Routledge
Taylor & Francis Group

Review of Political Economy

ISSN: 0953-8259 (Print) 1465-3982 (Online) Journal homepage: www.tandfonline.com/journals/crpe20

Structural Change, Innovation and Gender Gaps

Maria Savona & Giovanna Vertova

To cite this article: Maria Savona & Giovanna Vertova (08 Aug 2025): Structural Change, Innovation and Gender Gaps, Review of Political Economy, DOI: 10.1080/09538259.2025.2522761

To link to this article: https://doi.org/10.1080/09538259.2025.2522761

© 2025 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group

Published online: 08 Aug 2025.

Submit your article to this journal

Article views: 976

View related articles

View Crossmark data

Citing articles: 1 View citing articles

Full Terms & Conditions of access and use can be found at
https://www.tandfonline.com/action/journalInformation?journalCode=crpe20

REVIEW OF POLITICAL ECONOMY
https://doi.org/10.1080/09538259.2025.2522761

Routledge
Taylor & Francis Group

OPEN ACCESS Check for updates

Structural Change, Innovation and Gender Gaps

Maria Savona [a,b] and Giovanna Vertova [c]

[a]Department of Economics and Finance, Luiss Guido Carlo University, Rome, Italy; [b]Science Policy Research Unit, University of Sussex, Falmer Brighton, UK; [c]Department of Economics, University of Bergamo, Italy

ABSTRACT

While there is a large literature that links structural changes and innovation, their impact on gender gaps is fairly overlooked. This paper aims to fill this gap by providing a selected, and therefore necessarily non-exhaustive, review of the literature and fresh descriptive evidence on the role of structural change and innovations on the gender pay gaps and the gender employment segregation. We look at how firms that innovate tend to share innovation rents and premia heterogeneously, at disadvantage for women, and mention other sources of gender pay gaps. Structural change leads to sectoral compositions mix, which are shown to affect differently the ways women enter and remain employed. Female employment includes a higher share of unpaid work and alternative work arrangements than male employment and is due more to gender stereotypes than women's capabilities, skills or education. We conclude by offering reflections on how gender gaps, both in terms of employment prospects and equality of earnings, can be tackled within Pasinetti's framework.

ARTICLE HISTORY
Received 15 September 2024
Accepted 16 June 2025

KEYWORDS
Structural change; gender; innovation; employment segregation; gender wage gap

JEL CODES
O33; O14

1. Introduction

Pasinetti has devoted a large part of his academic work to the study of long-term economic growth. In his 1981 seminal book, *Structural Change and Economic Growth: A Theoretical Essay on the Dynamics of the Wealth of Nations*, Pasinetti's main argument revolves around the idea that economic growth is not a static phenomenon, but rather a dynamic process characterized by continuous structural changes, driven by shifts in the composition of output, factor endowments, and technological progress. Hence, economic growth is not merely a result of increasing inputs of capital and labour but is fundamentally influenced by changes in the organization of production and the utilization of resources.

While we have no pretense of offering a theoretical model à la Pasinetti, this paper aims to be a very first step to incorporate in some of Pasinetti's theoretical framework on structural change considerations of how structural change is linked

CONTACT Maria Savona m.savona@sussex.ac.uk Professor of Economics, Department of Economics and Finance, Luiss Guido Carlo University, Rome, Italy; Professor of Economics of Innovation, Science Policy Research Unit, University of Sussex, Falmer Brighton, BN1 9SL, UK

© 2025 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group
This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent.

to innovation and how this impacts gender inequality, both in terms of gender employment segregation and gender pay gaps. By contextualizing these dynamics within broader economic transformations, we aim to show how changes in technology, demand patterns, and institutional factors influence the allocation of labour across sectors and to some extent how pay gaps might be due to these processes.

We do so first by looking at how innovation-led structural change might have an impact on the gender pay gap if innovation rents are not equally distributed. For instance, technological change and innovation in firms might result in a dominating male representation in leading managerial positions, that are at the top of the wage distribution, and in innovation-led rents being unfavorably distributed to women via differences in rent sharing. Second, we focus on the composition of employment and how structural change might lead to gender employment segregation, with an empirical application to the Italian case. For instance, technological advancements may lead to the decline of traditionally male-dominated sectors like manufacturing, potentially exacerbating gender disparities if women are not equally represented in emerging industries. Technological innovation has the potential to result in a reduction of sectors that are characterized by a predominantly male workforce composition (for example, manufacturing) and to encourage an increase in new sectors (for example, services). This structural change could potentially lead to a reduction in gender segregation if female workers were more equally distributed in the new sectors. However, in advanced countries, the transition to a service economy has not resulted in a reduction in occupational segregation, primarily due to the concentration of female workers in a limited number of tertiary occupations, such as teaching, nursing, and retail.

We structure the contribution as follows. Next section builds upon Pasinetti's theoretical framework and attempts to offer a systematization of the factors that make structural change inclusive from a number of perspectives that focus on innovation. One such aspects of inclusion is linked to the gender dimension. We then move to a selected review of the (mostly firm level) literature that has looked at the effects of innovation on gender inequality and the gender pay gap. The following section offers a selected review on gender employment segregation linked to structural change. We show that employment reveals persistent patterns of gender segregation, where certain occupations are predominantly male, or female dominated. The descriptive analysis is based on the case of Italy.

We conclude by reiterating the importance of extending Pasinetti's theoretical framework on structural change in a two-fold way. First, by explicitly including *the effects on inclusion* that result from the very driving forces of structural change, such as innovation and technical change. Second, by articulating the effects of innovation and structural change on one of the most important aspects of inclusion: gender inclusion, via employment and pay gaps. Policies aimed at promoting gender equality in the labour market, such as affirmative action measures, educational initiatives, and anti-discrimination legislation, can help mitigate the effects of segregation and pay gap so to promote a more equitable distribution of opportunities across sectors. Moreover, efforts to foster inclusive structural change should consider the intersectional nature of gender, recognizing how factors such as race, ethnicity, and class intersect with gender to shape the labour market.

2. Structural Change, Innovation and Gender Gaps. Firm Level Evidence

2.1. Inclusive Structural Change

This section outlines the conceptual framework of *Inclusive Structural Change* (ISC), as proposed by Ciarli, Savona, and Thorpe (2021). The framework seeks to systematise the principal mechanisms linking innovation, structural transformation, and inclusion. It enables the integration of gender-based analyses within a broader understanding of how innovation-led structural change can produce either inclusive or exclusionary outcomes.

The Schumpeterian notion of *creative destruction* (Schumpeter 1934) is foundational to this framework, as it foregrounds the potential for new goods, services, and production processes to generate socio-economic disruption. Process innovation, as conceptualised by Schumpeter, entails the introduction of new productive methods that render existing ones obsolete, often generating demand for novel skills and rendering traditional competencies redundant. On the demand side, certain societal groups benefit from access to new goods and services, while others are systematically excluded. On the supply side, some segments of the labour force are able to adapt to shifting skill requirements, whereas others — lacking the necessary capabilities — become marginalised within low-productivity or informal sectors (see Section Three).

Innovation is often cumulative (Schumpeter 1942), which can lead to increased market concentration and higher barriers to entry, particularly for smaller firms and new entrants. When innovation becomes institutionalised in large research-intensive organisations, it tends to reinforce these dynamics (Autor et al. 2017), frequently exacerbating inequalities in income distribution (Aghion et al. 2019; Lee 2011). Hence, innovation may generate both inclusive and exclusionary outcomes, based not only on participation in production but also access to the consumption of new goods and services.

At the macro level, innovation can induce either high or low degrees of structural transformation — typically through productivity gains across sectors or the reallocation of labour toward more productive activities. Where structural change and inclusion are negatively correlated in the short run, innovation may proceed along pathways that favour either inclusive but less transformative outcomes or more disruptive trajectories that intensify exclusion.

Ciarli, Savona, and Thorpe (2021) develop a framework to analyse the co-evolution of innovation, structural change, and inclusion through the lens of *pathways analysis*, illustrated in Figure 1. Pathways analysis identifies dynamic trajectories shaped by enabling conditions, key actors, and the interactions among them. Inclusive structural change is characterised by the diffusion of innovation in ways that broaden participation and reduce inequalities. The extent to which such outcomes materialise depends on a constellation of enabling conditions — including education systems, financial infrastructure, and regulatory environments — as well as the roles played by diverse actors: firms, entrepreneurs, workers, households, communities, and public institutions. These actors operate within historically and institutionally contingent contexts, shaped by socio-political dynamics and path-dependent processes.

