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A review of the literature

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Abstract

Economic (in)security is attracting a growing interest in the social policy debate. However, there is a lack of consensus about how to measure it. In this paper we review the existing measures of economic insecurity, with a particular emphasis on objective measures. Our assessment is that all the measures are to some extent arbitrary, and that no clear consensus has so far emerged in the literature. This stems from some analytical confusion that still surrounds the concept, and from the lack of clear normative foundations. We also identify and discuss some characteristics that ideal measures of economic insecurity should have.

KEYWORDS: insecurity, precarity, uncertainty, insurance, social protection, risks

JEL CLASSIFICATION: D63

I shall not today attempt further to define [it],
and perhaps I could never succeed in intelligibly doing so.
But *I know it when I see it* [...].

US Supreme Court Justice Potter Stewart
describing his threshold test for obscenity in Jacobellis v. Ohio case (1964).

1 Introduction

While there is ample evidence that economic insecurity is an important feature of our times, its quantification remains elusive and controversial, in stark contrast with the vast amount of knowledge that has been accumulated on related concepts like poverty and inequality.

Little doubt exists that economic insecurity has important consequences for the well-being of individuals and households. Stiglitz et al. (2009) point out that a high level of current economic insecurity may lead to insufficient investment in the education of children, which also affects the well-being of future generations. Linz and Semykina (2010) find that consumption tends to be lower for households who perceive economic insecurity. Ciganda (2015) uses French data to show empirical evidence of the negative effect of employment instability on the final number of children for both men and women, and also its effect on fertility postponement for men. Here, employment instability is measured by the cumulative number of spells and months out of full-time employment. Busetta et al. (2019) find persistent joblessness is associated with reduction of intention of fertility for women. Kopasker et al. (2018) use UK data to identify the causal effect of various aspects of economic insecurity on mental health, where economic insecurity is measured by the index proposed by Hacker et al. (2014) that we will discuss. Bossert et al. (2019) find economic insecurity predicts political participation and political preferences towards the right. Margalit (2019) suggests populism might be driven by four economic changes (increased import competition, technological change, financial crisis, and immigration) which feed into individual insecurity.

We should also not ignore the potential broader macroeconomic consequences of economic insecurity. For instance, Haurin (1991) finds that income volatility, which is one source of economic insecurity, has a significant impact on housing demand. Rohde and Tang (2018) suggest that when the sense of economic insecurity becomes widespread, potential macroeconomic consequences such as an increase in unemployment and a reduction in output growth may follow. Furthermore, the macroeconomic consequences would in turn reinforce the original sense of insecurity and further worsen the macroeconomic conditions, leading to a vicious circle.

There is also evidence that insecurity has become more widespread in recent years, a phenomenon connected to the diffusion of precarious jobs (Berton et al., 2012), increased use of subcontracting (Heery and Salmon, 2000), globalisation (Mau et al., 2012) and the rise of automation (Frey

and Osborne, 2017; Nedelkoska and Quintini, 2018). A recent survey conducted by Populus in Great Britain reveals that 30% of workers feel that their income from work does not provide them with enough to maintain a decent standard of living in 2019, compared to 26% in 2017; 45% (up from 40% in 2017) don't expect to have enough savings to maintain a decent standard of living in retirement; 24% (up from 19%) have occasional troubles meeting their basic living costs because of income volatility (Wallace-Stephens, 2019).

However, and different from concepts like poverty or inequality, there is no consensus about how to measure economic insecurity. Indeed, the related methodological discussion is still at an early stage. In this paper we critically review the main indicators put forward in the literature, highlight what we consider their shortcomings, and suggest some characteristics that a measure of economic insecurity should have.

The paper is structured as follows. Section 2 discusses the concept of economic insecurity, and the many methodological issues involved. Section 3 describes the main measures introduced in the literature, which are then critically discussed in Section 4. Section 5 summarises and concludes.

2 Conceptual issues

Definition Since the seminal paper of Osberg (1998), the concept of economic insecurity has attracted increasing amount of attention among academics. Osberg defined insecurity as "the anxiety produced by a lack of economic safety, i.e. by an inability to obtain protection against subjectively significant potential economic losses". Other definitions include:

- "the anxiety produced by the possible exposure to adverse economic events and by the anticipation of the difficulty to recover from them" (Bossert and D'Ambrosio, 2013);
- "the degree to which individuals are protected against hardship-causing economic losses" (Hacker et al., 2014);
- "the downward economic risks that individuals are unable to adequately insure against or avoid or ignore" (Osberg, 2015).

Although a consensus has not yet emerged, there seem to be two parts in the definition of economic insecurity: (i) the condition of not having "stable resources to support an adequate standard of living now and in the foreseeable future" (Berton et al., 2012), and (ii) the anxiety associated to it.

Objective measures focus on the economic circumstances of individuals rather than their perceptions of those circumstances, and hence refer to (i) alone. They typically look at statistical evidence for the lack of economic safety. Subjective measures sometimes replace that statistical evidence with a subjective perception of economic risks, as elicited by survey questions, and

sometimes look only at the associated stress.[1] Some subjective measures ask both for a subjective perception of the risks, and for a quantification of the associated anxiety. Some measures combine both objective and subjective indicators.

Dimensions of economic insecurity The dimensions considered in the extant literature refer to economic risks as unemployment, sickness, widowhood, and old age. Osberg (2015) explicitly refers to the hazards identified in Clause 25 of the UN Universal Declaration of Human Rights:

> Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control.

Note that, as highlighted in the Declaration above, the reference to "adequate" standard of living implies that individual and household characteristics —for instance, the number of dependent children— should also play a role in the analysis. This multidimensionality makes it challenging to define a comprehensive measure of economic in(security) that subsumes all possible aspects.

Micro or macro? Differently from inequality, insecurity refers to an individual condition. Hence, measures of economic insecurity should be individual-specific, and then possibly aggregated up. However, some influential measures (e.g. Hijzen and Menyhert, 2016; Osberg and Sharpe, 2014) are computed directly at an aggregate level.

Levels or changes? The inability to support an adequate standard of living might not derive solely from downward economic risks. A constant stream of inadequate resources would qualify for a condition of insecurity, as well as an increasing trend but still of insufficient amount.[2] This is a very important point that —as we will make clear— has been somewhat overlooked in the literature: economic (in)security arises from a combination of *levels* and *changes* in the availability of economic resources over time.

Forward or backward looking? Essentially, people are insecure about future hazards, which implies that conceptually economic insecurity is a forward-looking concept. This forward-looking perspective requires in principle the prediction of future resources and needs. While most of the literature on subjective insecurity adopts such a forward-looking perspective by leaving the burden of prediction to the questionnaire respondents, all the literature using objective information has so far looked at realised data on individuals' past experiences. There are two justifications for this. First, it can be argued that the confidence an individual has today is determined by the past gains and losses (Bossert and D'Ambrosio, 2013; Bossert et al., 2019) or realised income volatility (Rohde et al., 2014) or large year-to-year economic losses (Hacker et al., 2014). This requires looking at the past to assess the present level of insecurity about the

[1] The subjective perception can of course be affected by the mental state of the individual, for instance by his/her level of anxiety, triggering a potentially self-reinforcing loop.

[2] In those cases, as we will discuss later, it would be impossible to insure against the risk of future insufficient resources, even if financial markets were perfect.

future. Second, risks evaluated at some aggregate (population or sub-population) level might be used as a proxy of individual risks, under the two crucial assumptions of homogeneity (all individuals are similar) and stationarity (the future looks like the past). Hence, looking at what happened to older individuals in the past might offer guidance to what will happen to younger individuals in the future. This *a fortiori* holds for aggregate measures of economic insecurity, where individual risks are collectively evaluated as social risks.

