IMAGINE Gender Equality Project Report
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Project Report

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Acknowledgement

We pay tribute to Associate Professor Allison Milner, the original Chief Investigator who tragically died before this project could commence. Allison was beloved by many, and an inspirational researcher and human being, whose intellect, wit, and passion for research will not be forgotten.

EXECUTIVE SUMMARY

Gender equality remains a key concern for governments and organisations around the world. Inequalities experienced by women and girls continue to limit life opportunities and outcomes globally, including in Australia. However, how to assess gender equality and track advancement is a persistent and challenging issue. Whilst existing international Gender Equality Indices (GEIs), incorporating multiple indicators of gender-based inequalities in resources and opportunity, have offered compelling proof of gender disparities worldwide, their primary purpose is to compare nations globally. They are not designed for, nor detailed enough, to fully document and assess gender equality within a nation and have limitations when it comes to capturing gender equality in high-income environments like Australia.

Given the recent rapid expansion of laws and programs addressing gender equality in Australia, there is a distinct need to track and measure progress. Additionally, accurate measurements of gender equality are required to direct government and private sector efforts to instigate successful programs and policies that promote gender equality in Australia. Therefore, to address these gaps, and to better understand the patterning of gender inequality in Australia, we identified that an Australian specific gender equality index was required. In direct response, the Innovative Measurement of Australian Gender (IN)Equality (IMAGINE) project was conceived. The project firstly establishing a conceptual framework for the operationalisation of gender equality in Australia, and subsequently developing a multi-dimensional measure of gender equality for application to the Australian context, known as the Australian Gender Equality Index (AGEI).

The AGEI is the first of its kind in Australia. Developed through extensive consultation with government and stakeholders, it is an area-level relative measure of gender equality specific to Australia. Importantly, the measure is underpinned by a conceptual framework that integrates feminist, social, and intersectional theories, including prominent thought leaders on social and economic capitals, gender equity, and how the gender system distributes power and socially reproduces gender across the life course. As per other GEIs, the AGEI incorporates multiple indicators of gender-based inequalities. Indicator selection was a considerable process, focused on how gendered social positions are reflected across a range of domains in society (e.g. economic wellbeing, educational attainment, and representation in leadership). Ultimately, indicator selection was informed not only by expert opinion/consultation as well as conceptual fit but was also dictated by data availability and feasibility considerations.

The resultant AGEI is a composite index comprised of 12 indicators. Drawn from aggregated linked census data, it measures the gender gap in Australian adults in: poverty; housing stress; receipt of single parent pension; annual income; investments and wealth; time spent on domestic chores; caregiving; STEM education; full-time employment; occupational skill level; retirement savings; and valued male dominated occupations.

Operationalised at statistical areas 3&4, for the comparison of geographical areas across Australia, the goal of indexation in developing the AGEI was to reduce the set of 12 selected indicators to a single area-level measure of female disadvantage. Three different approaches were applied to weight the indicators to derive an overall index of gender equality across Australia: (1) an equally weighted average of indicators, (2) a scaled weighted average with weights determined by principal components analysis (PCA), and (3) a weighted average of indictors, with weights determined by a survey of a panel of experts. Based on high-level results, the AGEI estimates that Australian women on average are approximately 70% more disadvantaged than men. Results also indicate consistent inequality across states and territories (60%-80% more female disadvantage). It is important to note that the most striking observation to arise from the preliminary findings is the universal level of disadvantage experienced by Australian women relative to Australian men, regardless of geographic level. It is also noteworthy that there was relative consistency in the state-based patterning across the different weighting approaches, and further, there were substantial consistency between estimates calculated at both SA3 and SA4. In future applications, we anticipate that the index could lead to better understanding how gender equality is patterned throughout Australia, how it varies at different intersections, and how it is associated with a variety of other experiences, behaviours, and outcomes.

In summary, while numerous limitations of this index are acknowledged, the AGEI is novel measurement tool that offers a means to understand the distribution and patterning of gender equality across Australia.

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STATEMENT REGARDING GENDER TERMINOLOGY

For the purpose and scope of the Innovative Measurement of Australian Gender (IN)Equality (IMAGINE) Gender Equality Project (GEP) and this associated report, women and girls are considered to be all those who identify as women and girls (whether born female or not). Likewise, men are considered to be all those who identify as men. Furthermore, in line with data availability constraints, throughout this report, gender is discussed and compared as a dichotomous construct (women compared to men), despite full concession that gender is not a binary construct.

ACRONYMS

ABS - Australian Bureau of Statistics
ACOSS – Australian Council of Social Service
AGEI - Australian Gender Equality Index
ANZSCO – Australia and New Zealand Standard Classification of Occupations
COVID – Coronavirus disease
EGEI - European Gender Equality Index
EU - European Union
GDI - Gender Development Index
GEM - Gender Empowerment Measure
GEI - Gender Equality Index
GE - Gender Equality
GEP – Gender Equality Project
GII – Gender Inequality Index
HIED – Higher Education
HILDA – Household, Income, Labour Dynamics in Australia (Survey)
IMAGINE - Innovative Measurement of Australian Gender (IN)Equality
LGA – Local Government Area
LGBTQI – Lesbian, Gay, Bisexual, Trans, Queer, Intersex
MADIP - Multi-Agency Data Integration Project
OECD – The Organisation for Economic Cooperation and Development
PIT – Personal Income Tax
PLIDA - Person Level Integrated Data Asset
PPS – Parenting Payment Single
UNDP - United Nations Development Programme
SA (1-4) – Statistical Area
SEIFA - Socio-Economic Indexes for Areas
SDGs – Sustainable Development Goals
SIH – Survey of Income and Housing
STEM – Science, Technology, Engineering and Mathematics
SSRI - Social Security and Related Information
ROI – Return on Investments

1. INTRODUCTION

1.1. Background

The pursuit of gender equality remains an important priority for governments and organisations worldwide. Gender equality and the empowerment of all women and girls is an explicit goal of the 2030 Agenda for Sustainable Development and is key to the successful implementation and monitoring of the Sustainable Development Goals (SDGs).[1] Across the globe, abundant initiatives seek to increase the empowerment and advancement of girls and women. While in most countries there have been monumental gains in gender equality in the past 100 years, substantial gender gaps on many metrics persist.

A persistent issue for countries and agencies internationally is how to assess gender equality, and how to measure and monitor progress. Gender Equality Indices (GEIs), which combine multiple indicators of gender-based differences in resources and opportunities, have become a popular approach to attempt to capture the diverse ways in which women face ongoing disadvantage. Many such indices have provided powerful evidence of gender inequalities across the globe.[2-4] Creating a GEI requires a balance between the abstraction necessary to distil billions of experiences into a single number and ensuring that the abstraction is not so great as to conflate important analytical or ethical differences. Although every woman is individual and her experiences unique, there are similarities in the privilege afforded to men relative to women which are amenable to measurement and aggregation. For example, with some exceptions, men have greater access to financial capital than women. Composite indices of gender inequality can be powerful in capturing and considering key issues like persistent, gendered access to resources. Notwithstanding the risk of over-simplification using composite measures, measuring gender inequality remains a vitally important way to quantify inequalities between men and women and to spur improvement in the position of women vis-à-vis men.

This project started with the ambition to create a measure that could capture gender equality across Australia. At the inception of this project, there was a lack of conceptual clarity about how to assess and measure gender equality within the Australian context. It is recognised that good measures of gender equality are needed to guide government and industry efforts to develop, implement, and evaluate effective policies and initiatives to advance gender equality and build a more equitable Australian society.[5,6] Moreover, given the rapid development of policies and programs targeting gender equality in Australia in recent years, robust and appropriate measures of gender equality were required to track progress. The Innovative Measurement of Australian Gender (IN)Equality (IMAGINE) project aimed to address these gaps by firstly developing a conceptual framework for the operationalisation of gender equality for adults in Australia, and then secondly to develop a measure of gender equality. It was intended that the resultant measure be utilised to assess the contribution of gender (in)equality to social, economic, and health outcomes in Australia. This report documents the rationale and development of this measure: a multi-dimensional measure of gender equality for application to the Australian context, known as the Australian Gender Equality Index (AGEI). This report starts by outlining a brief conceptual account of what gender equality is, before describing in detail how this was translated into a measurement framework and then forged into a single index (the AGEI) for the comparison of geographical areas in Australia.

1.2. What is Gender Equality?

While gender equality and gender equity are commonly used interchangeably, they represent different concepts. The concept of gender equality denotes the ideal state in which the rights, opportunities and responsibilities of women and men are equal, and not dependent on whether they are born male or female.[7] Not just a women's issue, gender equality is a human rights issue concerning men also, and is considered both an indicator for, as well as essential to, sustainable development.[7] Meanwhile, gender equity is a process that denotes the fair and just treatment of women and men, girls and boys in a way that seeks to achieve equality of outcomes and results.[7] Some describe gender equity as the pathway to gender equality, given that gender equity recognises the need to consider the social disadvantages, biases and other inherent differences that limit women's access to opportunities.[8] However, assessments of what is fair and just can be based on tradition, history and custom, meaning that judgements about what is gender equitable may not necessarily advance equity for women.[7] A focus on equity rather than equality can also lead to essentialist positions based on what is perceived to be natural for, and intrinsic to, men and women. Thus, our index intentionally measures gender in(equality), and the term gender equality used in this report refers to an equal sharing of social status and resources across both public and private spheres of life between men and women.

1.3. Acknowledging Gender Diversity

The focus of this project is on gender (in)equality between women and men. While this captures the large proportion of the population who identify as men, women, boys, or girls, we acknowledge the significant diversity of gender identities within Australia (and the world more broadly). To consider gender beyond the male/female binary requires appropriate data, and there is simply insufficient data on gender identity within Australia for transgender, non-binary, intersex, and other gender diverse identities to be subsumed within the index. We note however, that application of index to other datasets will enable the examination of the experiences of gender equality for gender diverse populations. Further, more specific data collection about gender and sexuality by the relevant agencies will make it possible for us to expand the current index to encompasses the whole population.

