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Inclusive Income Accounts: Practical Measures to Go Beyond GDP

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Keywords: National Accounts, welfare, income, official statistics, economic measurement, modern economy, capital, time use

JEL classification: A13, I31, E01, E21, E22

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1. Introduction

Many policymakers globally are unsatisfied with the present state of statistical information about the economy and society, in particular the effective treatment by many of Gross Domestic Product (GDP) as the dominant indicator of economic welfare[2] (see Stiglitz et al, 2009). As has been noted (e.g. Coyle (2015) and Dynan and Sheiner (2018)), whilst real GDP *is* a welfare measure due to the constant utility assumptions underlying the price deflators which convert nominal data to volume, it is a *weak* measure because of what it omits. Nevertheless, there appears to be an increasing gap between the information contained in GDP and the factors which contribute towards people's well-being. Recognising that value can be generated in different domains, (e.g. the environment) with different levels of human participation and finding a way to measure this in a form which is consistent with National Accounts should enable better policy-making by exposing the inherent trade-offs. The authors view the internalisation of climate-change related economic damage as a key requirement of a modern macroeconomic accounting framework.

This paper aims to contribute to this debate by demonstrating a practical empirical application which can be delivered as a routine statistical output and demonstrates that objective, monetised measures of economic welfare can be efficiently produced in a country which has well-developed National Accounts, a Household Satellite Account produced in line with the System of National Accounts 2008 (United Nations (2008) – referred to below as SNA 2008), a set of Natural Capital Accounts produced in line with the System of Environmental Economic Accounts (SEEA) (United Nations (2021)), and a measure of Human Capital stocks produced in line with the relevant UN statistical guidance (United Nations (2016)).

By applying proven National Accounts methods to a broader definition of economic activity and a broader definition of capital, this paper utilises pre-existing data to implement an extension of the national accounts framework. All factors of production are treated as capitals, while the definition of economy activity (i.e. the production boundary) is expanded beyond that of the System of National Accounts 2008 to include the production of any products which could be bought or sold on a market. In practice within this article, this means the inclusion of unpaid household services and unpaid ecosystem services. A set of accounts are produced from which variations on traditional macroeconomic aggregates – such as GDP, final consumption, investment, etc. – can be derived and used for modelling and analysis.

This paper discusses the measurement challenge (section 2), proposed methods (section 3), empirical results (section 4), and conclusions (section 5).

2. The measurement challenge

GDP as a single-measure index is often preferred for decision-making over other more complex presentations because it has a range of attractive analytical qualities – simplicity, international and historical comparability, objectivity of weights, regularity and frequency of publication, accuracy in terms of measuring the volume of output produced largely in the market, and the ability to be broken down into its component parts (Heys, Martin, & Mkandawire (2019), Zoe Institute (2023)). These attributes make GDP dominant in many users' eyes, even if it is not

[2] This paper refers to "welfare" in a narrow sense – as "economic" welfare measured as the flow of goods and services received by consumers. We reserve "well-being" for a more expansive and general definition. "Welfare" is therefore neutral toward the impact of the use of resources – whether they do in fact raise life satisfaction, decrease anxiety, etc. or not. This is to be contrasted with more direct measures of well-being, for example that directly ask about life satisfaction or anxiety.

conceptually aligned with the item of interest. Production of more suitable metrics alone is insufficient – there are plenty of alternatives to GDP already (see Hoekstra (2019), or WISE Database (2024)). To be successful, any new metric has to be better aligned conceptually *and* achieve equivalence in terms of the above attributes if it aspires to better serve users. Pragmatically this requires the use of pre-existing data, at least in terms of providing meaningful historical time series, but also to ensure budget constrained national statistics institutes (NSIs) can deliver these data at a low marginal cost. Nevertheless, it is important to ask *how* to improve conceptual alignment if we are looking to use pre-existing data.

GDP is a poor indicator of a society's standard of living, of overall economic welfare, because it is a partial measure which excludes important components to focus primarily on the market. GDP does not directly account for activities conducted outside the market, such as unpaid work in the home or community, leisure, and the value that society may place on many services provided 'free at the point of delivery'[3]. Therefore, it does not portray a complete picture of household consumption. It equally tells us little about the distribution of income or the impact of increases in variety and technology. GDP can be argued to also measure the outcomes of public services poorly, pays little attention to environmental quality, and obfuscates the impact of health and education services on human capital. These are just a few examples of goods and services which affect people's welfare, whether or not they are bought and sold, and whose social value is not fully captured in their price even when they are transacted in the market.

This paper does not present a micro-data based solution to this challenge, and is not explicitly predicated on an underlying social welfare function. Rather, it presents an accounting-based approach[4] to tackling this question, which is predicated on utility being a function of consumption. Using pre-existing data sources, this paper takes the existing National Accounts framework and makes simple extensions to the stock and flow concepts to widen the range of consumption goods and services in scope, similar to the logic in Kendrick (1979). Throughout we shall rely on the standard national accounts methods which (on the non-financial side) can be simplified as a flows argument:

$$GDP = Y_1 = f(K_1,L_1) = r_1K_1 + w_1L_1 = C_1 + I_1 + G_1 + (X_1 - M_1) \quad (1)$$

a stocks argument:

$$K_1 = K_0 + I_0 - \delta_0 + \text{revaluation}_0 - \text{other changes in volume}_0 \quad (2)$$

And from which we can also develop a net statement of flows:

$$Y^N_1 = Y_1 - \delta_1 \quad (3)$$

Where Y represents output (GDP), K represents capital assets, L represents labour, r is the rate of return on capital, w is average wages and salaries, C is consumption, I is investment, G is government expenditure, X is exports, M is imports, and δ is depreciation, with sub-scripts indicating time periods and super-script N indicates a net measure. The SNA definition of each of these variables is defined by a set of constraints or 'boundaries' defining what is in scope and not, alongside well-established methods to determine the value of each component. Within the current national accounts, key to the decision whether an item is in scope is whether there

[3] Excluding those delivered by the public sector and 'paid for' via taxation; a meaningful economic transaction.

[4] Developed via two discussion papers in the Economic Statistics Centre of Excellence Discussion Paper series - Heys, Martin, and Mkandawire (2019), and Bucknall, Christie, Heys, and Taylor (2021)

is clear human intervention in its creation, as well as its exchange through a meaningful economic transaction / change of economic ownership. See SNA 2008 for detail.

This paper extends these 'boundaries' to capture wider concepts and data within essentially the same 'stocks and flows' national accounts methods to develop new measures of welfare. These, therefore, are on the same monetisable exchange value basis (i.e. excluding consumer surplus and externalities[5]), in both current price (CP) and real chain-linked volume measure (CVM) terms. To do this, we need to understand GDP's limitations.

The current GDP and National Accounts framework is predicated on two main inputs to produce output (Y): produced capital (K) and labour inputs (L). It excludes, by definition, natural, and human[6] capital, and even excludes some intangible produced capital (Corrado, Hulten and Sichel 2009). The absence of a wider perspective on capital is the central challenge from which all others flow. It is surely incongruent to ask policy-makers in an increasingly capital-dependent world (e.g. see Piketty 2014), in which both natural and human capital have growing importance and impact, to make decisions based on a measure which partially excludes both in different ways. Various authors and measurement authorities (e.g. Dasgupta (2021), World Bank (2022) and UNEP (2023)) have considered this challenge.

This paper also notes that these concepts and their relationship with the National Accounts is not clear-cut. Produced capital is broadly equivalent to K within the current national accounts model, noting there are several intangible assets not currently included ('capitalised') into the accounts. A subset of natural capital is capitalised ("cultivated biological resources"), whilst human capital exists in a 'halfway house' where the human capital *stock* itself is not captured in the accounts but the resultant *flows* are. Salary differentials received as a result of human capital acquisition are included, but only as a labour reward in the form of 'compensation of employees' (broadly equivalent to wL in (1)), and the investment to create human capital (for example in the form of education, health services, or in-firm training) is included as recurrent spending (C or G), but not as investment (I), and hence not flowing into (2).

Even if one believes we should give productive capital primacy and exclude natural (K^N) and human capital (K^H), it is odd to focus our attention on a measure which suffers from only having a partial coverage of productive capital through the exclusion of a number of intangible assets, which are generally recognised as being increasingly important in economies utilising advanced technologies (see, for example, Goodridge and Haskel 2022). It becomes ever clearer a new strategic vision is required.

A new framework needs to embed this core insight; that policy is increasingly grappling with and seeking to support a world where the inputs to economic production function as capitals, even when these capitals do not sit entirely within the market. Doing so consistently and comprehensively means also bringing into scope the additional non-market flows associated with these capitals.

[5] Noting that the flow of benefits received from natural assets, such as carbon sequestration, could be considered externalities because of the absence of a market. In this work we look to capture this in line with the general trend in the measurement and policy communities to recognise that the environmental impact of economic and other human activity is an essential component of understanding the economy.

[6] Social capital is often described as a fourth, but there is a powerful argument by Dasgupta that social capital is a contextual factor which determines the value of other capitals: a machine might be valuable to its owner in a country with operating laws and justice functions, but the same machine has no value in a failed state where it could be immediately stolen. As such, it can be considered to be 'priced into' the framework proposed in this paper.

A core assumption in this paper is that people derive economic utility or value both from what they consume from within the productive economy as defined in the SNA08, but also from the more broadly defined productive economy – including any goods or services which could be sold in a market. This means that, regardless of whether the good/service is sold in a market, if there is evidence to suggest that there could be a market for a good/service – i.e. with buyers and sellers at an economically meaningful, non-zero price – then all production and consumption of that good/service is in scope.

In practice, this means including at least the flow of services produced and consumed in the unpaid household satellite account, and similarly the ecosystem services associated with environmental assets. By considering each of these in terms of providing either a proxy or equivalent to a flow of income one can view the summation of these incomes as a total measure of monetised and non-monetised income and hence a feasible measure of economic welfare. Therefore, one needs to include into revised equations 1, 2 and 3, all three capitals, alongside the flows of benefits and costs consumers derive from / incur from these, even if they arise without human intervention. This paper therefore widens the 'production boundary' to include all output arising from the three capitals, irrespective of whether there is a paid transaction, or indeed whether there is human involvement in the production process at all. That is, the 'production boundary' is widened in line with the changes implemented to the 'asset boundary'. As far as possible, all other national accounts concepts and methods remain untouched.