Absolute or relative? Analogously to the discussion about poverty, we can define *absolute* and *relative* measures of economic insecurity. Absolute measures assign a level of economic insecurity on the basis of the absolute level or the absolute changes in the availability of economic resources, or an absolute quantification of the future uncertainty / current anxiety associated to individual circumstances. Relative measures, on the other hand, normalise such assessments with respect to some reference values, either at the individual level —for instance measuring the drop in income associated to a job loss in percentage of the current income as in Hijzen and Menyhert (2016)— or at the population level —for instance standardising the indicator by the sample mean and variance as in Rohde et al. (2015). Relative measures are therefore pure numbers and are bounded, typically between 0 and 1, while absolute measures are expressed in specific accounting units (e.g. dollars) and can in principle take any value.[3]

There are pros and cons for both alternatives. In particular, when looking at income or wealth, standardisation implies invariance to the choice of the accounting unit, and therefore comparability across space and time. On the other hand, standardisation implies that the "size" of the overall problem does not matter, and only relative positions count. Standardising the size of the cake implies all cakes look equal, and only the relative size of individual slices can be compared. This implies, for instance, that an economic crisis that reduces the available resources for everyone causes no changes in the level of individual security.[4] Finally, when the indicator is standardised at the population level changes in individual circumstances have an ambiguous effect on the overall index, as they also affect the reference value (hence the level of insecurity of everyone else) —a well known issue in the literature on relative poverty.

Differences with other concepts. We can then use the characterisation of economic insecurity offered above to distinguish the concept from other social concerns, and in particular *inequality*, *poverty*, *social mobility* and *income volatility*.[5]

To start with, inequality and social mobility are distributional measures, hence defined only at the population level. By contrast, economic insecurity (as well as poverty and income volatility) are conceptually defined at the individual level. Also, inequality and poverty are concerned with describing the present, while economic insecurity are concerned with the anticipation of future

[3] It is possible that an absolute indicator —for instance, the probability of being unemployment as in Green et al. (2000) is also bound between 0 and 1. There is however a distinction between an absolute value which is naturally bounded, as a probability, and a standardised value.

[4] Possibly after a first year when the drop in security would be picked up by measures that look at changes in individual economic situations. To reduce the problem it is certainly possible to look at changes in individual circumstances over more periods, or normalise the individual indicator by a moving average of the past sample means, hence introducing more memory in the measure. This memory however inevitably fades away with time.

[5] We do not explicitly refer to *lifelong inequality* as conceptually very similar to income volatility.

events; social mobility and income volatility are typically measured in the past but similarly to insecurity have a dynamic nature. Finally, inequality and poverty are typically concerned with levels, while volatility looks only at changes. Only social mobility —as measured for instance by quantile transition matrixes— shares with economic insecurity a reference to both levels (the starting quantile) and changes (the upward or downward trajectory).

Economic insecurity also differs from *job insecurity*, which refers to specific job spells rather than broader individual circumstances and is typically related to involuntary separations (e.g. Gottschalk and Moffit, 1999). Some contributions however (e.g Green et al., 2000) extend the definition of job insecurity to include re-employment probabilities, and equate it with economic insecurity. As a rule, we consider in this review only definitions that look at more than one single spell of employment or unemployment, including those based on such an extended interpretation of job insecurity, but we warn against confusing the two concepts. Analytically, job insecurity (and its opposite of job security) should be referred to the characteristics of a specific job, both formal (i.e. the employment protection legislation applicable) and substantial (i.e. related to labour market dynamics). Concerns about work trajectories (possibly spanning multiple employment spells) should be referred to as *work insecurity* (Berton et al., 2012), while economic insecurity should be used when analysing economic risks arising from broader life course dimensions.

3 Existing measures

This section reviews the main approaches that have been proposed to measure economic in(security). We start with subjective measures (Sections 3.1 and 3.2), then move to combinations of subjective and objective indicators (Section 3.3), to focus more in details in Sections 3.4-3.9 on objective measures.

3.1 Subjective perceptions of the risk of economic misfortune

Dominitz and Manski (1997) initiate the Survey of Economic Expectations (SEE) in America to measure economic insecurity based on subjective probabilities of three events in the year ahead: absence of health insurance, victimisation by burglary, and job loss. Based on the responses to these questions, individuals are classified as secure, relatively insecure, and highly insecure according to some ad-hoc thresholds (e.g. individuals whose subjective probabilities in the three dimensions all exceed the population .75-quantiles are classified as highly insecure). They then do some descriptive statistics to find that respondents with a high risk of one adverse outcome tend also to perceive high risks of the other outcomes, and that economic insecurity tends to decline with age and with schooling. Greater insecurity is perceived by black respondents than whites. They also find that expectations and realisations of health insurance coverage and of job loss tend to match up quite closely.

Similarly, Mau et al. (2012) look at three questions from the European Social Survey, asking for a subjective assessment of the probability of unemployment, material deprivation and lack of healthcare in the year ahead. They standardise the answers to each of the three questions on a scale from 0 to 3, and add them up to obtain an index of economic insecurity that ranges from 0 (not at all likely on all dimensions) to 9 (very likely on all dimensions). They then continue to analyse the determinants of economic insecurity in a cross-country perspective, looking in particular at social protection and the mediating role of social classes.

Finally, Nau and Soener (2019) measure economic insecurity based on a set of questions in the Federal Reserve Board's Survey of Consumer Finances (SCF) that ask respondents whether their income in the past year was normal, unusually low, or unusually high. The two measures they propose are:

1. Income precarity: the probability that a respondent reports unusually low income.

2. Risk-reward index: the probability of an income windfall minus the probability of an income loss, as defined above.

Probabilities are estimated by means of logistic regressions controlling for various individual and household characteristics. These indicators are subjective as they are based on the individual perception of what is the "normal" level of income (the authors recognise that the effects of some losses might take several years to dissipate, and it is not clear how this affects the perception of the reference value). Also, the indicators do not consider the size of losses and gains.

3.2 Self-reported job security

A few papers equate economic insecurity with job insecurity, generating some analytical confusion. As we have discussed (see Section 2), we only include in this review contributions that look at more than the characteristics of the current job.[6] Among those, Green et al. (2000) measures job security from two aspects. The first aspect is the perceived risk of job loss, and the second aspect is the cost of job loss, measured by a subjective assessment of the likelihood to find a job as good as the current one in case of unemployment.

The authors then assign scores of zero to five of increasing perceived risk of job loss and refer to this score as the Job Insecurity (JI) Index. They also allocate scores of one to four in increasing order of difficulty of re-employment and refer to it as the Difficulty of Re-employment (DR) Index. These measures are obviously defined only for the employed population.

[6]For instance, we exclude Scheve and Slaughter (2004), who measure economic insecurity using the following question asked in the British Household Panel Survey (BHPS): "I'm going to read out a list of various aspects of jobs, and after each one I'd like you to tell me from this card which number best describes how satisfied or dissatisfied you are with that particular aspect of your own present job", with job security being one of the items.

3.3 Combining subjective and objective indicators

Rohde et al. (2015) introduce an individual synthetic measure to aggregate up six dimensions related to individual insecurity including both objective and subjective aspects based on the Household Income and Labour Dynamics in Australia (HILDA) Survey. The six dimensions are as follows.

1. *Job security*
   The respondents are asked to rate on a seven-point scale whether or not they believe they have a secure future in their main form of employment.

2. *Financial satisfaction*
   Respondents are asked to describe their overall sense of financial satisfaction.