The framework in Figure 1 integrates elements that are recurrent in Pasinetti's structuralist theory — particularly within the 'conditions' dimension of the model — with insights drawn from Schumpeterian innovation theory. These *conditions* serve as

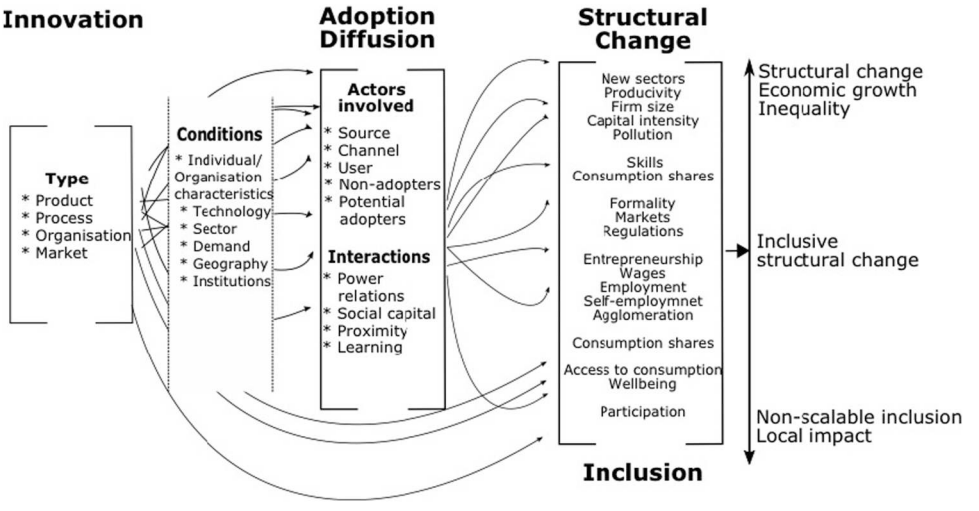

Figure 1. Innovation Pathways to Structural Change and Inclusion. Source: reproduced from Ciarli, Savona, and Thorpe (2021).

mediators that influence how innovation is adopted within an economy. They encompass the sources of innovation, channels of diffusion, characteristics of adopters, and the nature of the technology itself. The process of diffusion is further shaped by contextual factors such as market structure, the position of innovators within core or peripheral sectors, and the nature of final demand.

Actors within the framework refer to both individuals and organisations engaged at any stage of the innovation process, including its generation, diffusion, or adoption. These actors may function either as originators/sources — such as entrepreneurs or public sector institutions — or as recipients and users of innovation. The *interactions* among actors may be market-mediated, socially embedded, or shaped by institutional and power relations, and are central to understanding the trajectories of inclusive or exclusionary outcomes.

As illustrated in Figure 1, some innovation pathways operate primarily through processes of adoption and diffusion, while other variables may exert a more direct influence on structural change and inclusion. From a dynamic perspective, innovation may yield positive effects on structural change while simultaneously exerting negative effects on inclusion (as illustrated at the upper end of the right axis). Conversely, innovation may have limited or even negative impacts on structural transformation, while contributing positively to inclusion (as indicated at the lower end of the left axis). The axes in the diagram capture these potential trade-offs between structural and inclusive outcomes, illustrating that structural change and inclusion are not mutually exclusive, but are instead affected by varying degrees of synergy or tension within specific innovation trajectories.

The framework is sufficiently broad to accommodate Pasinetti's theoretical contributions, while explicitly articulating — through a Schumpeterian lens — how innovation drives structural transformation. At the same time, it foregrounds the key trade-offs between structural change and inclusion, enabling the consideration of variables that

condition the distributional outcomes of innovation, including those that reinforce or mitigate gender inequality.

It is important to emphasise that the Inclusive Structural Change (ISC) framework does not purport to offer a formalised model of structural transformation à la Pasinetti. Rather, it aims to systematise, through a pathways analysis approach, the diverse configurations of enabling conditions, actor constellations, and institutional interactions that produce specific outcomes in terms of structural change and inclusion. In what follows, we focus on one of the most salient dimensions of inclusion that may be disrupted by technological change: the equitable distribution of income and wage remuneration.

2.2. Innovation and Wage Inequality

In the context of rising global inequality, a growing body of literature has looked at the role and responsibility of firms in affecting income distribution. A significant portion of income inequality is driven by disparities in wages, particularly at the upper end of the earnings distribution. Atkinson, Piketty, and Saez (2011) notably argued that rising wage inequality can be attributed to increased compensation in top-tier occupations, often through bonuses, high base salaries, and profit-linked mechanisms such as stock options (see also Frydman and Jenter 2010). Also, increased market concentration has contributed to higher markups and profits, which are increasingly retained rather than shared with employees — a phenomenon associated with the emergence of so-called 'superstar firms' (Autor et al. 2020).

A substantial body of empirical evidence at the firm level now demonstrates that workers with comparable characteristics may receive markedly different remuneration depending on the productivity and profitability of the firm that employs them. Wage inequality, therefore, is largely explained by *between-firm* rather than *within-firm* variation (Card, Lemieux, and Riddell 2018; Song et al. 2015). For instance, Song et al. (2015) estimate that approximately two-thirds of earnings dispersion in the United States is attributable to inter-firm differences.

This heterogeneity in wages premia across firms is often examined through the lens of differential productivity (Card, Lemieux, and Riddell 2018) and job polarization (Goos et al. 2009) and is theoretically grounded in rent-sharing models (Hildreth and Oswald 1997). According to this perspective, firms that generate super profits — or for instance innovation rents — may share part of these 'rents' with workers, to reward their contribution to rent generation and retain skilled labour (Card et al. 2018). However, rent-sharing within firms is highly uneven: workers with greater bargaining power, higher qualifications, or irreplaceable skills are more likely to appropriate a larger share of these rents (Card et al. 2018).

If, as the evidence suggests, wage inequality is primarily driven by heterogeneity in firm performance, then *innovation* — a key driver of firm-level rents — assumes a central role in the reproduction of wage disparities. Innovation rents may arise from returns on R&D investments, the commercialisation of new products or processes, or the temporary monopolistic advantage afforded by novel technologies (Nelson 1959; Hall and Helmers 2024).

Early contributions to this literature include Van Reenen (1996), who investigated the relationship between major innovations in the United Kingdom (1945–83) and wage

outcomes, using a headcount measure of innovation events. His findings support a rent-sharing interpretation, whereby workers actively engage in bargaining to capture a share of innovation-generated rents, particularly during the early stages of technological development. Crucially, these rents are not typically associated with the adoption of off-the-shelf technologies — which involves a market transaction — but rather with the firm's own investment in R&D and innovation.

Other studies have offered empirical evidence on the distributive implications of Information and Communication Technology (ICT) adoption (Van Reenen 2011), while also accounting for compositional shifts in the workforce at the firm level (Kline et al. 2019). Despite the robustness of the rent-sharing hypothesis in explaining wage elasticity with respect to productivity rents, relatively limited empirical work has systematically examined its applicability to *innovation* rents. Notable exceptions include studies that employ innovation proxies such as product counts (Van Reenen 1996), ICT adoption (Van Reenen 2011), and patents (Aghion et al., 2019; Kline et al. 2019).

Ciarli et al. (2018) contribute to this literature by analysing the relationship between firm-level R&D investment, employment composition, and wage inequality in the UK. Their preliminary findings indicate that R&D is associated with a significant wage premium, with elasticity estimates ranging between 0.24 and 0.41. Consistent with rent-sharing models, the study shows that R&D expenditures account for a substantial share of between-firm wage inequality. However, within-firm wage effects are unevenly distributed across occupational categories and individual worker characteristics, mirroring patterns observed in the US context (Kline et al. 2019).

It is important to note that innovation strategies are typically embedded within broader organisational routines and require complementarities with other intangible investments — such as design, software, and branding (Corrado et al. 2022) — as well as external knowledge inputs, including human capital. Therefore, the distributive effects of innovation are likely to be mediated by several institutional, organisational, and labour market factors that extend beyond rent-sharing behaviour per se.

