STUDIES

Proposal for the regionalisation of gender equality measures in Europe

Jon Olaskoaga-Larrauri
(corresponding author)
University of the Basque Country
(UPV/EHU),
Department of Business
Administration,
Bilbao, Spain
Email: jon.olaskoaga@ehu.eus

Judith Ranilla-Arija
University of the Basque Country
(UPV/EHU),
Department of Business
Administration,
Bilbao, Spain
Email: judit.ranilla@ehu.es

Patxi Elissalde
ESTIA Institute of Technology,
Bidart, France
Email: p.elissalde@estia.fr

Ernesto Cilleruelo-Carrasco
University of the Basque Country
(UPV/EHU),
Department of Business
Administration,
Bilbao, Spain
Email: ernesto.cilleruelo@ehu.eus

Advances in measuring differences in living conditions between men and women, along with the growing trend of regionalising social statistics, have prompted efforts to develop regional gender equality measures. This study presents a methodological proposal for creating regional gender equality indices within the European context. Our approach involves adapting the methodology developed by the European Institute for Gender Equality (EIGE 2017a) to the regional level, as in di Bella et al. (2021) but maintaining comparability between the regional data and the data the EIGE regularly publishes for the 27 European Union countries. The main advantages of this approach are twofold: a) it aligns with the EIGE's conceptualisation of equality and its domains, benefitting from the institution's decades of experience and a methodology duly validated by the European Commission (Papadimitriou et al. 2020); b) it produces results that are comparable, albeit imperfectly, with those published by the EIGE for EU countries. However, the proposed solution has some limitations: it prevents a selection of basic indicators tailored to the specific realities of each region and the apportionment of weight to the equality domains based on the interests and priorities of regional stakeholders.

Introduction

Today, gender equality is an outstanding objective for social policies in developed countries and a phenomenon of interest owing to its foreseeable implications in other aspects of economic, political and social life (Carmichael 2014, Brinda et al. 2015). Monitoring gender equality has become an unavoidable task for the analysis of its implications. Stable, reliable and relevant (in)equality measures are required; hence the development of methodologies and the spread of initiatives in this field.

However, advances in measuring (in)equality have concentrated almost exclusively on describing the achievements of countries, resulting in the concealment of regional particularities. This study presents a proposal for measuring gender equality in European regions which, unlike previous proposals, does not comprise designing a new index. Instead, the proposal is based on adapting the methodology developed by the European Institute for Gender Equality (EIGE 2017b) to the specific characteristics of the regional level. This methodology 'has a more comprehensive framework than other gender indexes and is tailored for European Union policy objectives' (Berik 2022: p. 58); it has become 'the eminent measure of gender equality levels in Europe' (Schmid–Elliot 2023: p. 390) and the European Gender Equality Strategy (2020–2025) (European Commission [EC] 2020) has selected it to monitor progress in this area across EU member states.

The advantages of this approach are evident. First, the results derived from this method inherit the conceptual and methodological robustness of the EIGE index. Second, these results can be reasonably compared with those regularly published by the EIGE for all European Union countries.

This approach has been applied successfully in three Spanish regions: Catalonia, the Basque Country and Navarre. The authors of this study have collaborated with the official statistical offices of the Basque Country (Eustat), since 2015, and Navarre (Nastat), between 2018 and 2020, in the design and development of their respective gender equality indices (GEIs), accumulating experience that is now shared in this study. Eustat (2024) offers a time series on gender equality in its region through its website, covering the years 2010, 2012, 2015, 2017, 2019 and 2021. Nastat (2022) covers the years 2010, 2012, 2015, 2017, 2018, 2019, and 2020. Both institutions provide methodological documents describing the general framework of the EIGE methodology and some features of their own statistics (Eustat 2024, Nastat 2022).

Proliferation of gender equality measurement

Claims related to gender equality have been a focus of the feminist movement for approximately two centuries (Malinowska 2020), although public attention to measure this phenomenon statistically is relatively recent. Several factors underpin this interest.

One significant factor contributing to this shift is the recognition that achieving mere formal equality no longer suffices as a political goal; instead, there is a growing

emphasis on achieving substantive equality (Becker 1999). Additionally, with several national governments openly embracing feminism, there is increased pressure to implement mechanisms for monitoring progress. This has led to the development of statistics that aim to assess the extent to which material equality truly exists across all pertinent domains.

At the international level, gender equality is also championed as an integral component of Goal 5 (*Achieve gender equality and empower all women and girls*) within the Sustainable Development Goals (SDGs), endorsed during the 2015 United Nations General Assembly, where the 2030 Agenda was unveiled. The United Nations assesses progress towards achieving the SDGs on an annual basis by utilising a set of indicators selected by the United Nations Statistical Commission, currently totalling 231, with the potential for an expansion tailored to each country's needs. In Spain, the National Institute of Statistics (INE) employs a framework wherein each UN indicator is disaggregated into a series of sub-indicators (INE 2021). For instance, while the UN delineates an indicator for Goal 5.4 – *Recognize and value unpaid care and domestic work* – the INE breaks it down further into three sub-indicators. In essence, the adoption of the SDGs has spurred intensified efforts to measure various aspects of gender (in)equality comprehensively.

Technological advances and augmented investment in statistical production, encompassing both the public and private sectors, have enhanced the accessibility of statistical information about all facets of social reality substantially. Concurrently, scholars worldwide have scrutinised even the most intricate aspects of social reality meticulously, providing comprehensive statistical descriptions and analyses derived from their observations. In the domain of gender equality, researchers' enthusiasm is fuelled not only by the novelty of the subject but also by its potential implications: a meticulous evaluation of gender equality facilitates a systematic investigation into its interactions with other economic and social factors, a realm where significant progress has already been made (Kingma–Vandeplas 2022, Mills 2010, Morais Maceira 2017, Moore et al. 2021).