As such we apply changes to the definitions of Y, K and other variables (denoted by Y*, K* etc), taking account of the need to maintain internal coherency, and prevent double-counting. Effectively we 'loosen' the 'asset boundary' to allow the inclusion of all three capitals, (such that $K_1^* = K_1 + K^H_1 + K^N_1$) irrespective of the degree of human intervention, and make equivalent changes to incorporate the resultant flows from all three capitals within the 'production boundary', that defines which output is in scope of Y in equation 1. In doing so, we also act to treat produced capital more consistently. For example, produced capital purchased by households to deliver services in the home (as such fridge-freezers, domestic cars and home computers) are currently treated as consumption items within the national accounts, and not capitalised in (1).[7] I* will now capture this as investment.

This inclusion of household capital within the asset boundary is consistent with our inclusion of unpaid household services within the production boundary. Production of services undertaken by households for their own use (i.e. for which they will receive no pay, and which is not for exchange with another institutional unit – such as home cooking to be consumed by the family), utilising a combination of labour and household capital appliances, are currently excluded from the SNA production boundary and are therefore not included in Y in (1). Since these activities contribute to living standards, any indicator of welfare would be incomplete without them, so we need to bring these assets within the definitional scope of K* and I*. But in doing so we need to also capture the output they produce within Y*[8], leading to the following re-defined equations:

[7] The SNA (para 1.40) defines the production boundary for GDP as "carried out under the responsibility, control and management of an institutional unit, in which labour and assets are used to transform inputs of goods and services into outputs of other goods and services. All goods and services produced as outputs must be such that they can be sold on markets or at least be capable of being provided by one unit to another, with or without charge."

[8] As we bring more assets / services into scope, both the flow of benefits from these assets and the depletion / depreciation are added to the measure together.

$$GDP = Y_1^* = f(K_1^*, L_1^*) = r_1 K_1^* + w_1 L_1^* = C_1^* + I_1^* + G_1^* + (X_1^* - M_1^*) \quad (1^*)^9$$

$$K_1^* = K_0 + K^H{}_1 + K^N{}_1 + I_0^* - \delta_0^* + revaluation_0^* - destruction_0^* \quad (2^*)$$

$$Y^N{}_1^* = Y_1^* - \delta_1^* \quad (3^*)$$

The elements for inclusion are as below, noting that the authors rely wholly on the wider UK statistical system in terms of the data used. This is predicated on the joint assumptions that i) statistics have been accurately produced against a relevant international framework, ii) where measures have been monetised, these are in a consistent market equivalent price or exchange value form where they can be used, aggregated or compared in equivalent terms – that is £100 of market output is equivalent to £100 for services received from trees acting as stores of carbon is equivalent to £100 of home-produced transport services , and iii) the frameworks under which these statistics are derived are mutually consistent without double-counting or exclusions. This means that all production-based welfare measures described in this paper exclude consumer surplus[10], as well as many externalities.

Nevertheless, there are still several areas where data are unavailable or experimental. As such, the estimates presented in this article should be treated as experimental and as proofs of concept. Contingent on user feedback, the aim is both to update this work to further improve these measures, as well as use this framework to highlight gaps and identify areas for future work.

3. Methodology

To widen the production boundary (converting ,Y in equation 1 to Y*) this paper applies four adjustments: (1) quality adjustment of public services, (2) adding unpaid household services, (3) expanding intangible capitals, and (4) incorporating the ecosystem services of natural capital.[11]

In relation to the value of public services, as summarised in Foxton, Grice, Heys and Lewis (2019), to understand the value added from public services which are delivered at zero price, one needs to follow the methods laid out in SNA08 to quality adjust these measures to take account of the quality of the outcomes achieved, in line with the methods proposed in Atkinson (2005). The UK does not currently conform to this standard as it aligns to the European System of Accounts 2010 (ESA10), which deviates from SNA08 in this important dimension[12].

[9] We assume that government expenditure already include spend on environmental activity and that unpaid household goods and services are not internationally traded. There is no trade in environmental services.

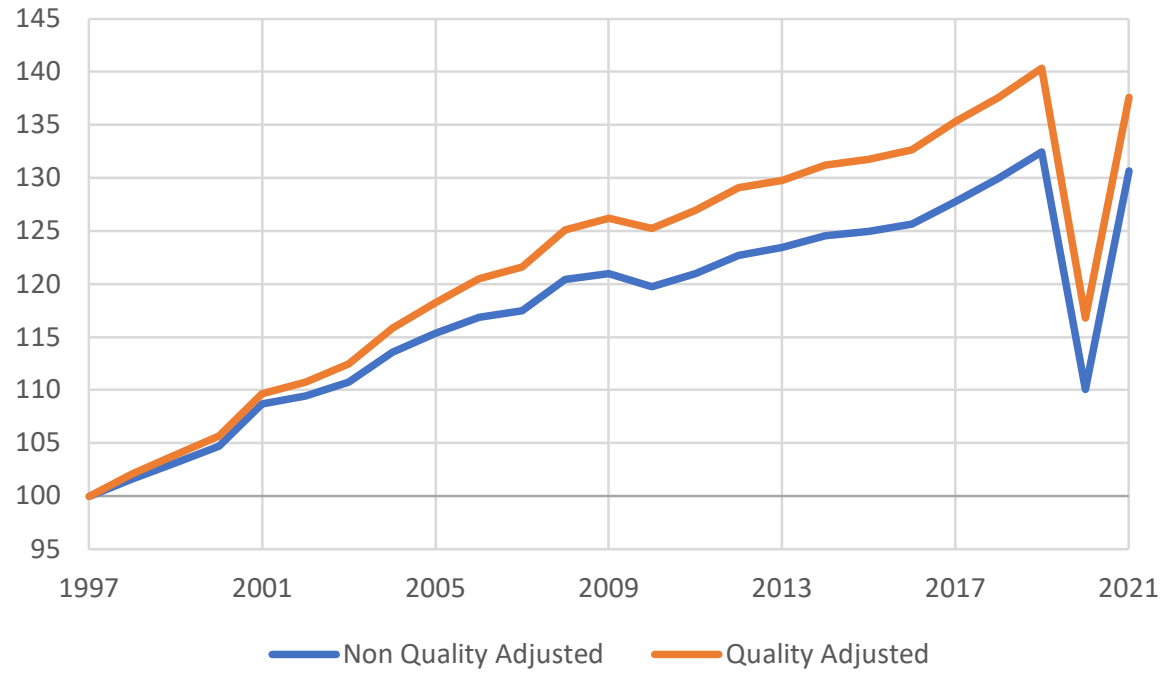
[10] In the case of the household satellite account, where the producer is the consumer, the distinction between consumer surplus (which is excluded from National Accounting frameworks) and producer surplus (which, as this money is included in the transaction, is included in National Accounting frameworks) is conceptually a little more difficult to determine.

[11] Wherever a method is presented in summary terms, full methods and datasources can be found either in Bucknall, Christie, Heys, and Taylor (2021) or the Data Sources and Quality sections of ONS Inclusive Wealth and Income Accounts available at https://www.ons.gov.uk/economy/economicoutputandproductivity/output/articles/ukinclusiveincome/previousreleases.

[12] ESA10 regulates the production of GNI estimates for each EU country, which determine contributions to the EU budget. The EU wished to observe further method developments to confirm comparable methods across all countries to ensure consistent application and therefore a 'fair' budgetary allocation.

Figure 1: The effect of quality adjustment on Government, Health, and Education (O, P, and Q) Output

Chained Volume Measure, 1997 = 100



This paper uses the ONS's work to develop quality adjustments on the public services to produce public service productivity data to implement an adjustment to the non-market component of the public service industries[13]. To do this, we take the average quality adjustment on the 56.8% of public services where quality adjustments exist, (ONS 2024c) and extrapolate this across the whole of the non-market portion (around 80%) of the public service industries using a simplifying assumption that the whole of government is subject at any time to the same spending constraints and a consistent requirement for efficiencies and service improvements. To derive this measure, we uprate the CVM measures of non-market output of the industries associated with the provision of the public service industries in line with the average quality adjustment of service areas with calculated quality adjustments.[14]

In relation to unpaid household activities, the sum of these is simply drawn from the household satellite account (ONS 2024a) in current price terms and CVM estimates are constructed using;

- Direct volume estimates in the case of childcare (where hours of childcare a child receives is used) and transport (where distance travelled is used)
- From 2017 onwards, hours worked are used as volume measures for household housing services, adult care, and voluntary activity. Prior to 2017,

[13] For clarity, these incorporate UK Standard Industrial Classification sectors O, P and Q. Whilst there are other non-market sectors of the economy, such as imputed rentals on owner-occupied housing, we do not propose any adjustment of these.
[14] The quality adjustment of public services has no effect on current price data, as the quality adjustment only applied to volume measures.

    - Services producer price indices are used for laundry (specifically, the "Washing and (Dry-)Cleaning Services of Textile and Fur Products" SPPI)
    - Industry deflators for comparable industries are used for household housing services, nutrition, and adult care.
    - The whole economy implied GVA deflator is used to deflate voluntary activity.
- From 2017 onwards, volume measures of nutrition services are calculated using calories consumed, and volume measures of laundry services are calculated using total washes. Prior to 2017, industry deflators for comparable industries are used to deflate current price estimates of GVA nutrition and laundry services, respectively.
- Volume measures for clothing services are calculated using current price GVA and deflating these using the whole economy GVA deflator.

In relation to uncapitalised intangibles or Intellectual Property Products (IPPs), under the assumption that this would previously have been accounted for as intermediate consumption we need to add these in the form of additional value added, and resultingly as additional investment and depreciation in equation 2. Data is drawn from ONS publications estimating the value of these uncapitalised capitals (e.g. ONS 2024d). As elsewhere, this assumes definitions for these additional IPPs are mutually exclusive from those already accounted for in the National Accounts, although in this instance work is currently being undertaken in ONS to examine the extent to which this is the case.