2.3. Innovation and the Gender pay gap

The literature on the gender pay gap is very large. Women might earn less than men due to their being employed in lower paying occupations and industries (see Section Three below), work less hours then men, are more likely to be employed in alternative work agreement (Ciarli et al. 2018).

However, the literature on gender pay gap that is directly linked to innovation is much less developed.

Emerging evidence suggests that innovation contributes to the gender pay gap within innovating firms. As mentioned above, successful innovation gives a competitive advantage over competing firms, the ability to create barriers to entry, the opportunity to command a mark-up on new goods. Innovation is usually associated to higher profits which the firm might (or might not, see Autor et al. 2020) decide to share with their employees (Van Reenen 1996; Kline et al. 2019). However, these benefits tend to accrue to those who are already at the top end of wage distribution, such as the innovators themselves and top executives, who also tend to be male (Ciarli et al. 2018; Ciarli et al. 2023).

Card et al. (2018) identify the main underpinning dynamics of rent-sharing as composed by a sorting and a bargaining effect. The high complementarity between innovation investments and individual characteristics of workers is likely to increase the magnitude of the effects of both sorting and bargaining from top paid and/or highly skilled employees. Interestingly, Card et al. (2018) find that both the sorting and bargaining effects that underpin the rent-sharing mechanism contribute to the gender wage gap in the context of Portuguese firms and find that women are not only less likely to work in firms that pay higher premia but also to bargain much less for a higher premium compared to their male counterparts.

In the UK, Ciarli et al. (2018) show preliminarily that top paid occupations gain more from innovation, routinised occupations gain less, and, crucially, women's wage elasticity to innovation is much lower than that of men. Interestingly, they find a specific innovation-related gender wage gap, which is persistent along wage quintiles and routinisation. These preliminary results show that the gender wage gap led by R&D investments in firms in the UK amounts to 12 percentage points (albeit this gender pay gap results not significant in top occupations). This result resonates with the evidence documented in Card et al. (2018) who refer to general firm-specific premia in Portugal. The gender wage gap attributable to innovation-related rents might therefore result from a lower bargaining power of women, which is a structural characteristic of the UK labour market, other individual workers characteristics being equal.

More recently, contributions have attempted interesting explanations of the gender pay gap, that might not be related to firm innovation performance, such as gender gaps in self-promotions (Exley and Kessler 2019). Based on experiments, Exley and Kessler (2019) find that women rate their performance less favourably than men who perform similarly. This might affect the gender pay gap illustrated above. In the same vein, employers might be conducive of persistent gender wage gaps as their managerial decisions lead women to be systematically paid less than their similarly educated and skilled male colleagues (Forth and Theodoropoulos 2023).

If innovative firms tend to have an impact on increasing inequality both between and within firms, while contributing to the gender pay gap amongst other forms of wage polarisation, then arguably public support to innovation investments in firm might indirectly have a 'side effect', depending on firm organizational structures, innovation intensity and composition of the workforce. Carpentier and Raffo (2023) for instance, show that women's participation in international patent applications between 1999 and 2020 globally, are only the 23 per cent of the total patent applications, and women represent the 13 per cent of the listed inventors. Similarly, firms have been found responsible of a large share of differences in early career upgrading between men and women in Italy (Card et al. 2025).

This is a fairly gloomy, though plausible picture of how several innovation related variables — from patent applications to research funds' allocation to their very own perception of how worth of promotion they are — can represent determinants of gender wage gaps that go beyond firms' strategies of rent sharing. While public support to innovation is undoubtedly the backbone of innovation performance and likely productivity increases, it is relevant to understand what its unintended consequences in terms of gender pay gap is.

3. Structural Change and Gender Segregation. Sectoral Level Evidence

As stated in the introductive section, the dynamics of economic transformation over time, particularly shifts in the composition of sectors and the allocation of labour between them, present a strong gender dimension. The evolution of sectors within an economy demonstrates how certain sectors traditionally dominated by men or women undergo changes in their relative importance over time. For instance, in many economies, the shift from manufacturing to services has implications for gender segregation, as certain service sectors may have different gender compositions compared to manufacturing industries. Furthermore, gender segregation is influenced not only by historical allocation of men and women to different sectors, but also by the dynamics of labour market entry, mobility, and discrimination.

The issue of income distribution and inequality is inextricably linked to shifts in the economy's structure, and is inextricably intertwined with gender segregation and with disparities in wages and earnings between male-dominated and female-dominated occupations. As certain sectors become more or less important in the economy, the differential valuation of male and female labour can contribute to income inequality. To illustrate this point, consider occupations that have historically being associated with women, which tend to exhibit lower wages relative to those dominated by men. This phenomenon can be interpreted as a reflection of more pervasive patterns of gender discrimination and the devaluation of women's work. Moreover, integrating the concept of gender segregation with the theoretical framework of structural change underscores the necessity for policy interventions that address both economic restructuring and gender inequality.

This section aims to analyse the role of structural change in the gender distribution of sectoral employment in Italy, historically. The work relies on two streams of literature, which are still, unfortunately, separated. Early labour market analyses with a gender perspective focus on the feminization of the labour force, examining the different ways in which men and women are employed, and how these change according to the country's growth and development process. In these types of analyses, gender employment segregation is not a primary focus, as the underlying idea is to understand how the long-term historical development of a country affects women's employment opportunities. Subsequently, a growing body of literature, particularly empirical one, has begun to examine gender segregation in employment. The objective of these studies is twofold: firstly, to identify the factors that result in the concentration of men and women in specific occupations, and secondly, to highlight the gender stereotypes that perpetuate the misconception that there are 'men's jobs' and 'women's jobs' (also known as 'sex-typing' occupations). The subsequent section presents a concise, and therefore necessarily non-exhaustive, review of these two bodies of literature.

3.1. Theories and Evidence on Gender Segregation

The initial corpus of literature examines the specific circumstances under which women, particularly married ones, engage in the labour market, in relation to economic development. The fundamental premise is that the economic growth of a country, which typically occurs in a staged process, from agriculture (the initial stage of relative poverty) to services (the advanced stage), is accompanied with varying rates of female

participation in paid work. The seminal work by Sinha (1967) was the first to identify this relationship in her analysis of the Indian census data, showing that female participation in rural areas varies inversely with agricultural prosperity and the share of non-agricultural labour. Consequently, when the agricultural sector is still technologically backward and the others (manufacturing and services) are underdeveloped, the female labour force participation rate is particularly high. As a nation embarks on the path of industrialization, however, there is an improvement in the standard of living and the literacy of the population, resulting in a decline in the female labour force participation rate. Nevertheless, at a relative advanced stage of economic development, with rapid growth in higher education and an expansion in the service sector, which tends to be the main employer for women, the trend reverses.

Subsequent investigation of this phenomenon in other countries has revealed a substantial body of literature demonstrating that female labour force participation follows a U-shaped trend as countries develop (see Boserup 1970; Durand 1975; Psachropoulos and Tzannatos 1989; Goldin 1994, 1995).

In the initial phase of economic development, when agricultural is the predominant sector, women exhibit a high rate of participation in the labour market, particularly in the context of specific agriculture activities such as poultry, dairy, rice, cotton, and peanuts. In these circumstances, women are occasionally remunerated employees; however, more commonly, they function as unpaid labourers within family farms or family businesses. These types of jobs facilitate a more seamless integration of work and family responsibilities, particularly childcare, given that fertility rates remain high. However, as economic development progresses and society becomes wealthier, the industrial sector emerges as a major employer, creating more formal job opportunities and, by extension, reducing women's participation in the labour market. The increased difficulty in balancing paid and unpaid work, especially in the case of married women with children, creates greater difficulty for women in benefiting from the new opportunities from industrialization. This may be more relevant for the industrial sectors where heavy manual labour is required. The improvement in living conditions, associated with industrialization, relegates women to the role of housewives, mothers, and wives, and the male breadwinner model becomes dominant. A pervasive social stigma exists against women and manual labour, with the underlying message being that only a lazy and negligent husband would allow his wife to do such work. The shame attached to husbands serves to enforce a powerful social norm that obliges men to provide for their families. Nevertheless, the stigma does not apply to women working in the white-collar sectors. As societies evolve and transition from industrial to service-based economies, female labour force participation increases once again. The emergence of a white-collar service sector has created new and attractive employment opportunities for women, who are now free from the stigma or sanctions previously associated with certain forms of employment. Moreover, the augmentation of post-primary education has engendered an erudite female labour force that is prepared and eager to engage in remunerated employment. Concurrently, the substantial growth has facilitated the establishment of a welfare system that assists women with childcare and domestic responsibilities, notwithstanding the decline in the fertility rate.