Taken together, these factors have led to a proliferation of initiatives and methodologies for the statistical measurement of gender equality. Most of these initiatives are based on synthetic indicators, which condense all dimensions of equality into a single measure and, consequently, describe the level of equality achieved in a particular country with a single value. This is the case with well-known proposals from the UN – the gender development index (GDI) and the gender empowerment measure (GEM) – and from the EIGE. However, they are joined by a growing number of more specific initiatives, such as those proposed by Dijkstra–Hanmer (2000), Dijkstra (2002), Plantenga et al. (2009), Castaño et al. (2011), Bericat (2012), Permanyer (2013, 2015), Ferrant (2014), and Ertan (2016).

Towards the regionalisation of the measurement of gender equality

The methodologies mentioned in the previous section were designed to measure and compare progress in gender equality across countries. More recently, several initiatives have emerged that aim to expand this measurement to encompass regional contexts, and in our opinion, at least two factors justify this trend:

a) Gender equality measures rely primarily on indicators that assess various aspects of economic development and social well-being, but it is common for regions within the same country to show disparate levels of achievement in these indicators. According to the Organisation for Economic Co-operation and Development (OECD [2018]), regional disparities often surpass those observed between different countries. In the same vein, disparities in well-being between genders are influenced by numerous factors, ranging from economic development to the prevalence of specific cultural norms and policies aimed at fostering equality. These multi-faceted factors contribute to significant variations in gender equality within a single country, variations that can only be unveiled through the regionalisation of gender metrics.

b) Meanwhile, European countries exhibit varying degrees of political and administrative decentralisation. In nations such as Italy or Spain, decentralisation entails the presence of regions with special statutes and greater autonomy from the central administration. In Italy, regional governments have political responsibilities in the field of social welfare and they require regional indicators to assess the effectiveness of their actions or identify any unintended consequences (Calcagnini–Perugini 2019). The same applies to other countries, such as Spain, where autonomous communities enjoy extensive decentralised powers in areas related to social welfare, such as healthcare, education and social policy.

In addition to these two reasons, which imply a growing need for gender equality statistics at the regional level, we can provide further testimony based on our professional experience. Over the past two decades, we have observed explicit and repeated calls from various political and social stakeholders for regional statistical offices to enhance their efforts in describing statistically the reality and evolution of gender equality in their respective territories.

Alternatives for calculating a measure of gender equality in the European regions

Once we have acknowledged and justified the importance of having tools for monitoring gender equality at the regional level, our objective is to consider existing alternatives and propose a practical solution for measuring gender equality at the regional level. The design of the proposal is carried out assuming the following circumstances, which are shared by some European regions:

We envision a European region that is committed to measuring the degree of gender (in)equality within its geographical and institutional boundaries, aiming for regular assessments and striving for measurement results that are reasonably comparable both over time and with other regions and countries. In essence, this region seeks to monitor the evolution of gender equality thoroughly within its territory, to compare its progress with that of other benchmark regions and countries. Additionally, we envision regions equipped with statistical offices possessing adequate infrastructure to collect their own basic statistics, while also leveraging those operations conducted by national statistical offices.

Once the objectives have been described, we will begin by ruling out some options.

First, we dismiss the possibility of relying on findings stemming from academic initiatives. There have been several experiences in this regard, both in Europe (Martínez Peinado–Cairó Céspedes 2004, Blancas Peral et al. 2008, Bericat Alastuey–Sánchez Bermejo 2008, Perrons–Dunford 2013, di Bella et al. 2021, Cascella et al. 2022) and elsewhere in the world (Frias 2008, Avolio–Del Carpio 2020). Most of this literature contains original proposals and is based on simple mathematical and statistical procedures. However, these proposals have three significant drawbacks from the perspective of the objectives set out in this study: a) authors often apply them exclusively in the regions of their home country, which, at worst, disqualifies them as sources of information and, at best, severely restricts opportunities for cross-sectional comparison (with other regions and countries); b) furthermore, academic initiatives are, by their nature, short-lived: they are usually tested only once to assess their applicability, analyse their results and publish them in a scientific journal. Thereafter, the experience loses interest for the authors, who generally do not revisit it; and c) finally, the application of the methodologies contained in these proposals would require the statistical office of the region wishing to compare itself with other countries to implement these methodologies in all the countries (or regions) with which it seeks comparison. This effort is significantly greater than that required to adapt a methodology that is regularly applied to all European countries.

Currently, there is also an initiative in Europe (Norlén et al. 2019, 2021), supported by the European Commission, that addresses the challenging task of measuring gender equality in 270 European regions (Nomenclature of Territorial Units for Statistics [NUTS] 2) from two different perspectives: the achievement of equality and the disparity experienced by women compared to men. This initiative has led to the development of two original composite indices. The benefit of this initiative lies in its comprehensive analysis, enhancing the comparability of each region with others, both domestically and across the entire union. However, there are no guarantees regarding the continuity of this project in the future, raising serious doubts about its ability to

provide information with the regularity demanded by regional stakeholders. Consequently, this alternative must also be ruled out.

Given that European regions concerned with measuring gender equality cannot rely on external data, their only option is to conduct their own measurements, and this avenue also opens up two possibilities. The first involves developing an original methodology that fits perfectly with regional circumstances – primarily the availability of statistical information – and the priorities of regional policymakers and other stakeholders. One drawback of this approach is that comparisons with other regional or national realities can only be made at the cost of applying the same methodology to one or several regional or national benchmarks, which must also be chosen according to specific criteria. However, this approach has the advantage of facilitating longitudinal comparisons over time, unaffected by methodological changes in international sources potentially compromising the homogeneity of the historical series.

