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Keywords: National Income and Product Accounts; Consumption; Welfare,

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JEL classification: E01, D14, I31

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We develop a framework to measure changes in material well-being—defined as real market consumption plus government-provided Social Transfers in Kind across income groups, consistent with the System of National Accounts. Applying this framework to eleven OECD countries, we find that Social Transfers in Kind matter for evolution of material living standards, albeit with significant differences between countries and income groups. Across countries, no clear income gradient can be found in the evolution of material well-being. However, the cost-of-living, both adjusted and unadjusted for Social Transfers in Kind, has tended to rise faster for low-income households. Significant gaps in deflators for these transfers highlight a key measurement challenge.

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1 Introduction

Aggregate measures of economic activity, such as employment, unemployment, and inflation, are crucial for macroeconomic management. However, they provide only a partial view of economic well-being. The limitations of these measures have been well-documented, notably by Stiglitz, Sen, and Fitoussi [22]. These limitations arise from variations in household endowments and preferences, leading to differences in wealth, income, inflation, and exposure to economic shocks.

The concept of a representative consumer or firm, while analytically convenient, does not accurately reflect welfare. It is essential to consider how income, consumption, wealth, and inflation are distributed among households.

Although distributional measures, particularly of income, have long existed and remain valuable, they often rely on different concepts than aggregate national accounts-based measures. This discrepancy makes it challenging to establish clear links between totals and their distribution.

To address this, several statistical institutions and academic projects, such as the World Inequality Database[1], have developed Distributional National Accounts (DNA). These accounts aim to provide comprehensive, coherent, and comparable distributional data consistent with macroeconomic aggregates. For more than a decade, Eurostat, the OECD, and member countries have collaborated to create a common methodology[2] for ensuring international comparability. Implementation of this methodology has advanced in several countries.

A key aspect of this work is measuring income, consumption, and savings by socio-economic groups, particularly household income quintiles, in a manner consistent with the System of National Accounts (SNA). SNA consistency is more than just a statistical detail; it ensures that household consumption for each income group aligns with aggregate household consumption in the SNA sector accounts. Survey-based measures of average income or consumption often diverge from SNA-based measures, both in levels and trends.

SNA compatibility allows us to use *Actual Individual Consumption (AIC)* instead of *Household Final Consumption Expenditure (HFCE)* as the target measure for material well-being. AIC is defined as HFCE plus Social Transfers in Kind (STiKs), which are services provided to households for

[1] *World Inequality Database* at `https://wid.world/wid-world/`.

[2] *Household Distributional Results in Line With National Accounts* at `https://www.oecd.org/en/data/datasets/household-distributional-results-in-line-with-national-accounts-experimental-statistics.html`.

free or at subsidized rates, such as government-provided healthcare, education, or housing services. AIC is a better indicator of material well-being than market-based final consumption, and we derive indices of the cost of material well-being that reflect changes in STiKs.

This work has a two-fold objective:

- Develop a methodology to measure AIC, our indicator of material well-being, for each income group *in real terms*, using the economic theory of index numbers.

- Apply this methodological approach to data from 11 OECD countries. The choice of these countries is governed by data availability: these countries participated in the methodological development and have since started publishing the releant series. Our starting point is nominal data for STiKs by income group, based on the internationally agreed methodology described in OECD[21] or Zwijnenburg et al.[23]. This data is supplemented with various sources for deflators for STiKs and well-established national accounts deflators for HFCE. This allows us to measure changes in real material well-being for different income groups within a framework fully consistent with the SNA.

2 Material well-being, the cost-of-living and STiKs

The traditional measurement of material well-being and the cost of living within a national accounts framework relies on aggregate or average patterns of consumer expenditure or income. However, empirical evidence shows[3] that consumption patterns vary significantly among households with different characteristics, particularly those with different income levels. This variation means that different types of households experience different rates of change in their material well-being and cost of living.

For market goods and services, standard index number formulas can measure living standards and the cost of living for each household group. However, when dealing with STiKs, which are provided at below-market prices, additional questions arise about the choice of index number and the associated value of real consumption. The presence of STiKs introduces complexities that need to be addressed.

[3]See for instance, Hobijn and Lagakos [14], Javarel[15], Grégory et al[13] or Klick and Stockburger[16]

- Consumers do not directly choose the quantity of government-supplied services to minimize their overall expenditure. These services are often provided based on need (such as social housing) or specific circumstances (such as healthcare or education). From the individual consumer's perspective, free choice of the quantity of STiKs is limited. In a sense, these services are exogenous factors that enhance material well-being but remain outside market transactions, similar to other 'environmental' variables like road infrastructure, safety, or clean air. This setup suggests that measures of material well-being and cost of living should encompass both market products and STiKs.

- Even though consumers do not freely choose the quantity of STiKs based on market prices, they still value these services or the possibility of accessing them when needed (such as healthcare). Consumer valuation depends on personal preferences and circumstances. Therefore, each service has a household-specific 'virtual' price, which in principle should be used to value and weigh STiKs when calculating living standards for households.

However, virtual prices are not readily observable. What *is* observable - at least in principle - is the overall cost and the unit cost of *producing* STiKs[4] Our approach treats this by assuming that governments provide additional income to households which is then used to "purchase" government services at their unit production costs. This is consistent with how prices are formed and with the measurement in the National Accounts.