The extant literature suggests the existence of a U-shaped relationship between per capita GDP and female labour supply, and several mechanisms through which such a

relationship may arise have been described. Goldin (1994, 1995) employs typical neoclassical tools to elucidate the U-shaped relationship between per capita GDP and female labour supply. The income effect, defined as the alteration in an individual's working hours in response to a modification in family income, and the substitution effect, denoting the change in an individual's working hours in response to a change in wage, serve as two pivotal mechanisms that contribute to this phenomenon. Assumptions made permit the downward segment of the curve to be explained by an initial robust income effect and a modest substitution effect, in conjunction with the transition of production from the domestic sphere to the industrial sector. However, the upward portion of the curve is of particular interest. An understanding of the changing direction of the curve provides insights into the reasons why women enter the labour force at a higher stage of economic development. Goldin posits that the reasons for this phenomenon are not solely attributable to individual or familial characteristics (such as personal or family income), but also to societal factors, particularly the evolution of women's education and the expansion of white-collar sectors.

More recent literature has described several potential mechanisms through which the relationship may arise. In particular, the U-curve has been linked to structural change, fertility dynamics, variation in the gender gap in education levels along the process of economic development, and gender-role cultural norms that prevail as an economy embarks on the process of economic development (Caĝata and Özler 1995; Gaddis and Klasen 2014; Luci 2009; Mammen and Paxson 2000; Ngai, Olivetti, and Petrongolo 2022; Tam 2011).

The second body of literature focuses on gender segregation, which can be both horizontal and vertical. Horizontal segregation refers to the distribution of men and women across different occupations, based on gender stereotypes of jobs considered suitable for men (e.g., truck drivers) and for women (e.g., secretaries). Vertical segregation concerns the distribution of men and women within the same occupation, where one sex is more likely to be at a higher grade or level. The tendency for men and women to be concentrated in certain occupations or professions is a pervasive and enduring feature of labour markets around the world. A substantial and continuously expanding body of literature has demonstrated that gender segregation is a pervasive phenomenon in all regions, at all levels of development, under any political system, and in diverse social, cultural, and religious environments (Arora, Braunstein, and Seguino 2023 for Latin America; Batchuluun 2021 for Mongolia; Gedikli 2020 for Turkey; Gradin 2021 for post-apartheid South Africa; Lind and Colquhoun 2021 for Australia; Makarevich 2023 for the US; Mavrikiou and Angelovska 2020 for Europe, just to name a few).

The extant empirical literature is unanimous in its demonstration of the existence of gender segregation, however the theoretical one is divided on explanations of its causes and consequences (see Anker 1997 for a review). Mainstream explanations focus on both labour supply and labour demand, within a mainstream framework where both workers and employers are economically rational agents, and labour markets function efficiently (Becker 1971). From a supply-side perspective, workers seek to secure the most lucrative employment opportunities, taking into account their own factor endowments, constraints, and preferences. These factors include, but are not limited to, their level of education, work experience, familial responsibilities, and personal preferences regarding work environment. Consequently, explanations tend to emphasize the lower levels of

women's human capital and labour productivity. Women make rational decisions, choosing occupations with low returns to experience, low penalties for temporary withdrawal from the labour market, and flexibility in terms of entry and working hours. From the perspective of the demand-side, employers seek to maximize profits by minimizing costs and maximizing productivity. Consequently, explanations tend to focus on employers' beliefs about women being higher-cost workers, due to their higher absenteeism rates and turnovers (both generally due to family responsibilities).

Theories of market segmentation that diverge from the mainstream propose that women are employed in the 'secondary' market, characterized by relatively inferior quality of employment, lower wages, limited opportunity for advancement, suboptimal working conditions, and inadequate job protection and security (Doeringer and Piore 1971). Feminist and gender theories content that women's disadvantage position in the labour market is a consequence of their subordination within society, particularly within the family structure (Hartmann 1976). The prevailing patriarchal societal structure, which allocates the bulk of domestic and care work to women, endangers substantial challenges for women in achieving a balance between paid work outside the home and unpaid work at home. The concept of the 'double burden,' initially identified in the 1970s as a primary catalyst for gender discrimination in the labour market, persists as a salient issue.

Regardless of the theoretical approach that is pursued, it is imperative to study gender segregation and to comprehend its underlying causes with the objective of reducing (or, at the very least, eliminating) it. It is important to consider whether the social and economic consequences of gender segregation are negative. In addition to its inefficiency in the labour market, Anker's words (1997, pp. 6–7) underscore a salient social problem: occupational segregation 'has an important negative effect on how men see women as well as how women see themselves by reinforcing and perpetuating gender stereotypes.'

3.2. The Italian Case

The Italian case explores the efforts to integrate the two strands of literature previously discussed, with the aim of analysing the trends in gender segregation in the context of Italian structural transformation. Italy offers a particularly suitable setting for this analysis due to its economic history, which differs from other countries in that its process of industrialization commenced only after World War II, thus resulting in a relative recent transition from agriculture to industry to service. A notable milestone was reached in 1961 when the industrial sector surpassed agriculture in terms of employment, and a similar transition occurred in 1981 when services surpassed industry in employment (see Figure A1).

Italy is regarded as a 'latecomer' nation in terms of its economic growth and development. The economic boom of the 1950s marked a pivotal turning point (Zamagni 1993). During that period, Italy experienced an unparalleled growth in industry, new construction, exports, and investments, which significantly increased the industrial character of the country. In the 1980s, a notable expansion of the service sector occurred in tandem with an increase in female labour force participation (Figure A2).

3.2.1. Data and Measurements

A historical analysis of gender segregation during the Italian economic development is conducted using employment data from the ten-year census, which was collected by

the Italian statistical office (Istat) from 1951 to 1981. For subsequent years, Labour Force Survey data are utilized, adhering to the 10-year time frame, as gender segregation typically takes time to manifest. However, conducting such a long-term historical analysis inevitably poses challenges in ensuring the comparability of the data.

As delineated in Table 1 of the Appendix, the data utilized, the modifications implemented to ensure the comparability of the time-series, and the discrepancies that persist despite these efforts, rendering comparison arduous, if not unfeasible, are meticulously explicated. In this analysis, the emphasis is directed towards the salient points that necessitate consideration during the examination of gender segregation trends. Primarily, the composition of the working population is not constant, undergoing transitions from the 'active population' to the 'employment' category during the periods under scrutiny. Secondly, the age criteria for inclusion in the working population have been subject to change over time, initially set at 10 years and subsequently adjusted to 14 and then 15 years. A further challenge arises from the evolving categorization of sectors. The adoption of a two-digit sector classification, aimed at enhancing comparability across time, has introduced additional complexity. The reconciliation tables provided by the censuses facilitate the systematic organization of data, at least for select years. Consequently, the 1951, 1961, and 1971 census data comprise the same sectors. However, the 1981 classification diverges from previous ones, as Italy was in the process of adapting to the European classification system, which differed significantly from those employed in earlier censuses.

For the subsequent years, the Italian Censuses do not offer data at the two-digit level, compelling us to utilize the Labour Force Survey (LFS) by Eurostat, which, regrettably, begins in 1992. In an effort to maintain the 10-year gap, we have opted to employ LFS data from 1992, 2001, 2011, and 2021. However, this choice poses an additional problem: the change in the classification of economic activities from NACE REV.1 used in 1992 and 2001 to NACE REV. 2 for the following 2011 and 2021, meaning a different number of sectors are used to calculate gender segregation indices. Consequently, a comparison can only be made between 1992 and 2001 on the one hand, and 2011 and 2021 on the other. Regrettably, there is no solution to the problem of data comparability over such extensive historical periods. The only viable course of action is to acknowledge the issues when analysing gender segregation trends.