1.4. Existing Gender Equality Indexes

Since gender equality indices were first proposed in the late 1980's, many measures of gender equality have been developed and utilised, and they are described comprehensively elsewhere.[2,3,9] Prominent examples include the Gender Development Index (GDI), the Gender Empowerment Measure (GEM), and the Gender Inequality Index (GII), all developed by the United Nations Development Programme (UNDP). Whilst important in measuring and advancing gender equality globally, these UNDP indices are primarily designed for the worldwide comparison of countries, and their composition is commonly based on the availability of data across multiple jurisdictions. Such indicators are limited in their ability to capture gender equality in high-income contexts such as Australia and are not sufficiently granular for the understanding of gender equality within a country. European nations responded to the need for more detailed gender equality data, producing the European Gender Equality Index (EGEI). Developed by the European Institute for Gender Equality in 2013, this index was designed to specifically measure the progress of gender equality in the European Union (EU).[2,3] The EGEI has been acknowledged as a reliable measurement tool for gender equality in the EU, and its conceptual framework and considerations of what constitutes gender equality within a high-income context informed much of the initial deliberations for our Australian specific measure. Importantly, in contrast to the EGEI, our index, the AGEI, is a specific within- or intra-country measure (rather than a cross-national comparison measure) comprising indicators that represent relevant dimensions of gender equality within the Australian context, and exclusively measuring gender (in)equality.

2. CONCEPTUAL FRAMEWORK

To guide the development of our index, we developed a conceptual framework for a gender equality measure founded upon the theorised and recognised multiple pathways that structure gender relations. Published in 2023,[9] our conceptual framework represents a theoretical apotheosis in terms of defining the conditions that we considered vital to delivering gender equality.

In developing our conceptual framework, we drew from multiple theories to identify a set of domains which best provided a cohesive framework for the understanding of gender differences in social status across multiple dimensions. We integrated work of feminist, social equity and intersectional theorists to the classical social theorists, particularly drawing on Pierre Bourdieu's forms of capital[10] and Nancy Fraser's principles of gender equity.[11] Bourdieu's theory of capital defines distinct forms of capital that structure the distribution of power. These include economic capital (financial resources) and symbolic capital, which includes cultural and social capital. While not explicitly addressed by Bourdieu, gender and race/ethnicity/culture are important forms of symbolic capital that we incorporated into our conceptual framework.

We also drew on the work of Heise and colleagues[12] who formulated a framework specifying a vision for the way the gender system impacts on health. According to this framework, individuals are immersed in a gender system from birth that distributes power and defines polices, and in doing so reinforces gender norms, consequently leading to the social production of gender. This gender system operates across all levels and domains of society; within families, in the community and broader society (e.g., through organisations and resources available, or by way of media representation), through structures and policies; and through institutions (e.g., educational institutions, religion, legal/justice systems). Experiences within this gender system shape a person's gendered social position. Importantly, this process is inherently intersectional, whereby different social identities (which may represent positions of advantage and privilege, or disadvantage and oppression) intersect to influence an individual's gendered social position. These gendered social positions can be observed across a range of domains in society including economic wellbeing, educational attainment, and representation in leadership.

Ultimately, to define and delimit the scope of our gender equality measure, we focused on dimensions that reflect these gendered social positions both conceptually and methodologically. This focus enabled us to distinguish between upstream determinants or drivers of gender equality (such as social policy for example), measures of gendered social positions (included in this index), and outcomes of these gendered social position (such as health outcomes). Within the broad parameters defining these measures of gender social positions, we acknowledge that some components reinforce and influence other social positions. For example, occupational skill level is included in our index, noting that this is an upstream determinant of income and wealth, which are also included in the index.

3. DEVELOPMENT OF THE MEASUREMENT FRAMEWORK

In the following section, we describe the steps undertaken to develop our measurement framework, as well as many of the principles that guided the process by which indicators were selected in addition to describing the data source.

3.1. Stakeholder consultation

Stakeholder consultation was embedded throughout the project. To achieve this, at the project outset we established an advisory group comprised of stakeholders and Australian gender equality experts working across diverse areas, including violence against women, women's health, academia, and workplace gender equality. This group was consulted extensively, particularly throughout the process of refining the list of indicators.

3.2. Mapping indicators to conceptual framework

In defining the conditions that we considered vital to delivering gender equality, our conceptual framework[9] provided a clear starting point upon which our measurement framework was developed. As per Table 1, the conceptual process 'operationalised' our theoretical framework and, in consultation with project partners and stakeholders, identified a working set of measurement domains of social status and power considered pertinent to gender (in)equality in the current Australian context. From this list, the IMAGINE GEP project working group developed a set of proposed measurement dimensions mapped against each of the measurement domains (noting that many of the domain dimensions could sit within more than one measurement domain).

Table 1: Measurement framework – Gender equality measurement domains & proposed dimensions

Bourdieu's capitals	Fraser's equities	Measurement domains	Proposed dimensions
Economic Symbolic - Cultural capital - Social capital - Gender & racial privilege	Anti-poverty Anti-exploitation Income inequality Leisure time Anti-marginalisation Equality of respect Anti-androcentrism	Precarity	Welfare
			Poverty
			Housing precarity/stress
			Tax benefits
			Age of retirement
			Employment precarity
		Protections and entitlements	Pensions
			Self-employment
			Occupational pay inequalities
			Assets and wealth
			Level of debt
			Reproductive health services
			Crime and Justice
		Economic wellbeing	Buffers/retirement savings
			Occupational skill level
			Income
			Assets and wealth
			Paid labour force participation
		Time use	Unpaid domestic labour
			Caregiving
			Leisure time
		Inclusion and voice	Representation in parliament (federal/state)
			Representation in LGA (local governance)
			Ministerial representation
			Science, Technology, Engineering and Mathematics (STEM) education
			Representation in higher education
			Secondary school completion
			Leadership – board representation
		Value and respect	Violence and safety
			Childcare norms
			Representation of females (sportspeople, presence of cheerleaders)
		Normative maleness	Normative attitudes/prevalent gender norms
			Caregiving norms
			Flexible work arrangements for men
			Occupational gender segregation/under-representation
			Beauty culture
			Recreation opportunities

3.3. Indicator assessment process

The proposed indicators were then assessed for conceptual fit, feasibility, and data availability for ultimate inclusion in the AGEI. In the following subsection, we describe many of the broad principles that guided this process.

3.3.1. Social position, not causes

According to our framework, and following the precedent of other work[2,13] we focused on measures that reflected gendered social positions such as participation and behaviours, rather than determinants or causes. Specifically, we focused on measures such as labour force participation, rather than factors that precede or determine this, such as workplace policies or the availability of childcare that enable or constrain workforce participation. While elements of the gender system, such as resources and policies, should be an important focus of research attention, separating these out and assessing levels of gender equality according to these measures of gendered social positions is a necessary first step that precedes initiatives to drive gender equality.

3.3.2. Individual versus area measures

To accurately align with our framework, it was important to include measures that distinguished between measures that were collected from individual-level measures, and those collected at the area level or representing area-level characteristics. We specifically sought to derive a gender equality index that provided an indication of the level of gender equality experienced by individuals within each geographic area. Thus, our framework focussed on individual measures that could be aggregated at different area levels (e.g., percentage of women employed full-time, relative to men in the same area), and excluded measures of area level resources and attributes (such as street lighting), or measures captured at an area level (such as economic and social policies). Further, from the point of view of conceptual clarity, measures of the built environment are likely determinants of gender equality, not indicators of gendered social positions.

3.3.3. Country/state-based measures

The ability to assess area variation in gender equality across Australia was an important requirement for our gender equality measure. Many measures that are key components of global gender equality measures (e.g., GII or GDI) are collected at the national level. Examples include proportion of women/men in federal ministry, or the proportion of men/women on company/organisational boards nationally. While such country or state-based measures are useful when comparing variations across countries or gender equality regimes, we sought greater granularity in data. The need to assess variation within Australia therefore motivated our selection of measures at small area levels. The Australian Bureau of Statistics (ABS) divides Australia into a hierarchy of geographical statistical areas (see Box 1), and our goal was to construct an index that could be operationalised from a Statistical Area 2 (SA2) level and up.

Box 1. Statistical Geographical Areas of Australia	
The Australian Bureau of Statistics (ABS) divides Australia into a hierarchy of statistical areas for the publication and analysis of official statistics and other data via the Australian Statistical Geography Standard (ASGS) classification. The six interrelated hierarchies of regions are outlined below, noting that each level directly aggregates to the next level. At each hierarchical level, all of Geographic Australia is covered without gaps or overlaps.	
Mesh Blocks (MBs)	*The smallest geographic areas defined by the ABS, MBs form the building blocks for the larger regions of the ASGS. Most MBs contain 30 to 60 dwellings.*
Statistical Areas Level 1 (SA1s)	*Encompassing around 60,000 base statistical areas, SA1s are designed to maximise the geographic detail available for Census of Population and Housing data while maintaining confidentiality. Most have a population of between 200 to 800 people.*
Statistical Areas Level 2 (SA2s)	*Medium-sized general-purpose areas (n= approx. 2,500) built to represent communities that interact together socially and economically. Most SA2s have a population range of 3,000 to 25,000 people.*
Statistical Areas Level 3 (SA3s)	*Designed for the output of regional data, SA3s (n=approx. 360) are often the functional areas of regional towns and cities with a population more than 20,000 or clusters of related suburbs around urban commercial and transport hubs within the major urban areas. Most have populations between 30,000 and 130,000 people.*
Statistical Areas Level 4 (SA4s)	*Comprised just over 100 areas, SA4s are the largest sub-state regions. Designed for the output of a variety of regional data, SA4s represent labour markets and the functional area of Australian capital cities. Most have a population of over 100,000 people.*
States and Territories (S/T)	*These are a cartographic representation of legally designated state and territory boundaries in Australia. There are 9 in total comprising 6 states (VIC, NSW, QLD, SA, WA, TAS) and 3 territory classifications (NT, ACT and 'Other Territories').*
Australia (AUS)	*The largest region in the ASGS and represents the geographic extent of Australia.*

3.3.4. Area level homogeneity

When developing the measurement framework, we sought measures that were likely to vary across area. One example of an exclusion that this condition precipitated was media representation. Given that mainstream media is a key vehicle through which gendered values and norms are promulgated,[14] our conceptual framework considered media representation of women to be a key component of Fraser's "equality of respect" and "anti-androcentrism".[11,15] However, we considered female representation in the media to be a feature of the Australian public and social landscape that would vary so little across Australia, that there was little to justify its inclusion. This is particularly so given that the dominance of print media has waned as reliance on online media has increased. Further, Australia has one of the most concentrated media markets in the world,[16] which means that there is too little heterogeneity to warrant inclusion of media when interrogating area level differences within a gender equality measurement framework.