3. *A household's perceived ability to raise emergency funds*
   Respondents are asked to rate on a four-point scale on how easily they could raise emergency funds of $2,000-$3,000 over a one-week period.

4. *Income drop*
   This is a dichotomous variable that takes a value of 1 for all individuals in a household if (i) their disposable income has fallen by 25% or more from the previous year and (ii) their current income is less than their permanent income level which is defined as the long-run average household income. This variable is inspired by Hacker et al. (2014).

5. *Expenditure distress in the short-term future*
   Dummy variables are taken to indicate an inability to pay rent, the pawning of household item, inability to pay utility bills and having to skip meals. An index from 0 to 4 is derived from counting the number of stress criteria the household meets. In order to capture the forward-looking nature of the risks, an ordered probit model is fitted with this index being the dependent variable. Based on this estimation, individual probabilities of obtaining a score of 3 or 4 are used as the measure of expenditure distress in the short-term future.

6. *Unemployment risk*
   Here the same idea is used as in the previous item. The forward-looking unemployment risk is predicted by regressing the dummy variable of unemployment on lagged regressors.

Note that the first three dimensions above capture subjective insecurity, while the last three dimensions capture objective insecurity. One caveat pointed out by the authors for the second question about financial satisfaction is that factors such as an ambition for greater wealth will influence this variable.

Romaguera-de-la Cruz (2019) follows this approach but uses different data (EU-SILC), with some minor modifications to adapt to the information available in the data. The fundamental difference between Rohde et al. (2015) and Romaguera-de-la Cruz (2019) is the way they aggregate up the six dimensions of insecurity at the individual level. Rohde et al. (2015) apply

Principal Component Analysis and select the first principal component to be the individual insecurity index.[7] On the other hand, Romaguera-de-la Cruz (2019) converts the indexes for each dimension to dichotomous variable which takes the value of 1 if individuals lacks security in respective dimension in reference with some ad-hoc thresholds, and then counts the number of weighted dimensions in which the individual lacks security with respect to the total number of dimensions, i.e.

$$0 \leq EI_i = \frac{\sum_{j=1}^{D} w_j I_{ij}}{D} \leq 1 \tag{1}$$

where I_{ij} is a variable that takes the value 1 if the individual i lacks security in the dimension j and 0 otherwise and D is the total number of dimensions. The weight for dimension j, w_j, is defined as

$$w_j = \frac{DP_j}{\sum_{j=1}^{D} P_j} \tag{2}$$

where P_j is the proportion of individuals who do not lack security in dimension j. This is because the author believes that people feel worse if they observe that a large part of the population has security when they are among those who are insecure.

3.4 The OECD index of labour market security

The OECD has developed a measure of labour market (in)security (Hijzen and Menyhert, 2016), which looks like an objective version of the subjective index proposed in Green et al. (2000). Insecurity is defined by the OECD —as in Green et al. (2000)— in terms of the unemployment risk and its expected cost. The latter however depends both on the expected duration of unemployment and the degree of public unemployment insurance. Ultimately, the OECD index expresses the expected cost of job loss in % of current income, and measures it by looking at (i) the probability of becoming unemployed, (ii) the expected duration of unemployment, and (iii) the degree to which unemployment benefits compensate for lost earnings during unemployment.

The OECD index only focuses on the financial costs associated with unemployment although the well-being impact of unemployment risk goes beyond the loss of income. Hijzen and Menyhert (2016) argue that the non-material (physical or psychological) costs are difficult to account for and do not affect the rankings of insecurity as long as these non-pecuniary costs of unemployment are constant and the same for all. The overall labour market insecurity indicator is defined as unemployment risk times one minus unemployment insurance, and measures the expected proportional loss in earnings due to unemployment:

$$\text{Labour market insecurity} = U * (1 - I) \tag{3}$$

The unemployment risk is computed as the product of the unemployment inflow probability and

[7] This is done after normalising the insecurity index in each dimension so that they all have a mean of 100 and a standard deviation of 10 over the pooled sample.

the average duration of completed unemployment spells:

$$U_t = X_t D_t, \tag{4}$$

the unemployment inflow probability being

$$X_t = \frac{u_{t+1}^{<1}}{e_t} \tag{5}$$

where e_t is the total number of persons in employment, $u_{t+1}^{<1}$ is the number of persons who are (newly) unemployed for less than a month at time $t+1$. Thus X_t is the share of employed persons at a given point in time that becomes unemployed during the following month.

The average duration of completed unemployment spells, in turn, is computed as

$$D_t = 1/(1 - \frac{u_{t+1} - u_{t+1}^{<1}}{u_t}) \tag{6}$$

where u_t is the total number of unemployed persons, and the denominator measures the unemployment outflow probability.

The last component of the OECD index is effective unemployment insurance, which looks at benefit coverage rates and replacement rates. Benefit coverage rates C are calculated as the ratio of number of benefit recipients based on self-reported information from labour force surveys. Replacement rates R, in turn, are calculated based on the OECD's Tax-Benefit model as the simple mean of the household-specific replacement rate across six different household types and two different (previous) earnings levels. Effective unemployment insurance is thus measured by taking the product of coverage rates and replacement rates by benefit category, and adding them up:

$$I_t = \sum_i C_{i,t} * R_{i,t} \tag{7}$$

3.5 The IEWB Index of Economic Security of Osberg and Sharpe (2014)

Osberg and Sharpe (2014) develop a compound macro index to measure objective economic security. As this index is one of the four components of the Index of Economic Well-Being (IEWB) proposed by Osberg and Sharpe (2002), it is referred to as the "IEWB Economic Security Index".[8] Osberg and Sharpe (2014) use the "named risk" approach and focus on four specific risk (unemployment, sickness, widowhood and old age) which are all measured at the national level, weighted by the relative population size directly affected and then aggregated to an overall index of economic security. To be specific, their index depends on the following four sub-indices:

(i) *Security from unemployment.* In the event of unemployment, the IEWB index of security is driven by the probability of unemployment and the size of financial loss it produces.

[8]The four components of IEWB are: (1) current effective per capita consumption flows; (2) net societal accumulation of stocks of productive resources; (3) income distribution; (4) economic insecurity.

As unemployment benefits partially compensate for the earnings loss, two variables are utilised to measure security from unemployment: the employment rate and the financial protection rate. The employment rate is measured as employment/population ratio. The financial protection rate is measured by the average percentage of lost earnings replaced by unemployment benefits (i.e. the "Gross Replacement Rate") for two earnings levels and three family situations produced by the OECD, Tax-Benefit models.
To arrive at the overall security index from unemployment, the employment rate and the financial protection rate are weighted by four-fifths and one-fifths respectively.[9]

(ii) *Security from financial cost of illness.* The risk of health care cost is assumed to be proportional to the share of uninsured private medical care expenses in disposable income. The IEWB measures the financial risk implied by illness by the percentage of disposable household income spent by households on health insurance.

(iii) *Security from single parent poverty.* The risk of becoming poor because of family breakup is measured in an "expected value" sense, i.e. (probability of divorce)*(poverty rate among single female parent families)*(average poverty gap ratio among single female parent families). Poverty is defined in relative terms as the proportion of households below 50% of median equivalent income. Because males are a small fraction of the single parent population and have substantially smaller increases in poverty probability following separation, they ignore single male parents.

(iv) *Security from poverty in old age.* The risk of poverty in old age is measured by the poverty intensity (=poverty rate*average poverty gap ratio) experienced by households headed by a person aged 65 and over.