The data presented above are used to calculate the sectoral segregation, which is a type of horizontal occupational segregation referring to the concentration of men and women in specific sectors. Efforts to understand the changing patterns of gender segregation in the labour market have led to the development of several composite indexes. Their purpose is to summarize the level of segregation in a single value that can be used as a basis for comparison over time. The assessment of gender segregation occurs by using the most prevalent indicators of the literature.

The most common indicator is the ID dissimilarity index, which was defined by Duncan and Duncan (1955) as follows:

$$ID = \frac{1}{2}\sum_i \left|\frac{M_i}{M} - \frac{F_i}{F}\right|$$

where M_i/M and F_i/F are, respectively, the male and female share of employment in sector *i*. The index is a metric used to determine the extent of gender segregation in

various sectors of the economy. It is calculated by determining the percentage of men and women who would need to change sectors, without replacement, in order to achieve an equal distribution across all sectors. The index ranges from zero (*no segregation*) to one (*complete segregation*). The accessibility and simplicity of the interpretation and calculation have been key factors in the widespread use of this index (Albelda 1986; Barbezat 2003; Bettio 2002; Borrowman and Klasen 2020; Reskin 1993). Another advantage is that the index is not sensitive to changes in female labour force participation rates. This indicates that even in scenarios where the proportion of women in the labour force experiences an increase, provided that the distribution of women across sectors remains constant, the Duncan Index will not be subject to alteration.

Nonetheless, the ID is not without its flaws (Charles and Grusky 1995; Lewis 1982; Watts 1992). The present study does not aspire to provide a comprehensive review of these flaws; rather, it identifies those that may impact our analysis. Given that the formula compares the male and female shares in a particular sector, it is susceptible influenced by a large sector. To illustrate, if an economy is dominated by a single, large sector that is highly segregated, while the other smaller sectors exhibit a lower level of segregation, the ID index would yield a higher value than if the dominant sector were very equal and the numerous small sectors were highly segregated. Furthermore, if a large, highly segregated sector shrinks over time, the value of the index may decrease, even if the drivers of segregation remain unchanged. This issue may arise when cross-sectional analysis is conducted using a limited number of sectors. However, this is not a problem in the present case, where the minimum number of sectors is 44, since the same index was calculated with significantly fewer sectors (and occupations) (Borrowman and Klasen 2020 use 10). Moreover, given the examination of changes over time, the level of aggregation becomes less consequential, as aggregated measures and indices calculated on more disaggregated data have exhibited analogous movements over time (Jacobs and Lim 1992; Charles and Grusky 1995).

To achieve a more comprehensive understanding of gender segregation, we employed also the IP index by Karmel and Maclachlan (1988), which is defined as follows:

$$IP = \frac{1}{T}\sum_{i}\left|(1-a)\frac{M_i}{M} - a\frac{F_i}{F}\right|$$

where M_i/M and F_i/F are interpreted similarly to the ID index. The term T signifies the total number of employed individuals, inclusive of both men and women. The term *a* represents the proportion of males in the overall workforce, calculate as M/T. This index quantifies the proportion of persons, irrespective of their sex, who would need to transition to different occupations to achieve an equal distribution of the female workforce compared to the male workforce, while preserving the occupational structure constant. The IP index ranges from 0 (*no segregation*) to 0.5 (*complete segregation*). The primary distinction between the ID and the IP index is that the latter is contingent upon the sectoral composition of the economy. For instance, if the proportion of women in employment increases, while the sectoral distribution of women (and men) remains unchanged, the ID index remains unchanged, whereas the IP index increases. Despite the noted discrepancy between the IP and ID index, both are typically employed in conjunction (Borrowman and Klasen 2020; Zuazu 2023).

3.2. Evidence on Gender Segregation in Italy

Table 1 presents the segregation indexes for Italy. It is imperative to bear in mind the previously stated caveats when interpreting the data; and to remember that the primary focus is on the trend over time.

Table 1. Gender segregation indexes.

	1951	1961	1971	1981	1991	2001	2011	2021
ID index	31.6	36.0	36.0	38.1	34.0	32.3	40.8	40.1
IP index	11.9	13.4	14.2	16.8	15.4	15.2	19.7	19.5

The comparable indices of 1951, 1961, and 1971 are quite high, showing a very strong initial upward trend (from 1951 to 1961) followed by a steady one.

During the period under consideration, female employment remained relatively stable (Figure A2), thereby indicating that it was not affected by the Italian structural change. The gender segregation of the period can be attribute to Italy's transition process from a country with a predominantly agrarian structure to a predominantly industrial one. This process of industrialization was accompanied by an increase in segregation: few Italian women could find factory jobs, and those who did were concentrated in traditional sectors (especially textiles) (Betti 2010). During the period of industrialization, the male workforce was predominantly concentrated in sectors such as manufacturing, construction, and engineering, which offered higher compensation and were, thus, male-dominated. These industries were often characterized by physically demanding work, which was considered more suitable for men according to prevailing gender norms. Conversely, women were predominantly employed in sectors such as agriculture, textiles, and domestic services, which offered lower wages and were characterized by more precarious working conditions. Women's participation in the labour force was often constrained by part-time or informal work arrangements, due to the societal expectations of prioritizing family responsibilities. The gender segregation was also perpetuated by a number of barriers to entry for women in male-dominated industries, including discriminatory hiring practices, a lack of access to education and training opportunities, and limited childcare support. Furthermore, the reinforcement of gender segregation was attributable to the influence of cultural norms and gender stereotypes. The perception that certain occupations were more suitable for either men or women was deeply entrenched in Italian society, influencing individuals' career choices and employers' hiring practices. Likewise, gender segregation was firmly embedded in Italian social norms. Italy, similar to numerous other countries during that era, maintained conventional gender roles, wherein men were predominantly regarded as the primary breadwinners, while women were expected to prioritise domestic responsibilities.

The 1970s witnesses the rise of feminist movements in Italy, which challenged conventional gender roles and advocated for gender equality across all facets of life, including the labour market. These movements played a pivotal role in raising awareness about the systemic barriers faced by women in accessing equal employment opportunities and in pushing for legislative reforms to address gender discrimination in the workplace. Furthermore, the feminist movement was part of a much broader movement that encompassed numerous objectives related to wages. For instance, trade unions and worker's parties

successfully eliminated regional disparities in wages, known as 'gabbie salariali'. The fundamental worker's law (Statuto dei lavoratori) granted workers numerous rights concerning education, working conditions, and more. The struggle against the gender pay gap was an integral component of the rise of the working class, which effectively altered the balance of power in workplaces, thereby contributing to the growth of wages and workers' rights. The outcome was a gradual increase in female employment (Figure A2).

Despite the limitation of comparing the 1981 index with earlier ones, as discussed in the previous section, the relatively high level of segregation persists. It is reasonable to infer that the 1981 census employment data reflect the industrial restructuring of the Italian production system, triggered by the 1970s oil shocks and stagflation. According to extant literature (Amin et al. 1994; Boyer 2007), this period is characterized by the transition from Fordism to post-Fordism, marked by, among other things, the shift to a smaller average firm size and the processes of outsourcing and offshoring. In Italy, this period witnessed the decline of the few large Italian companies and the emergence of industrial districts, even in regions that had not experienced the organization of firms in this manner (Baculo and Gaudino 2010; Viesti 2001). This shift has led to and expansion of the service sector, which has become a significant source of employment for women, while industrial production has undergone a transition towards smaller firms and male-dominated roles. The post-Fordist era has also witnessed a shift from an industrial economy to one that is increasingly service-oriented. In Italy, this transition has been accompanied by a notable increase in women's employment in private services, particularly in office work and sales roles. However, perhaps the most significant development has been the surge in public sector employment, which has played a crucial role in facilitating the balance between professional obligations and personal commitments, particularly for women (Pescarolo 2019).

The 1992 and 2001 indices demonstrated a relatively elevated level of segregation, accompanied by a modest decline over the decade. Notwithstanding the progress in gender equality legislation and the augmentation of women's participation in the workforce, select sectors persisted in their heavy segregation along gender lines. A salient illustration of this phenomenon is the predominance of women in traditionally feminized sectors such as education, healthcare, and social services, which frequently proffered reduced compensation and constrained prospects for career advancement in comparison to male-dominated domains. The underrepresentation of women in professional fields such as engineering, information technology, and other sectors characterized by physical demands and long work hours is indicative of societal norms that perpetuate gender disparities in the workforce. These norms, entrenched in societal expectations, dictate that women should primarily engage in caregiving and nurturing professions, while men are expected to dominate sectors such as manufacturing, construction, and technology. As a result of these norms, men have historically dominated leadership roles and have received higher average salaries in these sectors. The aforementioned industries are often characterized by long working hours, physically demanding work, and a culture that prioritizes masculine traits and behaviours, further entrenching gender disparities in employment.