3.3.5. Policy level measures

Social protection policies and economic and labour market policies are important drivers of gender equality.[17] These however were excluded from our measurement framework based on the following conditions. First, we consider them to be determinants of gendered social positions, rather than measures of these social positions. Second, policy measures are imposed and operationalised at an area level, and not collected from individuals, as demanded by our measure. Third, there is likely little heterogeneity across Australia to warrant inclusion. To this point, within Australia, the Sex Discrimination act[18] seeks to eliminate discrimination against women and sexual harassment. It is accompanied by other state and federal laws that protect women's human rights, as well as several federal and state policies that aim to reduce violence against women and children and promote respectful relationships. While different local councils, organisations and institutions develop and apply different strategies and plans to advance gender equality within their jurisdictions, we considered that federal and state policy frameworks and legislation would likely be the most significant and influential, and given their invariance at statistical area levels (see Box 1) we omitted them from the framework.

3.3.6. Relative vs absolute measures

Measures of gender equality can be structured in relative or absolute terms. Absolute measures assess the overall attainment of women and men separately and are particularly useful in comparing women's advancement across multiple countries. Relative measures assess gender equality by measuring the outcomes or position of women relative to men. While many previous gender equality measures have combined relative and absolute measures in their overall index, it is increasingly observed that this can lead to confusion in interpretation.[3,19] Importantly, relative measures cohere with conceptualisations of gender equality because they assess outcomes in women relative to men (and vice versa).[13] We, therefore, excluded a small number of indicators that could not be operationalised as relative measures, such as teenage birth and maternal mortality.

3.3.7. Interpretation challenges

In developing the measurement framework, it was recognised that a small number of measures did not allow for easy interpretation, for example retirement age. On the one hand, retirement age could be seen as a proxy for sufficient financial security enabling a sustainable retirement, whereby a relatively younger retirement age (or indeed retiring before the standard age of 65 years) would suggest greater advantage. However, women are disproportionally discriminated against amongst the aging workforce compared to men, and this in combination with a lifetime of precarious and insecure work and ongoing unpaid caregiving demands, often lead to women being siphoned into early retirement despite not being sufficiently financially solvent.[20] Therefore, if a geographic area features a higher proportion of women retiring earlier compared to men, is this indicative of gender equality in favour of women? or is their experience of paid and unpaid labour barriers to lasting quality employment indicative of age discrimination and poorer gender equality? Thus, whilst earning an income and protection from poverty, particularly protection from poverty in old age, is fundamental to gender equality, using retirement age as an indicator poses interpretative challenges due to it being potentially determined by opposing factors. Resultantly, when faced with such interpretative challenges, some indicators were removed.

3.3.8. Health outcomes

Many existing gender equality measures include indicators of health outcomes. This presents challenges principally because the domain of health is unique in the extent to which biological factors are important.

Cisgender women give birth, and this brings a range of medical risks and encounters with the health system. Additionally, many diseases and conditions present different risks for men and women: a larger proportion of women relative to men experience breast cancer for example. Incorporating health outcomes in a measure of gender equality is therefore problematic.

3.4. Intersectional considerations

Experiences and effects of gender equality vary by intersectional positions and identities such as race, culture, and ethnicity, LGBTQI+ identities, disability, poverty and socioeconomic position and area region. Intersectionality was therefore key to our approach, however a challenge posed by the inclusion of intersectionality in an index such as this is a methodological one. It would be impossible to stratify data according to all axes of intersectionality, as conceptual fidelity to our conceptual framework would demand. Further, there are limitless intersections that could be applied to a gender equality index, for example it is not enough to compare the experiences of white women to those of women of colour, because the experiences of those in each group will further vary by experiences of disability, or other axes of disadvantage. Our gender equality index then, has been created for women and men at the aggregate level. This then enables users of the index to apply quantitative intersectional techniques[21-25] to examine the intersections of their choice.

3.5. Data source

As described above, to construct a national index, population level data was needed down to a granular geographical level for every area across the country. Person Level Integrated Data Asset (PLIDA), formerly known as the Multi-Agency Data Integration Project (MADIP), was ideal for this purpose. Managed by the Australian Bureau of Statistics (ABS), PLIDA is a partnership among seven Australian Government agencies to combine longitudinal information on key population demographics (including the Census) to create a comprehensive picture of Australia over time.[26] Moreover, the PLIDA Modular Product contains data for the resident Australian population at small statistical area levels on key topics pertinent to our gender equality framework, such as income, education, government payments, personal income tax, healthcare and more. Given this project preceded release of the 2021 Census data, we elected to utilise data from the 2016 Census (and from [or as close to 2016 that was available] for other linked datasets). All PLIDA data was accessed and analysed in the ABS DataLab.

The PLIDA datasets used for this project included:

- The Census of Population and Housing (Census) – 2016
- Social Security and Related Information (SSRI) – 2016
- Survey of Income and Housing (SIH) - 2017
- Personal Income Tax (PIT) – 2015/2016
- Higher Education (HIED) – 2016

4. THE AUSTRALIAN GENDER EQUALITY INDEX MEASUREMENT FRAMEWORK

Table 2 presents our AGEI measurement framework and lists each of the twelve indicators corresponding to each domain. While this was informed by our conceptual framework, compromises and omissions were made in the development of this measurement framework. In line with section 3 above, many proposed indicators were excluded due to poor conceptual fit or a lack of data. These exclusions are detailed in Appendix 1 and necessary omissions from the index as a result of data constraints are acknowledged as a key limitation of our index in Section 8. Importantly, for the purposes of deriving a meaningful national index, all twelve gender equality indicators that inform the AGEI were derived from aggregated population level data available at both the national level and small area level.

Table 2: Measurement framework - 12 gender equality indicators

Measurement domain	Dimension	Indicator
Precarity	Poverty	• Gender gap in risk of poverty
	Housing stress	• Gender gap in being in housing stress
	Welfare	• Gender gap in recipients of single parent pension
Protections and entitlements	Retirement savings	• Gender gap in accumulated superannuation
	Occupational skill level	• Gender gap in occupation skill level
Economic wellbeing	Income	• Gender gap in average annual income (wages/salary)
	Investments and wealth	• Gender gap in investments and wealth
	Paid labour force participation	• Gender gap in full-time employment
Time use	Unpaid domestic labour	• Gender gap in time spent on domestic chores
	Caregiving	• Gender gap in caregiving (disabled and elderly)
Inclusion and voice	STEM education	• Gender gap in STEM higher education
Normative maleness	Occupational gender under-representation	• Gender gap in highly valued male dominant occupations

5. DIMENSIONS AND INDICATORS

In the following section we detail each of the twelve indicators that inform the AGEI. We describe and outline the data source and rationale for each of the indicators and how they were operationalized. Table 3 presents the data source and data area level availability for each of the indicators, whilst Appendix 2 provides further information regarding each indicator including the variable names and variable categorisation from which they were obtained. For all twelve indicators, some rules regarding operationalising the measures were uniformly applied. These general indicator methods were as follows: 1) the sample population was persons 18 years and over for every indicator, unless otherwise specified, 2) in calculating each indicator, only valid values for contributing variables were used. For example, where variables had "not applicable" or "no code assigned" values, these were omitted. These are detailed per indicator in Appendix 3. Lastly, given only valid values for variables were used to construct each indicator, the population of individuals creating the denominator for each of the 12 indicators varied, and is also presented in Appendix 3.

Table 3. Indictors, data sources and data area level availability

Indicator	Data source	Area level availability of data
Gender gap in risk of poverty	Census	SA1-SA4
Gender gap in being in housing stress	Census	SA1-SA4
Gender gap in recipients of single parent pension	SSRI	SA1-SA4
Gender gap in average annual income (wages/salary)	PIT	SA1-SA4
Gender gap in investments and wealth	SIH	SA1-SA4
Gender gap in time spent on domestic chores	Census	SA1-SA4
Gender gap in caregiving (disabled and elderly)	Census	SA1-SA4
Gender gap in STEM higher education	HIED	SA1-SA4
Gender gap in full-time employment	Census	SA1-SA4
Gender gap in occupation skill level	Census	SA1-SA4
Gender gap in accumulated superannuation	SIH	SA1-SA4
Gender gap in highly valued male dominant occupations	Census	SA1-SA4

5.1. Poverty

Women are more likely than men to live in poverty.[27] This is driven by some key factors. First, women are less likely than men to participate in sustained employment throughout their lives. This places them in a position of dependence on the income of others – typically their male partner and rends them vulnerable to poverty in the face of relationship dissolution.[28] Secondly, it is known that women are channelled into (and subsequently over-represented in) poorer paying professions (such as caregiving) and less secure working environments (casual and contract), resulting in lower lifetime earnings.[29,30] Thirdly, even when performing the same work as men, a persistent gender pay gap and promotional glass ceilings translate to significantly less earning potential, irrespective of profession.[31]

Indicator and data source

This dimension was measured by the indicator "gender gap in risk of poverty". Data source was PLIDA using 2016 Census data items. Poverty was defined as per international (OECD) and national guidelines (ACOSS and HILDA/Melbourne Institute) to be living below the poverty line, calculated as 50% of equivalised household median disposable income. Based on this definition, the poverty line for a single person household in 2016 equated to $477 weekly income.[32] Given the equivalised weekly household income variable in Census is categorised into 15 brackets, we used the $400-499 weekly household equivalised income band for this cut-off, such that a person was classified as in poverty if equivalised total household income (census_2016_hied) is <$500 per week (categories 01 - 05). Whilst acknowledging that some variation in this 2016 estimate exists across ACOSS, HILDA, and Melbourne Institute sources (according to workforce participation and housing costs) most estimates for 2016 fell in this bracket for the 50% definition. As such, for equivalised single households, those in this band and below were considered at risk of poverty, whilst those above were not. The indicator was therefore dichotomous and operationalised within the measurement framework as the proportion of women (or men) at risk of poverty among women (or men) for whom full income information was available.