However, our proposal involves using a methodology that has already been tested and applied regularly in the reference countries. In Europe, the initiative that meets these two requirements is the gender equality index (GEI) developed by the EIGE. The EIGE furnishes comparable data on the GEI for all European Union countries annually, presenting a consistent series for the years 2012, 2015, 2017, 2018, 2019, 2020 and 2021. The EIGE methodology adapts to the characteristics of socially and economically advanced countries (di Bella et al. 2021), and its robustness has been verified by independent agencies (Papadimitriou et al. 2020), although, like any other methodology, it still includes contentious issues (Permanyer 2010, Schmid–Elliot 2023). However, this solution is not devoid of challenges, particularly concerning the difficulty of accessing the essential regional information necessary for applying the chosen methodology. Later, we will tackle these challenges and propose specific solutions, drawing on our experience in developing GEIs for the Spanish regions of the Basque Country and Navarre. However, before exploring that, we will provide a detailed description of the EIGE methodology.

The EIGE methodology: features and controversy

The GEI is a composite index that summarises information on gender equality across 31 pre-selected indicators. As with all composite indices, critical methodological decisions revolve around selecting basic indicators, defining metrics and determining aggregation procedures – topics we will discuss further:

Selection and structure of basic indicators

The EIGE methodology comprises 31 indicators descriptive of key aspects of the given population's work, economic, social, political and family life (EIGE 2017a).

These 31 indicators are organised into 14 sub-domains and 6 different domains (Table 1).

Metrics

The metrics of equality in the GEI have been the subject of strong controversy. The measure of equality in each basic indicator is obtained using the following general formula (EIGE 2017a):

$$M_{(X_{it})} = 1 + \left[CC_{(X_{it})} \cdot GG_{(X_{it})} \right] 99 \qquad (1)$$

The metric (M) for equality in the indicator X is determined by two factors: the gender gap (GG) and the correction coefficient (CC); 'i' stands for country and 't' for period. The GG strictly measures the observed differences between men and women in indicator X. It is calculated as follows:

$$GG_{(X_{it})} = 1 - \left| \frac{X_{it}^{woman}}{X_{it}^{average}} - 1 \right| \qquad (2)$$

where $X_{it}^{average}$ represents the simple average of the indicator values observed in male and female groups.

The value of GG can range from 0 (minimum equality) to 1 (maximum equality), which occurs when the value of X is the same for both male and female populations. The CC is calculated as follows:

$$CC_{(X_{it})} = \left(\frac{X_{it}^{T}}{X_{ref}^{T}} \right)^{1/2} \qquad (3)$$

where X_{it}^{T} represents the value of indicator X for the entire population (male and female)[1] in country i and year t, while X_{ref}^{T} is the best (highest) level achieved in the indicator by any EU-28 country in the years 2005, 2007, 2012 and 2015 (EIGE 2017b: p. 108).

The CC compares 'the performance of each country with the best performer in the EU-28' (EIGE 2017a: p. 13). Its incorporation into the metric suggests that a country's performance is deemed excellent only when it achieves a high level of gender equality, along with a (relatively) high level across the entire population in the indicator (EIGE 2013: p. 37).[2]

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[1] Exceptionally, for some indicators, X_{it}^{T} represents the simple average of the indicator values observed in male and female groups, respectively.

[2] The correction coefficient is employed in only 21 out of the 31 indicators of the GEI. Conversely, for the remaining ten indicators, a simplified equality metric is adopted, without including this coefficient.

Table 1

Hierarchical structure of the EIGE gender equality index

Domain	Subdomain	Indicator	Source	Basque country[a]	Navarre[a]
Work	Participation	W1. Full-time equivalent employment rate	Eurostat		
		W2. Duration of working life	Eurostat		
	Segregation and quality of work	W3. People employed in education, human health and social work activities	Eurostat		
		W4. Ability to take an hour or two off during working hours to take care of personal or family matters	Euro-found	S	S
		W5. Career prospects index	Euro-found	R	R
Money	Financial resources	M1. Mean monthly earnings	Eurostat	S	
		M2. Mean equivalised net income	Eurostat		
	Economic situation	M3. Not at risk of poverty, ≥60% of median income	Eurostat		
		M4. S20/S80 income quintile share	Eurostat		
Knowledge	Attainment and participation	K1. Graduates of tertiary education	Eurostat		
		K2. People participating in formal or non-formal education and training	Eurostat		
	Segregation	K3. Tertiary students in the fields of education, health and welfare, humanities and arts	Eurostat		
Time	Care activities	T1. People caring for and educating their children or grandchildren, elderly or people with disabilities every day	Euro-found	S	S
		T2. People doing cooking and/or housework every day	Euro-found	S	S
	Social activities	T3. Workers doing sporting, cultural or leisure activities outside of their home at least daily or several times a week	Euro-found	S	S
		T4. Workers involved in voluntary or charitable activities at least once a month	Euro-found	S	S
Power	Political	P1. Proportion of ministers	EIGE	S	S
		P2. Proportion of members of parliament	EIGE	S	S
		P3. Proportion of members of regional assemblies	EIGE	S	S
	Economic	P4. Proportion of members of boards in largest quoted companies, supervisory board or board of directors	EIGE	S	S
		P5. Proportion of board members of central bank	EIGE	S	R
	Social	P6. Proportion of board members of research-funding organisations	EIGE	S	S
		P7. Proportion of board members in publicly owned broadcasting organisations	EIGE	S	R
		P8. Proportion of members of the highest decision-making body of the national Olympic sports organisations	EIGE	S	S

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Domain	Subdomain	Indicator	Source	Basque country[a]	Navarre[a]
Health	Status	H1. Self-perceived health, good or very good	Eurostat		
		H2. Life expectancy in absolute value at birth	Eurostat		
		H3. Healthy life years in absolute value at birth	Eurostat		
	Behaviour	H4. People who do not smoke and are not involved in harmful drinking	Eurostat		
		H5. People doing physical activities and/or consuming fruits and vegetables	Eurostat		
	Access	H6. People without unmet needs for medical examination	Eurostat	S	S
		H7. People without unmet needs for dental examination	Eurostat	S	S

a) Procedure adopted. R: replication; S: substitution.
Source: EIGE (2023) and author's elaboration.