The above four indices are scaled using linear scaling techniques (Sharpe and Salzman, 2003) before aggregating into the IEWB security index. Finally, to aggregate the scaled values of the four components of the economic security domain into an overall index, they weigh each risk by the relative size of the populations most affected:

(i) for unemployment, the proportion of the population aged 15-64 in the total population;

(ii) for illness, the proportion of the population at risk of illness, which is 100 percent;

(iii) for single parent poverty, the proportion of the population comprised of married women with children under 18;

(iv) for old age poverty, the proportion of the population in immediate risk of poverty in old age, defined as the proportion of the population aged 45-64 in the total population.

The final index is therefore a weighted sum of the scaled values of security from unemployment, illness, single parent poverty and old age poverty.

[9]This is because the literature on happiness and well-being in affluent nations consistently found that the large negative impact of unemployment on happiness is stronger than the mitigating effect of unemployment compensation.

3.6 The Economic Security Index (ESI) of Hacker et al. (2014)

Hacker et al. (2014) construct their Economic Security Index (ESI) by focusing on large income losses. The authors define a broad "available household income" which tries to subsume whatever resources are available to households, considering income pooling (in case of multiple earners in a family), support from relatives and access to public transfers. The available household income thus includes earned income, property and asset income, cash transfer payments (including private transfers, such as gifts), private pension payments, unemployment benefits, lump-sum and one-time payments, and regular salary or other income from a self-owned business, net of debt service and the most important non-discretional spending (the out-of-pocket medical spending). They then focus on year-on-year declines of 25% or more of this (inflation adjusted) measure, which they consider to be large enough to cause insecurity unless household have sufficient wealth to cope with the income losses and/or enter retirement. In particular, the dichotomous index of loss is defined as:

$$L_{it} = \begin{cases} 1 \text{ if } \left(\frac{y_{it}-M_{it}-D_{it}}{e_{it}}\right) < \left(\frac{3}{4}\frac{y_{it-1}-M_{it-1}-D_{it-1}}{e_{it-1}}\right) \cap (W_{it} < W_{it}^{*}) \cap (1 - R_{it}) \\ 0 \text{ otherwise} \end{cases} \tag{8}$$

where y_i is total household income, M_i is household out-of-pocket medical spending, and D_i is the annual household debt service burden. $e_i = (0.7(children_i + adults_i))^{0.7}$ represents a family size equivalence scale, which gives less weight to children and assumes a concave relationship between household size and needs. The last two terms in eq. (8) are dichotomous indicators for lacking sufficient financial wealth ($W_{it} < W_{it}^{*}$) and not transitioning into retirement ($1 - R_{it}$). They calculate the individual dichotomous index using three sources of data - the March Current Population Survey (CPS) and sequential mini-panels from the Survey of Income and Program Participation (SIPP) and the Panel Study of Income Dynamics (PSID) and then aggregate them up across households by taking the arithmetic mean. This gives an index as the proportion of individuals who experience at least a 25% decline in their income from one year to the next except when entering retirement. To be specific, their aggregate measure is

$$ESI_t = \frac{\sum L_{it}}{n_t} \tag{9}$$

which is the proportion of individuals who experience loss, L defined as eqs. (8) and (**??**).

The 25% criteria that set the threshold for losses large enough to cause insecurity is recognised by the authors to be arbitrary. The authors further check the robustness of it and suggest the 25% criterion is consistent with the self-perceptions of hardship from polling data.

3.7 The buffering role of current wealth level and the confidence shaped by past wealth variations: An axiomatic approach by Bossert and D'Ambrosio (2013)

Bossert and D'Ambrosio (2013) set up an axiomatic framework for measuring economic insecurity. They recognise the role of wealth as a buffer stock and suggest that wealth is a measure of how anxious people are about the future, i.e. past wealth fluctuation induces insecurity about the future. They define wealth in a comprehensive manner, i.e. wealth is assumed to "encompass everything that may help an individual in coping with adverse events". Wealth streams including past and current wealth are used as the primitives of analysis. Theoretically the length of these streams are allowed to vary among people with different ages. They also acknowledge that the availability of data might restrict how far back in the past they can go when assessing economic insecurity although there is no empirical application in this paper. And they allow net wealth to be negative. The measures they arrive at depend on wealth changes in the past as well as the current wealth level. The intuition behind this is that the past wealth variations shape the confidence of an individual to overcome a loss in the future, while the current wealth level serves as a buffer stock for potential adverse future event. This index assigns a degree of insecurity to each individual (net) wealth stream $w = (w_{-T}, ..., w_0) \to V$.

The axioms they consider are:

i *Difference Monotonicity.*
This requires past gains to decrease insecurity, and past losses to increase insecurity:
for all $T \in N_0$, for all $w \in R^{T-1}$ and for all $\gamma \in R$, $V^T(w_{-(T-1)} + \gamma, w) \geq V^{T-1}(w) \Leftrightarrow \gamma \geq 0$.

ii *Homogeneity.*
This ensures that the proportional changes in wealth are mirrored in the corresponding insecurity values, that is the V function is of homogeneous of degree 1:
for all $T \in N_0$, for all $w \in R^{(T)}$ and for all $\lambda \in R_{++}$, $V^T(\lambda w) = \lambda V^T(w)$.
This looks like a counter-intuitive property, as it means for instance that if wealth increases by 10% in each period, insecurity also increases by 10%, but is motivated by the authors with their emphasis on variations, which are bigger the higher the levels of wealth.[10] The property is also problematic as it implies that the level of insecurity changes when converting wealth in a different currency.

iii *Translatability.*
This requires that if the wealth in each period is increased by the same amount, the value of insecurity is the original one minus the increase in wealth:
for all $T \in N_0$, for all $w \in R^{(T)}$ and for all $\delta \in R$, $V^T(w + \delta) = V^T(w) - \delta$.

iv *Temporal Aggregation Property.*
This is a recursivity property that allows a measure of insecurity to be calculated by recursively

[10] A sort of "I'm Rich, and That Makes Me Anxious" type of argument (Kerry Hannon in The New York Times, Nov. 7, 2017).

moving back from the current period to the earliest relevant period.

They then define two measures of insecurity which they call two-sequences Ginis and two-parameters Ginis, as they look like generalised Ginis applied longitudinally (different measures for the same individual at different times) rather than cross-sectionally (different measures for different individuals at the same time) and consider loss aversion by assigning different weights to past gains and losses.

1. The *two-sequences Ginis*:

$$V^T(w) = \sum_{t\in 1,...,T: w_{-t} > w_{-(t-1)}} \alpha_{-t}(w_{-t} - w_{-(t-1)}) + \sum_{t\in 1,...,T: w_{-t} < w_{-(t-1)}} \beta_{-t}(w_{-t} - w_{-(t-1)}) - w_0 \tag{10}$$

2. The *two-parameters Ginis*:

$$V^T(w) = \sum_{t\in 1,...,T: w_{-t} > w_{-(t-1)}} \alpha(w_{-t} - w_{-(t-1)}) + \sum_{t\in 1,...,T: w_{-t} < w_{-(t-1)}} \beta(w_{-t} - w_{-(t-1)}) - w_0 \tag{11}$$

These two parametric classes differ as the two-sequence variant allows parameters α and β to be time dependent, while the two-parameters one considers them constant. Both indexes satisfy the main axioms above, but they differ in terms of "proximity monotonicity" or "proximity indifference" property:

If "proximity monotonicity" holds, a *ceteris paribus* gain (loss) reduces (increases) insecurity to a higher extent the closer to the present this gain (loss) is. By contrast, if "proximity indifference" holds, the timing of a *ceteris paribus* gain (loss) does not affect the magnitude of reduction (increase) in insecurity. As such, "two sequences" reduce to "two parameters" as they are both time-invariant. Formally, the two properties are defined as:

- *Proximity Monotonicity*
  For all $T \in N \setminus 1$, for all $w \in R^T$ and for all $t \in 1, ..., T-1$,
  $V^T(w_{-T}, ..., w_{-(t+1)}, w_{-(t+1)}, w_{-(t-1)}, ..., w_0) \geq V^T(w_{-T}, ..., w_{-(t+1)}, w_{-(t-1)}, w_{-(t-1)}, ..., w_0) \Leftrightarrow$
  $w_{-(t+1)} \geq w_{-(t-1)}$.