5.2. Housing stress

When considering gender equality in Australia, housing precarity (affordability, suitability, and security) is another domain dimension considered important under the larger conceptual domain of precarity. Housing precarity is strongly linked to wellbeing, interacts with precarious employment, and is commonly gendered.[33,34] It can take many forms and varies in severity, but includes experiences of housing stress, temporary and crisis living arrangements, frequent evictions and/or moves, and homelessness. Whilst housing precarity is predominantly driven by affordability barriers, it is pertinent to acknowledge the role of domestic and family violence as the leading cause of homelessness in Australia,[35] and thus a key downstream driver of housing precarity for women. There is also an alarming increase in homelessness rates of older women driven by poverty in recent years.[34] For the purposes of our broader AGEI matrix however, we have employed the most widely used measure of housing affordability in Australia (in both policy and research settings), known as "housing affordability stress". Classified as per the "30:40 rule", this proxy measure for unaffordability focuses on low-income households, whereby a household is considered to be in housing stress if its housing costs (rent or mortgage) exceed 30 per cent of income and the household is in the bottom 40 per cent of the income distribution.[36] Whilst the 30:40 housing stress measure has been criticised for inadequately representing overall financial stress, [37] it provides a point-in-time measure through which we can examine if (how large) a gender gap exists within this measure of housing precarity.

Indicator and data source

Data source for the indicator "gender gap in being in housing stress" was PLIDA, using 2016 Census data items. Housing affordability stress, being defined as per the 30/40 rule outlined above, was derived using best-available data from household income, and rental and mortgage cost variables (all of which were categorical nature in the Census data and presented as ranges. A key hurdle in the calculation of this index was the fact that the income variable in PLIDA was available as a categorical variable. As such, we accepted the mid-point of each variable (rent, mortgage, and household income ranges) as the estimated value for a person. A person was subsequently classified as being in housing stress if: a) equivalised total household income (census_2016_hied) is <$800 per week (codes 01-07), which translates roughly to being in the bottom 40% (~38%) of adults in the census. We call this being in a low-income house and: b) housing expenses (rent or mortgage) / household income > 0.3 (i.e., spends more than 30% of household income on housing expenses). The indicator was dichotomised and operationalised within the measurement framework as a proportional statistic of the proportion of women (or men) in housing stress among all women (or men) for whom the housing stress indicator could be determined.

5.3. Welfare

Welfare is a multifaceted domain when considering gender equality both in Australia and abroad. Not only do different countries have differing welfare and social policies to support disadvantaged populations, but receipt of welfare can be viewed as either an indicator of precarity, as an equalising tool to foster equality, or both. For the purposes of our matrix, welfare is considered an indicator of precarity or disadvantage. In Australia, welfare assistance is a complex network of government payments, welfare-related tax concessions and welfare services.[38] One such government payment is the Parenting Payment Single (PPS), an income support payment for single parents, paid in recognition of the impact that caring for young children can have on a parent's capacity to undertake full-time employment.[38] This particular welfare payment was selected for our AGEI measure given that single parenting is highly gendered. In Australia, 80% of all single parent families are female,[39] a figure starkly representative of the gendered distribution of care. Notwithstanding recent changes, in 2016 (when the data used in this index were collected) the PPS was widely criticised and considered to be insufficient for the maintenance of an adequate standard of living. Further, parents were ineligible for the PPS once one's youngest child turned eight (it changed to 14 years of age in July 2023), meaning that 95% of single parent families (led by women) were living near or below the poverty line.[40] Therefore, choosing this welfare indicator, in the Australian context, was considered to be a suitable and sound predictor of gendered precarity.

Indicator and data source

As aforementioned, welfare was measured by the indicator "gender gap in recipients of single parent pension". Data source was PLIDA, using the 2016 Social Security and Related Information (SSRI) data items. The question is binary and asks whether the person did or did not receive PPS at any point during the 2016 calendar year. Within the measurement framework it was operationalised as the proportion of women (or men) receiving single parenting payment benefits among all women (or men) for whom the provision of parenting benefits could be determined (i.e., all those not marked as not applicable).

5.4. Income

Income is central to economic wellbeing. Women's financial independence and security is gained predominantly by participating in the paid workforce and gaining income. Income earning capacity is driven by many factors, including education, occupation, opportunity, and personal circumstances, and it is undisputed that women, both historically and presently, experience lower incomes than men. Firstly, a gender pay gap persists whereby men are paid more than women despite similar qualifications and equivalent occupations. In 2023, Australia's total remuneration gender pay gap was almost 22% and the base salary gender pay gap was 13%.[41] Secondly, women consistently trade their paid working (income earning) time in order to meet their unpaid labour and childcaring responsibilities, subsequently reducing their income earning potential and affecting opportunities for promotion and professional development. Given women's economic parity is central to realising gender equality, personal income (salary/wages), and the other measures of economic wellbeing measured within this domain, are vital components of our measurement framework/index.

Indicator and data source

This was measured by the indicator "gender gap in average annual wage income". Data source was PLIDA, using 2016 Personal Income Tax (PIT) data items. This source provides a continuous numerical dollar value of the total annual income (of employee salary/wages) for an individual for the financial year 2016/2017. A person is classified as being above the median income if their reported salary/wages exceed the median of salary/wages of all those in the dataset who have reported salary/wages. Note that zero income is accepted as valid if reported. This metric was reversed such that a higher proportion reflects more disadvantage in the measure, so that within the measurement framework, it was the proportion of women and men with a wage/salary *lower* than the overall population median, among all women and men who have recorded a wage/salary.

5.5. Investments and wealth

It is historically the case that women receive less inherited wealth, with inheritance typically transferred to first born males. While such practices are highly uncommon in Australian society today, many older Australians have been subject to these arrangements, placing older women at much greater risk of financial insecurity than men. Moreover, another contributing factor to the gender gap in wealth accumulation is the gender gap in financial literacy. While two-thirds of Australian men are financially literate, fewer than one in two of Australian women are financially literate, with this gap commencing in teenage years and persisting across all age groups.[42] Lastly, in addition to financial literacy gaps, persistent gaps in women's ability to accrue and build independent wealth relate to having less money to invest from the outset; with aforementioned lower incomes and greater time out of the paid workforce, as well as social and gender stereotypes affecting how women interact with money. To capture these factors, we include an indicator of personal assets and wealth accumulation.

Indicator and data source

This was measured by the indicator "gender gap in investments and wealth". Data source was the Survey of Income and Housing (SIH) Australia, 2017, from the ABS. This provides a continuous numerical dollar value of the total value of weekly income from all investments (including property, dividends, shares, bonds, interest, silent partner income, shares/trusts net of expenses) for an individual. Within the measurement framework it was operationalised as the weighted median weekly income from investments (or return on investments (ROI)). The metric was calculated as the proportion of women (and men) whose weekly ROI was *lower than* the weighted median weekly ROI of the whole sample, among women and men who recorded a weekly ROI in the SIH.

5.6. Unpaid domestic labour

The way time is distributed between men and women is highly gendered, with women spending vastly more time than men engaged in unpaid work (or domestic labour) and men spending more time than women in the paid workforce.[43] It is widely agreed that gender equality cannot occur without major reconfiguration of the way time is distributed between genders, in particular a reconfiguration of the normative division of household labour, enabling men to take on more responsibilities within the home.[44] The shift of women into the labour-force has not, in the main, been matched by shifts of men into the unpaid realm of caring and household responsibilities. Many existing measures of gender equality have been unable to or have omitted the inclusion of time use. This has hampered efforts to adequately understand the state of gender equality and levers upon which to progress it.

Importantly, the unpaid domestic labour burden that women shoulder substantially impacts women achieving gender parity in almost every other domain in this matrix. As such, we include a measure of unpaid domestic labour time to capture the pervasive gender disparities present in this dimension.

Indicator and data source

This dimension was measured by the indicator "gender gap in time spent in unpaid domestic labour". Data source was PLIDA, from the 2016 Census data. Our indicator is derived from a question regarding time spent performing unpaid domestic work in the week prior to Census night. Response options were categorical, 5 bands of time (in hours) spent in previous week from nil through to 30 hours or more. A binary variable was created at the midpoint of 15 hours per week, where 15 or more hrs/week represented a higher level of time, and less than 15 hrs/week represented low levels of unpaid labour. This was then operationalised as a proportional statistic of the proportion of women (or men) doing 15hrs or more per week among resident women (or men) for whom domestic work hours could be determined.

5.7. Caregiving

As highlighted above, the way time is distributed between men and women is highly gendered. Time spent in care provision or informal unpaid care is no different, with women performing an unequal, and often large, amount of unpaid care work, often to the detriment of their financial security and health.[45,46] Unpaid caregiving is variously defined and measured, with no single accepted definition of informal caregiving. Nonetheless, regardless of how it is measured (whether delimited to disabled persons or elderly kin, or inclusive of all types of care including dependent children and/or able spouses), the gender gap in care provision remains. The caregiving dimension in our AGEI matrix was captured using a binary measure of care provision (to disabled or elderly persons), as detailed below.

Indicator and data source

This dimension was measured by the indicator "gender gap in caregiving (disabled and elderly persons)". Data source was PLIDA, from the 2016 Census data. Our indicator was derived from the question capturing whether people spent time providing unpaid care, help or assistance to family members or others because of a disability, a long-term health condition or problems related to old age in the two weeks prior to Census night. Response options are binary, and the variable does not include unpaid care work done through a voluntary organisation or group. This indicator was operationalised as the proportion of women (or men) who provide unpaid care among all women and men for whom we could establish caring status.