Aggregation

Aggregation is the process by which equality measures for basic indicators are translated into a single measure of gender equality, referred to as the GEI. In EIGE's methodology, the solution adopted involves establishing a hierarchical structure comprising four levels: basic indicators, sub-domains, domains and ultimately, the GEI. The procedure is straightforward: first, equality metrics (M) are computed for the basic indicators, and then various types of mean values are used to calculate equality indices at the subsequent levels. Aggregation of indicators into sub-domains is achieved by arithmetic means, sub-domains into domains by geometric means and finally, domains into the overall index by weighted geometric means. Weights (Table 2) were determined through a hierarchical analysis process based on the importance assigned to each domain by a panel of experts (EIGE 2015: p. 20).

Table 2

Weights associated with the domains of the GEI

Work	Money	Knowledge	Time	Power	Health
0.19	0.15	0.22	0.15	0.19	0.10

Source: EIGE (2013: p. 51).

Critical voices

Regarding other similar initiatives in measuring gender equality, The EIGE approach stands out as one of the most recent and dynamic (Olaskoaga-Larrauri−Salaverri-Ruiz-Ozaita 2020). Its merits are further enhanced by notable transparency in the statistical elaboration process and the frequency with which results are published. Since the 2020 edition, a new edition of the GEI has been released annually (EIGE

2020: p. 17). While this means that the values of some indicators cannot be updated compared to previous editions, it also reflects the EIGE's commendable effort to meet an increasingly urgent demand for information.

The EIGE's methodology has also faced some criticisms, most of which are related to the equality metric and, in particular, to the CC. These criticisms can be summarised as follows:

1. The metric used by the EIGE shares a common trait with such pioneering UN measures as the GDI and the GEM: it integrates both gender equality (GG) and the level of development attained by countries (CC) into its calculation (Dijkstra–Hanmer 2000, Dijkstra 2006, Klasen 2006). According to some authors (Dijkstra 2002, Beneria–Permanyer 2010), this constitutes an 'odd combination', potentially introducing bias regarding the index's principal objective and posing a risk of misinterpretation of its findings. Permanyer (2015) quantified the impact of each factor, revealing that the CC's effect exceeded that of the GG in roughly three-quarters of the cases. After Permanyer's analysis, the EIGE made adjustments to its metric in the 2017 edition. Now, instead of calculating the CC as the ratio between the indicator value in the country and the reference value, it is computed as the square root of this ratio. This modification reduced the factor's impact on the equality measure, although it did not eliminate it (Schmid–Elliot 2023).

2. More developed countries typically excel in welfare and social development indicators, resulting in higher CCs. Consequently, the GEI metric tends to overstate the correlation between economic development and gender equality (Permanyer 2015, Olaskoaga-Larrauri–Salaverri-Ruiz-Ozaita 2020, Schmid–Elliot 2023).

3. Despite the EIGE's efforts to improve the longitudinal comparability of its index by introducing fixed references into the calculation of the CC, other methodological attributes still hinder comparability. Specifically, for a given country, if the indicator's value improves over time, the CC (and equality metric) also improves, irrespective of whether the GG remains constant (4).

$$X_{it1}^T < X_{it2}^T \Rightarrow CC_{(X_{it1})} < CC_{(X_{it2})} \qquad (4)$$

In indicators M1 and M2 (Table 1), both measured in current units, the design of the equality metric implies that the CC tends to increase as a mere consequence of inflation. There are situations where no real improvement occurs, but the CC reflects a relative improvement of the population as a whole, resulting in an apparent enhancement of gender equality in the indicator (Olaskoaga-Larrauri–Salaverri-Ruiz-Ozaita 2020). In summary, the GEI tends to exaggerate the improvement of gender equality over time.

4. The latest bias stemming from the design of the equality metric in the GEI consists of a tendency to overestimate the convergence of countries in gender

equality. As references are fixed, the value of the expression $\left(\frac{X_{it}^T}{X_{ref}^T}\right)^{1/2}$ can eventually exceed one, which is indeed happening with countries ranking high in both gender equality and economic and social development. For such cases, the EIGE's methodology stipulates that the correction factor should be exactly one. This means that countries surpassing the reference value in certain indicators (which are typically those with a narrower GG) have only one route to enhance the equality metric: by addressing the GG. Conversely, other countries can bolster their metrics by addressing both the GG and the CC. Essentially, these countries enjoy a 'methodological advantage' enabling them to narrow the disparity with countries ahead of them in gender equality.