- *Proximity Indifference*
  For all $T \in N \setminus 1$, for all $w \in R^T$ and for all $t \in 1, ..., T-1$,
  $V^T(w_{-T}, ..., w_{-(t+1)}, w_{-(t+1)}, w_{-(t-1)}, ..., w_0) = V^T(w_{-T}, ..., w_{-(t+1)}, w_{-(t-1)}, w_{-(t-1)}, ..., w_0)$.

Under each of the two classes, a *loss priority axiom* requires a further restriction on the two sequences/parameters such that losses carry a higher weight than gains in each period ($\alpha_{-t} > \beta_{-t}$ for all $t \in N$).

Unlike many other papers that suggest taking the arithmetic mean as the aggregation of

individual indices, Bossert and D'Ambrosio (2013) leave as an open question the study of economic insecurity for society as a whole. They also suggest including (non-monetary) variables other than wealth in order to arrive at a more comprehensive notion of insecurity as a research agenda.

D'Ambrosio and Rohde (2014) apply the two-sequences Gini (eq. 10) to the US and Italy, using data respectively from the Panel Study of Income Dynamics (PSID) and the Survey of Household Income and Wealth (SHIW). For each individual, insecurity indices are only generated for three waves using a uniformed four lags and the current wave. For example, the insecurity indices computed in 2009 use observations from 2009, 2007, 2005, 2003 and 2001 in the US, i.e. $T = 4$. The reason of not using longer history available in the data is because a balanced panel is required to generate wealth accumulation over time and this will require dropping too many observations if they use too many waves of data to compute the indices. The weighting series for past losses (α_{-t}) and gains (β_{-t}) are defined as $\alpha_{-t} = \frac{\gamma}{2t-1}$ and $\beta_{-t} = \frac{\alpha_{-t}}{2}$, where the parameter $\gamma \geq 0$ weighs the importance of the current wealth w_0 against past wealth variations for forming the insecurity index. In their application, results are generated for γ being 1 and 5, respectively.

3.8 A refinement of the axiomatic approach: Bossert et al. (2019)

Bossert et al. (2019) have a similar framework as Bossert and D'Ambrosio (2013), with the theoretical contribution of including one additional axiomatic property (stationarity) and changing the definition of another property (proximity monotonicity) to limit the scope to a smaller class. They claim that the advantage of the change of properties is to narrow down the large class of measures identified by Bossert and D'Ambrosio (2013) and make the selection of suitable weights less formidable. Another feature that distinguishes Bossert et al. (2019) from Bossert and D'Ambrosio (2013) is that Bossert et al. (2019) use generic "resources" rather than "wealth" as the basis of analysis. The main result of Bossert et al. (2019) is a class of measures based on geometrically-discounted resource differences. In their empirical application, the variable used to represent "resources" is income. To be specific, the two additional properties included are:

- *Stationarity.*
  Stationarity implies that no significance is attached to the way in which time periods are numbered, and it is necessary to avoid that the measure of insecurity changes with the mere passage of time.

- *Proximity monotonicity.*[11]
  This has an intuitive interpretation in the sense that it links the notion of economic insecurity to a preference for "first-down-then-up" variations in economic resources, indicating the ability to recover from some losses, with respect to "first-up-then-down" movements which are bound to induce a more pessimistic outlook. For example, given the following five resource streams: $x_1 = (0, 0, 1, 0), x_2 = (0, 1, 0, 0), x_3 = (0, 0, 0, 0), x_4 = (0, -1, 0, 0), x_5 =$

[11] This property is called "Resource-variation monotonicity" in an earlier version of their working paper.

$(0, 0, -1, 0)$, the associated insecurity levels satisfy $V(x_1) > V(x_2) > V(x_3) > V(x_4) > V(x_5)$.

The main result is a class of economic insecurity measures as a weighted sum of the pairwise difference of wealth in two adjacent periods, giving more weight to past losses than to gains (loss aversion) and to more recent events than to those further back in time. Mathematically the main insecurity index is:

$$V^T(x) = l_0 \sum_{t\in 1,\ldots,T: x_{-t} > x_{-(t-1)}} \delta^{t-1}(x_{-t} - x_{-(t-1)}) + g_0 \sum_{t\in 1,\ldots,T: x_{-t} < x_{-(t-1)}} \delta^{t-1}(x_{-t} - x_{-(t-1)}) \quad (12)$$

where $(x_{-(T-1),\ldots,x_0})$ is the most recent resource levels, l_0 and g_0 are positive constants to give weights to losses and gains, δ is the discount factor that is the same for past gains and losses. Geometric discounting follows from stationarity. It should be noted that the subclass of the measures that satisfies the loss priority must be such that $\delta \in (0, g_0/l_0)$.

This index satisfies gain-loss monotonicity, proximity monotonicity, linear homogeneity, translation invariance, quasilinearity and stationarity.[12]

3.9 Downside income volatility relative to trend: Rohde et al. (2014)

Rohde et al. (2014) look at household income streams to measure income insecurity. They share the perspective of Bossert and D'Ambrosio (2013) that realised experience is a good proxy for future insecurity if expectations are formed based on the past experience. To construct the index, Rohde et al. (2014) assume households have a CRRA utility function of income, then calculate the Certainty Equivalent (CE) income that provides the same welfare as the original stream of incomes so that every household has one CE income including the information of all the time periods considered.

$$u_{it}(x_{it}) = \frac{x_{it}^{1-\alpha}}{(1-\alpha)} \quad (13)$$

$$x_i^{CE}(\alpha) = \left[\left(\frac{1}{T}\sum_{t=1}^{T} u_{it}\right)(1-\alpha)\right]^{\frac{1}{1-\alpha}} \quad (14)$$

They go on to compute a "risk premium" r_i as the difference between the long-run income level x_i^* (defined as the arithmetic average of household incomes over time, i.e. $x_i^* = \frac{1}{T}\sum_{t=1}^{T} x_{it}$) and the CE income x_i^{CE}:

$$r_i = x_i^* - x_i^{CE} \quad (15)$$

[12]The mathematical expression of gain-loss monotonicity is slightly different compared to the difference monotonicity in Bossert and D'Ambrosio (2013), but both of them capture the idea that a past gain (loss) decreases (increases) insecurity. Linear homogeneity has the same meaning as "homogeneity" in Bossert and D'Ambrosio (2013). Quasilinearity is a special case of the temporal aggregation property in Bossert and D'Ambrosio (2013) in the sense that the former requires recursion in an additive way while the latter only requires recursion.

which they then normalise to form the basis of their insecurity index:

$$I_i = \frac{r_i}{x_i^*} \tag{16}$$

They distinguish themselves from the strand of literature on income volatility by focusing on downside income volatility relative to trend. To meet this goal, they use panel data to estimate a time series regression for each household i of the form

$$x_{it} = \phi_0 + \phi_1 t + e_{it} \tag{17}$$

where x_{it} is income for household i in period t.