To formalise, consider H groups of households, where each group represents a particular income bracket such as a quintile or decile. All households in a particular group h ($h = 1, .., H$) will be treated as a single representative household that consumes quantities $q_h \equiv \left[q_{h1}, ...q_{hN}\right] \geq 0_N$ of N products that are purchased on the market at prices $p \equiv \left[p_1, ...p_N\right] \gg 0_N$. Households also benefit from M types of social transfers in kind, i.e., quantities of services $z_h \equiv \left[z_{h1}, ...z_{hM}\right] \geq 0_M$ that are provided by government for free or at a subsidised price as is often the case for health, education or housing services. These prices are a component of p[5]. Preferences are captured by a utility function $F\left(q_h, z_h\right)$ that is continuous and non-decreasing in its elements.

[4]Diewert[8] and [9] provides a conceptual treatment of the measurement of the production of public sector output, including when virtual prices are not observable.

[5]National accounts treat any actual payments for STiK by households as part of final consumption. For instance, fees for schooling borne by parents are part of education expenditure by private households. STiKs may therefore have a double nature - as part of market products where they are valued at subsidised prices/fees and as free government

We consider quantities of STiKs z_h as exogenous variables. This situation is represented by a conditional cost or expenditure function[6] $c(u_h, p, z_h)$, defined as:[7]

$$c(u_h, p, z_h) \equiv \min_{q_h} \{p \cdot q_h : F(q_h, z_h) \geq u_h\} \tag{1}$$

The conditional expenditure function $c(u_h, p, z_h)$ is the minimum expenditure that the consumer has to incur to obtain utility u_h given prices p and transfers in kind z_h. The function is non-decreasing in u_h, non-decreasing and linearly homogenous in p for fixed u_h and z_h and non-increasing in z_h for fixed u_h and p (see Browning[2]). Under cost minimization, observed expenditure on market products is also the minimum expenditure: $p^t \cdot q_h^t = c(u_h^t, p^t, z_h^t)$. Suppose for a moment that consumers' marginal willingness to pay for z_h was known in the form of a set of virtual prices $\tilde{p}_{zh} \equiv [\tilde{p}_{zh1}, ...\tilde{p}_{zhM}]$. We could then model consumer behaviour with the help of an unconstrained cost function $m(u_h, p, \tilde{p_{zh}})$, defined as

$$\begin{aligned} m(u_h, p, \tilde{p_{zh}}) \quad &\equiv \min_{z_h, q_h} \{p \cdot q_h + \tilde{p_{zh}} \cdot z_h : F(q_h, z_h) \geq u_h\} \\ &= \min_{z_h} \{c(u_h, p, z_h) + \tilde{p_{zh}} \cdot z_h\} \\ &= p \cdot q_h + \tilde{p_{zh}} \cdot z_h \\ &\textit{where } \tilde{p}_{zh} \equiv -\nabla_{z_h} c(u_h, p, z_h). \end{aligned} \tag{2}$$

The final part of equation (2) introduces the concept of unobserved virtual prices, which represent the marginal willingness of consumers to pay for various STiKs. From the consumer's standpoint, these virtual prices, denoted as $\tilde{p}_{zh}$, accurately reflect the value of the components within z_h. If these virtual prices were known, traditional index number theory could be applied to create a corresponding quantity or price index. However, virtual prices are typically not observable.

In practical terms, the value of STiKs is usually determined by summing the costs incurred by the government to produce these services. The 'prices'

services valued at virtual prices or unit costs net of fees as explained further below

[6]Formally, the same approach is used for consumption under rationing, see Deaton[5] or Neary and Roberts[20]. The general properties of a cost function are developed in McFadden[18] or Diewert[6], for a discussion of the conditional cost function see Browning[2].

[7]We use the notation $p \cdot q_h \equiv \sum_{i=1}^{N} p_i q_{hi}$ to indicate sums of products.

associated with STiKs are the unit costs of their production, which generally do not align with consumers' virtual prices. Furthermore, consumers' virtual prices are marginal valuations, not average ones, and they depend on preferences, varying among different types of households. In contrast, the unit costs of production are generally independent of consumers' preferences. To implement our measures of material well-being and its cost, we need to accept that lines 2 and 3 in equation (2) will not be exactly equal. Instead, we will use the following approximation:

$$m(u_h, p, \tilde{p_{zh}}) = \min_{z_h} \{c(u_h, p, z_h) + \tilde{p_{zh}} \cdot z_h\} \qquad \approx p \cdot q_h + p_z \cdot z_h. \tag{3}$$

where $p_z \equiv [p_{z1}, ...p_{zM}]$ are the observed unit costs of producing STiKs. We create a quantity index, Q_h, which enhances the conditional expenditure function by incorporating unit values and quantities for STiKs. This approach does not assume that consumers make cost-minimizing choices regarding government services[8].

$$Q_h \equiv \frac{m(u_h^1, p, \tilde{p_{zh}})}{m(u_h^0, p, \tilde{p_{zh}})} \approx \frac{p \cdot q_h^1 + p_z \cdot z_h^1}{p \cdot q_h^0 + p_z \cdot z_h^0}. \tag{4}$$

The quantity index of material well-being, Q_h, is defined for a set of reference prices p and p_z. If the base period prices p^0 and p_z^0 are chosen as references, we obtain a Laspeyres-type quantity index Q_{Lh}[9]. Alternatively,

[8] An alternative 'environmental variables' method defines a quantity index via the conditional expenditure function as $\frac{c(u_h^1,p,z_h^1)}{c(u_h^0,p,z_h^0)} \approx \frac{p^0 \cdot q_h^1}{p^0 \cdot q_h^0} + \frac{\tilde{p_{zh}}^1[z_h^1 - z_h^0]}{p^0 \cdot q_h^0}$. The second term linearly approximates a Laspeyres-type version of the quantity index with a direct adjustment for changes in STiKs $\tilde{p_{zh}}^1[z_h^1 - z_h^0]$, valued at virtual prices $\tilde{p_{zh}}^1$. A Paasche-type approximation is also possible. This approach yields a conventional quantity index for market products augmented by a direct STiK adjustment (see for instance Deaton[4]) and *any* volume increase in STiKs provided to consumers would raise the growth rate of material well-being, everything else equal. However, the approach requires knowledge of preference-dependent virtual prices, which are not typically observable.

