level, and in most cases the substantial historical growth, in the proportion of all work located outside the money nexus, and as a result unmeasured in conventional National Product.

Missing for the moment from these arguments is empirical evidence that this has important implications for the ***distribution of wellbeing*** within societies (see however Madsen et al 2025, which presents the first effort at estimating these, the next step in this discussion). The evidence so far adduced shows the large volume and faster growth of the extra-SNA economy, but not that this has positive or negative consequences for particular social groups, whether by age, sex or economic level. So far, the discussion has focussed on the overall "Great Day", the 1440 minutes of the (adult, >=18-year-old) populations of developed societies. But we do have a great deal of contextual information associated with the time-use diaries, both on the material circumstances of the diarists (particularly their own earnings and their households' incomes). The next stage in this developing argument is investigating which individuals and households are

engaged in which sorts of SNA and extra-SNA production and consumption, together with the consequences for their health and happiness—and also for the good of the material environment.

Bibliography

Aas, D.: 'Studies of time-use: problems and prospects', *Acta Sociologica* (1978) 21(2): 125-140,

Ainsworth, Barbara E., William L. Haskell, Stephen D. Herrmann, Nathanael Meckes, David R. Bassett Jr, Catrine Tudor-Locke, Jennifer L. Greer, Jesse Vezina, Melicia C. Whitt-Glover, and Arthur S. Leon. "2011 Compendium of Physical Activities: a second update of codes and MET values." *Medicine & science in sports & exercise* 43, no. 8 (2011): 1575-1581.

Bean, Charles R. *Independent review of UK economic statistics*. London, UK: HM Treasury, (2016).

Becker, Gary S. "A Theory of the Allocation of Time." *The Economic Journal* 75, no. 299 (1965): 493-517.

British Museum 2025, Exhibition *Ice Age Art Now,* 21-Jun-14 September

Coyle, Diane. *GDP*. Princeton University Press (2020).

Dolan, P. and Kahneman, D., 2008. Interpretations of utility and their implications for the valuation of health. *The economic journal*, (525): 215-234.

Erlich, Alma. 1987 "Time allocation: focus personal care." *Unilever Household Research Project, TIS* G87002 (1987).

Esping-Andersen, Gøsta. *The three worlds of welfare capitalism*. Polity (1990).

Freeman, Christopher. *The economics of innovation*. Edward Elgar Publishing, (1990).

Gallie, Duncan, Catherine Marsh, and Carolyn Vogler. *Social change and the experience of unemployment*. Oxford University Press, 1994. Chapter 7

Gershuny, Jonathan I. "Post-industrial society: The myth of the service economy." *Futures* 9, no. 2 (1977): 103-114.

Gershuny, Jonathan "Social innovation: change in the mode of provision of services." *Futures* 14, no. 6 (1982): 496-516.

Gershuny, Jonathan. "National utility: Measuring the enjoyment of activities." *European sociological review* 29, no. 5 (2013): 996-1009.

Gershuny, Jonathan, Teresa Harms, Aiden Doherty, Emma Thomas, Karen Milton, Paul Kelly, and Charlie Foster. "Testing self-report time-use diaries against objective instruments in real time." *Sociological Methodology* 50, no. 1 (2020): 318-349.

Gershuny Jonathan and Brendan Halpin in Offer, Avner, ed. *In pursuit of the quality of life*. Oxford University Press, USA, 1996.

Giffen, Robert [1887] ”The Recent Rate of Material Progress in England” in *Economic Inquiries and Studies* Vol II, London: George Bell and Sons (1904) 99-144

Glorieux, Ignace. "Social interaction and the social meanings of action: A time budget approach." *Social Indicators Research* 30 (1993): 149-173.

Goldschmidt-Clermont, Luisella. *Economic evaluations of unpaid household work*. ILO (1987).

Goldschmidt-Clermont, Luisella, and Elisabetta Pagnossin-Aligisakis. "Households Non-SNA production: Labour time, value of labour and of product, and contribution to extended consumption." *Review of Income and Wealth* 45, no. 4 (1999): 519-529.