Finally, we have the ecosystem services of natural capital, where the value of both natural capital stocks and the flows of capital services arising from these are included in the Natural Capital Accounts (ONS 2024e). The flow of benefits from carbon sequestration and urban heat regulation in the Natural Capital Account are used as provided in current price terms and deflated using the whole economy GDP deflator. This deflator is used for the time being as the benefits received from environmental assets are difficult to compare with other broad categories of products from the market sector – in theory, the best deflator to use would be one which represents a market-equivalent of the service the environmental asset provides. Future work would be required to identify these market equivalents and their relevant deflators, which in some cases may require additional data collection.

We have only added greenhouse gas regulation services, pollution regulation services, and urban heat regulation services from ONS's Natural Capital Accounts as other ecosystem services not already included in GDP have short time-series which only begin after 2005. As such, these estimates should be seen as a component of the contribution of environmental assets to value added – and not as a proxy for the entirety of environmental asset services.

We label Y* **Gross Inclusive Income (GII)**, which can be considered as conceptually equivalent to GDP with a widened production and asset boundary. In summary, GII is calculated as:

Gross Inclusive Income (GII)

GDP (minus non-market gross value added in industries O, P, and Q)
Plus: Quality adjusted non-market GVA in industries O, P, and Q

Plus: Household flow of benefits[15]
Plus: The flow of benefits from a subset of natural capitals providing regulating services (greenhouse gas, pollution, and urban heating regulation)
Plus: Investment in previously uncapitalised Intellectual Property Products (i.e. intangible capital)
= Gross Inclusive Income (GII)

Investment in Human Capital, in the form of Education and Health spending is already captured within GDP and GVA so is not included separately. Similarly, investment in household capital is simply re-classified from household consumption to investment, with no impact on overall output. Human Capital flows are incorporated as derived in Mubarak et al (2024).

Capturing depreciation and depletion

GII is still a gross measure, failing to capture the impact of depreciation or depletion of various types of assets. Alongside Y*, we also compute new equivalent values for K* via equation (2*) taking into account uncapitalised productive capital, natural capital and human capital[16].

We also develop a new net measure of Y^N*, **Net Inclusive Income (NII)**, which can be considered as broadly equivalent to the existing Net National Disposable Income (NNDI) variable already produced within the ONS Blue Book (e.g. ONS 2024f). NII takes GII and converts it to a net measure in line with the methodological steps used to convert GDP to NNDI by taking account of the depreciation of capitals, covering; produced capital, a wider set of IPPs ('intangible capitals'), household durables, and natural capital (effectively δ*).

Income and transfers from abroad are also taken into account to arrive at NII, derived from net national income by adding all income and current transfers in cash or in-kind receivable by resident institutional units from non-resident units and subtracting all income and current transfers in cash or in kind payable by resident institutional units to non-resident units.

Net Inclusive Income (NII)

Gross Inclusive Income (GII)
Plus: Income from abroad
= Gross National Income
Less: Transfers from Abroad
= Gross National Disposable Income
Less: Depreciation / depletion of
    i) Tangible and Intangible Produced Capital[17]
    ii) Human Capital
    iii) Natural Capitals from the Natural Capital Account[18]
Less: Degradation and depletion of Atmosphere due to Carbon Emissions
= Net Inclusive Income (NII)

[15] To be expanded to include household production using digital services in future work.
[16] Derivations of stock estimates, including asset lives etc is contained in Heys, Bucknall, Christie and Taylor (2021).
[17] Includes all capital from the national accounts, as well as additional intangibles and household durables used in household production.
[18] Due to data availability, this is currently restricted to the depletion of oil and gas.

Almost all of these data are available from ONS national accounts and satellite accounts as previously discussed. The single caveat to this is the degradation and depletion of the atmosphere due to carbon emissions. The scope of natural capital within the SEEA currently does not extend to the atmosphere, and so does not capture a key mechanism by which climate change impacts the economy, so this paper has produced an experimental measure[19]. More information on this is given later in this paper.

Deflation

We compute GII and NII in both current price (CP) and chain volume measure (CVM) terms[20]. For CVMs we also need to determine how to deflate assets and flows outside the national accounts to ensure we adequately control for the relative change in real value over time of different flows of benefit or cost, noting that in some instance direct measures of volume are available which do not require deflating.

This is one of the most complex issues in this study: how best to ensure that prices have been adjusted into comparable terms which make conceptual sense. In a number of instances we have derived volume measures in terms of CVM values from available current price estimates. As such, we made every attempt to utilise deflators from other ONS data sources (such as producer price indexes), from National Accounts, or have used the GDP deflator where appropriate local deflators are unavailable. In some cases direct volume measures are available and have been used where high-quality deflators are not available. Both GII and NII CVMs have been constructed by chaining together the relevant components.

Exclusions and areas for future work

For the purposes of demonstrating the practicality of the new measures we have worked with available data. One of the material advantages the UK holds is that work to develop statistics against the international standards in these areas is well developed in most areas. In some instances data are not available, or the work to align the conceptual frameworks has not been fully undertaken. Some data is therefore excluded, which we would wish to later incorporate, and we have provided experimental estimates where international methods agreement has not yet been achieved. These include the experimental, purpose-built estimates of greenhouse has related atmosphere degradation and depletion, the treatment of public service quality adjustments, and the use of the ONS's experimental estimates of uncapitalised intangibles. Finally, in the interest of pragmatism we have identified further conceptual changes which would be required to make our system fully internally consistent but where we have not been able to make progress. These include the use of free digital services and platforms, degradation of other environmental assets, and the full alignment of human capital.

[19] This model only reflects degradation due to carbon emissions. As this excludes greenhouse gases such as methane, the model could be thought of as a lower bound estimate of atmospheric degradation – or, more accurately, atmospheric degradation purely accounted for by carbon emissions. The model also makes no assumption of the proportion of the atmosphere – if any – which would be included within the UK's national or domestic boundary, or which economic sector owns the atmosphere. Instead, degradation of the (global) atmosphere, as included in NII, can be interpreted as a combination of two phenomenon, both of which have the same effect on the numbers. The first is the UK 'consuming' its own atmospheric environmental asset through the emission of carbon. The second is the UK importing degradation (akin to importing capital services) of the atmosphere through the emission of carbon into the non-UK atmosphere. As both of these (consumption of 'capital' and importing of 'capital services') have the same effect on a 'net' measure of production, the question of which is taking place can be put to one side.

[20] In line with UK National Accounts 2023 vintage, Chain Volume estimates for 2021 are based on 2019 weights.

Improving atmospheric degradation and depletion estimates

Due to its importance to the national and global economy, the atmosphere (specifically in its role as a carbon sink) is treated as an asset in this framework. The atmosphere is conceptualised it two ways[21]; as a carbon sink to be *depleted* via greenhouse gas emissions, and as a capital providing ecosystem services being *degraded* via the emission of greenhouse gases. While the quantification of the volume of greenhouse gases and their measurement in homogenous units for the purposes of emissions measurement is now well established, the question of what price to put on a unit of carbon is still debated. A recent IPCC (2022) report highlighted the vast differences in valuations of the damage of climate change.

Depletion of the atmosphere accounts for the role of the atmosphere as a carbon sink, and the 'using up' of this carbon sink over time. Economic units (such as companies and households) can emit greenhouse gases into the atmosphere rather than using some alternate technology to avoid these emissions (such as renewable energy or carbon capture). However, practically this is a finite resource; only so much carbon can reasonably be emitted into the atmosphere. As such, when economic units emit greenhouse gases they are using a finite natural resource to do so – they are depleting the atmosphere's capacity as a carbon sink.

The volume of this depletion can be measured by the UK's carbon emissions. The price to be applied per unit of carbon should be the opportunity cost associated with not emitting carbon rather than doing so – the 'abatement cost'. For this, we use the carbon abatement costs supplied in supplementary guidance to the UK Government's Green Book which come from UK's Department for Energy Security and Net Zero (DESNZ 2023).

Degradation of the atmosphere separately conceptualises the atmosphere as a provider of an ecosystem service, which we might broadly refer to as "atmospheric services"; providing the world with a climate system that is conducive to life and work. Greenhouse gas emissions cause these services to change negatively by causing climate change, which makes the climate system less conducive to life and work. By valuing the net present value of this reduction in atmospheric services caused by carbon emissions, we can value the degradation of the atmosphere.

We rely on analysis from IPCC (2022) of the relationship between the global temperature anomaly and damage to the economy to value the reduction in atmospheric services, and the relationship between carbon emissions and the global temperature anomaly to value the UK's contribution to the reduction in atmospheric services and so do atmosphere degradation. Detail on the model used is available in Annex E of Bucknall, Christie, Heys, and Taylor (2021) , with the caveat that IPCC (2022) is now used as the principle data source for climate change related data.

These methodologies for measuring the depletion and degradation of the atmosphere associated with climate change are experimental, still in their early stages, and should be treated with appropriate caution, but represent (in the authors' views) a substantial step forward in incorporating a fundamental part of measuring sustainable income.

Improving quality adjustments for public services.

[21] The methodology for atmosphere depletion and degradation outlined here benefited from discussions with Sylvain Larrieu and Sébastien Roux around similar work they have done for France, which can be found in Larrieu and Roux (2024)

Quality adjustment of output, particularly that of public service output, remains challenging in the National Accounts. While quality adjustment of market output can be achieved indirectly through adjusting prices and deflators, this approach cannot be used for public service output due to it being provide free at the point of consumption. Hence, finding conceptually ideal indicators with which to quality adjust the output of this sector remains challenging and an area always needing further improvement and development. While this paper uses those adjustments available and expands them to cover all non-market production of public services, this is no substitute for the rigorous development of new and improved quality metrics on a service-by-service basis. This process was commissioned by the Chancellor of the Exchequer in 2023 in a review led by Sir Ian Diamond, the National Statistician, and the relevant UK Statistics Authority (UKSA) processes have been followed such that once developed, these metrics can be integrated into UK GDP. This would effectively align GII and GDP in this respect and this adjustment would therefore drop out of the GII compilation process at that time to prevent duplication.

Improving Intangibles estimates

The ONS already publishes long time series of investment data for these assets. Despite this, there was not international agreement on incorporating these into the 2025 revision of the SNA. Given the degree to which acceptable methods exist and have had prolonged use in the UK, the authors consider it likely that future SNA revisions will return to this topic, and therefore methods may need to be amended to align with agreed international best practice when it arrives.