[9] The theoretical Laspeyres-type index is $\frac{m(u_h^1,p^0,\tilde{p_{zh}}^0)}{m(u_h^0,p^0,\tilde{p_{zh}}^0)}$. A first-order Taylor approximation of the numerator is $m(u_h^1, p^0, \tilde{p_{zh}}^0) \approx m(u_h^1, p^1, \tilde{p_{zh}}^1) + \nabla_p m(u_h^1, p^1, \tilde{p_{zh}}^1)[p^0 - p^1] + \nabla_{\tilde{p_{zh}}} m(u_h^1, p^1, \tilde{p_{zh}}^1)[\tilde{p_{zh}}^0 - \tilde{p_{zh}}^1] = p^1 \cdot q_h^1 + \tilde{p_{zh}}^1 \cdot z_h^1 + q_h^1 \cdot [p^0 - p^1] + z_h^1 \cdot [\tilde{p_{zh}}^0 - \tilde{p_{zh}}^1] = p^0 \cdot q_h^1 + \tilde{p_{zh}}^0 \cdot z_h^1$. With $m(u_h^0, p^0, \tilde{p_{zh}}^0) = p^0 \cdot q_h^0 + \tilde{p_{zh}}^0 \cdot z_h^0$ in the denominator, Q_{Lh} as defined in (5) follows.

if prices are set to the target period, p^1, we obtain a Paasche index Q_{Ph}:

$$Q_{Lh} \equiv \frac{p^0 \cdot q_h^1 + p_z^0 \cdot z_h^1}{p^0 \cdot q_h^0 + p_z^0 \cdot z_h^0},$$
$$Q_{Ph} \equiv \frac{p^1 \cdot q_h^1 + p_z^1 \cdot z_h^1}{p^1 \cdot q_h^0 + p_z^1 \cdot z_h^0}. \tag{5}$$

The Fisher index - the geometric average of the Laspeyres and Paasche indexes - has a number of desirable properties (see Diewert[10] or Balk[1]) and is used in several countries' national accounts. We shall follow this practice and define the group-specific Fisher-type quantity index of material well-being as

$$Q_{Fh} \equiv \left[Q_{Lh} Q_{Ph}\right]^{1/2}. \tag{6}$$

The change in nominal value of material well-being between periods 0 and 1 can be decomposed into the Fisher quantity index Q_{Fh} and the corresponding Fisher price index P_{Fh}:

$$P_{Fh} \equiv \left[\frac{p^1 \cdot q_h^0 + p_z^1 \cdot z_h^0}{p^0 \cdot q_h^0 + p_z^0 \cdot z_h^0} \cdot \frac{p^1 \cdot q_h^1 + p_z^1 \cdot z_h^1}{p^0 \cdot q_h^1 + p_z^0 \cdot z_h^1}\right]^{1/2} \tag{7}$$

P_{Fh} functions as the group-specific price index related to the evolution of material well-being Q_{Fh}. To be precise, it is a mixture of transaction prices p and unit cost approximations p_{zh} to virtual prices $\tilde{p}_{zh}$. For simplicity, we shall keep referring to P_{Fh} as 'price indexes'.

It is of note that Q_{Fh} will only surpass the change in real market consumption, given by $\left[\frac{p^0 \cdot q_h^1}{p^0 \cdot q_h^0} \frac{p^1 \cdot q_h^1}{p^1 \cdot q_h^0}\right]^{0.5}$ (which excludes STiKs), if the volume of STiKs increases faster than the volume of market consumption. Similarly, the cost of living P_{Fh} will only rise less than market product inflation if the price (unit cost) of STiKs increases by less than the average price of market products.

Lastly, it is important to recognize that the approximations in (3) and (4) overlook the fact that group-specific indexes generally depend on the level of utility u_h or on group-specific income. These equations are first-order approximations (see footnote 9), which means there is no explicit dependence on income[10]. However, expenditure *patterns* are permitted to differ between groups, which helps to account for some of the variations in spending behaviors.

[10]For reference independence, the underlying expenditure function must be homothetic, meaning it can be expresses as $e(u_h, p, z_h) = e(u_h) f(p, z_h)$.

3 Results for eleven countries

The true test of any measure is in its application. We have calculated indicators of material well-being and its cost for different income quintiles in eleven OECD countries. We utilized current price data on household market consumption and STiKs from the OECD's distributional national accounts database[11]. This database categorizes consumption data according to the Classification of Individual Consumption by Purpose (COICOP) and provides detailed information on STiKs. The distributional data adheres to a standardized OECD methodology and aligns with the national accounts aggregates for the household sector in each country. Although methodologies remain consistent across countries, the time periods for which statistical offices have developed and updated the DNA data vary widely. It is important to consider this variability, even though the data is structural in nature and, excluding periods of extraordinary shocks like the pandemic, tends to change gradually.

For our analysis, we used data at the first-digit level of COICOP for each income group. STiKs were further divided into three categories: Health, Education, and Other, for each income quintile. This breakdown allows for a more granular understanding of how social transfers impact different income levels.

3.1 Selecting deflators

We obtained deflators for different categories of market consumption from the OECD national accounts database. However, deflators for STiKs are not readily available. To address this, we explored three different approaches, each with its own set of advantages and disadvantages.