5. The aggregation methods selected by the EIGE also generate some issues. First, the use of average values inherently assumes a specific weight for each basic indicator in the overall index, which introduces an element of subjectivity (Schmid–Elliot 2023). Furthermore, at the final level of aggregation, the EIGE employs weighted geometric means to transition from the six dimensions to the GEI. The use of geometric means results in the effective weight of each dimension in the overall index differing from the weights explicitly assigned by the EIGE (Schmid–Elliot 2023). There are some solutions to mitigate these problems. For example, the use of the synthetic indicator of distance P_2 (Somarriba–Pena 2009) would avoid arbitrary weighting, as the method itself assigns weights to the dimensions. A different approach involves dispensing with traditional aggregation methods (Carlsen et al. 2023). This solution avoids the arbitrary assignment of weights to the various basic indicators. Conversely, traditional aggregation methods typically use arithmetic means (or similar procedures), which to some extent allow for 'a high value of one indicator [to] be compensated [for] by a low value of another indicator, obviously causing information loss', an effect that can be avoided by employing the 'partial order methodology' (Carlsen–Bruggemann 2021: p. 1128). Nevertheless, most international methodologies for measuring gender equality continue to use composite indices based on the aggregation of basic indicators. According to Berik (2022: p. 7), this is because composite indices have the advantage of 'provid[ing] a summary communication tool to generate attention, stimulate policy debate, help monitor progress towards gender equality and support advocacy'.

The list of drawbacks of the EIGE methodology could be even longer as no social indicator captures its intended measure perfectly. However, in our view, the benefits offered by the EIGE approach far outweigh its drawbacks, and from the perspective adopted in this study, the EIGE proposal represents a better option than any other methodology for measuring gender equality in European regions.

Regionalisation of the GEI: problems and solutions

The EIGE formulated its methodology with the explicit objective of assessing the extent of gender equality across European Union countries. As a result, the choice of the 31 basic indicators was governed by the prerequisite that their values, disaggregated by gender, could be computed for each member state of the union, but this scenario undergoes a significant shift when endeavouring to compute those indicators within regional contexts. Under such circumstances, one probably encounters either of the following two difficulties:

1. The definition of the indicator is incompatible with its application at the regional level. This difficulty is best understood with an example: indicator P5 of the GEI entails calculating the gender composition of the governing body of the country's central bank. However, central banks are state institutions, and there are no equivalent institutions at the regional level.

2. There are insufficient data to compute the indicator (by gender) within the regional context. The EIGE relies on three primary sources of information: Eurostat, Eurofound and its own data regarding the gender composition of decision-making bodies pertinent to the power domain indicators (Table 1). Most of the data from Eurostat and Eurofound can be accessed by the general public through the dissemination channels of these two agencies, but only at the country level. However, depending exclusively on these channels would render it impossible for someone tasked with developing a regional GEI to calculate the equality measure corresponding to any of the 31 indicators comprising the index. The challenge of obtaining basic data fluctuates: statistical sources such as the *Labour Force Survey* (LFS), which is used in no fewer than five basic indicators, furnish information with a NUTS 2 level of detail, theoretically adequate to address the issue within the Autonomous Communities of Spain, as well as the regions of France, Italy or the German Regierungsbezirke. However, the representativeness of regional LFS samples might fall short when the calculations demand estimates that involve the interaction of multiple variables. For instance, when calculating the duration of working life, precise estimates rely on activity rates disaggregated by region, gender and age group. These difficulties are exacerbated when the primary data source is Eurofound, as it did not initially aim to utilise regionally representative samples in the two key surveys pertinent to the GEI: the *European Working Conditions Surveys* and the *European Quality of Life Surveys*. However, in certain instances, regional statistical systems can compensate for these data gaps. For instance, in the Basque Country, the official statistical office (Eustat) conducts its own survey, known as *Population in Relation to Activity*. This survey is methodologically consistent with the LFS, utilises significantly larger sample sizes within the region and its data are used to calculate the W1, W2 and W3 indicators (Table 1). The same applies to the D2,

D3 and D4 indicators, which the EIGE obtains from the European Union Statistics on Income and Living Conditions (EU-SILC). In the Basque Country, the *Survey on Poverty and Social Inequalities* is used instead, a statistical operation conducted by the Basque government but to the same standards as EU-SILC. Hence, it is apparent that the viability of replicating the computation of the equality metric precisely for a particular indicator should be evaluated on a case-by-case basis, considering both the informational requirements of the indicator and the accessibility of data within the region.

When the two difficulties described cannot be resolved, the only option is to circumvent them. There are three ways to do this:

1. Elimination: This process entails the removal of the problematic indicator, followed by the computation of the regional GEI using the remaining basic indicators.
2. Replication: This method involves adopting values from a higher geopolitical level, normally the national level, under the assumption that they reflect the characteristics of the region accurately.
3. Substitution: This approach requires the calculation of an alternative indicator that captures the same aspect of reality as the original indicator, albeit in a different form.

These solutions can be combined, and each has its advantages and drawbacks.

Elimination results in a notable reduction in comparability between the regional and national outcomes, particularly as some more basic indicators are excluded. If a substantial number of indicators are removed and the resulting loss of comparability is considered unacceptable, there is the option to recalculate the GEI value for all European countries using the subset of basic indicators employed in the regional index. However, this approach compromises the definition of gender equality endorsed by the EIGE and diverges from the conceptual framework and methodology that was chosen precisely for its theoretical and methodological robustness (Papadimitriou et al. 2020, Schmid–Elliot 2023). Consequently, no elimination of indicators has been carried out, either in the Basque Country or in Navarre.

Replication also has significant drawbacks. As it is applied to an increasing number of basic indicators, the outcome for the region tends to align closely with that of the country it belongs to, undermining the primary objective of regionalising the measurement of gender (in)equality. Replication has been conducted only once in the Basque Country and three times in Navarre. Replication was applied in both regions in indicator W5: career prospects index (refer to Table 1). This index is unique in that it is a composite measure calculated by Eurofound for the EIGE, based on data from the *European Working Conditions Survey*. However, the methods used are not sufficiently transparent to allow for regional application. Additionally, Eurofound provided these results to the EIGE only for 2015, meaning the value published by the EIGE remains the same for each year in the 2010–2021 series. Under these circumstances, calculating

a complete series for this indicator for the Basque Country and Navarre was not only impossible but also meaningless.