Granovetter, Mark S. "The strength of weak ties." *American journal of sociology* 78, no. 6 (1973): 1360-1380. 38

Harms, T., Berrigan, D. and Gershuny, J, "Daily metabolic expenditures: estimates from US, UK and Polish time-use data", *BMC public health*, (2019)*19*: 1-12.

Hart, Keith. "Informal income opportunities and urban employment in Ghana." *The journal of modern African studies* 11, no. 1 (1973): 61-89.

Hirsch, Fred "Social Limits to Growth" Routledge and Kegan Paul (1976).

Hawrylyshyn, Oli. "A review of recent proposals for modifying and extending the measure of GNP." *Statistics Canada* (1974).

Hawrylyshyn, Oli. "The value of household services: A survey of empirical estimates." *Review of Income and Wealth* 22, no. 2 (1976): 101-103.

Holloway, Sue, Sandra Short, and Sarah Tamplin. "Household satellite account (experimental) methodology." *London: ONS* (2002).

Ironmonger, Duncan. "Measuring volunteering in economic terms." *Volunteers and volunteering* (2000): 56-72.

Ironmonger, Duncan, and Faye Soupourmas. "Estimating household production outputs with time use episode data." *electronic International Journal of Time Use Research* 6, no. 2 (2009): 240-268.

Jahoda, Marie, Paul F. Lazarsfeld, and Hans Zeisel. "Marienthal." *Chicago: Aldine-Atherton* (1933).

Jahoda, Marie. *Employment and unemployment*. *Cambridge Books* (1982).

Juster, F. Thomas, Paul N. Courant, and Greg K. Dow. "A Theoretical Framework for the Measurement of Well-Being." *Review of Income and Wealth* 27, no. 1 (1981): 1-31.

Juster, F. Thomas. and Stafford F., (eds) "Time, goods, and well-being." *Survey Research Center, Ann Arbor Press* (1985).

Juster, F. Thomas, 1990. "**Rethinking utility theory**," Journal of Behavioral Economics, Elsevier, vol. 19(2), pages 155-179

Kan, M.Y., Sullivan, O. and Gershuny, J., 2011. "Gender convergence in domestic work: Discerning the effects of interactional and institutional barriers from large-scale data". *Sociology*, *45*(2), pp.234-251.

Kahneman D, "Objective Happiness" in Kahneman, Daniel, Edward Diener, and Norbert Schwarz, eds. *Well-being: Foundations of hedonic psychology*. Russell Sage Foundation, 1999.

Kahneman, Daniel, Alan B. Krueger, David A. Schkade, Norbert Schwarz, and Arthur A. Stone. "A survey method for characterizing daily life experience: The day reconstruction method." *Science* 306, no. 5702 (2004): 1776-1780.

Krekel, Christian, and George MacKerron. "Back to Edgeworth? Estimating the value of time using hedonic experiences." IZA Discussion Papers 16308 (2023).

Kneeland, Hildegarde. "Woman's economic contribution in the home." *The Annals of the American Academy of Political and Social Science* 143, no. 1 (1929): 33-40.

Kuznets, Simon. *National income*. New York: National Bureau of Economic Research, 1946.

Lamote de Grignon Pérez, Juana, Oriel Sullivan, Jonathan Gershuny "The Multinational Time Use Study 2023", https://timeuse.org/mtus/access.

Longhi, Simonetta. "Residential energy expenditures and the relevance of changes in household circumstances." *Energy economics* 49 (2015): 440-450.

Lynd, R.S. and Lynd, H.M., *Middletown; a study in contemporary American culture (*1929).

Madsen, Sofia Topcu, Bo Pedersen Weidema, Jonathan Gershuny (2025) "Uncovering Consumption Inequalities by Integrating Household Activity Patterns in UK Input-Output Tables" *Review of Economics of the Household*" https://doi.org/10.1007/s11150-025-09792-3**2024**

Mishan, Edward J., *The costs of economic growth*. London: Staples Press, (1967).

Payne C. Changes in the value and division of unpaid care work in the UK: 2000 to 2015 ONS (2016).

Reid, Margaret Gilpin "Economics of household production." , Wiley. (1934).

Robinson, John, and Geoffrey Godbey. *Time for life: The surprising ways Americans use their time*. Penn State Press, (1997)

Samuelson, Paul A. and William D. Nordhaus, **Economics** 20th Edition McGraw Hill (2015)

Smith, Adam. *An Inquiry Into the Nature and Causes of the Wealth of Nations: By Adam Smith* William Porter, (1793).