- The first one (Option A) is to use the deflators of equivalent COICOP categories (market consumption of education, health, other) as a proxy. For the 'other' category, we used COICOP category 'Housing, water, electricity, gas and other fuels', as this category mainly consists of social housing. While there is a good concordance in terms of products, the disadvantage of this approximation is that deflators of household consumption expenditure reflect the payments by consumers and there is no guarantee that these deflators are a good approximation to the

[11] For more information on the data source, see the OECD's detailed report, available at `https://www.oecd.org/en/data/datasets/household-distributional-results-in-line-with-national-accounts-experimental-statistics.html`.

actual change in unit cost of producing and delivering the corresponding STiK.

- The second approach (Option B) is to use the deflator of government consumption expenditure, also from the OECD's National Accounts database. While in principle reflective of the change in unit cost of delivery, these data tend to suffer from a lack of breakdown of deflators by type of STiK. Also, deflation methods vary between countries and are often input-based, thereby ignoring productivity changes in the provision of such services.[12]

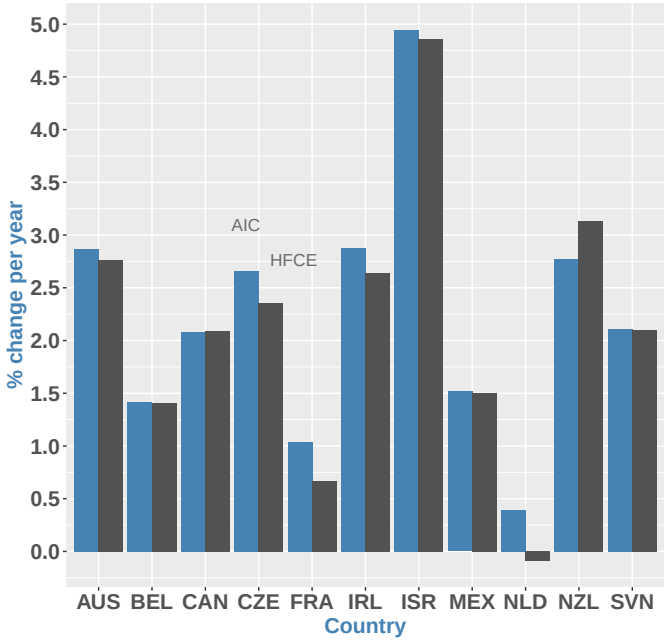
- We also explored a third approach, using data for health, education and housing collected as part of the Eurostat-OECD Purchasing Power Parity (PPP) programme. These data constitute well-developed unit costs for STiKs, they are internationally comparable, and conceptually appealing as output-based unit costs. However, they are designed for spatial rather than for temporal comparisons, with time series constructed from data exhibiting frequent structural breaks. Also, the length of time series is uneven between countries and the base data is subject to rules of confidentiality. As a consequence, only results for options A and B are presented below.

3.2 Improved Material Well-Being Overall, Income Group Trends Unclear

For the household sector as a whole, our measure of material well-being tended to grow somewhat faster than real consumption of market products alone, implying that the provision of STiKs exceeded market consumption growth as pictured in Figure 1. Note important country differences, however. A striking case is the Netherlands where average real consumption of market products fell by about 0.1% per year between 2015 and 2020 whereas the broader measure including STiKs rose by 0.54% per year (or 0,39% per year of Option A were used). In France, too, AIC rose markedly faster than market consumption. The impact is less pronounced in other countries. New Zealand is the only occurrence where market consumption clearly outpaced the broader AIC measure. More often than not, STiKs were delivered at a faster rate than market products, although overall differences tend to be small. This is confirmed by the small differences between the growth rates of

[12] See Mitchell et al[19] for a recent overview.

Figure 1: In About Half the Countries, Social Transfers are Delivered at a Faster Rate than Market Consumption*



*STiKs as part of AIC were deflated using the general price index for government consumption (Option B). Time periods: Australia: 2009-17, Belgium 2009-22, Canada 2008-23, Czech Republic 2015-22, France 2011-16, Ireland 2011-22, Israel 2015-17, Mexico 2008-22, New Zealand 2009-15, Netherlands 2015-20, Slovenia 2012-22.

AIC and HFCE, captured through the constant term and country dummies in the panel regression in Table 1.

The regression analysis in Table 1 shows that across all countries there is no statistically significant income gradient of AIC growth. However, this cross-country average hides notable differences between countries as is evident from Figure 2 and 3 as well as the Annex Table. For example, Israel shows a strong negative gradient with AIC growth of low incomes largely outpacing those of higher incomes. Note, however, that Israel's data relates to a very short period (2015-17) with particularly strong overall economic growth and deflation that may have favoured lower income groups, so it is not clear whether there is longer term decrease in inequality of material well-being. Indeed, when Israel is excluded from the regression (second column in Table 1), the coefficient for income quintiles in Table 1 drops further. We also see a clear negative gradient in Mexico and Belgium. Australia is the