In Navarre, two additional indicators were replicated: P5: Composition of the main decision-making body of the Central Bank, and P7: Proportion of board members in publicly owned broadcasting organisations. This was done because Navarre has neither equivalent financial institutions nor a regional broadcasting service. Conversely, the Basque Country does have these institutions, so these two indicators were not replicated there.

In contrast to the limited use of elimination and replication solutions, the proposal advocated in this study primarily involves substituting basic indicators and applying national value replication only in exceptional cases, as outlined above. Specifically, this approach is recommended only when it is impossible to find a satisfactory substitute.

Table 3 reports on the indicators used in the GEIs of the Basque Country and Navarre when substitution has been applied.

Table 3

Substitution of the EIGE indicators with specific indicators in the GEIs of the Basque Country and Navarre

EIGE indicator	Indicator in Basque Country GEI	Indicator in Navarre GEI
W4. Ability to take an hour or two off during working hours to take care of personal or family matters	Ability to balance work schedule with family and social obligations considered good or very good (WCS)	Possibility of balancing work with household tasks with little or no effort (LCSS)
M1. Mean monthly earnings (working population)	Mean monthly earnings of the salaried population (WCS)	–
T1. People caring for and educating their children or grandchildren, elderly or people with disabilities every day	People who care for children and/or the elderly or dependents (LCS)	People who engage in any of the following activities whenever it is necessary to perform them: caring for children under 15; caring for dependent individuals (LCSS)
T2. People doing cooking and/or housework every day	People who engage in any of the following activities: shopping; meal preparation; clearing the table; washing dishes; preparing clothes; house cleaning (LCS)	People who engage in any of the following activities whenever it is necessary to perform them: shopping; meal preparation; clearing the table; washing dishes; preparing clothes; house cleaning (LCSS)
T3. Workers doing sporting, cultural or leisure activities outside of their home at least daily or several times a week	Employed people who regularly go to the cinema, theatre and concerts and take part in other leisure activities, or who go hiking or engage in sports (LCS)	Employed people who regularly or on weekends go to the cinema, theatre, concerts or sporting events, or who go hiking or engage in sports (LCSS)

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(Continued.)

EIGE indicator	Indicator in Basque Country GEI	Indicator in Navarre GEI
T4. Workers involved in voluntary or charitable activities, at least once a month	Employed people who are involved in neighbourhood, youth, religious, charitable, educational, artistic, cultural or recreational associations, or in organisations focused on social assistance, health, human rights or environmental defence (LCS)	Employed people who are involved in neighbourhood, youth, environmental, religious, educational, artistic or recreational associations, or in organisations focused on development cooperation, social assistance or the defence of human rights (LCSS)
P1. Proportion of ministers	Proportion of members in regional government (GEIE)	Proportion of members in regional government (GEIN)
P2. Proportion of members of parliament	Proportion of members in regional parliament (GEIE)	Proportion of members in regional parliament (GEIN)
P3. Proportion of members of regional assemblies	Proportion of members in territorial assemblies (GEIE)	Proportion of members in municipal councils (GEIN)
P4. Proportion of members of boards in largest quoted companies, supervisory board or board of directors	Proportion of board members in the most significant companies in the region (GEIE)	Proportion of board members in the most significant companies in the region (GEIN)
P5. Proportion of board members of central bank	Proportion of board members in public or semi-public banking companies (GEIE)	R
P6. Proportion of board members of research-funding organisations	Proportion of collegiate bodies for decision-making on public funding for R&D (GEIE)	Proportion of collegiate bodies for decision-making on public funding for research and development (GEIN)
P7. Proportion of board members of publicly owned broadcasting organisations	Proportion of collegiate bodies for decision-making of public information media (GEIE)	R
P8. Proportion of members of the highest decision-making body of the national Olympic sports organisations	Proportion of members of the highest decision-making body of the most popular sports organisations (GEIE)	Proportion of members of the highest decision-making body of the most popular sports organisations (GEIN)
H6. People without unmet needs for medical examination	People without unmet needs for medical examination for economic reasons (HS)	People without unmet needs for medical examination for economic reasons (LCSS)
H7. People without unmet needs for dental examination	People without unmet needs for dental examination for economic reasons (HS)	People without unmet needs for dental examination for economic reasons (LCSS)

Notes: WCS: Working Conditions Survey (Basque Government). LCS: Life Conditions Survey (Eustat). HS: Health Survey (Basque Government). GEIE: Primary source data for the GEI (Eustat). LCSS: Life Conditions and Social Survey (Nastat). GEIN: Primary source data for the GEI (Nastat).

Sources: Eustat (2024), Nastat (2022).

In any case, our preference for the substitution method should not be mistaken for ignorance of its flaws. Indeed, precisely because it is the recommended solution, our analysis of its drawbacks and the difficulties it causes is outlined more extensively in the following section.

Practical issues of variable substitution

The substitution method varies in its appropriateness depending on the indicator and its inherent characteristics. This method is considered suitable when an indicator cannot be defined within a regional context but can be adapted accordingly. This scenario arises frequently in the domain of 'power', where the EIGE indicators are primarily associated with national institutions such as parliaments or national governments. In such instances, the solution involves applying the same calculation criteria to regional representative and governing bodies, where applicable. This is the case, for example, in indicators P1, where the composition by sex of the national government is substituted with that of the regional government; P2, where the composition of the national parliament is replaced with that of the regional parliament (in Spain, each region has its own legislative chamber); and P4, where the composition of the decision-making bodies of the largest quoted companies in the country is replaced with that of the decision-making bodies in a sample of the most relevant companies in each region, which, to ensure it is not too small, is not limited to quoted companies (Table 3).