5.8. STEM education completion

While education attainment at secondary and tertiary level has reached gender parity in Australia, participation in science, technology, engineering, and mathematics (STEM) courses remains one area in which significant gender disparities persist. In 2022 in Australia, only 38% of students of higher-level mathematics subjects in secondary school were girls,[47] and at the university bachelor level the number of female graduates in disciplines such as engineering or information technology (IT) was persistently low, shifting little from 15% in 2016 to 18% in 2022.[48,49] This gender gap is considered to reflect gender stereotypes, social conditioning and gender-biased learning environments.[50] There is also evidence that the gender gap in mathematics is related to gender equality: using data from the Programme for International Student Assessment (PISA) data, researchers found that the mathematics gender gap disappeared in countries with greater gender equality.[51] The under-representation of females in mathematics/STEM represents an important gender equality issue. Employment opportunities and careers in maths/STEM are often prestigious and well paid[52] and the under-representation of girls and women in these areas means that they are being omitted from potentially advantageous roles[52] while, comparably, occupations with higher education requirements in which women are over-represented remain poorly paid (e.g early childhood education, nursing and health care). Lastly, given twice as many women (13%) compared to men (6%) who begin STEM courses switch and complete a degree in a different field,[49] we chose to capture STEM tertiary completion rates rather than enrolment rates in our measure.

Indicator and data source

This dimension was measured by the indicator "gender gap in STEM education completion". Data source was PLIDA, from the 2016 Higher Education (HIED) data. Our indicator is derived from the question regarding completed field of study of a person's higher education course in the 2016 calendar year. Response options were categorical, based on the Australian Standard Classification of Education (ASCED) Field of Education Classification under 12 broad fields of classification. In line with the Australian Government STEM Equity Monitor,[49] four of these fields are classified as STEM: Natural and Physical Sciences, Information Technology (IT), Engineering and related technologies, and Agricultural, Environmental, and related studies. A binary variable was created of having completed one of the four (01, 02, 03, 05) broad STEM fields of study or not (other 8 categories). This was then operationalised as the proportion of women (or men) *who did not* complete a STEM higher education course (determined from first two digits of the completion code), among all completers.

5.9. Labour force participation

In Australia, almost 70% of men work full time, compared to about 43% of women.[53] Social and economic policy, embodied in tax transfers, have shaped social patterns in which households with children frequently adopt the "1.5 earner household model" in which women, considered the secondary household earner, work part-time and men work full-time. This weakens women's attachment to the labour market and has clear implications in terms of reduced earnings, and reduced opportunities for career advancement and leadership. As such, full time employment is included as an indicator in this index.

Indicator and data source

This dimension was measured by the indicator "gender gap in full-time employment". Data source was PLIDA, from the 2016 Census data. Our indicator is derived from the question regarding labour force status for the week prior to

Census night. Response options were categorical including employed full-time, employed part-time, unemployed etc. A binary variable was created (as being in full-time employment or not) and was operationalised as a proportional statistic of the proportion of women (or men) *not in* full-time employment among resident women (or men) who gave sufficient or applicable information about their employment and were younger than 65 years.

5.10. Occupational skill level

Gender differentiated patterns of employment and labour market gender segregation by occupation remain persistent in Australia.[54] Whilst the share of highly skilled females employed in full-time work has increased in recent decades, marked differences persist in the occupational distribution of skill level.[55] Substantial inequalities remain in terms of those holding senior roles within an occupation or industry. For example, women experience significantly less upward mobility and opportunities than their male counterparts and are chronically underrepresented in high level and/or managerial roles in Australia (regardless of the sector).[5] Pervasive sociocultural norms around the division of unpaid care in Australia also has repercussions for gender differences in occupational skill level. Compared to men, women spend disproportionately more time away from the paid labour force after having children and are also often channelled into (and self-select) less skilled (more flexible) work to accommodate their family requirements.[5,56]

Indicator and data source

This dimension was measured by the indicator "gender gap in occupational skill level". Data source was PLIDA, from the 2016 Census data. Our indicator is derived from the question regarding occupation, based on the 2-digit Australian and New Zealand Standard Classification of Occupations (ANZSCO) code.[57] ANZSCO is a skill-based classification used to classify all occupations and jobs in the Australian and New Zealand labour markets. In ANZSCO, skill level is defined as a function of the range and complexity of the set of tasks performed in a particular occupation. The greater the range and complexity of the set of tasks, the greater the skill level of an occupation. The Occupation code (census_2016_occp_2d) assigned to a response is based on the occupation title and tasks of the main job held during the week prior to Census night. At its broadest classification level, ANZSCO assigns occupations to one of eight major groups based on aspects of both skill level and skill specialisation, where level 1 denotes the highest skill level and 8 the lowest (detailed in Appendix 4).[58] Occupational skill groups 1 (Managers) and 2 (Professionals) are broadly considered by ANZSCO to be higher skilled occupations and therefore, for this indicator, a binary variable was created (as being highly skilled (level 1 or 2) or not (level 3-8). The metric was operationalised as the proportion of women between 18 and 64 years (or men) *not in* highly skilled occupation groups among women and men who gave clear/applicable information about their profession.

5.11. Retirement savings

Superannuation is a savings system for workplace retirement pensions. In accordance with federal law in Australia, employers compulsorily contribute to the superannuation savings of their employees, with payments proportional to employee's wages.[59] Women's engagement in the workforce is more likely to be interrupted than that of men, with women more likely to take time out of the workforce when they have children. When women do return to the workforce, they often take positions that enable them to juggle family and work life. This means that many more women (than men) find themselves in positions of lower pay for which they are over-qualified and working in more precarious working environments (casual and contract) with fewer legal protections.[60,61] Importantly, many such roles are informal, bringing no entitlement to superannuation (retirement funds). Additionally, even when roles are accompanied by superannuation benefits, the net effect of women's intermittent workforce attachment on their accumulated superannuation is substantial. It is estimated that the gap in women's superannuation at retirement in Australia is 28%.[62] For these reasons, our gender equality index includes accumulated superannuation.

Indicator and data source

This was measured by the indicator "gender gap in accumulated superannuation". Data source was the Survey of Income and Housing (SIH) Australia, 2017, from the ABS. This provides a continuous numerical dollar value of the total value of accumulated superannuation for an individual. Within the measurement framework we operationalised this as an age-group (5yr brackets) standardised weighted[i] median of accumulated superannuation for all women and men in the age bracket. Our indicator then, was the proportion of women (or men) with an accumulated super that *is lower* than the age-standard weighted median accumulated super of their age sample, among women and men who recorded an accumulated super in the SIH.

5.12. Occupational gender under-representation

Gender norms are firmly embedded across all levels and domains of society. They are the tacit but recognised rules that define the behaviours, roles and attitudes that are acceptable, desirable and valued for men, women and gender minorities.[12] These rules influence behaviour and opportunities across many domains, including occupational opportunities and choices, whereby certain occupations are male dominated due to entrenched and accepted normative maleness of certain work (for example machine operators or trades workers are highly male dominated). In contrast, other occupations that involve caregiving, teaching, service, or clerical work tend to be female dominated.[54] Moreover, cultural norms regarding household division of labour and care also drive patterns of gender-based employment segregation given the demands and expectations of different occupations may be incompatible with work-family balance.[63] These gender and cultural norms create barriers for both men and women to not only cross into the occupational realms that lie at each end of the gender occupational divide, but also to stay and succeed. Importantly, one defining component of gendered occupation segregation is that "women's work" or traditionally female dominated occupations are undervalued and underpaid. It is noteworthy that gender-based employment segregation can be both horizontal (gender differences in women and men concentrating in different sectors, industries, occupations) and vertical (gender disparities (inequalities) in positions with different

[i] Weights used were SIH survey weights "sihpswt"

statuses, managerial responsibilities, or potential for promotion).[63] Whilst the gender gap in traditionally female dominant occupations is equally important in assessing gender (in)equality, given the direction of the measurement framework (assessing/measuring female disadvantage), we use the gender gap in highly valued male dominant occupations for this framework.

Indicator and data source

This dimension was measured by the indicator "gender gap in highly valued male dominant occupations", as measured by remuneration. Data source was PLIDA, from the 2016 Census data. Our indicator is derived from the question regarding occupation type, where response options are categorical, based on the two-digit (Australian and New Zealand Standard Classification of Occupations (ANZSCO) code (n = 50 occupations). The occupation code assigned to a response is based on the occupation type of the main job held during the week prior to Census night. To derive our indicator, occupations were firstly assigned as male dominated based on a previously constructed three-level variable measure (using ABS data)[64] of whether an occupation is male, or female dominated or gender-neutral. Secondly, occupations were identified as being highly valued (or not) if the mean full-time working salary for an occupational code was in the highest tertile for the full-time working age salary for the population. The metric was finally operationalised as the proportion of women between 18 and 64 years (or men) *not* in a highly valued male dominated profession, among resident women and men who gave sufficient or applicable information about their employment.

6. STATISTICAL METHODS

6.1 Constructing the GE matrix

The GE matrix comprised female-metric to male-metric ratios (gender equality ratios) for all indicators in all areas (e.g., in each SA4). To produce the matrix[ii], a consistent set of calculations was performed, as follows. First, female, and male metrics (proportions) were calculated for each indicator/area, under the operationalisations described in the previous section. To determine the female proportion, we summed exposed females (e.g., those in poverty) in an area and divided this number by total selected females in the area (e.g. for whom income information was available). The same procedure was followed for males. Finally, we divided the female proportion by the male proportion to produce the (female to male) gender equality ratio for each indicator in each area. For each indicator, a higher number reflects more female disadvantage, with a value > 1 indicating an excess of female disadvantage. For example, a ratio of 1.5 indicates that women are 50% more disadvantaged than men on a given indicator in given area. After matrix construction, we excluded ratios based on female or male proportions with fewer than 10 people in the denominator. This allowed us to reduce the number of extreme and/or unrepresentative ratios caused by small sample sizes.

[ii] Here we define the "matrix" as the table we constructed in which each statistical area was listed in rows, and 12 columns corresponded to each indicator. This is distinguished from the "index", which was the combined gender equality score, calculated by combining the 12 indicators.