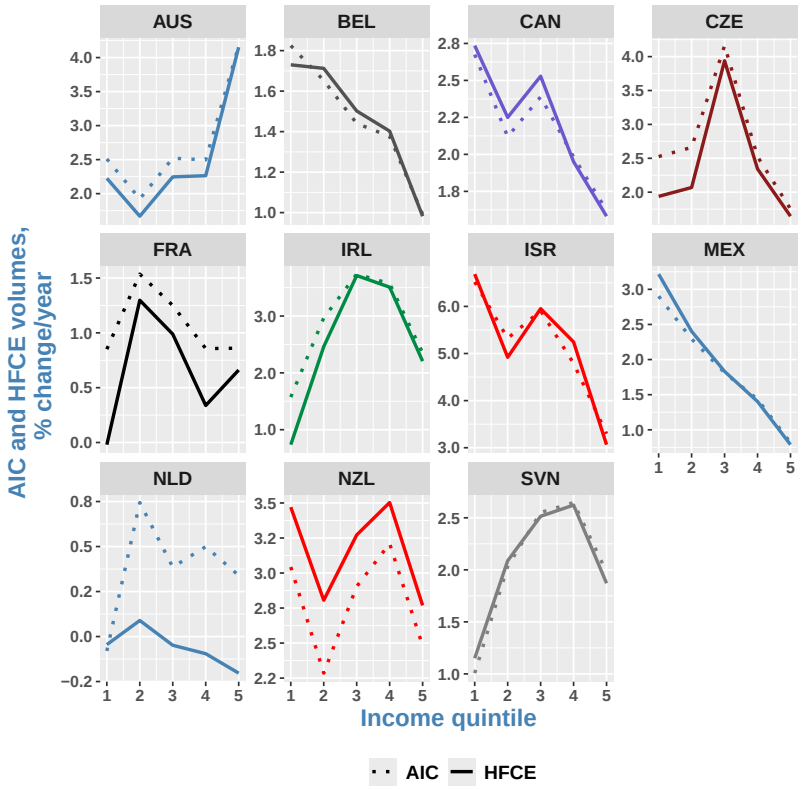
Table 1: Material living standards have generally risen but only in some countries outpaced household consumption growth, and there is no clear income gradient

	Dependent variable:		
	AIC		HFCE
	AIC	AIC excl. ISR	
	(1)	(2)	(3)
Constant	2.98^{***} (0.37)	2.80^{***} (0.34)	2.73^{***} (0.42)
Income Quintile	−0.09 (0.07)	−0.03 (0.06)	−0.07 (0.08)
Belgium	-1.27^{***} (0.44)	-1.27^{***} (0.40)	-1.05^{**} (0.50)
Canada	−0.57 (0.44)	−0.57 (0.40)	−0.30 (0.50)
Czech Republic	0.0004 (0.44)	0.0004 (0.40)	−0.12 (0.50)
France	-1.65^{***} (0.44)	-1.65^{***} (0.40)	-1.86^{***} (0.50)
Ireland	0.12 (0.44)	0.12 (0.40)	0.01 (0.50)
Israel	2.44^{***} (0.44)		2.66^{***} (0.50)
Mexico	-0.87^{*} (0.44)	-0.87^{**} (0.40)	−0.58 (0.50)
Netherlands	0.06 (0.44)	0.06 (0.40)	0.65 (0.50)
New Zealand	-2.35^{***} (0.44)	-2.35^{***} (0.40)	-2.57^{***} (0.50)
Slovenia	−0.68 (0.44)	-0.68^{*} (0.40)	−0.46 (0.50)
Observations	55	50	55
R^2	0.79	0.66	0.77
Adjusted R^2	0.73	0.58	0.71
Residual Std. Error	0.70 (df = 43)	0.64 (df = 39)	0.79 (df = 43)
F Statistic	14.38^{***} (df = 11; 43)	7.71^{***} (df = 10; 39)	13.16^{***} (df = 11; 43)
Note:			*p<0.1; **p<0.05; ***p<0.01

opposite case, with a significantly stronger real AIC growth of the upper income quintile than the lower ones. Several other countries show growth rates in the form of a hump where middle income households' consumption grows relatively faster. It is also noteworthy that the move from market consumption to AIC shifts the income profiles but does not fundamentally change their shapes.

Figure 3 corroborates this finding with a different measure of inequality, the difference between the growth in real AIC (or HFCE) of the highest income quintile and the lowest income quintile. A negative number indicates falling inequality (the situation of households with higher incomes improved by less or deteriorated by more than the situation of lower income households), a positive number indicates the opposite. As can be seen in Figure 3, the inequality in real living standards fell in about half of the countries and rose in the other half.

Figure 2: No significant gradient of real AIC and HFCE across countries



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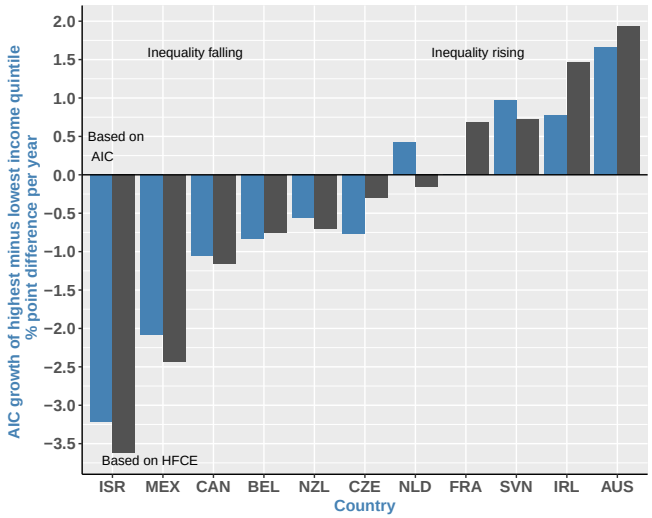
3.3 STiKs matter for the evolution of material living standards across across income groups