Schipper, L., Bartlett, S., Havk, D. and Vine, E.,. Linking life-styles and energy use" F. *Annu. Rev. Energy*, *4*, 1989 pp.273-320.

Stiglitz, Joseph E., Amartya Sen, and Jean-Paul Fitoussi. *The measurement of economic performance and social progress revisited*. Vol. 33. France: Ofce, 2009.

Sullivan,Oriel and Jonathan Gershuny, "Time use, gender, and public policy regimes." *Social Politics: International Studies in Gender, State & Society* 10, no. 2 (2003): 205-228.

Sullivan, Oriel, Jonathan Gershuny, Almudena Sevilla, Francesca Foliano, Margarita Vega-Rapun, Juana Lamote de Grignon, Teresa Harms, and Pierre Walthéry. "Using time-use diaries to track changing behavior across successive stages of COVID-19 social restrictions." *Proceedings of the National Academy of Sciences* 118, no. 35 (2021):), e2101724118.

Taylor, Timothy (2022) https://conversableeconomist.com/2022/08/23/adam-smith-and-pin-making-some-inconvenient-truths/

Tudor-Locke, Catrine, Tracy L. Washington, Barbara E. Ainsworth, and Richard P. Troiano. "Linking the American Time Use Survey (ATUS) and the compendium of physical activities: methods and rationale." *Journal of Physical Activity and Health* 6, no. 3 (2009): 347-353.

Veblen, Thorstein. *The Theory of the Leisure class*. (1899).

APPENDIX MATERIALS

Table A1 Consumption activity, inside and outside the SNA Production Boundary

4-digit time use categories from the Harmonized European Time Use Study (HETUS)

Final consumption, SNA Production Boundary (31 activities0	Final consumption, General Production Boundary (32 activities)
1 Going out to eat and drink 3000 eat out at pub, restaurant 5002 eat, drink located at restaurant, pub* 5003 eat out located @ at shop or other* * from diary location code	**2 Eating and drink at home** 121 eat, drink at home 5004 eat at home of friend, relative*
3 meetings, religious activities 4320 Religious activities 4190 Other participatory activities	**4 sociable activities at home** 5100 spending time with friends, family 5110 Socialising with family 5120 Visiting and receiving visitors 5130 Celebrations 5190 Other social life 7241 Social media *5140* Phone, text, email, letters
5 education etc 2000 formal education 2100 Other activities related to study 2110 Classes and lectures 2190 Breaks at school, university 2210 recreational courses, study 2210 Extracurricular classes activities	**6 consuming childcare** 1001 (children receiving care) 2120 Homework 2210 Free time study
7 marketed final services 3630 doctor, dentist, hairdresser etc	**8 consuming adult care** 120 Sick in bed
8 theatre, cinema, public events 5200 cinema, theatre, sports, cultural events 5210 Cinema 5220 Theatre and concerts 5230 Art exhibitions, cultural sites, museums 5240 Library 5250 Attending live sports events 5292 Zoos, botanical gardens, nature reserves 5299 Other entertainment and culture	**10 media consumption** 8100 reading including e-books 8110 Reading periodicals 8120 Reading books 8190 Other reading 8219 Watch, stream ,TV/DVD ,listen to music 8220 Watching TV, video or DVD 8310 Listening to radio or recordings
11 hotel services 1003 (hotel services)	**12 sleep, rest, personal toilet** 110 Sleeping 300 Washing, dressing, personal care 301 Wash and dress 390 Other personal care 5310 Resting - Time out
13 play sport, physical exercise 6000 playing sports, exercise 6110 Walking and hiking 6120 Jogging and running 6130 Cycling, skiing and skating 6140 Ball games 6150 Gymnastics and fitness 6170 Water sports 6190 Other sports or outdoor activities 6311 Sports related activities	**14 hobbies, games at home** 7100 Making handicraft products 7140 Arts (visual, performing, literary) 7150 Hobbies 7160 Collecting 7190 Other hobbies 7320 Parlour games and play 7330 playing computer games 7340 Solo games and play, gambling 6200 Productive exercise: hunt ,fish, forage

entirely SNAPB
partly within SNAPB
mostly between SNAPB and GBP

Table A2 Productive activity inside and outside the SNA Production Boundary

4-digit time use categories from the Harmonized European Time Use Study (HETUS) (79 activities)

paid work and related activity (6 activities)