6.2 Developing the index

The goal of indexation was to reduce the set of 12 indicators to a single area-level measure of female disadvantage. Ultimately, the index was calculated at SA3 and SA4 levels. This meant that, where possible, each SA3 and SA4 was assigned one value that measured female disadvantage in the area. We obtained this value using three different methods of data reduction (described below). We excluded SA3 and SA4s with no spatial area (typically offshore shipping zones) and Australian External Territories (e.g., Christmas Island).

We could not realise our original ambition to also produce the index at more detailed SA1 and SA2 levels due to significant missing data. After ABS metric and ratio denominator rules were imposed and incalculable values were accounted for (i.e., where the male proportion equalled zero), we were missing 226,795 SA1 gender equality ratios (34% of SA1s) and 4,398 SA2 gender equality ratios (21% of SA2s) across all areas and indicators. Consequently, we were missing at least one of 12 gender equality ratios (i.e. had incomplete data) in all SA1s and 94% of SA2s, which was too excessive to proceed. The situation was better at SA3 and SA4 levels. We were missing 171 SA3 gender equality ratios (4% of SA3s) across all areas and indicators, equating to incomplete matrix data in 26% of SA3s. Data were complete at the SA4 level. Across SA1-SA3 levels, missing data were greatest for the *Superannuation* and *Wealth (investment)* indicators which relied on the relatively small SIH collection, and the *Education in STEM* indicator which relied on a small denominator of university completers in 2016. Census-based indicators had good coverage across Australia's small areas.

To proceed with indexation at the SA3 level, we first imputed the small percentage of missing SA3 gender ratios using a multiple imputation procedure in Stata MP17.[65] The procedure employed chained equations with 20 simulations to estimate missing values from observed gender equality values at the SA3 and SA4 level. We then used the mixture of original and imputed values to create the index (see below). SA3s that required the imputation of eight or more values were not assigned an index value (two SA3s in total). Accordingly, the final total of imputed gender equality ratios was 147 (4%).

6.3 Computing the index

Three methods were used to reduce the twelve indicators to one value per area: (1) an equally weighted average of indicators, (2) a scaled weighted average with weights determined by principal components analysis (PCA), and (3) a weighted average of indictors, with weights determined by a survey of a panel of experts.

6.3.1. Equally weighted average

For each area, the 12 indicators were transformed to the natural log scale, averaged with the arithmetic mean then exponentiated to return the result to the original scale. The initial transformation normalised the indicators and prevented any one indicator from exerting undue influence over the single value obtained.

Back transformation returned the index to the original metric. The resulting figure estimates the extent of female disadvantage in an area. For example, an area with a value of 1.5 indicates that women are, on average, 50% more disadvantaged than men in that area.

6.3.2. Principal components analysis (PCA)

PCA indexation process

PCA was performed to assign statistically driven weights to the 12 indicators, which were then used to produce a weighted sum of gender ratios. PCA is a procedure that reduces the dimensionality of a set of variables that theoretically measure a common phenomenon. It is used by the ABS to compute measures of socioeconomic inequality (e.g. SEIFA). The method outputs a set of underlying variables (the principal components) that capture the maximum variation in the overall dataset. PCA produces as many components as variables (in our case 12), where the first component accounts for the most variance. Each component is defined as the linear combination of a set of weights (one for each variable) and the original variable values. The set of weights is known as the Eigenvector. For indexation purposes, it is common to take the first principal component as the representative underlying measure of the dataset.[66-68]

To produce a PCA driven index of female disadvantage, we followed a standard process of PCA-based index construction.[69] First, each ratio value representing the 12 indictors was converted to a z score (i.e., where each indicator has a mean of zero and a standard deviation of one). PCA was then performed on the covariance matrix of the 12 transformed indicators. The SA3 and SA4 analyses produced an Eigenvector with a different sign profile (SA4 weights were all positive except one indicator, SA3 weights were all negative) – see Table 4. The sign profile is arbitrary in PCA, however, it was important to make both the SA3 and SA4 indices directionally consistent, in this case, so that higher number reflected more female disadvantage. Accordingly, SA3 weights were multiplied by minus one.

To produce a raw index score for each area, we computed the weighted sum of standardised indicator scores, using the (sign adjusted) Eigenvector. Specifically, for a given area, we computed the total of the standardised indicator scores multiplied by their respective weights. The raw PCA index score is not individually meaningful but does provide relative information on an ordinal scale. Here, as mentioned, a higher number reflects more female disadvantage, and a lower number reflects less female disadvantage, but the extent of disadvantage is not described. For consistency with other indexes, we scaled each score such that the mean of all scores was 1000 and the standard deviation was 100, where scores higher than 1000 indicate more female disadvantage than the national average and scores lower than 1000 indicate less female disadvantage than the national average (see ABS, 2016[68] for an identical treatment).

PCA Results

The SA3 PCA produced a first principal component that accounted for 25.5% of the variance in the transformed SA3 AGEI. The SA4 PCA produced a first principal component that accounted for 31.6% of the variance in the transformed SA4 AGEI. Table 4 displays the Eigenvectors outputted in each analysis. In both solutions, Full-time employment and Annual income received the highest weights.

Table 4. PCA-determined weights for SA3 and SA4 solutions

Indicator	SA3 weights	SA4 weights
Gender gap in risk of poverty	-0.27618	0.255971
Gender gap in being in housing stress	-0.27265	0.348803
Gender gap in recipients of single parent pension	-0.29466	0.151577
Gender gap in accumulated superannuation	-0.08513	0.252817
Gender gap in occupation skill level	-0.03133	-0.15997
Gender gap in average annual income	-0.42504	0.446068
Gender gap in investments and wealth	-0.05431	0.107666
Gender gap in full-time employment	-0.50916	0.440357
Gender gap in time spent on domestic chores	-0.35238	0.157901
Gender gap in caregiving	-0.26767	0.37803
Gender gap in STEM higher education	-0.18613	0.282197
Gender gap in highly valued male dominant occupations	-0.28463	0.219943

6.3.3. Modified Delphi

Modified Delphi method

The Delphi method was originally devised in the 1950s, and is one of several methods developed to identify the collective opinion of experts.[70] There are many variants of the Delphi method, often referred to as modified Delphi panels, and modified versions are frequently employed to construct or identify indicators or criteria, and then subsequently utilised to rank or rate these resultant indicators.[71,72] In our modified Delphi we asked experts to assign weighting to each of the 12 indicators. Based on evidence that reliability and accuracy have been shown to improve with a greater number of participants,[73] we aimed to recruit a minimum of 15 respondents.

Panel selection and recruitment

Experts were defined as persons with rich experiences in governance, direction, and leadership (industry experts) and/or senior researchers (academics) in the gender (in)equality arena in Australia. They were identified via partner organisations and governmental and non-governmental industry bodies concerned with gender equality, and via Australian university contacts and "find an expert" pages. There was also a snowballing recruitment component, with those initially invited to participate able to nominate other gender equality experts within their organisations. In total, 59 experts (34 industry experts and 25 academics) in Australia were invited to participate. Of these, 38 (21 industry experts and 17 academics) agreed to participate and were sent the link to take part. A total of 26 (10 industry experts and 16 academics) completed the questionnaire and formed our sample for the modified Delphi weighting process.

Data collection

A link to the online questionnaire (designed and hosted in Qualtrics) was emailed to all experts who had agreed to participate. Experts were asked the following question: "Please weight (out of 100%) each of 12 indicators on their relative importance to gender equality in Australia." A weighted prioritisation method was utilised,[74,75] such that all assigned weights needed to add up to 100%, noting that each indicator would be weighted at about 8% if equal weight were to be assigned to each indicator. Table 5 displays the results of the survey. Experts ranked unpaid caregiving as the most important (mean = 13.35 %) and STEM education the least important (3.52%).

Index construction

For each area, the AGEI score was calculated by: (1) converting the 12 indicators to the natural log scale, (2) taking the weighted average of the transformed values, using the mean percentage weights directly as weights and (3) exponentiating the result to return to the original scale. Like the equally weighted average, the result measures the extent of female disadvantage in an area (e.g., a value of 1.5 indicates that females are, on average, 50% more disadvantaged than males). The difference is that the estimation of female disadvantage is more aligned with the average opinion of survey respondents.

Table 5. The 12 indicators and their respective mean, minimum and maximum scores assigned by 26 experts involved in a modified Delphi panel on gender (in)equality in Australia.

Indicator	Minimum	Maximum	Mean	Std Deviation	Count
Gender gap in risk of poverty	0	30	11.65	6.82	26
Gender gap in being in housing stress	0	20	8.37	5.74	26
Gender gap in recipients of single parent pension	0	20	8.69	5.02	26
Gender gap in accumulated superannuation	0	15	6.81	3.67	26
Gender gap in occupation skill level	0	10	5.23	3.21	26
Gender gap in average annual income	0	20	10.81	4.74	26
Gender gap in investments and wealth	0	30	6.58	5.91	26
Gender gap in full-time employment	0	20	6.65	4.53	26
Gender gap in time spent on domestic chores	0	20	8.58	4.74	26
Gender gap in caregiving	5	40	13.35	7.00	26
Gender gap in STEM higher education	0	10	3.52	3.09	26
Gender gap in highly valued male dominant occupations	0	25	9.77	6.07	26

7 AGEI INDEX – TOP LEVEL RESULTS

Table 6 displays the similarity of results produced under the equally weighted, Delphi weighted and PCA weighted indexation approaches. Each method produced highly correlated values, suggesting that each measured a similar construct. SA3 level correlation coefficients were high, ranging from 0.99 for equally weighted vs. Delphi to 0.88 for equally weighted vs. PCA = 0.88. Similarly, at the SA4 level, there was high correlation between measures with 0.995 for equally weighted vs. Delphi = 0.995 to 0.83 for both equally weighted vs. PCA and Delphi weighted vs. PCA. Despite the close numerical relationship, when the gender equality index was quintiled, there was less concordance between measures. At the SA3 level, in 12.5% of cases the equally weighted vs. Delphi calculated scores were different, however this was much higher for equally weighted vs. PCA = 41.9%, and Delphi weighted vs. PCA = 40.1%. Percentage quintile classification differences the SA4 level were slightly higher: equally weighted vs. Delphi = 15.9%, equally weighted vs. PCA = 52.2%, Delphi weighted vs. PCA = 51.1%.