Finally, they define the income security index as

$$I_i^* = \begin{cases} I_i, & \text{if } \hat{\phi_1} < 0 \\ 0, & \text{if } \hat{\phi_1} \geq 0 \end{cases} \tag{18}$$

They refer to this as the "cleanest index of income security" because only the volatility that arises when income falls relative to the household's overall trend ($\phi_1 < 0$) counts for insecurity. In other words, households who increased their income over time were judged to be free of income insecurity. The index they propose is thus a truncated form of Atkinson's inequality index.[13] Their risk aversion parameter α is analogous to the parameter of inequality aversion in the Atkinson index. While the Atkinson index is a comparison of each person's income with the population mean, the untruncated version of economic insecurity index by Rohde et al. (2014) is a comparison of a household's income in each period with the long-run income level for the same household. At the extreme of $\alpha = 0$, i.e. when there is no aversion toward income volatility, the untruncated index by Rohde et al. (2014) is always zero regardless of how volatile the income is. The higher α, the more sensitive is the index to periods of relatively low income.

After defining their index of income insecurity, the authors compute it using the Cross National Equivalent Files (CNEF) on US, Germany and Britain. The CNEF is valuable for cross national comparisons as it draws comparable variables from different surveys across countries and provides constructed variables that are not directly available in the original sources (Burkhauser et al., 2001). Rohde et al. (2014) then study the effects of taxes and transfers on income insecurity and do cross-country comparison.[14]

[13] The Atkinson inequality index is $A = 1 - [\frac{1}{n}\sum_{i=1}^{n}(\frac{y_i}{\mu})^{1-\epsilon}]^{\frac{1}{1-\epsilon}}$ for $\epsilon \neq 1$ where y_i is the income for individual i, ϵ is the inequality aversion parameter, n is the total number of individuals, μ is the mean of income. It is easy to see the relevance between Atkinson index and the insecurity index if we rewrite the insecurity index I_i as: $I_i = 1 - [\frac{1}{T}\sum_{t=1}^{T}(\frac{x_{it}}{x_i^*})^{1-\alpha}]^{\frac{1}{1-\alpha}}$.

[14] The post-government incomes for the US are not recorded and hence are simulated using the TAXSIM tax-benefit calculator (Feenberg and Coutts, 1993).

4 Discussion

4.1 Subjective vs. objective measures and the role of expectations formation

Subjective measures have the advantage of directly reflecting one's anxiety about the future, and thus have a forward-looking nature (as long as the survey questions asked reflect this). However, subjective measures rely on some unspecified model of expectation formation, which remains in the head of the individuals. As pointed out by Osberg (2015), these subjective responses might be sensitive to transient events (like a terrorist attack) and to the respondents' immediate personal life issues (like a domestic argument), and subject to cultural and linguistic bias. Even within the same cultural environment, they are likely to depend on personal attitudes like pessimism or optimism, raising normative issues regarding comparability between individuals.

Objective measures on the other hand need to make assumptions about what drives expectations formation. However, all existing indicators keep the process of expectations formation itself implicit, and simply assume a reduced-form association between the outcome (insecurity) and the current and past individual circumstances.

4.2 Disadvantages of a macro measure

All subjective measures are at a micro (individual) level, by definition. Most of the objective indicators proposed in the literature are also defined at an individual level, but some of the most influential (Hijzen and Menyhert, 2016; Osberg and Sharpe, 2014) are not. Without considering the heterogeneity of individual households, a macro-based measure is not well suited to identify the individual-level determinants and effects of economic insecurity. Moreover, the macro approach relies on a strong assumption that all individuals face similar risks (of unemployment, sickness, widowhood and old age).

We thus advocate a micro measure to allow for inclusion of individual heterogeneities. This makes it possible to study the distribution of insecurity over the population and analyse its change over time. Furthermore, a micro measure allows to identify the characteristics of individuals and households who suffer the most from economic insecurity, which may assist policy makers in the construction of social safety net.

4.3 Combining levels and changes

Within objective measures, Hijzen and Menyhert (2016), Bossert et al. (2019) and Rohde et al. (2014) only look at changes in the availability of economic resources. In contrast, Osberg and Sharpe (2014) are mainly concerned with population-level risks, and quantify these risks in levels. The indexes proposed by Bossert and D'Ambrosio (2013), Hacker et al. (2014) and Rohde et al.

(2019) on the other hand consider a combination of levels and changes, and are therefore closer to our interpretation of economic insecurity.[15]

4.4 Horizon of analysis

Much exant literature is based on measures computed at a point in time (Osberg and Sharpe, 2014; Green et al., 2000; Dominitz and Manski, 1997; Mau et al., 2012; Romaguera-de-la Cruz, 2019)[16] or between two points in time (Hacker et al., 2014; Hijzen and Menyhert, 2016). This is likely to underestimate the extent to which individuals care for —and worry about— the future. It also offers limited policy guidance, as policy implications at different accounting horizons can differ substantially (Roantree and Shaw, 2018).

Among objective measures, exceptions are Bossert and D'Ambrosio (2013); Bossert et al. (2019); Rohde et al. (2014), where multiple periods are potentially considered. However, all these contributions look only at the past. As we have already discussed, this backward-looking approach can be rationalised in terms of adaptive expectations. However, the adaptive expectations narrative is inconsistent with a long-term perspective. From an individual viewpoint, the past is a good guide to the future only in the short term. In the longer term, the future is inevitably different from the past, if only because of ageing. From a population point of view the same is true, especially at times of rapid population ageing, migration and labour market changes.

4.5 Normalisation

Subjective indicators asking respondents to assess the probability of an event happening provide absolute measures (although bounded between 0 and 1, see footnote 3), as in Dominitz and Manski (1997) and Green et al. (2000). On the other hand, subjective indicators asking to rate risks and prospects on an arbitrary scale from low to high, as in Mau et al. (2012), are relative in nature, as social norms and peer comparison are likely to influence what individuals consider low and what they consider high.

With the exception of the indexes proposed by Bossert and co-authors, all the objective measures examined here are normalised, meaning that they measure relative economic insecurity and produce an index which is bounded between 0 and 1. The OECD measure looks at the relative income losses due to the unemployment risk, irrespective of the absolute level of income. Osberg and Sharpe (2014) consider ratios for all their sub-indexes, for instance the percentage of disposable household income spent on health insurance. If households have to downgrade on their health insurance because of a drop in income, the measure could well remain constant, failing to show a deterioration in the security from the financial cost of illness. Analogously,

[15] Amongst subjective indicators, Rohde et al. (2015) and Romaguera-de-la Cruz (2019) also look at both levels (e.g. how secure is the current employment, or how difficult it is to pay rent and bills) and changes (e.g. an income drop).

[16] Although they may use multiple periods of data in the empirical analysis to show the evolution of (in)security, the construction of the (in)security index itself just utilises the information from one period.

Hacker et al. (2014) focus on the proportion of individuals experiencing a significant income loss —again expressed in percentage terms— while Rohde et al. (2014) normalise the "risk premium" by the long-run income level. On the other hand, the axioms put forward by Bossert and co-authors imply that the absolute level of resources matters. As we have said, there are arguments in favour and against each option, and an absolute and a relative version of the same index can certainly coexist, each telling a different story.

4.6 Arbitrariness

An issue with most of the approaches in the literature is their arbitrariness. This is to some extent unavoidable given the multidimensional nature of economic insecurity. When arbitrariness only involves the value of a parameter, sensitivity analysis can offer a solution. This is for instance the case of the 25% threshold for losses in Hacker et al. (2014) and Rohde et al. (2015).[17] But why not considering all losses, as in Rohde et al. (2014), possibly with more weight attached to bigger losses? And why not considering the potentially compensating effect of gains as in Nau and Soener (2019), who however totally abstract from the size of such losses and gains? Why weighing the employment rate and the financial protection rate 4 to 1 in Osberg and Sharpe (2014), and why considering a homogeneous health risk for the whole population? Why setting specific thresholds in the subjective and objective perceptions of the risk of economic misfortune to classify individuals into different levels of security (Dominitz and Manski, 1997; Romaguera-de-la Cruz, 2019)?