1110	paid work (incl. at home)	1120	Short breaks,travel for paid work
1210	work or study break	1300	Other activities related to employment
1310	Lunch break in main and second jobs	1398	Internship

Productive activity outside the SNA production boundary

Indoor operations (24 activities)

3100	preparing food, cooking, washing up	3110	Food preparation and baking
3130	clearing, dishwashing	3140	Store, arrange, preserve food
3200	cleaning tidying house	3210	Cleaning dwelling
3240	Arrange household goods, materials	3230	Heating dwelling and water
3290	Other household upkeep	3250	Recycling and disposal of waste
3310	Laundry	3300	clothes washing, mending, sewing
3390	Other textile care, eg mending	3320	Ironing

Outdoor operations 11 actvitities)

3220	Cleaning garden, yard	3420	Tending domestic animals
3410	Gardening	3440	walking or dog walking
3430	Caring for pets	3510	House construction and renovation
3490	Maintenance, DIY, gardening, pet care	3530	Make, repair, maintain equipment
3520	Repairs to dwelling	3590	Other construction and repairs
3540	Vehicle maintenance		

Household marketing and administration (8 activities

3610	shopping, banking unspecified	3721	Shopping online
3611	Shopping at shops	3640	Other shopping and services
3620	Commercial and administrative services	3711	online HH management
3710	HH management off-line	3720	Online HH management

care activities within own household (9 activities

3811	caring for own children	3819	Physical care, supervise child
3820	Teaching child, homework	3830	Read ,play, talk with child
3840	Accompanying child	3890	Other childcare
3910	help,care for adult household members	3911	Physical care of adult household member
3919	Other support to adult household member		

Care activities outside own household (11 activities)

4000	Meetings, clubs	4110	Organisation work
4120	vol work for club, organisation	4200	unpaid help, adults not in household
4240	Construction and repairs as help	4250	Help in employment and farming
4260	Other informal help: another household	4270	Childcare as help to another household
4271	Care own children in another household	4272	caring for other children
4280	Help adult person of another household		

Instrumental activities (5 activities)

7220	Using computer	7231	Information search using internet
7240	Communication by text: SMS, email, etc	7250	Other computing
9000	Travel		

Other categories (3 activities)