Free digital services and platforms

Top on the agenda is the impact of free digital services – and free digital *platforms* in particular – on the measurement of production of household services in the household satellite account.

The economic welfare of societies can be argued to have been increased partly through access to free digital platforms (and the content hosted on these platforms) such as those provided by Facebook, YouTube, Instagram, X/Twitter just to mention a few. Households use these platforms to engage in activities – such as sending tweets, developing TikTok dances, or composing pictures on Instagram – which may be thought of as own-account production within a household, or free-at-the-point-of-use trade in services between households. The reduction in the number of stamps sold whilst the number of messages has grown exponentially is a classic example of a movement across the current production boundary distorting our perception of growth in the economy, widely defined.

While the business model underlying these platforms is similar in some respects to long established industries, such as advertisement funded TV programming, the pace at which digital services have expanded mean the way in which we account for these services may impact not just our understanding of the long-run level of economic welfare, but its growth (or decline) in the short term. Where the value of household production of services using these free digital services as an input is affected by this, this should be accounted for in GII and NII and is an area of future research.

Ecosystem services derived from, and depletion of, natural capital

This work (i.e. ONS2024e and ONS 2024b) currently takes account of a limited number of ecosystem services, due to the short time series currently available for these assets. It is also

worth highlighting the relatively low values attached to these will, in part, reflect the efforts made to align pricing of these assets to market prices (alternatively called "exchange values"), which could exclude some or all of the externalities inherent in these services. The ONS is at the forefront of the work (see Taylor et al. 2024) to develop such measures internationally and we aspire to add to this element of the model as new data series are produced.

Human Capital

Human capital represents the most significant concept being added, and while Mubarak et al. (2024) provides a firm base for this, there remains some outstanding questions. These questions are discussed in Mubarak et al. (2024), but we would highlight two primary concerns; the first is a potential need to adjust existing national accounts concepts to align with the logic of human capital being bought into the accounts, while the second concerns the current method for calculating the stock being subtly different from that used for other capitals. Therefore, this data may require further developmental work to bring into a consistent form.

Alignment and compatibility with existing national accounts concepts and aggregates

Human capital, as with any produced capital[22], is created through investment. One therefore needs to identify the process by which this investment occurs. Clearly education output would be one source, but also business and household spending on adult education, apprentices, and non-firm specific training would need to be captured within our estimate of human capital investment. Under the current framework, firm-specific training[23], the benefits of which accrue to the corporate sector, would be captured in the existing estimates of uncapitalised intangibles already incorporated into GII and NII.

Resolving how the entirety of this educational investment is converted into capital is a substantive topic in its own right. For example, would primary school spending in year 1 be treated as capital investment in year 1, or as 'work in progress' until the child has completed their school career and joined the labour force? Equally, if human capital is a capital, what is the rate of return and where would this be observed? When one considers primary and secondary allocations of income, we require an agreed treatment of compensation of employees (CoE), mixed income and gross operating surpluses based on agreed sectoral ownership of the human capital asset, and indeed whether there is a need to disaggregate CoE into a return to labour and a return to human capital. Importantly, how would one account for depreciation (e.g., skills eroded through unemployment hysteresis), depletion (e.g., untimely death whilst still in the labour force), and retirement (e.g., people leaving the labour market as they reach the end of their career)? If one captures retirement, how then does one account for human capital deployed in the household for household production, either during retirement or before? What portion of unpaid childcare should be classified as investment in human capital? Does one adjust the human capital stock for the health of the workforce? How does one account for imports (immigration) and exports (emigration) of human capital?

Despite this, Mubarak et al. (2024), which builds on Dunn (2022) and UN (2016), provides a simple framework for integrating human capital into national accounting, and serves as a strong base to progress from. Estimates of human capital depreciation used in this paper are based on

[22] Given the roles of labour and produced capital it does not seem feasible to argue it is non-produced

[23] Defined as training which does not result in a transferable wage supplement – that is if the worker moves employer the new employer would not add a wage supplement in response to holding these skills/qualifications.

Mubarak et al. (2024), acknowledging that there is still more work to be done and these data are likely to be revised as a result.

Computational issues

UN (2016) lays out a model for the calculation of human capital stocks in line with the ground-breaking work of Jorgenson and Fraumeni (1989). This delivers a clear picture of the expected return to human capital acquisition recognising that human capital qualifications can serve two purposes; the acquisition of new skills, and acting as a gateway permitting access to further qualifications which will further enhance skills, increasing earning power, and themselves potentially permitting access to further qualifications. Let us take a simple three time period model (shown by t), where in period 1 people can receive education at level A with probability p(A), and in period 2, undergo education at level B with probability p(B) if and only if they have achieved education level A. Wages relate to training undergone (shown by sub-scripts – 0 representing not having achieved educational level A or B) where $w_0 < w_A < w_B$, w_0 is always received whether working or in education, and δ is a time discount factor.

The UN (2016) model calculates the human capital ($K^{H)}$ stock of an average individual at time 0 as the discounted sum of future earnings.

$$K^H_0 = w_{01} + \delta_1 [(1-p(A)).w_{02} + p(A).w_{A2}] + \delta_2 [(1-(p(A)).w_{03} + (p(A)-p(B)).w_{A3} + p(B)).w_{B3}]$$

The challenge with this approach in a National Accounts context is that the capital investment in future time periods (education B in *period 2*) is reflected in the stock in *period 1*. This is akin to arguing that, if one took the example of a building to which significant extension work was undertaken in future time periods, then this future investment should be incorporated into the capital value of that building today. Core national accounts principles are to reflect the value of the building today, in line with its current market valuation, and recognise future investment in maintenance or new capital acquisition in future time periods. In this light, it is not hard to see why human capital estimates for the UK at £25.5tn exceed the complete value of produced capitals (£6.4tn) to such an extent (see ONS (2024b)). National accounts consistent human capital data, with a clear bridging table to the existing data, is clearly the next required step to show the value of current investment without further investment, whilst existing published data show the full potential value of such investments including commensurate future investment. Initial exploratory work suggests the difference in stock values terms is likely to be, for the UK, in the region of 15% (£3-4tn).

Finally, there are two potential expansions to this model, relating to a) externalities and b) distribution.

Shadow (or "Accounting") Prices

As can be observed in the results section below, the output arising from environmental assets, in the form of ecosystem services, are dramatically low compared to other benefit streams. A key factor behind this is that, due to the limited time spans available for time series, we have not yet incorporated the full suite of non-provisioning ecosystem services produced by ONS to maintain comparability of our estimates across time.

As well as these practical factors, there is one important theoretical factor which may lead to these estimates being lower than expected – following SEEA, the estimates are based on exchange prices (i.e. market equivalent prices). Considering the externalities associated with

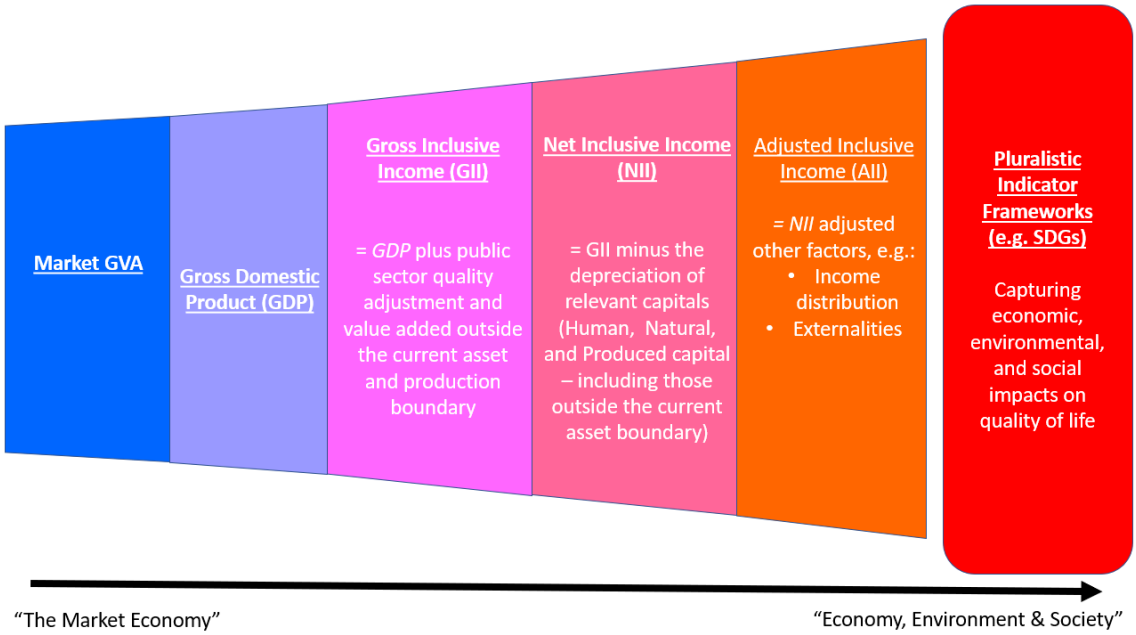
natural capitals and their corresponding ecosystem services, this could omit a substantial portion of the economic importance of these capitals. The work recommended by Dasgupta (2021) to make more use of shadow prices (or "accounting prices"), i.e. prices which do not reflect exchange values but instead try to internalise the cost of externalities, is clearly key to presenting a more realistic picture of these data. Initial research into how shadow priced estimates of value could be incorporated into a national accounts-based framework like Inclusive Income was undertaken in Taylor et al. (2024), but still requires substantial empirical work before Inclusive Income can be measured on this basis.

Distributional Analyses

By thinking about this work in 'income' terms, the key question arises as to 'whose' income this is and what do they consume from this income? Once this question is addressed, there is the further issue of sourcing relevant deflators for different groups. Drawing on Aitkin and Weale (2018a & 2018b), the question of 'whose income this is' can be expanded into several more particular questions, such as how to allocate non-household income to households, and which deflator is considered optimal, particularly for services delivered in the household or from the environment.