Given that the normative foundations of economic insecurity are still unclear, all measures appeal in some way to the common sense. But what is the common sense behind the Homogeneity axiom (Bossert and D'Ambrosio, 2013), stating that the higher the levels of wealth, the higher the level of insecurity? What is the justification for the Translatability axiom, which implies that a given increase in wealth reduces insecurity by the same amount irrespective of the initial level of wealth, that is proportionally more for rich people (with a lower level of initial insecurity) than for poor people (with a higher level of initial insecurity)? What is the rationale for the Proximity Monotonicity axiom (Bossert et al., 2019), which states that a person with no resources in any period is more economically secure than a person with at least some resources in some periods?[18]

4.7 Distinguishing between choices and constraints

An evident gap in the literature is how to distinguish economic insecurity resulting from agent's behaviours and external constraints. Questions on the perceived, subjective probability of loosing the job and going into unemployment make no reference to work effort, nor to the reservation wage, for instance. Hacker et al. (2014); Rohde et al. (2014, 2015) focus on large income losses and downside income volatility relative to trend, but they do not distinguish between voluntary

[17] Hacker et al. (2014) state that their results are robust to variations in this threshold.

[18] In the example of Bossert et al. (2019), $x_3 = (0, 0, 0, 0)$ is associated to less insecurity than $x_2 = (0, 1, 0, 0)$ and $x_1 = (0, 0, 1, 0)$.

income decline (such as choices to go back to school or withdrawal from labour force to care for children) and involuntary income decline (such as job loss due to layoff or income declines due to real wage or hours cuts). Likewise, Bossert and D'Ambrosio (2013) and D'Ambrosio and Rohde (2014) do not attempt to study whether the variations of wealth levels are due to choices of individuals or external shocks. For example, those households who are more anxious about the future may choose to save more, while those who are less anxious tend to be exposed to shocks by going into debt. There is a way to rationalise this, by considering that individuals try to maximise their well-being, so that the measure of insecurity is computed at a utility maximising level. Still, from a policy perspective it makes a difference whether individuals choose to stay out of the labour market or are unemployed. Distinguishing between choices and constraints requires having a model of individual behaviour, and then use it to build counterfactuals.

4.8 Distinguishing between market and transfer income

Subjective measures typically abstract from the role of social protection, even if in principle this could be investigated by asking respondents about their perception of the safety net provided by the state.

Within objective *micro* measures, one common drawback is that they do not distinguish between market and transfer income (Hacker et al., 2014; D'Ambrosio and Rohde, 2014). One exception is Rohde et al. (2014) where the US tax-benefit model TAXSIM is utilised to investigate the effect of tax and transfers on economic insecurity. This is important as those people who depend on government transfers should be most exposed to the policy uncertainty of benefits.

The literature on *macro* measures (Hijzen and Menyhert, 2016; Osberg and Sharpe, 2014) on the other hand does consider employment insurance and makes use of tax-benefits calculators to compute the cost of unemployment.

4.9 The Role of Insurance

Another aspect which is typically ignored in the literature on economic insecurity is the role of private insurance. In a world of perfect information, zero transaction costs, complete markets and perfect competition in all markets, any possible adverse event in the future can be fully insured against by purchasing actuarially fair private insurance. Although the smoothing role of private insurance is theoretically important, its practical relevance is however more doubtful. To start with, the textbook models do not capture the borrowing constraint that households face, the non-tradeable nature of human capital and the complex taxation system (Campbell, 2006). Furthermore, Barr (1992) is among those who have argued that in the real world of uncertainty, substantial transactions costs, and imperfect and often asymmetric information, private insurance markets are often unavailable to individuals, who moreover face substantial problems of financial literacy, myopia, reference dependence, loss aversion and all the other impediments to rational behaviours surveyed by Kahneman (2011).

Moreover, even if all the textbook conditions held, in order to be able to buy private insurance individuals still need an adequate level of lifetime resources. This is an important point that distinguishes the literature on economic insecurity from the one on income volatility. An individual with the certainty of receiving 0 income (including capital income) in every future period faces no volatility but is highly economically insecure, especially in absence of a public safety net.
Given the paucity of private insurance, there are mainly two ways for households to insure against economic risk over their life and over the business cycle, one is through government provided social insurance such as unemployment insurance and disable insurance, the other is through individual behaviours such as saving for a rainy day and working more today.

In summary, the measures available in the literature differ in terms of their emphasis, their subjective/objective nature, the unit of analysis (micro vs. macro), whether they look at levels or changes in the availability of economic resources, whether they are relative or absolute, whether they explicitly consider the role of social protection and whether they are objective or subjective (Table 1). On the other hand, none of the reviewed measures distinguishes between choices and constraints.

[insert Table 1 about here]

5 Conclusions

The literature on economic insecurity is still in its infancy, but many indicators have been put forward. A clear distinction arises between subjective and objective measures. Subjective indicators aim at describing perceptions and feelings (e.g. anxiety) about individual circumstances, and as such are more descriptive in nature. Objective indicators aim at identifying individual situations deemed to be of social concern, and have a more normative flavour.

Economic insecurity is a complex concept involving risks and hazards over many dimensions, so it is in a sense unavoidable that a summary measure will not be able to provide a complete picture. For instance, it is debatable whether economic insecurity concerns only the short term, or involves an evaluation over a longer horizon. Some of the measures in the literature have a short-term nature, while others depend ultimately on data availability. Other properties of existing measures, from the narrow focus on changes of some of them, to the backward-looking perspective that is common to many of them, seem however to miss important aspects of the concept.

The competition is therefore open and new measures could still enter the arena. We have argued that such new measures should (i) be computed at the individual level, (ii) be forward looking, (iii) consider both levels and changes in the availability of economic resources, (iv) consider risks over many life course dimensions, (iv) allow to identify the role of social protection, (v) be

sensitive to macroeconomic conditions, and (vi) allow to separate at least to some extent choices from constraints. In a companion paper (Richiardi and He, 2020) we elaborate on an indicator that satisfies all these specifications.

References

Barr, N. (1992). Economic Theory and the Welfare State: A Survey and Interpretation. *Journal of Economic Literature*, 30(2):741–803.

Berton, F., Richiardi, M., and Sacchi, S. (2012). *The political economy of work security and flexibility. Italy in comparative perspective.* Policy Press, Bristol.

Bossert, W., Clark, A., D'Ambrosio, C., and Lepinteur, A. (2019). Economic Insecurity and the Rise of the Right. *Eighth Meeting of the Society for the Study of Economic Inequality, Paris School of Economics*.

Bossert, W. and D'Ambrosio, C. (2013). Measuring Economic Insecurity. *International Economic Review*, 54(3):1017–1030.

Burkhauser, R. V., Butrica, B. A., Daly, M. C., and Lillard, D. R. (2001). The Cross-National Equivalent File: A Product of Cross-national Research. *Soziale Sicherung in einer dynamischen Gesellschaft (Social Insurance in a Dynamic Society). Festschrift für Richard Hauser zum*, 65:354–376.

Busetta, A., Mendola, D., and Vignoli, D. (2019). Persistent Joblessness and Fertility Intentions. *Demographic Research*, 40:185–218.