Next is the question whether considering STiKs changes the distribution of living standards in real terms. Figure 3 compares the relative growth of real AIC between the highest and the lowest quintile with the relative growth of HFCE between the highest and the lowest quintile, all in real terms. We first note that with the exception of the Netherlands, the direction of change in inequality - rising or falling - is the same, whether STiKs are taken into account or not. However, the degree to which measured inequality increases or falls is affected by considering STiKs. France is a case in point:

while a measure of market consumption only would suggest a visible rise in inequality, a measure including social transfers in kind suggests stability. In France, therefore, the provision of STiKs had a progressive effect over the period at hand. A similar pattern holds for Australia and Ireland where the inclusion of STiKs leads to less pronounced differences in the evolution of material well-being between the highest and the lowest income groups. This reflects two possible effects: one is that STiKs constitute a relatively larger share of consumption for the lower income groups than for the higher income groups, providing them with a relatively larger gain in overall consumption; two is that lower income household groups may have benefited from larger rises in the quantity of STiKs. However, in several countries with falling inequality, accounting for STiKs produces a slower reduction in the gap of material living standards than on the basis of market consumption alone. Belgium and the Czech Republic show a different pattern where the inclusion of STiKs accelerates the measured decline in inequality. Overall, including STiKs appears to attenuate movements, whether they are towards higher or lower inequality.

Figure 3: About Half of Countries Saw Rising Inequality in Real Terms, About Half Saw Decline



*STiKs as part of AIC were deflated using the general price index for government consumption (Option B). Time periods: Australia: 2009-17, Belgium 2009-22, Canada 2008-23, Czech Republic 2015-22, France 2011-16, Ireland 2011-22, Israel 2015-17, Mexico 2008-22, New Zealand 2009-15, Netherlands 2015-20, Slovenia 2012-22.

3.4 Cost-of-living and Cost of Material Well-Being

Turning to the price and cost indexes associated with market consumption and our broader measure of material well-being, AIC, Figure 4 indicates that, for the household sector as a whole, in about half the countries, the price index for AIC has increased faster than the cost-of-living associated with market consumption alone. Such a development is consistent with longer-terms trends in the share of government consumption in GDP. For example, health care costs tend to rise faster than prices of other consumption products. At the same time, the volumes of health care services are on the rise, driven by long-term demographic changes.

When it comes to breaking down the changes in the cost of material well-being by income group, a negative gradient is apparent in many countries: for the periods under consideration, costs have tended to rise faster for low income households than for higher income households (Table 2 and Figure 5). The regression in Table 2 suggests that, moving from one income quintile to the next reduces the average price of AIC by about 0.04 percentage points. On average, households in the lowest income group have therefore seen their cost of Material Well-being rise by about 0.2 percentage points per year more than households in the highest income group.

The augmentation in the measured growth of the cost of Material Well-being reflects the comparatively larger share of STiKs consumption by lower income households. It should be kept in mind, however, that by their very nature, the consumption of STiKs does not constitute out-of-pocket expenses for households. Rather, it is the combined effect of unit cost of STiKs for society and the price changes of market consumption by households that is measured here.

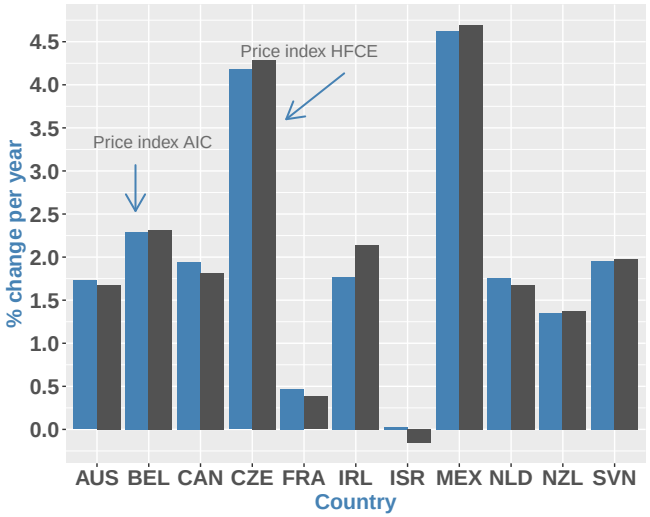
It is also evident that STiKs attenuate a slightly less steep gradient when only HFCE is considered. The corresponding coefficient in Table 2 is –0.03 percentage points per income group, translating to a –0.15 percentage point annual difference between the highest and lowest quintiles. Although our dataset excludes the United States, Carloni (2025)[3] finds that, in recent U.S. data, the cost of living—based on HFCE—increased by an average of 2.5 percent per year between 1984 and 2022 for households in the bottom fifth of the income distribution, compared to 2.2 percent per year for those in the top fifth. This implies a –0.3 percentage point differential between the highest and lowest quintiles.

We observe thus that the cost of living for poorer households has risen more rapidly than for wealthier ones (as measured by the price change of HFCE, which reflects actual household expenditures). At the same time, we found that this is not mirrored in systematically lower growth of real

consumption by poorer households. Thus, lower-income households must be absorbing these higher prices through faster earnings growth, increased government transfers, or dissaving[13]

While STiKs mitigate some of these effects, further investigation is needed to understand which resources poorer households rely on when facing such financial pressure. Given that the DNA data underlying our analysis aligns with other categories in the National Accounts, this line of inquiry can be pursued in future research. These findings underscore the value of incorporating distributional data into the National Accounts.