Net Inclusive Income (NII) denotes the most complete *plutocratic* aggregate measure of welfare possible using currently available data, as it reflects the average of all households not the average household[24]. Extending this framework is possible to develop a metric we would label **Adjusted Inclusive Income (AII).** This is a '*democratic'* measure which would attempt to adjust NII to take income distribution into account (Aitken and Weale 2018a), delivering the growth rates of different percentiles of the economy. The following figure is a diagrammatic representation of a potential end-state.

Figure 2: The range of inclusive income metrics



[24] A simple example is if a billionaire in a country of 60 million people purchased a £60m superyacht (if this was considered a consumption item), then the average individual would consume £1 of superyacht.

Within this framework, **well-being** would be measured by pluralistic indicator frameworks incorporating a wider range of quality-of-life factors which are harder to conceptualise as flows on consumption / proxied by income, as well-being includes intangible aspects that cannot be traded in a market. Such frameworks would include the full range of factors that influence what we value, reaching beyond its material side. This paper does not attempt to deliver this component of the spectrum, in the main because existing 'dashboards', such as the UK's Measuring National Well-being or the UN's Sustainable Development Goals (United Nations (2015)) address this need in terms of their spread and depth. The authors propose that NII or preferably AII could naturally fit into such a 'dashboard' and provide a powerful context for the other measures.

4. Results

As a proof of concept, a pilot model was compiled using the methods above to produce GII (Gross Inclusive Income) and NII (Net Inclusive Income) in previous working papers which was translated into a full statistical publication in 2022 and 2023 by the Office for National Statistics (ONS (2023a). Whilst data can be sourced for some variables for long time periods, the period for which all the key data are available is 2005-2022. Full tables are available in Annex A.

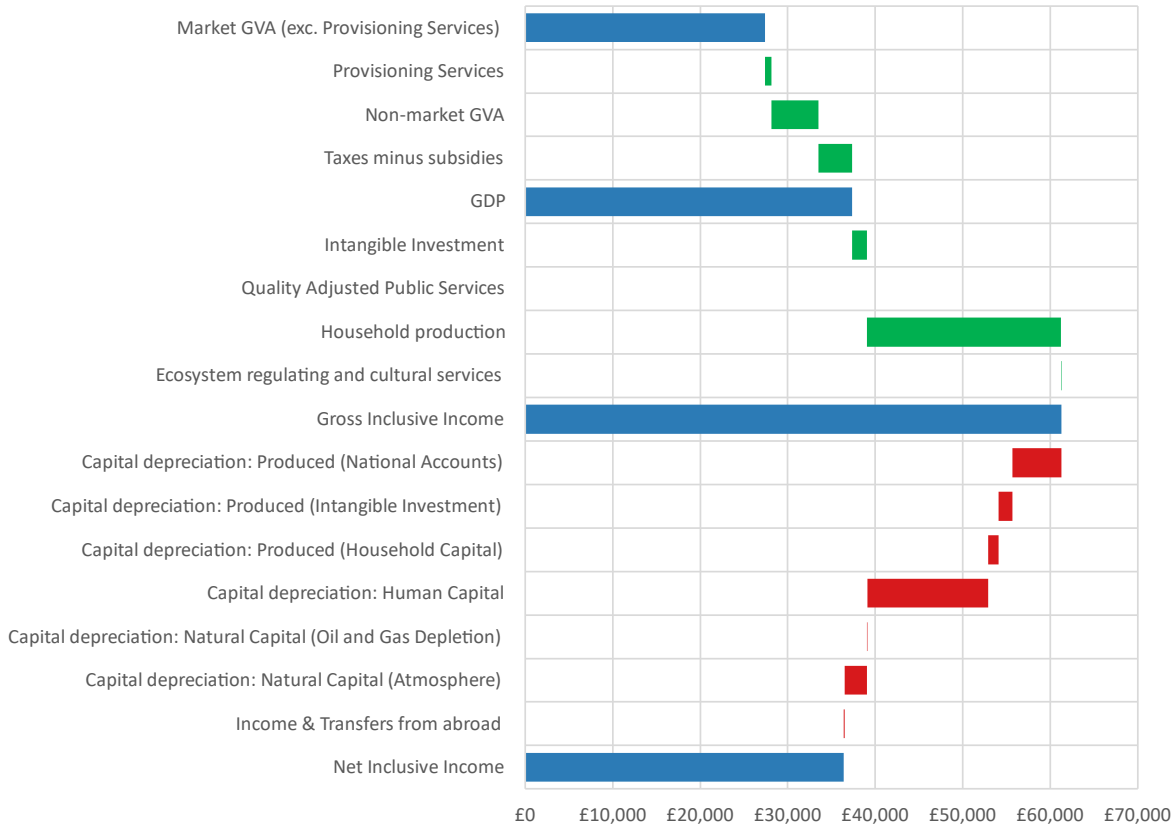
Current Price

Figure 3 presents the relative scale of the adjustments incorporated to derive GII and then NII in current prices for 2022, all on an annual per-person basis. Positive contributions are shown as green and negative contributions are shown as red. The inclusion of household production is by far the biggest adjustment – adding £22,200 per person in 2022. For context, this is around three times bigger than the size of the non-market elements of the economy currently contained within GDP and is nearly equivalent in scale of all market-based production. That is to say that the UK is in a position whereby the value of production within the household is only marginally less than the value of output produced in the market. If one chose to move imputed rental on owner-occupied housing from GDP, where it is currently held, to the unpaid household sector, the volume of household production would even exceed market GVA. Whilst we do not have historic data prior to 2005 to compare to, this may represent a significant turning point in UK society and merits further investigation. The size of other contributions added to GDP to derive GII are substantially smaller, or even negative[25].

[25] In the case of carbon sequestration this is negative because natural resources in the UK which should absorb carbon, such as peatland, are so damaged they currently emit / release carbon rather than capturing it.

Figure 3: From Market GVA per person to Net Inclusive Income per person

UK, £ per person, Current Prices, 2022



Note: Different measures are shown in blue, and green and red bars represent components added to progress from measures on the left to measures on the right. Quality Adjustment of Public Services has no impact on current price data, only volumes, but are included for completeness.

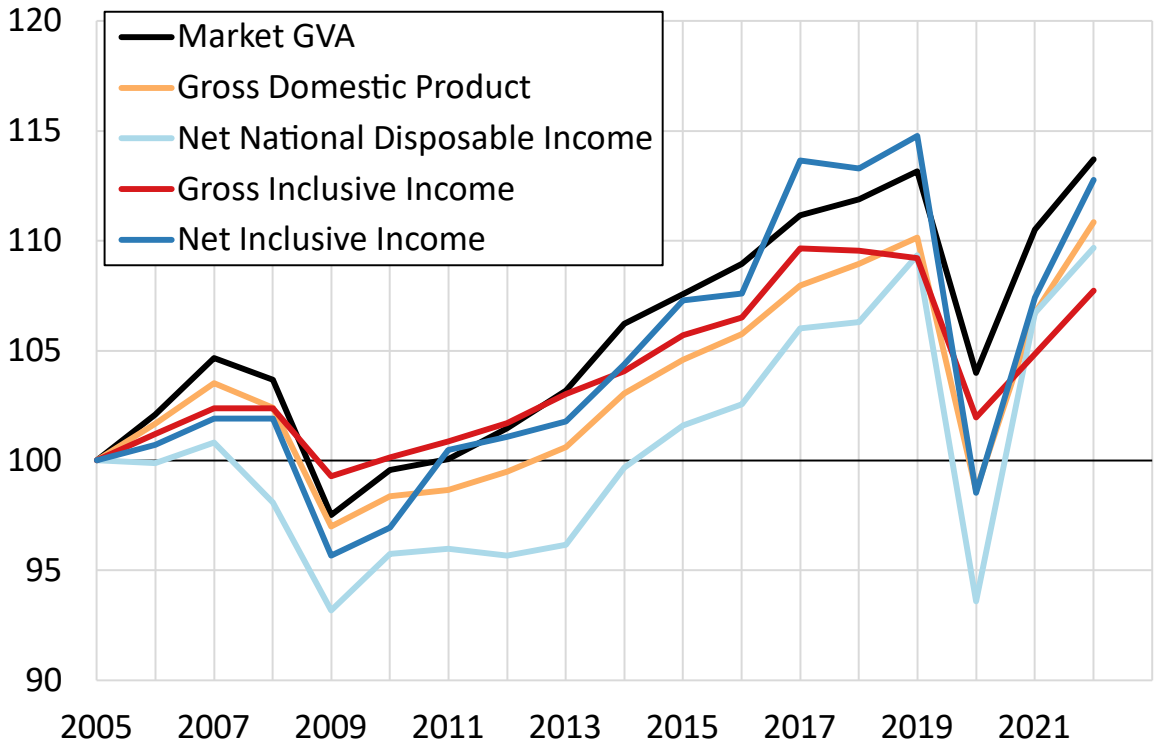
Turning to the contributions subtracted from GII to move to NII, we see less of a dominance of any one component. That said, depreciation of human capital accounts for around half the contributions at this stage (-£13,800 per person). In contrast with its effect on GII, the effect of accounting for household production on moving to net figures is much more subdued, amounting to just -£1,200 per person. Finally, the effect of greenhouse gas emission related depletion and degradation of the atmosphere is not large but is still notable, at -£2.5k per person. As emphasised in the methodology section, this figure should be treated with particular caution.

Volumes

As with standard GDP data, comparisons of growth over time are best undertaken using Chained Volume Measures (CVM) – which control for changes in prices – as shown in Figure 4, which compares GII and NII with either respective national accounts counterparts (GDP and NNDI) as well as with market-sector GVA. All figures are presented on a per-person basis.