The persistence of gender segregation can be attributed to a number of factors, including cultural norms, discriminatory hiring practices, and limited access to education and training opportunities for women in male-dominated fields. Furthermore, the neoliberal

agenda in conjunction with Italy's adoption of the euro and its subsequent entry into the Euro-zone, has precipitated the implementation of particularly restrictive fiscal policies aimed at reducing the Italian deficit and public debt (it is not the objective of this paper to provide a critique of so-called 'expansionary' austerity). These policies have culminated in a diminution of an already underperforming welfare system. The dearth of affordable childcare and support services has impeded women's capacity to pursue careers in traditionally male-dominated sectors, thereby perpetuating existing gender segregation in the labour market.

In the last two decades under investigation (2011 and 2021), no more major structural changes took place. However, these years were characterised by significant upheaval, including the Great Recession, the international health crisis caused by the novel strain on the virus known as SARS-Cov-2, the geopolitical crisis involving two ongoing wars at the time of writing, and the ongoing climate crisis. This sequence of crises, occurring simultaneously, has led to the conceptualization of a 'poly-crisis' by Tooze (2022).

During this period, Italy has sustained notably elevated levels of occupational segregation, a phenomenon that has been further exacerbated by the Great Recession (Antonopoulos 2014; Karamessini and Rubery 2014). Initially, the sectors most adversely affected were manufacturing and construction, resulting in a disproportionate impact on male employment, partly due to the protective nature of occupational segregation. Subsequent austerity policies have had a significant impact on the public sector, leading to a shift in employment segregation from a protective mechanism to a primary driver of further segregation. In response to the poly-crisis, the Italian economic system has adopted strategies, including an increase in temporary and part-time employment, which exhibits a high degree of feminization and is concentrated in sectors with significant female representation. Consequently, it can be concluded that the poly-crisis and the economic policies implemented to address it have contributed to the perpetuation of significant occupational segregation.

It is noteworthy that the pronounced occupational segregation coincides with a period in which the Italian economy, akin to that of the majority of industrialized countries, is characterized by predominantly service-oriented sectors that account for the majority of employment and generate the bulk of the country's value-added output. Contrary to the prevailing notion that a service economy should lead to the dissolution of occupational segregation, this study finds that, in Italy, occupational segregation persists. This phenomenon stands in contrast to the common belief that the absence of social stigmas that once prevented women from entering service occupations, as was the case during the industrialization phase when women were predominant in manual labour in factories, would inevitably lead to the eradication of occupational segregation. Instead, the data indicates that the service economy continues to relegate women to roles traditionally considered 'for women', largely influenced by prevailing gender stereotypes. These roles, such as secretary, teacher, nurse, and similar positions, reflect the continued presence of gender segregation in the Italian labour force. Furthermore, even in instances where women manage to enter male-dominated sectors, they are unlikely to attain top positions, a phenomenon often referred to as the 'glass ceiling'. The pervasive nature of gender segregation extends beyond the service economy, persisting in various facets of society and professional domains.

4. Concluding Remarks

This paper has offered a selected review of the literature on gender gaps that ensue from innovation and structural change dynamics. As mentioned, the ambition is not to contribute to a theoretical model à la Pasinetti, but rather to identify mechanisms that are conceptually aligned and consistent with Pasinetti's structuralist framework and might incorporate analysis of the gender gaps.

First, Pasinetti's framework is shown to be theoretically compatible with a Schumpeterian understanding of innovation and technical change as central drivers of structural transformation. This opens the possibility of synthesising Pasinetti's and Schumpeter's perspectives by identifying a set of dimensions that condition the inclusivity of structural change. Drawing on the framework of Inclusive Structural Change (ISC) proposed by Ciarli, Savona, and Thorpe (2021), we consider how actors, interactions, and institutional variables — extending beyond traditional economic indicators — may result in diverse pathways of structural change, each characterised by distinct trade-offs between productivity growth and social inclusion.

The analysis has subsequently focused on one critical and underexplored dimension of inclusion: gender. Specifically, we have examined two manifestations of gender inequality — namely, the gender pay gap and gender-based occupational segregation. While these phenomena are often treated as analytically distinct in the existing literature, our review indicates that they stem from common structural dynamics. The literature on innovation-induced gender wage gaps is predominantly firm-level and centres on unequal rent-sharing mechanisms linked to innovation and productivity, rather than on broader questions of income distribution or labour market segmentation.

A key conclusion of this paper is that extending Pasinetti's structuralist theory to account for gender wage disparities presents significant theoretical challenges. Existing analyses of gender wage gaps typically concentrate on firm-level behaviours, among which innovation strategies, which remain analytically detached from Pasinetti's macrostructural framework. Developing a Pasinettian foundation for the study of gendered wage inequality would thus require substantial theoretical work and should constitute a future research agenda.

By contrast, the sectoral dimension of gender inequality — namely, occupational segregation — proves more amenable to structuralist analysis. Drawing on both theoretical and empirical evidence, we have illustrated how the changing sectoral composition of the Italian economy since the post-World War II period has contributed to entrenched gender segregation in employment. Italy's service-led structural transformation has been disproportionately concentrated in non-tradable, low-skilled service sectors — sectors that have absorbed the most vulnerable segments of the labour force, especially women.

The empirical assessment of occupational segregation presents a rather pessimistic picture: in the Italian case, structural change has contributed to gendered employment segregation rather than reduced it. Women have often transitioned from unemployment into precarious employment in low-productivity service sectors. Moreover, while technological change and innovation investments may partially reverse patterns of low skill tertiarisation, they do not necessarily mitigate gender wage disparities. On the contrary, we find that innovation-driven sectors frequently reproduce and even exacerbate gender pay

gaps, particularly given women's underrepresentation in research-intensive firms and patenting occupations.

The findings presented here emphasise the importance of explicitly incorporating gender-sensitive perspectives into innovation and industrial policy. Achieving genuinely inclusive structural change requires a more comprehensive approach that acknowledges and addresses the gendered dimensions of both employment and wages.

We are aware that the picture offered here does not provide a ready-made answer to all the complex challenges that gender gaps still represent. Gender asymmetries on the labour market, and the gender pay gap in particular, are very complex phenomena, often attributable to different determinants at different levels, themselves interrelated. While policy makers would undoubtedly prefer a single, clearly identifiable cause of these, not only the extant literature demonstrates that this is not the case, but also, we believe that a single solution would be a ill-informed normative implication of academic research. Often the best policy advice is one that highlights the interconnected causes of an economic challenge, to be able to devise an articulate a consistent policy response, rather than a single line of action.

Acknowledgements

We would like to use this opportunity to acknowledge and thank the reviewers who read this article and aided in its publication. We would also like to thank the Guest Editors of this Special Issue in honour of Prof Pasinetti for their admirable support.

Disclosure Statement

No potential conflict of interest was reported by the author(s).

Funding

This work was conducted by members of the Centre for Inclusive Trade Policy, supported by the ESRC [grant number ES/W002434/1].

ORCID

Maria Savona http://orcid.org/0000-0003-4529-4869
Giovanna Vertova http://orcid.org/0000-0002-6397-9354

References

Albelda, R. P. 1986. 'Occupational Segregation by Race and Gender, 1958-1981.' *Industrial and Labour Relations Review* 39 (3): 404–411.

Amin, A., et al. 1994. *Post-Fordism: A Reader*. Oxford: Blackwell.

Anker, R. 1997. 'Theories of Occupational Segregation by Sex. An Overview.' *International Labour Review* 136 (3): 315–339.

Antonopoulos, R. 2014. *Gender Perspectives and Gender Impacts of the Global Economic Crisis*. London: Routledge.

Arora, D., E. Braunstein, and S. Seguino. 2023. '*A Macro Analysis of Gender Segregation and Job Quality in Latin America.' World Development 164*. ID Index.