Substitution becomes more controversial when the indicator cannot be calculated in the region due to a lack of homogeneous information. This situation arises more often with those indicators derived from Eurofound surveys (*European Working Conditions Surveys* and *Quality of Life Surveys*). Bearing in mind that these surveys are specifically intended to offer national estimates, it becomes necessary to rely on alternative statistical sources, whether from national or regional sources, to obtain indicators that differ from those employed by the EIGE, albeit aiming to measure the same social phenomena. For example, in our experiences in the Basque Country and Navarre, we have used data from surveys such as the *Living Conditions Survey*, and the *Working Conditions Survey* (both components of the Basque Statistics Plan), and the *Social and Living Conditions Survey* (included in the Navarre Statistics Plan). Furthermore, regional statistical offices may modify their survey questionnaires to include specific questions from Eurofound surveys. In such cases, it would no longer be necessary to apply the substitution method.

When implementing the substitution method, it is essential to address a challenge concerning the utilisation of the CC in EIGE's metric of equality. Let us consider two indicators designed to measure the same aspect of social reality: the first is the indicator proposed by the EIGE (X), and the second, is a potential substitute (Y). Each indicator is measured on a distinct scale and represented in different units.

Assuming that data are accessible regarding the values of both indicators across three demographic groups: women, men and both genders. If both indicators represent the same social phenomenon accurately, they should produce comparable GG values. This is because neither the scale nor the units used influence the calculation of the gaps, as they affect both the numerator and the denominator simultaneously in the metric (equations 5 and 6).

$$GG_{(X_{it})} = 1 - \left| \frac{X_{it}^{women}}{X_{it}^{average}} - 1 \right| \qquad (5)$$

$$GG'_{(Y_{it})} = 1 - \left| \frac{Y_{it}^{women}}{Y_{it}^{average}} - 1 \right| \qquad (6)$$

The problem arises when calculating the CC. With the substitution of the indicator, the expression for the CC becomes distorted (equation 8): in the numerator, there remains a value measured in the scale and units specific to the new indicator, while in the denominator there remains the reference value of the original indicator selected by the EIGE, which is measured on a different scale and in different units.

$$CC_{(X_{it})} = \left(\frac{X_{it}^{T}}{X_{ref.}^{T}} \right)^{1/2} \qquad (7)$$

$$CC'_{(Y_{it})} = \left(\frac{Y_{it}^{T}}{X_{ref.}^{T}} \right)^{1/2} \qquad (8)$$

For instance, T3 is an indicator that measures the time the working population dedicates to cultural, recreational and sporting activities. The data from the EIGE are obtained from the *European Working Conditions Survey*, conducted by Eurofound, and reflect the percentage of employed individuals who report engaging in such activities daily or several times a month. Similar information is available in Navarre, derived from the *Life Conditions and Social Survey*, a statistic arrived at by Nastat, which reports the percentage of employed individuals who regularly engage in a specific set of leisure or cultural activities or participate in sports, including hiking, which is a very common activity in the region. Given the differences between these two indicators (both in answer categories and descriptions of the activities considered), it seems logical to see differences between them. Thus, in 2020, 83.5% of employed women and 85.1% of employed men in Navarre regularly engaged in cultural, recreational or sporting activities, according to the *Life Conditions and Social Survey* by Nastat. In contrast, in all of Spain and the same year, only 39.3% of employed women and 45.5% of employed men engaged in cultural, recreational or sporting activities daily or several times a month, according to the Eurofound survey. Despite these differences in absolute values, the GGs calculated in Navarre and all of Spain were very similar: at 0.99 and 0.93, respectively. Considering the socio-economic reality of Navarre and Spain, Nastat analysts concluded that this small difference aligns with the intuition that gender differences are slightly lower in Navarre.

However, data from the *Life Conditions and Social Survey* by Nastat are not suitable for calculating the CC. If they were used for this purpose, the CC would take a value of 1.5 (84.3/57.2), where 84.3 is the value that Navarre achieves according to its *Life*

Conditions and Social Survey and 57.2 is the reference value for this indicator, that is, the maximum value achieved by a European country according to Eurofound data. This CC value does not reflect the social reality of Navarre at all, and is simply a consequence of the numerator and denominator being measured on different scales. The solution we propose to this problem involves adjusting the formula for the equality metric when substitution occurs. In such instances, the equality metric would be derived using the GG calculated from data on the substitute indicator, along with a CC value selected arbitrarily to represent the region's relative situation accurately. For instance, in Navarre's GEI, the equality measure for indicators in the domain of 'time' is calculated using the GG from indicators different from those proposed by the EIGE (yet still measuring the same reality) and applying the same CCs used by the EIGE for Spain (equation 9). This assumes that, concerning the use of time for certain social activities such as leisure, culture, sports, volunteering and charitable activities, there should not be significant disparities between Navarre and the rest of Spain.

$$M_{(X_{it})} = 1 + \left[CC_{(X_{Spain\ t})} \cdot GG_{(Y_{Navarre\ t})}) \right] 99 \qquad (9)$$

In the example, the CC for indicator T3 in Navarre is 42.6 (the same as in Spain), and the equality measure (M) is 85.6, which is slightly higher than in Spain (80.2), as expected.

In other regions or indicators, the choice of the CC may vary. For example, in the case of indicator M2 (mean equivalised net income), if wage levels in the region are significantly higher than the national average, instead of using the CC of the country to which the region belongs, the coefficient of another country that more closely resembles the region in this aspect can be used.