Table 6. Comparison of results by method of indexation.

	SA3		SA4	
Comparison	**Correlation**	**Quintile differences (%)**	**Correlation**	**Quintile differences (%)**
Equally weighted vs. Delphi	0.99	12.5	0.995	15.9
Equally weighted vs. PCA	0.88	41.9	0.83	52.2
Delphi weighted vs. PCA	0.90	40.1	0.83	51.1

High level index results are displayed in Table 7. Australian and State level figures were computed by averaging the index results of the constituent SA3s or SA4 (i.e. the index was not constructed from the ground up at these overarching levels). Based on the mean of Delphi and equally weighted indices, we estimate that Australian women on average are approximately 70% more disadvantaged than men. Given the way the PCA index was computed, itis uninformative at the national level. The high-level results indicate consistent inequality across states and territories (60%-80% more female disadvantage), regardless of geographic level. There was some minor variation in this across states, with Tasmania, ACT and South Australia recording the least gender inequalities, and Western Australia recording the greatest inequality. We note however that these state variations were relatively minor, and the most striking observation to arise from these preliminary findings is the universal level of disadvantage experienced by Australian women relative to Australian men. It is also noteworthy that there was relative consistency in the state-based patterning across the different weighting approaches, and further, there were substantial consistency between estimates calculated at both SA3 and SA4. Inspection of individual SA3 and SA4 results support this point (SA3 ranges: equally weighted 1.42 - 2.28, Delphi weighted 1.46 - 2.38; SA4 ranges: equally weighted 1.48 - 2.07, Delphi weighted 1.51 - 2.12). These preliminary results are presented for demonstration purposes and these results should be interpreted with caution. Further research will investigate these results at smaller area levels.

Table 7. Mean SA3 and SA4 index results. Australian and State level results are averages of constituent SA3 or SA4 values.

State/Territory	Mean Equally weighted Index (SA3)	Mean Delphi Index (SA3)	Mean PCA Index (SA3)	Mean Equally weighted Index (SA4)	Mean Delphi Index (SA4)	Mean PCA Index (SA4)
Australian Capital Territory	1.60	1.63	958.86	1.62	1.66	921.20
New South Wales	1.69	1.72	997.85	1.67	1.71	973.56
Northern Territory	1.63	1.68	968.97	1.63	1.68	995.26
Queensland	1.65	1.68	989.94	1.65	1.68	1013.91
South Australia	1.60	1.64	951.96	1.60	1.64	946.31
Tasmania	1.58	1.62	933.10	1.57	1.61	925.12
Victoria	1.73	1.76	1011.98	1.69	1.73	995.23
Western Australia	1.78	1.82	1096.12	1.78	1.82	1132.09
Australia	1.68	1.71	1000.00	1.67	1.71	1000.00

8 LIMITATIONS

As with the creation of any index, compromises have been made. Here we acknowledge the limitations of our index. First, there are many different ways of conceiving and operationalising gender inequality. While we have sought indicators that are derived from individual measures and reflect gendered social positions, such a conceptualisation does not capture the multitude of ways in which gender equality is considered to operate and limit the opportunities of individuals. Second, there were many proposed indicators that were considered important to the index, but data availability prevented their inclusion. The main data availability limitations were that: 1) data were not available at small geographical levels for some proposed indicators (e.g. only available at state level); or 2) more granular data *were* available but only in a handful of states (not across Australia). In addition to this, data for other proposed indicators were simply not available, for example time spent caring for children. Appendix 1 lists all the excluded proposed indicators with reasons for exclusion. Third, assembling an index requires combining different indicators. How this is done, and specifically whether to weight these indicators differently, is highly subjective, and raises questions about the relative importance and influence of different component indicators. We sought to address this by using three weighting approaches – equal weighting, PCA weighting, expert-rated weighting. The relatively strong correlation between the measures derived from these approaches, and the concordance in overall estimates provides some confidence in estimates, nonetheless we acknowledge the subjectivity in the derivation of this index. While indices are attractive in the way they bring together a range of different variables to make sense of a concept such as gender equality, in many ways they represent a black box in which much remains unknowable. For example, an index cannot tell us what specific components (if any) are driving gender inequalities. As a further point, we note that while small areas are desirable in many forms of area level analysis, our aim to capture gender equality at the Australian Bureau of Statistics Area Levels 1 & 2 was not realised due to missing data and low numbers in some of the statistical areas. The extent to which this is a limitation in this analysis is not yet clear. Lastly, this index was derived using data from 2016. It is therefore important to acknowledge that this represents one point in time and is subject to change in ways that are as yet unclear.

9 FUTURE DIRECTIONS

Importantly, the development of this index is a starting point, and there is a clear need for further work. A key next step for this AGEI is to carry out spatial mapping to assess spatial variation in gender equality across Australia. Future actions also include applying quantitative intersectional methods to assess the extent to which gender inequality varies by key intersections such as ethnicity, migrant background, disability, socioeconomic position and LGBTIQ+. Importantly, the AGEI can be linked to other datasets at the area level, allowing examination into the way in which gender equality is associated with a range of different outcomes including gender-based violence, health and wellbeing, as well as how these associations vary by key intersections. Moreover, funding will be sought to add multiple years of census data to the AGEI, enabling the monitoring and assessment of gender equality over time.

More broadly, we note that the resultant 12 indicators included in the AGEI predominantly reflect dimensions of economic gender equality in Australia. As the conceptual framework shows, many other indicators were considered, however the final composition reflects not only what was conceptually coherent with our framework, but what was available. This indicates clear gaps in the data available to measure gender equality, highlighting the need for a broader range of gender equality measures to be collected, as well as ensuring that these are captured uniformly across the country. Importantly however, a key advantage of the economic orientation of the available and included measures of the AGEI is that they reflect what the government has immediate policy levers on.

10 CONCLUSION

Gender inequalities continue to limit life opportunities and outcomes globally, including in Australia. Substantial gains in the pursuit of gender equality have been made in Australia – this is unequivocal, yet inequalities persist. To understand the patterning of these inequalities, and the way they impact on lives across Australia, an Australia specific measure of gender equality is required. Here we document the construction of the AGEI, a relative measure of gender equality specific to Australia, operationalized at statistical areas 3 &4. The AGEI is a composite index comprised of 12 indicators measuring the gender gap in: poverty; housing stress; receipt of single parent pension; annual income; investments and wealth; time spent on domestic chores; caregiving; STEM education; full-time employment; occupational skill level; retirement savings; valued male dominated occupations. We applied three different approaches to weight these indicators to derive an overall index of gender equality across Australia. We note that there are many limitations with this index, however it has great potential to be applied to understand the patterning of gender equality across Australia, variations by different intersections and associations with a range of other experiences, behaviours, and outcomes.

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Appendices

Appendix 1: Table of exclusions

Measurement domain	Domain dimensions	Potential Indicator	Reasons for exclusion
Precarity	Tax benefits	• Proportion receiving tax transfers (rebates and family tax benefits)	• Policy level measure (that would be of interest to compare across different countries) • Interpretability challenge • Calculated at household level
	Retirement	• Retirement age	• Interpretability challenge
	Employment precarity	• Gender gap in casual employment/contracts;	• Data limitations - only available at SA4
	Housing precarity	• Proportion of homeless living in different accommodation types (boarding houses, temporary lodging, crowded dwelling, improvised dwelling) • Seeking crisis accommodation • Eviction • Frequent moves	• Reduced to one housing measure (housing stress) and therefore excluded others as "captured elsewhere" • Eviction and crisis accommodation relatively rare (therefore excluded) and frequent moves difficult to assess
Protections and entitlements	Pensions	• Caregiving pension/compensation	• Policy level measure
	Self-employment	• Self-employed	• Interpretability challenge
	Occupational pay inequalities as a measure of value	• Pay discrepancy between equivalently skilled/trained occupations with different gender ratio (e.g., police vs nurses) • Pay inequalities between women and men in same occupations, and low paid junior, high paid senior	• Appropriate for country/regime comparison and these indicators do not enable operationalisation as relative indicator
	Assets and wealth	• Other real estate • Other financial assets • Shares, trusts, partnerships • Inheritance and gifts	• Reduced to one measure (investments) and therefore excluded others as "captured elsewhere"
	Level of debt	• Personal credit card debt	• Interpretability challenge
		• Overall personal debt	• No data
	Crime and Justice	• Laws and regulations	• Policy level measure
		• Proportion of women incarcerated vs men	• Appropriate for country/regime comparison

	Reproductive health services	• Access to abortion service providers and area • Access to sexual health services (distance needed to travel) and area • Access to contraception • Teenage birth (as proxy for access to SRH and contraception) • Number of pharmacists providing emergency contraception • Waitlists for IUDs at publicly funded service providers (e.g., per population)	• Difficulty of assessing relative measures (no male equivalent) • Many are area level resource measures
Time use	Leisure	• Time in leisure	• No data
Inclusion and voice	Representation in LGA	• Gender gap in representation at LGA level	• Data limitations (could not obtain for all states)
	Representation in parliament (federal/state)	• Proportion women in federal/state parliament	• Appropriate for country/regime comparison
	Ministerial representation	• Number of female ministers	• Appropriate for country/regime comparison
	STEM leadership	• Leadership roles in STEM	• Appropriate for country/regime comparison
	Representation in higher ed	• Women in tertiary education - participation	• Poor measure – parity reached
	Secondary school completion	• Completion of secondary school education	• Poor measure – parity reached
	Leadership – board representation	• Proportion of women on company/organisational boards • CEOS/business owners	• Appropriate for country/regime comparison
	Childcare norms	• Availability of state-based childcare	• Policy level measure
	Representation of females (sportspeople, presence of cheerleaders)	• Media representation (e.g., main tabloid newspaper). • Proportion of women who depicted as having agency and independence, vs proportion of men. • Media/page space devoted to women's sport vs men's sport • Media/page space allocated to female leader/scientist/expert vs male space	• Appropriate for country/regime comparison