Aghion, P., U. Akcigit, A. Bergeaud, R. Blundell, and D. Hemous. 2019. 'Innovation and Top Income Inequality.' *Review of Economic Studies* 86 (1): 1–45.
Atkinson, A. B., T. Piketty, and E. Saez. 2011. 'Top Incomes in the Long Run of History.' *Journal of Economic Literature* 49 (1): 3–71.
Autor, D., D. Dorn, G. H. Hanson, P. Shu, and G. Pisano. 2017. *Foreign Competition and Domestic Innovation: Evidence from U.S.* Patents.
Autor, D. H., D. Dorn, L. F. Katz, C. Patterson, and J. Van Reenen. 2020, May. 'The Fall of the Labour Share and the Rise of Superstar Firms.' *The Quarterly Journal of Economics* 135 (Issue 2): 645–709. doi:10.1093/qje/qjaa004.
Baculo, L., and S. Gaudino. 2010. *Globalizzazione. Distretti industriali: un caso studio nel Mezzogiorno*. Napoli: Edizioni Scientifiche Italiane.
Barbezat, D. 2003. 'Occupational Segregation Around the World.' In *In Women, Family and Work: Writings on the Economics of Gender*, edited by K. S. Moe. Oxford: John Wiley & Sons.
Batchuluun, A. 2021. 'The Gender Wage Gap in Mongolia: Sectoral Segregation as a Driving Factor.' *Review of Development Economics* 25 (3): 1437–1465.
Becker, G. S. 1971. *The Economics of Discrimination*. 2nd ed. Chicago: Chicago University Press.
Betti, E. 2010. 'Il lavoro femminile nell'industria italiana. Gli anni del boom economico.' *Storicamente* 6.
Bettio, F. 2002. 'The Pros and Cons of Occupational Gender Segregation in Europe.' *Canadian Public Policies* 28 (May): S65–S68.
Borrowman, M., and S. Klasen. 2020. 'Drivers of Gender Sectoral and Occupational Segregation in Developing Countries.' *Feminist Economics* 26 (2): 62–94.
Boserup, E. 1970. *Woman's Role in Economic Development*. New York: St. Martin's Press.
Boyer, R. 2007. *Fordismo e postfordismo: il pensiero regolazionista*. Milano: Università. Bocconi.
Caĝata, N., and S. Özler. 1995. 'Feminization of the Labour Force: The Effects of Long-Term Development and Structural Adjustment.' *World Development* 23 (11): 1883–1894.
Card, David, Ana Rute Cardoso, Joerg Heining, and Patrick Kline. 2018. 'Firms and Labor Market Inequality: Evidence and Some Theory.' *Journal of Labor Economics* 36: S1, S13–S70.
Card, D., T. Lemieux, and W. C. Riddell. 2018. *Unions and Wage Inequality: The Roles of Gender, Skill and Public Sector Employment. Technical report*. Cambridge, MA: National Bureau of Economic Research.
Card, D., F. Devicienti, M. Rossi, and A. Weber. 2025. 'The Gender Gap in Career Trajectories.' Do firm Matter?. *Rockwool Foundation Discussion Paper Series April 10/25*.
Carpentier, E., and J. Raffo. 2023. "The Global Gender Gap in Innovation and Creativity: An International Comparison of the Gender Gap in Global Patenting over Two Decades." *WIPO Development Studies Series*.
Charles, M., and D. B. Grusky. 1995. 'Models for Describing the Underlying Structure of Sex Segregation.' *American Journal of Sociology* 100 (4): 931–971.
Ciarli, T. M., Di Ubaldo, and M. Savona. 2023. "The weak link between productivity and wages in London: Evidence from firms and local labour markets (2004–2014)." Report for the Greater London Authority. November 2023. https://www.london.gov.uk/sites/default/files/the_weak_link_between_productivity_and_wages_in_london_-_full_report.pdf
Ciarli, T., M. Savona, and J. Thorpe. 2021. 'Innovation for Inclusive Structural Change.' In *The Challenges of Technology and Economic Catch-up in Emerging Economies*, edited by J.-D. Lee, K. Lee, D. Meissner, S. Radosevic, and N. S. Vonortas. Oxford University Press. doi:10.1093/oso/9780192896049.003.0012
Ciarli, T., A. Marzucchi, E. Salgado, and M. Savona. 2018. Firm R&D and Wage Inequality. Paper Presented at the Concordi 2019 Conference (25-17 September, EC JRC Seville).
Corrado, Carol, Jonathan Haskel, Cecilia Jona–Lasinio, and Massimiliano Iommi. 2022. 'Intangible Capital and Modern Economies.' *Journal of Economic Perspectives* 36 (3): 3–28. DOI: 10.1257/jep.36.3.3
Doeringer, P., and M. Piore. 1971. *Internal Labour Market and Manpower Analysis*. Lexington, MA: D.C. Heat and Co.

Duncan, O. D., and B. Duncan. 1955. 'A Methodological Analysis of Segregation Indexes.' *American Sociological Review* 20 (2): 210–217.
Durand, J. 1975. *The Labour Force in Economic Development: A Comparison of International Census Data, 1946-66*. Princeton: Princeton University Press.
Exley, C., and L. Kessler. 2019. The Gender Gap in Self-Promotion. NBER Working Paper No. 26345 October 2019.
Forth, J., and N. Theodoropoulos. 2023. 'Employers and the Gender Wage Gap.' *IZA World of Labour* 2023: 511. doi:10.15185/izawol.511.
Frydman, C., and D. Jenter. 2010. 'CEO Compensation.' *Annual Review of Financial Economics* 2 (1): 75–102.
Gaddis, I., and S. Klasen. 2014. 'Economic Development, Structural Change, and Women's Labour Force Participation: A Reexamination of the Feminization U Hypothesis.' *Journal of Population Economics* 27 (3): 639–691.
Gedikli, C. 2020. 'Occupational Gender Segregation in Turkey: The Vertical and Horizontal Dimension.' *Journal of Family and Economic Issues* 41 (1): 121–139.
Goldin, C. 1995. 'The U-Shaped Female Labour Force Function in Economic Development and Economic History.' In *Investment in Women's Human Capital and Economic Development*, edited by T. P. Schultz, 61–90. Chicago: University of Chicago Press.
Goldin, C. 1994. '*The U-Shaped Female Labour Force Function in Economic Development and Economic History*.' *NBER Working Paper* 4707.
Goos, M., Manning, A. and A. Salomons. 2009. 'Job Polarization in Europe'. *American Economic Review P&P*. 99 (2).
Gradin, C. 2021. 'Occupational Gender Segregation in Post-Apartheid South Africa.' *Feminist Economics* 27 (3): 102–133.
Hall, B. H., and C. Helmers. 2024. *The Economics of Innovation and Intellectual Property*. Oxford University Press.
Hartmann, H. 1976. 'Capitalism, Patriarchy and Job Segregation by Sex.' *Signs: Journal of Women in Culture and Society* 1 (3): 137–169.
Hildreth, Andrew K. G., and A. J. Oswald. 1997. 'Rent-Sharing and Wages: Evidence from Company and Establishment Panels.' *Journal of Labor Economics* 15 (2): 318–337. http://www.jstor.org/stable/2535392
Jacobs, J. A., and S. T. Lim. 1992. 'Trends in Occupational and Industrial Sex Segregation in 56 Countries, 1960-1980.' *Work and Occupations* 19 (14): 450–486.
Karamessini, M., and J. Rubery. 2014. *Women and Austerity: The Economic Crisis and the Future for Gender Equality*. London: Routledge; Taylor & Francis Groups.
Karmel, T., and M. Maclachlan. 1988. 'Occupational Sex Segregation – Increasing or Decreasing?' *Economic Record* 64 (3): 187–195.
Kline, Patrick, Neviana Petkova, Heidi Williams, Owen Zidar. 2019, August. 'Who Profits from Patents? Rent-Sharing at Innovative Firms.' *The Quarterly Journal of Economics* 134 (3): 1343–1404. https://doi.org/10.1093/qje/qjz011
Lewis, D. E. 1982. 'The Measurement of the Occupational and Industrial Segregation of Women.' *Journal of Industrial Relations* 24 (3): 406–423.
Lee, N. 2011. 'Are Innovative Regions More Unequal? Evidence from Europe.' *Environment and Planning C: Government and Policy* 29 (1): 2–23.
Lind, G., and R. Colquhoun. 2021. 'Analysis of Gender Segregation within Detailed Occupations and Industries in Australia.' *Australian Journal of Labour Economics* 24 (1): 47–69.
Luci, A. 2009. 'Female Labour Market Participation and Economic Growth.' *International Journal of Innovation and Sustainable Development* 4 (2/3): 97–108.
Makarevich, A. 2023. 'Workplace Gender Segregation in Standard and Non-standard Employment Regimes in the US Labour Market.' *British Journal of Industrial Relations* 61 (3): 697–722.
Mavrikiou, P. M., and J. Angelovska. 2020. 'The Impact of Sex Segregation by Economic Activity on the Gender Pay Gap across Europe.' *UTMS Journal of Economics* 11 (1): 1–12.