Figure 4: A comparison of market GVA, standard GDP and Net National Disposable Income with Gross and Net Inclusive Income

UK, per person, 2005 = 100, Chained Volume Measures, 2024 vintage

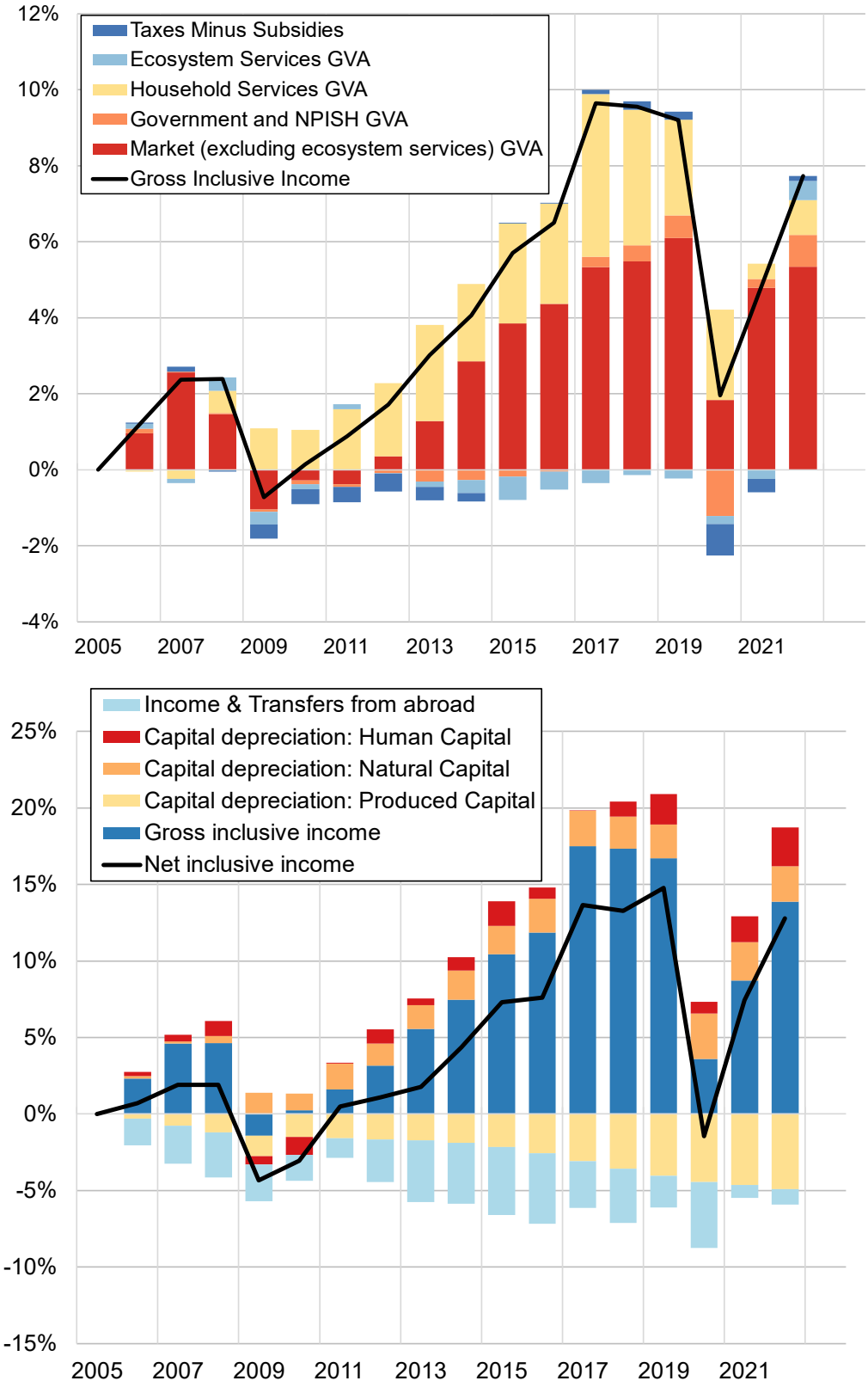


An immediate point which stands out is the extent to which, even with the substantial changes made in the inclusive income framework, GII and GDP exhibit very similar broad stories; two substantial economic downturns (during the financial crisis and covid pandemic) with an intervening period of growth. The most substantial way in which they differ is the relative prominence of these movements, with GII being more subdued in both the scale of downturns and growth. Looking at market GVA reveals one substantial factor driving this – the role of the market sector both in downturns and in driving growth.

NII on the other hand deviates more substantially from its national accounts counterpart, but mostly in scale rather than direction. In addition to the fall during the financial crisis being more subdued, the period of growth up to 2019 is markedly faster. These combined meant that NII per person in 2019 was 14.8% higher than in 2005, compared to 9.3% for NNDI.

But a key advantage of inclusive income is the decomposability it gains from being based on an accounting framework. As such, we can examine exactly which parts of the economy are driving various changes for both GII and NII. Figure 5 decomposes cumulative growth in CVM GII and NII since 2005, again on a per person basis.

Figure 5: Contributions to growth in CVM GII and NII since 2005
UK, % and percentage points



Looking first at contributions to GII, while the market economy is the largest contributor to growth in GII (and so NII), household production made a substantial contribution prior to the

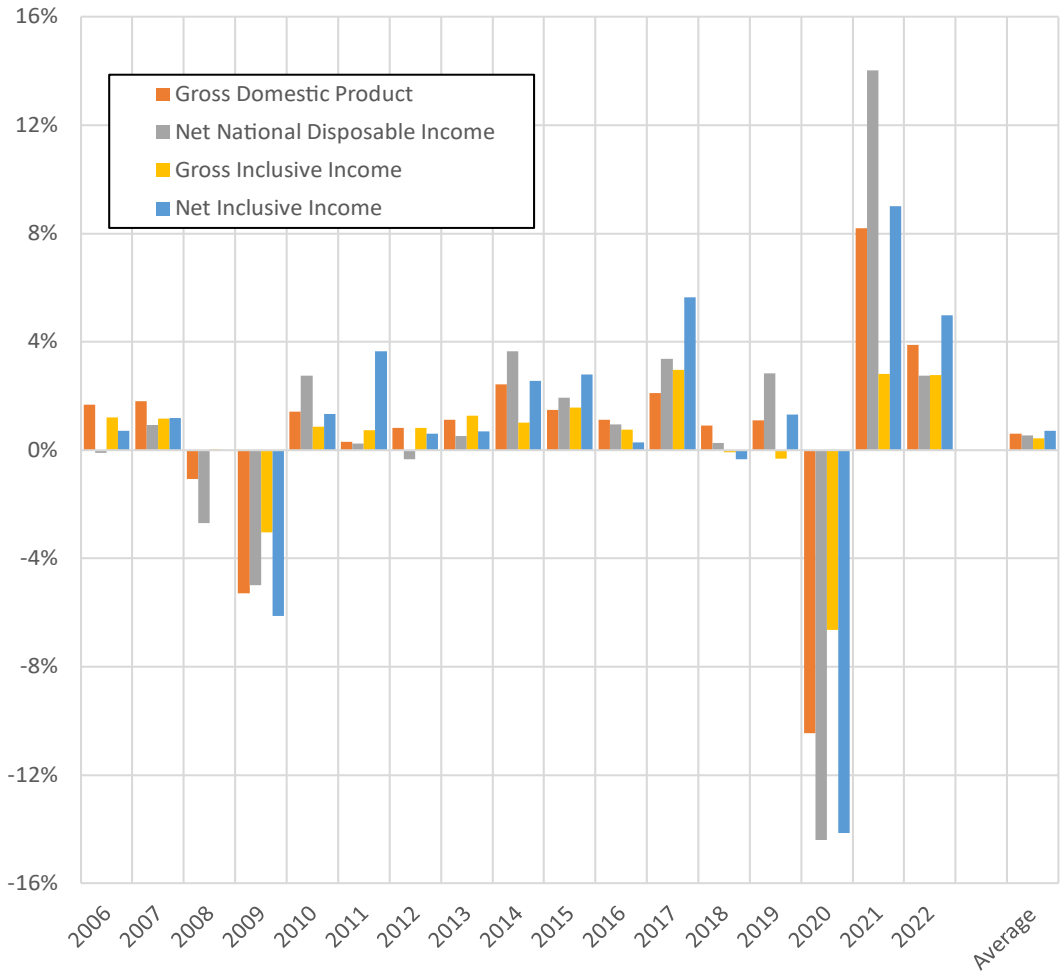
covid pandemic. Between 2005 and GII's per person peak in 2017, the market sector contributes 5.3 percentage points to GII's growth on a per person basis, while household production was not far away at 4.3 percentage points. When looking at the fall in GII per person between 2017 and 2022, at least two key stories stand out. The first is that household production is the key factor causing GII to fall prior to the onset of the covid pandemic in 2020, which in turn was driven by decreases in household nutrition services and household provided adult care. The second is that the covid pandemic saw a more widespread decline in economic activity than did the financial crisis. Whereas the financial crisis was mainly centred on the market sector (with household production growing in 2009 and Government & NPISH remaining fairly constant), the onset of the covid pandemic in 2020 saw activity fall in the market sector, Government & NPISH, as well as production in the household. That latter point is explained primarily by a large fall in household transport services in 2020 associated with lockdowns, which is only partially offset by other increasing areas of household services (such as childcare).

The second panel of Figure 5 shows contributions to NII, building from GII in dark blue – this includes the depreciation of the different capitals, as well as an adjustment for net income and current transfers with the Rest of the World. One prominent feature that stands out is the lack of consistency in the direction of the contributions from capital depreciation. Produced capital (i.e. capital as it is recorded in the national accounts, plus additional intangibles and household durables) has an increasingly negative contribution over time, reflecting more capital being consumed in production. In contrast, natural capital (which includes the depletion of oil and gas as well as the degradation of the atmosphere associated with carbon emissions) shows a positive contribution over time. This is primarily driven by a reduction in UK carbon emissions over the period. Simply put, while production in the UK is using more produced capital inputs, it is "using up" less of the atmosphere.

Finally, annual growth figures are summarised in Figure 6 for all measures. Differences between the growth rates remain mostly within two percentage points, with a few outliers; 2008-09 for example, reflecting the market-led economic downturn in those years, as well as 2020-21 reflecting the covid pandemic. Nevertheless, an overall effect can clearly be seen: GII tends to be the least volatile measure, while NII tends to be the most volatile. In the case of GII, this mostly reflects the broader production boundary reaching further beyond the economic cyclicality of the market sector. In the case of NII, this primarily reflects how much is netted from this measure. Capital consumption tends to be exhibit very low volatility (as it reflects the *expected* depreciation of the capital), so netting off this large value, almost half of GII, results in a series which is more volatile in proportionate terms.