Figure 4: In About Half the Countries, the Cost of Material Well-being (based on AIC) Outpaces the Cost-of-living (based on HFCE)



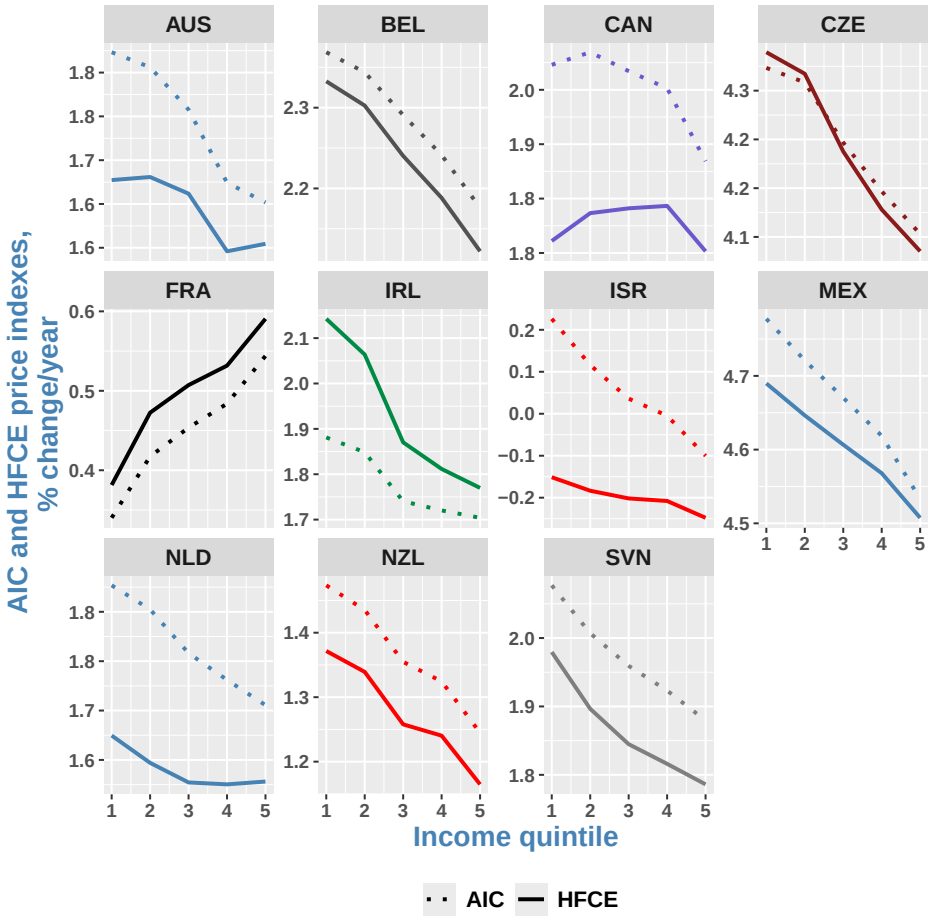
*STiKs as part of AIC were deflated using the general price index for government consumption (Option B). Time periods: Australia: 2009-17, Belgium 2009-22, Canada 2008-23, Czech Republic 2015-22, France 2011-16, Ireland 2011-22, Israel 2015-17, Mexico 2008-22, New Zealand 2009-15, Netherlands 2015-20, Slovenia 2012-22.

[13]It should then be the case that there is a negative gradient to nominal expenditure. While a regression of nominal consumption expenditure on different income groups does indeed produce a negative coefficient, it is not statistically significant.

Table 2: Across all Countries, Prices Rise Faster for Lower Income Households

	Dependent variable:	
	Cost of Well-being index (AIC) Percent change per year	Cost-of-living index (HFCE) Percent change per year
Constant	1.855^{***} (0.027)	1.735^{***} (0.032)
Income Quintile	-0.037^{***} (0.005)	-0.030^{***} (0.006)
Belgium	0.549^{***} (0.033)	0.625^{***} (0.038)
Canada	0.209^{***} (0.033)	0.183^{***} (0.038)
Czech Republic	2.453^{***} (0.033)	2.547^{***} (0.038)
France	-1.295^{***} (0.033)	-1.147^{***} (0.038)
Ireland	0.036 (0.033)	0.288^{***} (0.038)
Israel	-1.688^{***} (0.033)	-1.843^{***} (0.038)
Mexico	2.921^{***} (0.033)	2.960^{***} (0.038)
Netherlands	-0.376^{***} (0.033)	-0.369^{***} (0.038)
New Zealand	0.022 (0.033)	−0.004 (0.038)
Slovenia	0.227^{***} (0.033)	0.221^{***} (0.038)
Observations	55	55
R^2	0.999	0.998
Adjusted R^2	0.998	0.998
Residual Std. Error (df = 43)	0.052	0.059
F Statistic (df = 11; 43)	$3{,}209.010^{***}$	$2{,}516.404^{***}$
Note:		*p<0.1; **p<0.05; ***p<0.01

Figure 5: Price indexes: negative gradients



*STiKs as part of AIC were deflated using the general price index for government consumption (Option B). Time periods: Australia: 2009-17, Belgium 2009-22, Canada 2008-23, Czech Republic 2015-22, France 2011-16, Ireland 2011-22, Israel 2015-17, Mexico 2008-22, New Zealand 2009-15, Netherlands 2015-20, Slovenia 2012-22.

4 Conclusions

We have developed index numbers for material well-being or Actual Individual Consumption in the face of changing volumes of STiKs as well as cost indexes that account for STiKs. We have illustrated the approach with data for 11 OECD countries that have developed such internationally harmonized statistics[14]. Several key messages arise.

- We approximated the theoretical index of material well-being with an expansion of the volume index of market consumption (HFCE), adjusting consumption weights and adding quantity changes of STiKs. If the provision of STiKs grows faster (or falls by less) than the HFCE, the growth of material well-being will exceed that of traditional market consumption. We note that other approaches are conceivable, in particular a direct quantity adjustment of the volume growth of HFCE.