		• Presence of cheerleaders (i.e., rugby league cheerleaders in some states)	
Value and respect	Violence and safety	• Gender gap in death by intimate partner violence (IPV)	• Data limitations – cell sizes precluded use at a level below SA4 • Considered an outcome of gender equality. This will be examined in relation to our measure of GE
Normative maleness	Caregiving norms	• Proportion of men taking leave for children (behaviour, not just policy) vs proportion women	• No data
	Normative attitudes/ Prevalent gender norms	• Gender gap in those holding traditional gender norms and stereotypes	• Data limitations NCAS data - location only in capital cite and rest of state
	Flexible work arrangements for men	• Flexible work arrangements (proportion of men working flexibly vs women)	• No data
	Beauty culture	• Gender-specific cosmetic surgeries, e.g., breast augmentation, labiaplasty, penile enhancements (excluding re-constructive and gender reassignment) • FGM/cutting	• No Data • Interpretability
	Recreation opportunities	• Recreational opportunities e.g., local football (AFL/soccer) clubs with female/male senior team	• Appropriate for comparison of area level resources
	Recreation opportunities Area level factors	• Proportion of women vs men engaging in a team sport • Proportion women engaging in physical activity (e.g. attaining PA sufficiency)	• Health measure
		• Public amenity • Walkability	• Area level resources

Appendix 2: Table of inclusions (detailed)

Dimension	Indicator expressed in relative terms	Data sources	Variable name	Variable category	Area level data
Poverty	• Gender gap in risk of poverty	PLIDA- Census 2016	• census_2016_hied	01. $1-$149 ($1-$7,799) 02. $150-$299 ($7,800-$15,599) 03. $300-$399 ($15,600-$20,799) 04. $400-$499 ($20,800-$25,999) 05. $500-$649 ($26,000-$33.799) .. 14. $3,000 or more ($156,000 or more)	SA1-SA4
Housing stress	• Gender gap in being in housing stress	PLIDA – Census 2016	• census_2016_hied codes • census_2016_mrerd census_2016_rntrd	Derived variable (housing expense/household income): a) low-income household derived from equivalised total household income (census_2016_hied variable categories as per above) <$800 per week (codes 01-07). b) housing expenses from rent [rntrd] or mortgage [mrerd] payments per week. The census_2016_mrerd were 19 categories ranging from $0->$5,000/month that were converted to weekly costs and census_2016_rntrd were 23 categories ranging from $0->$950/week.	SA1-SA4
Welfare	• Gender gap in recipients of single parent pension	PLIDA - Social Security and	DCAD_2011_ben_pps_flag	0 – Did not receive benefits 1 – received benefits	SA1-SA4

		Related Information data items			
Retirement savings	• Gender gap in accumulated superannuation (SIH)	Survey of Income and Housing 2017	SUPVAL	(0-3900000)	SA1-4
Occupational skill level	• Gender gap in occupation skill level	PLIDA-Census 2016	census_2016_occp_4d	2-digit ANZSCO code (unit group)	SA1-4
Income	• Gender gap in average annual income (Salary/wages)	PLIDA-Census 2016, Personal Income tax	• census_2016_hied • census_2016_hind	06. $1-$149 ($1-$7,799) 07. $150-$299 ($7,800-$15,599) 08. $300-$399 ($15,600-$20,799) 09. $400-$499 ($20,800-$25,999) 10. $500-$649 ($26,000-$33.799) .. 14. $3,000 or more ($156,000 or more)	SA1-SA4
Investments and wealth	• Gender gap in investments and wealth	Survey of Income and Housing 2017	INVESCP8 Total current weekly income from investments (inc silent partner income, shares/trusts net of exp)	Continuous (-999999–99999999)	SA1-SA4
Paid labour force participation	• Gender gap in full-time employment	PLIDA-Census 2016	census_2016_siemp	01. Employed, worked full-time 02. Employed, worked part-time 03. Employed, away from work 04. Unemployed, looking for full-time work 05. Unemployed, looking for part-time work 06. Not in the labour force Not stated Not applicable	SA1-SA4

Unpaid domestic labour	• Gender gap in time spent domestic chores	PLIDA-Census 2016	census_2016_domp	01. Nil hours 02. Less than 5 hours 03. 5 to 14 hours 04. 15 to 29 hours 05. 30 hours or more Not stated Not applicable Overseas visitor	SA1-SA4
Caregiving	• Gender gap in caregiving – other	PLIDA-Census 2016	census_2016_uncarep	• Male/Female	SA1-SA4
STEM education	• Gender gap in STEM education (completion)	PLIDA-Census 2016, HIED 2016 field of education	hied_2016_field; hied_2016_completion_field	Coded using the Australian Standard Classification of Education (ASCED), 2001 (cat no. 1272.0), Field of Education Classification. It describes the field of study of a person's completed course in the 2011 calendar year 1272.0 - Australian Standard of Education (ASCED), 2001	SA1-4
Occupational gender under-representation	• Gender gap in highly valued male dominant occupations	PLIDA-Census 2016	census_2016_occp_4d	2-digit ANZSCO code (unit group)	SA1-4

Appendix 3: Table presenting data cleaning and missingness information

Indicator	Variable	Data cleaning	Missingness/Denominator
Gender gap in risk of poverty	census_2016_hied	Removed people with the census_2016_hied codes: "16" (partial income stated), "&&" (all incomes not stated) and "@@" (not applicable)	Cases removed = 2,122,847; N = 13,981,120
Gender gap in being in housing stress	census_2016_hied codes	Removed people with the census_2016_hied codes "16" (partial income stated), "&&" (all incomes not stated) and "@@" (not applicable) – because there is no value for household income	Cases removed = 7,087,002; N = 9,016,965
	census_2016_mrerd	Removed people with the census_2016_mrerd code "&&" (Not stated) – because a mortgage value has not been reported. We leave in "not applicable" people because they might be renting	
	census_2016_rntrd	Removed people with the census_2016_rntrd codes "&&" (Not stated) and "VV" (Overseas visitor) – no rent payment value is available. We leave in "not applicable" people because they might be paying a mortgage.	
	Final step	Removed people with the census_2016_mrerd code "@@" (Not applicable) **and** the census_2016_rntrd "@@" (Not applicable) – these are people who are not renting nor paying a mortgage.	
Gender gap in recipients of single parent pension	ssri_2016_ben_pps	Removed people with a ssri_2016_ben_pps_flag code: "@" (Not applicable)	Cases removed = 2,561,714; N = 13,542,253
Gender gap in accumulated superannuation	supval	No removals	Cases removed = 0; N = 19,432
Gender gap in occupation skill level	census_2016_occp_4d	Removed people with the census_2016_occp_4d codes: "0998" (inadequately described), "&&&&"(not stated), "@@@@" (not applicable), "VVVV" (overseas visitor) and/or anyone who is 65 or older.	Cases removed = 6,719,719; N = 9,384,248
Gender gap in average annual income	pit_1516_salary_wages	Removed people with no wages/salary recorded (pit_1516_salary_wages is N/A)	Cases removed = 4,711,821; N = 11,392,146
Gender gap in investments and wealth	invescp8	No removals	Cases removed = 0; N = 25,777
Gender gap in full-time employment	census_2016_ifsp	Removed people with the census_2016_ifsp codes: "&" (not stated), "@"(not applicable), "V" (overseas visitor) and "3" (employed, away from work – this includes people who did not record number of hours worked), and/or anyone who is 65 or older.	Cases removed = 3,927,599; N = 12,176,368
Gender gap in time spent on domestic chores	census_2016_domp	Removed people with the census_2016_domp codes: "&" (not stated), "@" (not applicable) and "V" (overseas visitor)	Cases removed = 531,136; N = 15,572,831

Gender gap in caregiving	census_2016_uncarep	Removed people with census_2016_uncarep codes: "&" (Not stated), "@" (not applicable) and "V" (overseas visitor).	Cases removed = 553,320; N = 15,550,647
Gender gap in STEM higher education	hied_2016_completion	Removed people with (a) a hied_2016_completion_field code: "@@@@@@" (Not applicable) and (b) people who didn't match to the HIED data (presumably didn't complete anything in 2016).	Cases removed = 15,932,679; N = 171,288
Gender gap in highly valued male dominant occupations	census_2016_occp_2d	Removed people with census_2016_occp_2d codes "0998" (inadequately described), "&&&&" (not stated), "@@@@" (not applicable) and "VVVV" (overseas visitor) and/or anyone who is 65 or older.	Cases removed = 6,719,719; N = 9,384,248

Appendix 4: Table presenting indicative skill levels attributed to major occupation groups in ANZSCO.[58]

Major group number	Occupation group	Predominant skill levels	Categories of ANZSCO skill level structure
1	Managers	1 & 2	• **Skill level 1.** Occupations that have a level of skill commensurate with a bachelor's degree or higher qualification. At least five years of relevant experience may substitute for formal qualifications. • **Skill level 2.** Occupations that have a level of skill commensurate with an Australian Qualifications Framework (Associate degree, Advanced Diploma or Diploma). At least three years of relevant experience may substitute for formal qualifications. • **Skill level 3.** Occupations that have a level of skill commensurate with an Australian Qualifications Framework (Certificate V or Certificate Ill including at least two years of on-the-job training). At least three years of relevant experience may substitute for formal qualifications. • **Skill level 4.** Occupations that have a level of skill commensurate with an Australian Qualifications Framework (Certificate Il or III). At least one year of relevant experience may substitute for formal qualifications**.** • **Skill level 5.** Occupations that have a level of skill commensurate with an Australian Qualifications Framework (Certificate I or compulsory secondary education). For some occupations a short period of on-the-job training may be required in addition to or instead of the formal qualification.
2	Professionals	1	
3	Technicians & Trade Workers	2 & 3	
4	Community & Personal Service Workers	2,3,4 & 5	
5	Clerical & Administrative Workers	2,3,4 & 5	
6	Sales Workers	3,4 & 5	
7	Machinery Operators & Drivers	4	
8	Labourers	4 & 5	