9950	Filling in the time use diary	9998	Other time use (write in)
9999	Missing		

text

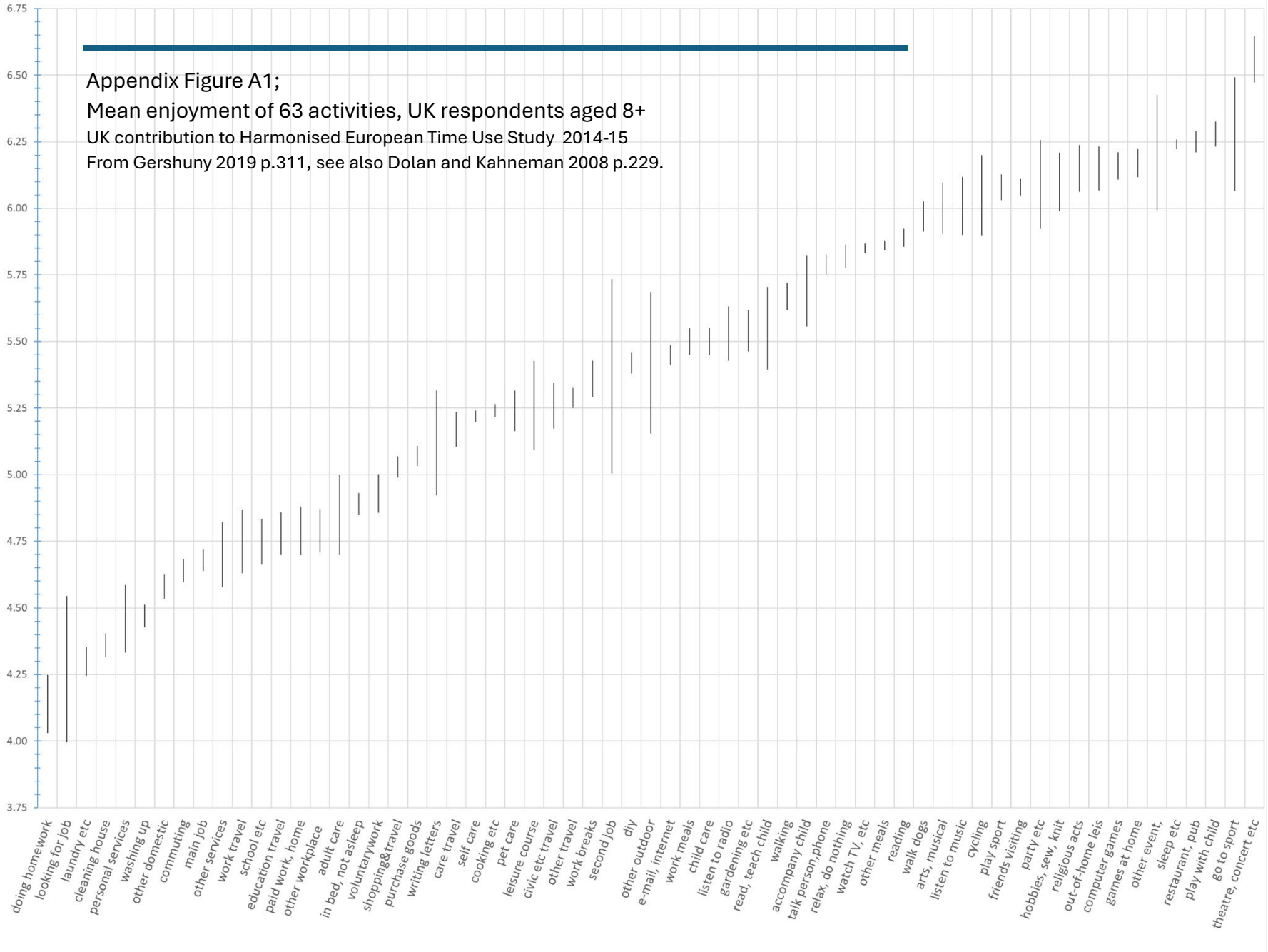
Table A3 Assigning UK household & government weekly expenditure to categories of want (also value of exports per week)						
	Z-good functional time-use categories	**2-digit COICOP expenditures**	**consumed as purchased**	**input to further production**	**Total weekly spending**	**% of all spending**
1	**basic h'hold services (sleep. shelter)**	part 3, part 4, part 5, part 7, part 8	£6	£29	£35	5%
2	**eating, drinking, private spaces**	1, 2, part 3, part4, part 5, part7, part 8	£6	£102	£108	16%
3	**Child and adult care**	part 3, part 4, part 5, part 7, part 8	£6	£29	£35	5%
4	**voluntary, and personal care services**	part 3, part 4, part 5, part 7, part 8	£6	£29	£35	5%
5	**leisure activities in private spaces**	part3, part 4, part 5, part 7, part 8, part 9	£16	£37	£53	8%
6	**physical exercise in public spaces**	part3, part 4, part 5, part 7, part 8, part 9, part 12	£26	£42	£68	10%
7	**leisure services in public spaces**	11, part3, part 4, part 5, part 7, part 8, part 9, part 12	£66	£52	£118	17%
8	**high-end services (ed, med, etc.)**	6, 10, 13, part 9, part 12	£45	£16	£61	9%
9	**Background Govt. services**		£38	£32	£70	10%
10	**(Exports)**				(£103)	(15%)
	Totals		£215	£368	£686	

Appendix Figure A1;

Mean enjoyment of 63 activities, UK respondents aged 8+

UK contribution to Harmonised European Time Use Study 2014-15

From Gershuny 2019 p.311, see also Dolan and Kahneman 2008 p.229.



Appendix Figure A2. Mean Daily Utilities, broad activity categories by daily durations

UK CaDDI surveys 2016-2022, women aged 35, time-varying enjoyment levels (see CaDDI Enjoy)