Campbell, J. Y. (2006). Household Finance. *The Journal of Finance*, 61(4):1553–1604.

Ciganda, D. (2015). Unstable Work Histories and Fertility in France: An Adaptation of Sequence Complexity Measures to Employment Trajectories. *Demographic Research*, 32:843–876.

D'Ambrosio, C. and Rohde, N. (2014). The Distribution of Economic Insecurity: Italy and the US over the Great Recession. *Review of Income and Wealth*, 60:S33–S52.

Dominitz, J. and Manski, C. F. (1997). Perceptions of Economic Insecurity: Evidence from the Survey of Economic Expectations. *The Public Opinion Quarterly*, 61(2):261–287.

Feenberg, D. and Coutts, E. (1993). An introduction to the TAXSIM model. *Journal of Policy Analysis and management*, 12(1):189–194.

Frey, C. B. and Osborne, M. A. (2017). The future of employment: How susceptible are jobs to computerisation? *Technological Forecasting and Social Change*, 114(C):254–280.

Gottschalk, P. and Moffit, R. (1999). Changes in Job Instability and Insecurity Using Monthly Survey Data. *Journal of Labor*, 17(4):S91–S126.

Green, F., Felstead, A., and Burchell, B. (2000). Job Insecurity and the Difficulty of Regaining Employment: an Empirical Study of Unemployment Expectations. *Oxford Bulletin of Economics and Statistics*, 62:855–883.

Hacker, J. S., Huber, G. A., Nichols, A., Rehm, P., Schlesinger, M., Valletta, R., and Craig, S. (2014). The Economic Security Index: A New Measure for Research and Policy Analysis. *Review of Income and Wealth*, 60:S5–S32.

Haurin, D. R. (1991). Income Variability, Homeownership, and Housing Demand. *Journal of Housing Economics*, 1(1):60–74.

Heery, E. and Salmon, J. (2000). *The insecure workforce*. Routledge.

Hijzen, A. and Menyhert, B. (2016). Measuring Labour Market Security and Assessing its Implications for Individual Well-Being. *OECD Social, Employment and Migration Working Papers 175, OECD Publishing*.

Kahneman, D. (2011). *Thinking, Fast and Slow*. Macmillan.

Kopasker, D., Montagna, C., and Bender, K. A. (2018). Economic Insecurity: A Socioeconomic Determinant of Mental Health. *SSM-Population Health*, 6:184–194.

Linz, S. J. and Semykina, A. (2010). Perceptions of Economic Insecurity: Evidence from Russia. *Economic Systems*, 34(4):357–385.

Margalit, Y. (2019). Economic Insecurity and the Causes of Populism, Reconsidered. *Journal of Economic Perspectives*, 33(4):152–70.

Mau, S., Mewes, J., and Schöneck, N. M. (2012). What determines subjective socio-economic insecurity? Context and class in comparative perspective. *Socio-Economic Review*, 10:655–682.

Nau, M. and Soener, M. (2019). Income precarity and the financial crisis. *Socio-Economic R*, 17(3):523–544.

Nedelkoska, L. and Quintini, G. (2018). Automation, skills use and training. Social, Employment and Migration Working Papers 202, OECD.

Osberg, L. (1998). Economic Insecurity. *SPRC Discussion Paper 88, Social Policy Research Centre, University of New South Wales, Sydney, Australia*.

Osberg, L. (2015). How should one measure economic insecurity? *OECD Statistics Working Papers, No. 2015/01, OECD Publishing, Paris, https://doi.org/10.1787/5js4t78q9lq7-en*.

Osberg, L. and Sharpe, A. (2002). An Index of Economic Well-being for Selected OECD Countries. *Review of Income and Wealth*, 48(3):291–316.

Osberg, L. and Sharpe, A. (2014). Measuring Economic Insecurity in Rich and Poor Nations. *Review of Income and Wealth*, 60:S53–S76.

Richiardi, M. G. and He, Z. (2020). Measuring economic insecurity: A microsimulation approach.

Roantree, B. and Shaw, J. (2018). What a difference a day makes: inequality and the tax and benefit system from a long-run perspective. *The Journal of Economic Inequality*, 16(1):23–40.

Rohde, N. and Tang, K. K. (2018). Economic Insecurity: Theoretical Approaches. In D'Ambrosio, C., editor, *Handbook of research on economic and social well-being*. Edward Elgar Publishing.

Rohde, N., Tang, K. K., D'Ambrosio, C., Osberg, L., and Rao, P. (2019). Welfare-based income insecurity in the us and germany: Evidence from harmonized panel data. Technical report.

Rohde, N., Tang, K. K., Osberg, L., and Rao, D. P. (2015). Economic insecurity in Australia: who is feeling the pinch and how? *Economic Record*, 91(292):1–15.

Rohde, N., Tang, K. K., and Rao, D. P. (2014). Distributional Characteristics of Income Insecurity in the US, G ermany, and Britain. *Review of Income and Wealth*, 60:S159–S176.

Romaguera-de-la Cruz, M. (2019). Measuring Economic Insecurity Using a Counting Approach. An Application to Three EU Countries. *Review of Income and Wealth*.

Scheve, K. and Slaughter, M. J. (2004). Economic Insecurity and the Globalization of Production. *American Journal of Political Science*, 48(4):662–674.

Sharpe, A. and Salzman, J. (2003). Methodological Choices Encountered in the Construction of Composite Indicators. In *Annual meeting of the Canadian Economics Association, Carleton University, Ottawa, Ontario*.

Stiglitz, J., Sen, A. K., and Fitoussi, J.-P. (2009). The Measurement of Economic Performance and Social Progress Revisited: Reflections and Overview. *http://www.stiglitzsenfitoussi.fr/documents/overview-eng.pdf*.

Wallace-Stephens, F. (2019). Economic Insecurity: The case for a 21st century safety net. Technical report, Royal Society for the encouragement of Arts, Manufactures and Commerce. https://www.thersa.org/globalassets/pdfs/reports/economic-insecurity-21st-century-safety-net-report.pdf.

Table 1: A summary of characteristics of different measures of economic (in)security

Study	**Focus**	**Objective or subjective**	**Micro or macro**	**Levels or changes**	**Absolute or relative**	**Social protection considered**	**Variables**
Dominitz and Manski (1997)	perception of risks	subjective	micro	levels	absolute	no	health insurance, burglary, job loss
Mau et al. (2012)	perception of risks	subjective	micro	levels	relative	yes	unemployment, material deprivation, health insurance
Nau and Soener (2019)	income gains and losses	subjective	micro	changes	absolute	no	income
Green et al. (2000)	perception of labour market risks	subjective	micro	changes	absolute	no	employment status
Rohde et al. (2015)	job and financial security	subjective and objective	micro	levels and changes	relative	no	job and financial satisfaction, expenditure distress
Romaguera-de-la Cruz (2019)	job and financial security	subjective and objective	micro	levels and changes	absolute	no	job and financial satisfaction, expenditure distress
Hijzen and Menyhert (2016)	expected cost of job loss	objective	macro	changes	relative	yes	income
Osberg and Sharpe (2014)	anticipated cost of specific risks	objective	macro	levels	relative	yes	income
Hacker et al. (2014)	large income losses	objective	micro	changes	relative	no	income and wealth
Bossert and D'Ambrosio (2013)	current wealth and past wealth variations	objective	micro	levels and changes	absolute	no	wealth
Bossert et al. (2019)	past income variations	objective	micro	changes	absolute	no	income
Rohde et al. (2014)	downside income volatility	objective	micro	changes	relative	yes	income

Note: Order follows the discussion in the text.