Table 1 shows the frequency of using the substitution method in the GEI of the Basque Country and Navarre. In the Basque Country, Eustat employs indicator substitution in 16 out of 31 GEI indicators, with half of these cases corresponding to indicators in the 'power' domain. Only one indicator replicates Spain's value. In Navarre, Nastat uses substitution in 13 indicators, while in three others, the value calculated by the EIGE for Spain is replicated. Table 3 shows the indicators that replace those which have been substituted.

According to these procedures, the GEI reached 74.5 points in the Basque Country in 2021 and 74.6 in Navarre in 2020. Both regions' values are close to each other (Figure 1), although slightly below Spain's, and exhibit equality values similar to those of other Western European countries.

Figure 1

GEI and GDP per capita in the European Union, 2021
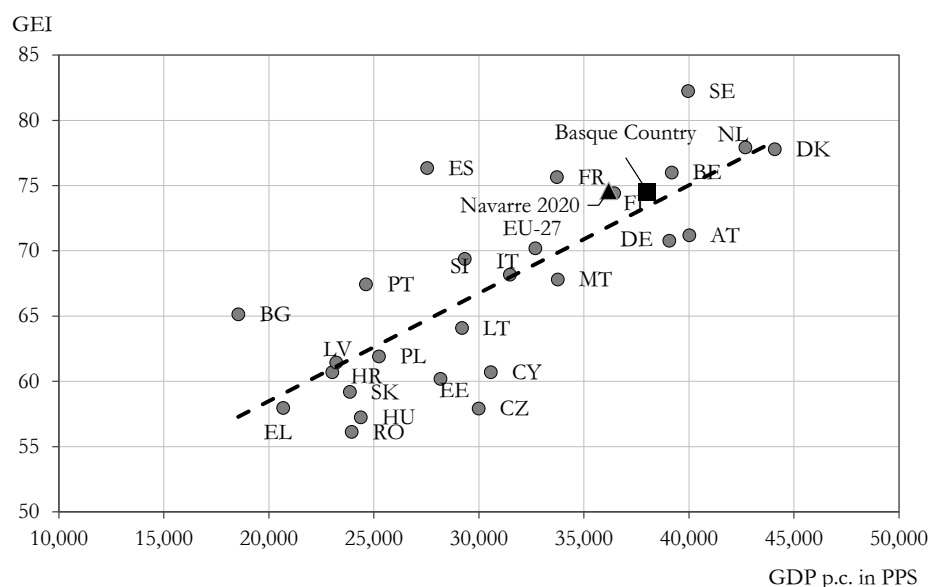
Note: AT: Austria; BE: Belgium; BG: Bulgaria; CY: Cyprus; CZ: Czech Republic; DE: Germany; DK: Denmark; EE: Estonia; EL: Greece; ES: Spain; FI: Finland; FR: France; HR: Croatia; HU: Hungary; IE: Ireland; IT: Italy; LT: Lithuania; LU: Luxembourg; LV: Latvia; MT: Malta; NL: Netherlands; PL: Poland; PT: Portugal; RO: Romania; SE: Sweden; SI: Slovenia; SK: Slovakia.
Source: EIGE (2023), Eustat (2024), Nastat (2022).

Conclusion

European regions possessing adequate autonomy, their own statistical infrastructure and a sincere concern for the societal impacts of public policies are likely to have initiated or considered measuring gender (in)equality within their boundaries. This study presents a proposal for measuring gender equality in European regions, leveraging the insights and expertise of two regional offices of official statistics based in Spain.

This proposal involves employing the EIGE methodology, which is the most reputable and robust among those applied in Europe and provides a sufficiently extensive time series of national indices. However, the adaptability of this methodology is constrained by its original design to gauge gender equality at the national level rather than within regions. Consequently, adjustments are necessary to tailor it to regional contexts. To make these adjustments, this study proposed a combination of three procedures: removing indicators, replacing indicators and replicating national values, although of these, the option of replacing indicators is recommended whenever possible.

Our proposal presents some limitations. Its allegiance to the EIGE methodology reduces its flexibility: the structure of indicators cannot be altered to reflect the specific characteristics of the region or the priorities of political and social actors in the region concerning gender equality. The same occurs with the weighting of the domains. If the weights are modified to better represent the priorities of regional actors, comparability with other countries is lost. If, on the other hand, the weightings set by the EIGE are respected, the index does not adequately reflect the perception by regional stakeholders of the relative importance of each domain.

Additionally, the three solutions proposed for cases where calculating the EIGE's basic indicators in the region is impossible (elimination, replication and substitution) impact the comparability between regional data and national data published by the EIGE. Moreover, substituting indicators can introduce bias. For instance, the indicator measuring participation in the main decision-making bodies of companies is computed by the EIGE using only the largest publicly traded companies (in Spain, those on the IBEX-35 stock index). To ensure large enough sample sizes, it is necessary in most Spanish regions (including both the Basque Country and Navarre) to include non-publicly traded, smaller and less socially visible companies, which typically exhibit lower levels of female representation on their boards.

Finally, the proposal has been developed from the perspective of regions with a developed statistical system that allows them to conduct their own statistical operations to describe certain aspects of their social reality. In regions that do not meet these requirements, the proposal is not applicable.

The experience in the regions of the Basque Country and Navarre demonstrates that, by applying these procedures, it is possible to obtain a regional gender equality index that not only facilitates the monitoring of equality within the region but is also reasonably comparable to GEI values calculated by the EIGE for the countries within the European Union. If the region possesses a well-established statistical system, particularly one with dedicated statistical operations focused on living conditions, health and demography, we can have confidence in the success of the endeavour.

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