Figure 6: Comparison of annual growth for economic welfare measures

UK, % change on same time previous year, Chained Volume Measure (CVM)



In both cases, for GII and NII, their changes in volatility reflect an increased focus on sustainability in different ways. GII helps extend our focus beyond the (cyclical) market sector and that less volatile, more expansive definition of economic activity aids a focus on the longer term by dampening down volatility from the market sector. Meanwhile, NII highlights the extent to which capital depreciation, still continues even when economic activity declines (under the standard assumptions of time-invariant depreciation rates) – so when thinking about the sustainability of the country's capital stock, a downturn might be even more unsustainable than it first seems. Clear examples of this stand out from the covid pandemic; whilst economic activity decreased, people's human capital continued to depreciate regardless of whether they spent their time at work or on furlough as they are one year closer to retirement.

These analyses demonstrate the power of these new aggregates in assessing expansions of the production and asset boundaries in order to better measure welfare – and evaluating how these expansions can change our understanding of events like the 2008-09 recession and the covid pandemic.

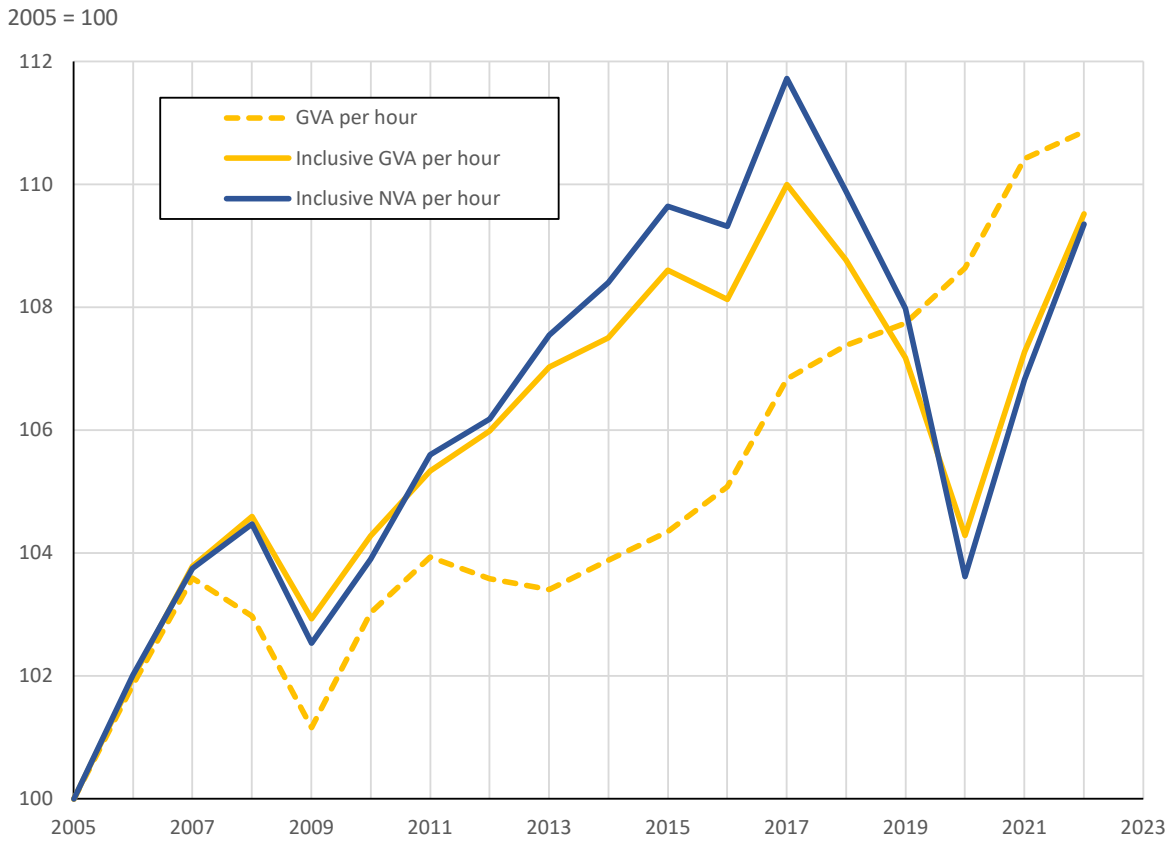
Applied Results

Perhaps the strongest feature of inclusive income is that it is drawn from a set of economic accounts, which enable not just the calculation of gross and inclusive income as headline economic indicators, but also comparators with many of the other key economic aggregates economists are familiar with and utilise for modelling and analysis.

One key economic aggregate with core relevance for understanding economic growth, living standards, and their sustainability is productivity. Gross Value Added (GVA) per hour worked is often used as a headline measure of productivity, and is shown in Figure 7. The familiar story of the UK's productivity puzzle is evident, with GVA per hour worked growing at a relatively slow pace over the period since 2005 as a whole.

Figure 7: A comparison of different productivity measures, using both national accounts based and inclusive income based measures of economic activity

UK, 2005 = 100, Chained Volume Measures



This economic narrative from the UK's existing national accounts can be built upon using the economic accounts underlying inclusive income. Inclusive Gross Value Added (IGVA) per hour worked (a comparator with GVA per hour worked) is also shown in Figure 7. IGVA is similar to GII, but subtracts taxes and adds subsidies (similar to the difference between GVA and GDP). Inclusive Net Value Added (INVA) per hour worked is also shown in Figure 7. This takes IGVA and subtracts the depreciation of produced and natural capital. The depreciation for human capital is not subtracted, as the hours worked data which will serve as the denominator for IGVA per hour worked already capture changes in human capital in this

productivity measure. The hours worked data which feed into both IGVA and INVA include both paid and unpaid work; so include the hours spent undertaking unpaid household services, derived from data underlying the household satellite accounts and time use surveys.

IGVA per hour worked paints a stronger picture of productivity growth in the decade to 2015, with growth around twice as high as that indicated by GVA per hour worked . This reflects two factors – higher productivity growth in household production (driven in particular by transport and childcare) than in the production boundary of GVA, and a decrease in the proportion of hours worked in unpaid household services. Between 2015 and 2019 these trends revert slightly, causing IGVA per hour worked to grow more slowly than GVA per hour worked. From 2020 onwards IGVA falls substantially, primarily reflecting a substantial increase in the proportion of hours worked doing unpaid household work relative to paid employment.

INVA per hour worked builds on IGVA per hour worked by accounting for produced and natural capital depreciation; essentially delivering a measure of sustainable labour productivity growth. The key insight from this measure of productivity is the stronger growth it exhibits between 2005 and 2017, particularly 2012-2017, even compared to IGVA per hour worked. Between 2005 and 2017 INVA per hour worked grows by 11.7% - compared with 6.8% for GVA per hour worked and 10.0% for GII per hour worked. A substantial factor behind this was the fall in climate degradation associated with carbon emissions over this period – hence a stronger increase when focussing on the *sustainability* of production.

This is a key narrative, also recently explored by Rodríguez et al (2018) and Agarwala and Martin (2022), which is missed if one only looks at traditional measures of UK productivity – these data suggest a key aim of innovation over the past few decades has been the reduction of carbon emissions to tackle climate change, rather than increases in economic output as traditionally measured in goods and services observed through GDP and GVA. If this is the case it is hardly surprising than GVA per hour worked has not increased, if that was never the aim. If decisions were instead aimed at reducing environmental harm rather than increasing output, the innovations which go to achieving them would not feature in traditional productivity metrics derived from the national accounts. The measures derived from inclusive income, however, reveal that the rate of innovation and the role it plays in the economy may not have deteriorated in this period as is generally accepted and clearly indicate the need for further research to further decompose and analyse the differences between these growth rates.

5. Conclusions

This paper brings together many pieces of work which have previously been treated in isolation and adds value by combining them within a framework consistent with the National Accounts. This allows this paper to present new indicators of welfare capturing a wider range of assets, goods, and services, using data which are available today. This integration of data allows several key insights to be made which touch on a variety of key current debates.

Firstly, our perspective of the way the UK produces goods and services has to reflect the impact of unpaid household production of goods and services. This article has shown that unpaid household production represents a large share of GII and has played a key role in both its periods of growth and its periods of decline. More research and focus are needed on this fundamental way we relate to production as a society.

Second, and inherent in the first, is the question of the relationship between paid and unpaid work, both following the 2007-9 financial crisis and the Covid-19 pandemic. It would be useful

to understand what factors caused labour to become dislocated from paid activity at these times, and here in particular the question of distribution is important: if this unpaid work is retired people on good pensions delivering unpaid childcare through enjoying days out with their grandchildren this is dramatically different from a lone parent providing the same childcare because they cannot afford to work and pay childcare fees. The relationship between financial and non-financial wealth and the decision to opt out (either fully or in part) of the labour market and deliver unpaid output is one we consider worthy of further investigation.

Third, the dramatic extent of growth *outside* the production boundary, and an increasing awareness of the importance of natural and human capital, necessarily compels us to think again about productivity and the puzzle of the UK's low growth since 2008. Whilst traditional analyses have focussed on investment and flatlining TFP growth, it needs to be questioned whether we should be considering the focus on traditional measures of output as a key factor. For example, could it be the case that business innovation and investment may be delivering growth outside the traditional measures of the market sector? Our analysis highlights the impact of investment in projects to reduce carbon emissions. A business could easily invest significant sums to do this, without delivering any increase in output, with the benefits being observed only through a reduction in the degradation of the atmosphere. Analysis presented in this article has shown that this may well be the case and traditional productivity measures underestimate the pace of innovation in the UK economy, and particularly its consumption patterns, as a result. Secondly, while outside the scope of the empirical work in this paper, free goods and services have dramatically changed the production technology for unpaid activities. Instead of writing one or two letters a week and posting these via the mail, today's digital correspondent sends dozens of written communications a day, via platforms such as email, LinkedIn, Facebook, WhatsApp and Twitter/X to name but a few. That exponential growth in unpaid output, from one or two communications to maybe hundreds is just one example of how free technologies may have created vast productivity growth, just not within GDP, which will only value these platforms in terms of the cost of production.