- We were not in a position to measure the theoretically appealing but non-observable virtual prices or marginal value that households attach to government services that are provided for free. Rather STiKs are valued with unit costs of production and we applied two sets of deflators - neither of them entirely satisfactory - to obtain real values. This points to a longstanding measurement agenda: robust deflators for STiKs at a reasonable level of disaggregation and internationally comparable are vital but scarce. Given the size of STiKs (well over half of government expenditure in OECD countries), work in this direction does pay off in terms of higher quality GDP data and better analysis of households' material well-being.

- Our work confirms that looking beyond averages has significant analytical value. Whether and to which degree different income groups experience different cost-of-living changes and developments in their material well-being is of strong policy interest. We find somewhat faster growth of AIC than HFCE for a number of countries although the picture is mixed. It also turns out there is no compelling indication of an income gradient for the growth of material well being across countries. On the other hand, a negative income gradient is pervasive when it comes to the price (and unit cost) changes of HFCE and AIC: these rise faster for worse-off households and raise the question of how these households finance this financial pressure.

[14] With further implementation of distributional national accounts, it will be possible to add more countries and to analyse more comparable time periods across countries

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Annex Table Growth in Real Actual Individual Consumption and Real Household Final Consumption Expenditure by Income Quintile

Average annual percentage change

Australia 2009-2017						
	Household income quintile					
	All	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**
Real AIC computed with STiKs deflator from:						
Equated household final consumption expenditure category (Option A)	2.69	2.17	1.68	2.32	2.36	4.10
Government final consumption expenditure (Option B)	2.87	2.51	1.92	2.52	2.50	4.18
For comparison:						
Real HFCE	2.77	2.23	1.67	2.25	2.26	4.15

Canada 2008-2023						
	Household income quintile					
	All	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**
Real AIC computed with STiKs deflator from:						
Equated household final consumption expenditure category (Option A)	2.12	2.73	2.17	2.43	2.02	1.65
Government final consumption expenditure (Option B)	2.08	2.67	2.12	2.39	1.98	1.62
For comparison:						
Real HFCE	2.09	2.74	2.25	2.53	1.95	1.58

Czech Republic 2015-2022						
	Household income quintile					
	All	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**
Real AIC computed with STiKs deflator from:						
Equated household final consumption expenditure category (Option A)	2.78	2.68	2.78	4.32	2.65	1.83
Government final consumption expenditure (Option B)	2.66	2.53	2.66	4.16	2.52	1.75
For comparison:						
Real HFCE	2.35	1.94	2.07	3.94	2.34	1.65

France 2011-2016						
	Household income quintile					
	All	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**
Real AIC computed with STiKs deflator from:						
Equated household final consumption expenditure category (Option A)	1.04	0.78	1.52	1.26	0.87	0.87
Government final consumption expenditure (Option B)	1.04	0.85	1.54	1.25	0.86	0.86
For comparison:						
Real HFCE	0.67	-0.02	1.30	0.99	0.34	0.66

Annex Table: Growth in Real Actual Individual Consumption and Real Household Final Consumption Expenditure by Income Quintile ctd.

Ireland 2011-2022						
	Household income quintile					
	All	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**
Real AIC computed with STiKs deflator from:						
Equated household final consumption expenditure category (Option A)	2.63	1.11	2.59	3.52	3.42	2.25
Government final consumption expenditure (Option B)	2.88	1.57	2.97	3.74	3.57	2.35
For comparison:						
Real HFCE	2.64	0.74	2.46	3.71	3.51	2.21

Israel 2015-2017						
	Household income quintile					
	All	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**
Real AIC computed with STiKs deflator from:						
Equated household final consumption expenditure category (Option A)	5.02	6.63	5.41	5.98	4.85	3.34
Government final consumption expenditure (Option B)	4.95	6.52	5.32	5.91	4.79	3.30
For comparison:						
Real HFCE	4.86	6.69	4.92	5.95	5.24	3.06

Mexico 2008-2022						
	Household income quintile					
	All	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**
Real AIC computed with STiKs deflator from:						
Equated household final consumption expenditure category (Option A)	1.57	3.03	2.39	1.88	1.49	0.84
Government final consumption expenditure (Option B)	1.52	2.90	2.29	1.81	1.44	0.82
For comparison:						
Real HFCE	1.51	3.22	2.40	1.83	1.40	0.79

New Zealand 2009-2015						
	Household income quintile					
	All	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**
Real AIC computed with STiKs deflator from:						
Equated household final consumption expenditure category (Option A)	2.40	2.47	1.83	2.51	2.90	2.24
Government final consumption expenditure (Option B)	2.77	3.04	2.29	2.90	3.21	2.48
For comparison:						
Real HFCE	3.13	3.47	2.81	3.27	3.50	2.77

Annex Table: Growth in Real Actual Individual Consumption and Real Household Final Consumption Expenditure by Income Quintile ctd.

Netherlands 2015-2020						
	Household income quintile					
	All	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**
Real AIC computed with STiKs deflator from:						
Equated household final consumption expenditure category (Option A)	0.54	0.10	0.92	0.55	0.64	0.44
Government final consumption expenditure (Option B)	0.39	-0.08	0.74	0.39	0.50	0.34
For comparison:						
Real HFCE	-0.09	-0.04	0.09	-0.05	-0.10	-0.20

Slovenia 2012-2022						
	Household income quintile					
	All	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**
Real AIC computed with STiKs deflator from:						
Equated household final consumption expenditure category (Option A)	2.25	1.18	2.19	2.70	2.78	2.08
Government final consumption expenditure (Option B)	2.11	1.01	2.03	2.55	2.65	1.98
For comparison:						
Real HFCE	2.10	1.15	2.09	2.51	2.62	1.87