Fourth, this work presents a significant challenge to natural capital measurement. The SEEA uses, as mentioned, market prices or imputes the equivalent to exchange values. Whilst these will internalise some current externalities, the threat is this may continue to under-value these assets and hence place relatively less importance onto them than justified. In part this is because of notable methodological challenges around how to value cliff-edges in marginal pricing models. This suggests further thought needs to be urgently given to the feasibility of using accounting prices rather than market prices, recognising the challenges both methodological and practical.

Finally, the impact of capitalising human capital on macroeconomic aggregates has been shown to be very significant, but is heavily dependent on continued methodological work. Where the current international methods appear to not fully align with national accounting norms means more work is required, and this may change our understanding of the relative value of human capital in the UK.

These are all key questions: the nature of the UK economy, the degree to which economic inactivity is actually a transferral of time into unpaid household activity, the relative importance of the environment, the productivity puzzle and the importance of human capital. Through the Inclusive Income framework, all are cast in a new light and we hope these new

data may better-inform policy-makers by presenting data in a way which allows direct observation of the economic trade-offs between the economic, social and environmental domains. Following sustained investment since the Bean Review (2016) the UK's Office for National Statistics, commenced publication of these data in 2022 and will be updating as well as improving upon them over time.

That is not to argue this model solves all the questions raised across the Beyond GDP landscape – it is not a substitute for the UN's Sustainable Development Goals, or other multi-dimensional analyses of wider wellbeing, where the components of these are harder to conceptualise in proxy income terms – but these data have the capacity to be improved further in future years. It is also worth focussing on how far applying proven methods and techniques across a wider landscape opens the door for economists to build upon, rather than rebuilding, national accounting and GDP, without further delay. Rather than long debates about how and whether to change GDP, this model allows consumer choice, and provides users a means to place the data they have previously used into a wider context at low additional cost to the taxpayer now the foundational investments by ONS have already been delivered. Whilst there is always more to do to perfect methods and data, we have enough data to aide users now, without compromising the quality of market-based metrics essential for macro-economic policy making.

Annex A: GII and NII Datasets

Table F1: Current price statistics for key National Accounts and Inclusive Income aggregates (bolded) and their components and contributions (£ billions)

Year Relation	Market GVA (exc. Provisioning Services) a	Provisioning Services (excluding fishing and renewable energy) b	Non-market GVA c	Taxes minus subsidies d	GDP **e = a + b + c + d**	Intangible Investment f	Quality Adjusted Public Services g	Household production h	Ecosystem regulation services (Greenhouse gas regulation, urban heat regulation, and air pollution regulation) i	Gross Inclusive Income **j = e + f + g + h + i**	Capital depreciation: National Accounts k	Capital depreciation: Intangible Investment l	Capital depreciation: Household Capital m	Capital depreciation: Human Capital n	Natural Capital Depletion o	Climate depletion and degradation p	Income & Transfers from abroad q	Net Inclusive Income **r = j + k + l + m + n + o + p + q**	Population (number of people) s	Hours worked (paid and unpaid, billions) t
2005	1,046	19	195	139	**1,399**	78	-00	685	2	**2,164**	-187	-69	-62	-596	-10	-124	2	**1,118**	60,413,300	181.7
2006	1,097	22	206	146	**1,472**	81	-00	711	2	**2,266**	-198	-73	-63	-617	-10	-128	-18	**1,159**	60,827,100	181.6
2007	1,158	18	215	154	**1,545**	85	-00	762	2	**2,393**	-210	-76	-64	-646	-11	-132	-28	**1,226**	61,319,100	181.9
2008	1,188	30	224	152	**1,594**	84	-00	822	2	**2,502**	-225	-82	-62	-673	-12	-135	-35	**1,278**	61,823,800	182.4
2009	1,162	14	234	139	**1,549**	83	-00	890	2	**2,524**	-235	-86	-61	-703	-12	-128	-29	**1,270**	62,260,500	181.2
2010	1,189	19	241	160	**1,609**	83	-00	918	2	**2,612**	-237	-88	-61	-713	-12	-136	-20	**1,346**	62,759,500	182.0
2011	1,215	27	243	178	**1,663**	83	-00	983	2	**2,731**	-244	-88	-62	-706	-10	-134	-14	**1,473**	63,285,100	183.1
2012	1,263	23	246	182	**1,714**	83	-00	1,022	2	**2,820**	-252	-87	-63	-711	-9	-142	-37	**1,519**	63,710,800	185.0
2013	1,325	20	245	192	**1,781**	86	-00	1,092	3	**2,962**	-259	-86	-64	-734	-9	-145	-58	**1,607**	64,138,700	186.7
2014	1,394	15	252	202	**1,863**	87	-00	1,144	2	**3,096**	-268	-86	-66	-744	-9	-142	-58	**1,723**	64,619,500	189.1
2015	1,445	7	257	207	**1,916**	92	-00	1,213	2	**3,223**	-277	-85	-67	-761	-9	-144	-66	**1,813**	65,088,100	191.2
2016	1,499	12	264	217	**1,992**	95	-00	1,243	2	**3,332**	-290	-86	-68	-794	-6	-142	-71	**1,875**	65,607,100	195.1
2017	1,566	16	275	226	**2,082**	102	-00	1,334	2	**3,521**	-306	-88	-69	-816	-4	-143	-45	**2,049**	65,966,000	198.8
2018	1,610	23	288	232	**2,152**	105	-00	1,317	3	**3,577**	-318	-91	-71	-820	-3	-151	-55	**2,067**	66,288,900	201.6
2019	1,671	21	304	238	**2,234**	107	-00	1,302	3	**3,645**	-332	-94	-75	-844	-3	-153	-29	**2,115**	66,630,700	205.0
2020	1,559	23	316	206	**2,103**	105	-00	1,369	3	**3,580**	-341	-102	-78	-891	-4	-146	-74	**1,945**	66,744,100	198.2
2021	1,689	22	337	237	**2,285**	111	-00	1,376	2	**3,775**	-352	-103	-82	-901	-4	-156	-5	**2,172**	66,983,500	198.2
2022	1,853	51	362	260	**2,526**	115	-00	1,498	3	**4,143**	-377	-109	-80	-932	-6	-170	-9	**2,459**	67,602,800	200.7

Table F2: Chained volume statistics for key National Accounts and Inclusive Income aggregates (bolded) and their contributions (£2022 billions)

Year	**Market GVA (exc. Provisioning Services)**	**Provisioning Services (excluding fishing and renewable energy)**	**Non-market GVA**	**Taxes minus subsidies**	**GDP**	**Intangible Investment**	**Quality Adjusted Public Services**	**Household production**	**Carbon sequestration and urban heat regulation**	**Gross Inclusive Income**	**Capital depreciation: National Accounts**	**Capital depreciation: Intangible Investment**	**Capital depreciation: Household Capital**	**Capital depreciation: Human Capital**	**Natural Capital Depletion**	**Climate depletion and degradation**	**Income & Transfers from abroad**	**Net Inclusive Income**	**Population (number of people)**	**Hours worked (paid and unpaid, billions)**
2005	1,469	28	322	230	**2,037**	109	-16	1,300	3	**3,437**	-268	-107	-49	-884	-13	-181	3	**1,949**	60,413,300	181.7
2006	1,507	32	325	232	**2,085**	111	-13	1,307	3	**3,502**	-276	-107	-49	-885	-12	-181	-26	**1,976**	60,827,100	181.6
2007	1,566	24	322	238	**2,140**	115	-10	1,310	3	**3,571**	-284	-108	-50	-890	-11	-183	-39	**2,016**	61,319,100	181.9
2008	1,548	40	322	233	**2,135**	111	-8	1,354	3	**3,601**	-293	-109	-51	-889	-11	-180	-47	**2,032**	61,823,800	182.4
2009	1,486	18	319	222	**2,036**	104	-6	1,384	3	**3,516**	-299	-108	-52	-920	-9	-168	-38	**1,921**	62,260,500	181.2
2010	1,524	25	319	223	**2,081**	105	-5	1,394	3	**3,575**	-305	-107	-53	-938	-9	-175	-25	**1,963**	62,759,500	182.0
2011	1,535	34	320	225	**2,105**	103	-2	1,427	3	**3,631**	-310	-106	-53	-924	-7	-169	-18	**2,051**	63,285,100	183.1
2012	1,572	29	320	224	**2,137**	103	-1	1,450	3	**3,686**	-314	-105	-54	-913	-6	-177	-46	**2,077**	63,710,800	185.0
2013	1,615	25	314	230	**2,175**	104	-1	1,483	3	**3,759**	-318	-105	-55	-929	-6	-177	-71	**2,106**	64,138,700	186.7
2014	1,682	18	317	236	**2,245**	105	-00	1,475	3	**3,825**	-322	-106	-57	-927	-6	-171	-70	**2,176**	64,619,500	189.1
2015	1,726	9	322	246	**2,295**	110	1	1,509	2	**3,914**	-328	-106	-58	-918	-6	-172	-79	**2,253**	65,088,100	191.2
2016	1,757	14	328	248	**2,339**	112	1	1,521	3	**3,975**	-336	-108	-60	-944	-6	-167	-84	**2,277**	65,607,100	195.1
2017	1,798	18	340	253	**2,401**	117	3	1,593	3	**4,114**	-345	-109	-63	-964	-6	-165	-52	**2,419**	65,966,000	198.8
2018	1,812	26	348	258	**2,435**	119	3	1,573	3	**4,131**	-353	-110	-67	-948	-7	-171	-62	**2,422**	66,288,900	201.6
2019	1,845	23	356	259	**2,474**	118	4	1,540	3	**4,139**	-359	-110	-71	-932	-7	-169	-32	**2,467**	66,630,700	205.0
2020	1,696	24	285	222	**2,219**	113	4	1,537	3	**3,871**	-364	-110	-75	-958	-6	-154	-78	**2,122**	66,744,100	198.2
2021	1,811	23	337	240	**2,410**	118	-00	1,464	3	**3,994**	-369	-107	-78	-941	-5	-165	-6	**2,321**	66,983,500	198.2
2022	1,853	51	362	260	**2,526**	115	-00	1,498	3	**4,143**	-377	-109	-80	-932	-6	-170	-9	**2,459**	67,602,800	200.7

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