Mammen, K., and C. Paxson. 2000. 'Women's Work and Economic Development.' *Journal of Economic Perspective* 14 (4): 141–164.
Nelson, R. R. 1959. 'The Simple Economics of Basic Scientific Research.' *Journal of Political Economy* 67 (3): 297–306. http://www.jstor.org/stable/1827448
Ngai, R. L., C. Olivetti, and B. Petrongolo. 2022. *Structural Transformation over 150 years of Women's and Men's Work*. Unpublished Working Paper.
Pescarolo, A. 2019. *Il lavoro delle donne nell'Italia contemporanea*. Roma: Viella.
Psachropoulos, G., and Z. Tzannatos. 1989. 'Female Labour Force Participation: An International Perspective.' *The World Bank Research Observer* 4 (July): 187–202.
Reskin, B. 1993. 'Sex Segregation in the Workplace.' *Annual Review of Sociology* 19: 241–270.
Schumpeter, J. A. 1934. *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle*. Cambridge, MA: Harvard University Press.
Schumpeter, J. A. 1942. *Capitalism, Socialism and Democracy*. London: Allan and Unwin).
Sinha, J. N. 1967. 'Dynamics of Female Participation in Economic Activity in a Developing Economy.' In *Proceedings of the World Population Conference 1965. Vol. 4*, edited by United Nations. 336–337. New York: United Nations.
Song, Jae, David J. Price, Fatih Guvenen, Nicholas Bloom, and Till von Wachter. 2019 February. "Firming Up Inequality." *The Quarterly Journal of Economics* 134 (1): 1–50. https://doi.org/10.1093/qje/qjy025
Tam, H. 2011. 'U-Shaped Female Labour Participation with Economic Development: Some Panel Data Evidence.' *Economic Letters* 110 (2): 140–142.
Tooze, A. 2022. 'Welcome to the World of the Polycrisis.' *The Financial Times*, October 28.
Van Reenen, J. 1996. 'The Creation and Capture of Rents: Wages and Innovation in a Panel of U. K. Companies.' *The Quarterly Journal of Economics* 111 (1): 195–226.
Van Reenen, John. 2011. 'Wage Inequality, Technology And Trade: 21st Century Evidence.' *Labour Economics* 18 (6): 730–741. https://doi.org/10.1016/j.labeco.2011.05.006.
Viesti, G. 2001. 'I distretti nell'economia meridionale.' *Rassegna Economica* 65 (1): 37–48.
Watts, M. 1992. 'How Should Occupational Sex Segregation Be Measured?' *Work, Employment & Society* 6 (3): 475–487.
Zamagni, V. 1993. *The Economic History of Italy*. Oxford: Clarendon Press.
Zuazu, I. 2023. *Structural Change and Gender Sectoral Segregation in Sub-Saharan Africa*, Working Paper n. 1027, Levy Economics Institute.

Appendix

Table A1. Data used for the calculation of the gender segregation indexes

Years	Source of data	Variable	Note	Number of sectors
1951	Census (Istat)	Active population (10 years old and over)	Summing 1.03 (Hunting and fishing in inland waters) and 1.04 (Fishing in sea waters) in order to make the 1951 sectors comparable to the 1961 and 1971 ones	44
1961	Census (Istat)	Active population (10 years old and over)	Conversion tables were used to make the 1961 sectors comparable to the 1951 ones	44
1971	Census (Istat)	Active population (14 years old and over)	Conversion tables were used to make the 1971 sectors comparable to the 1951 ones	44
1981	Census (Istat)	Active population (14 years old and over)	No comparability	62
1992			Missing data for: 10: Mining of coal and lignite; extraction of	56

(*Continued*)

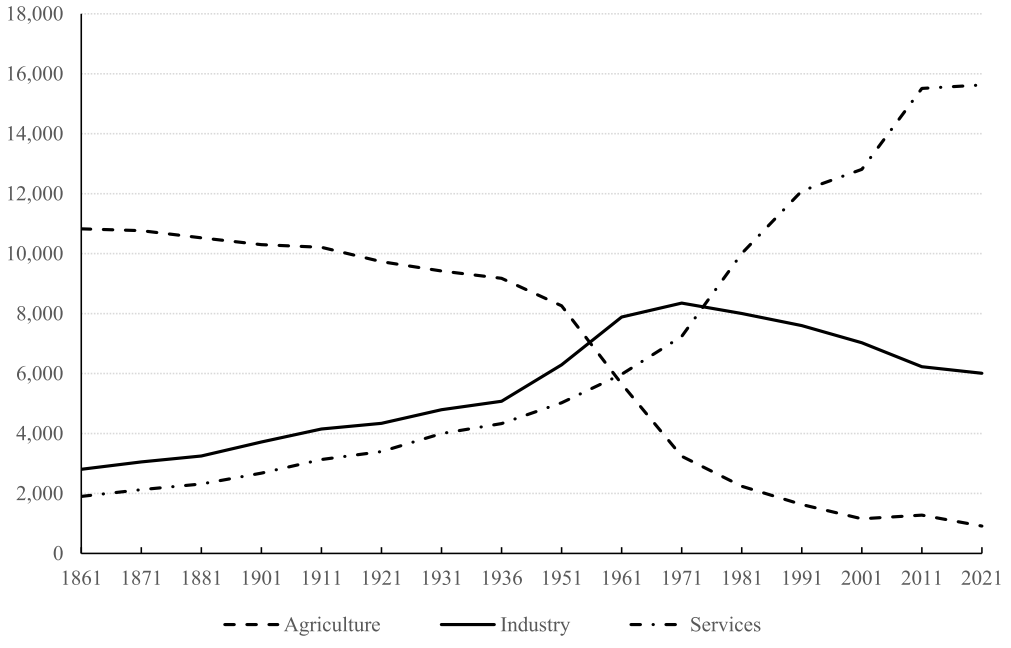

Figure A1. Active population/employment. Source: Istat (Census data). Note: The active population comprises the employed and the unemployed and excludes individuals seeking for their first employment. In the 1951 and 1961 Censuses the data on the active population pertained to individuals aged 10 years and over. From 1971 to 1991 the data referred to those aged 14 years and over. From 2001 onwards, the data pertains to individuals aged 15 years and over. The 2001 and 2011 Censuses do not include the 'active population' in their calculation, but rather employed people. Consequently, the comparison is not entirely comparable.

Table A1. Continued.

Years	Source of data	Variable	Note	Number of sectors
	Labour Force Survey (Eurostat)	Employed persons (15 years old and over) in NACE REV. 1 at two-digit level of economic activity	peat 12: Mining of uranium and thorium ores 13: Mining of metal ores 37: Recycling	
2001	Labour Force Survey (Eurostat)	Employed persons (15 years old and over) in NACE REV. 1 at two-digit level of economic activity	Missing data for: 10: Mining of coal and lignite; extraction of peat 12: Mining of uranium and thorium ores 13: Mining of metal ores 37: Recycling	56
2011	Labour Force Survey (Eurostat)	Employed persons (15 years old and over) in NACE REV. 2 at two-digit level of economic activity	Missing data for: 05: Mining of coal and lignite, 07: Mining for metal ores	86
2021	Labour Force Survey (Eurostat)	Employed persons (15 years old and over) in NACE REV. 2 at two-digit level of economic activity	Missing data for: 05: Mining of coal and lignite, 07: Mining for metal ores	86

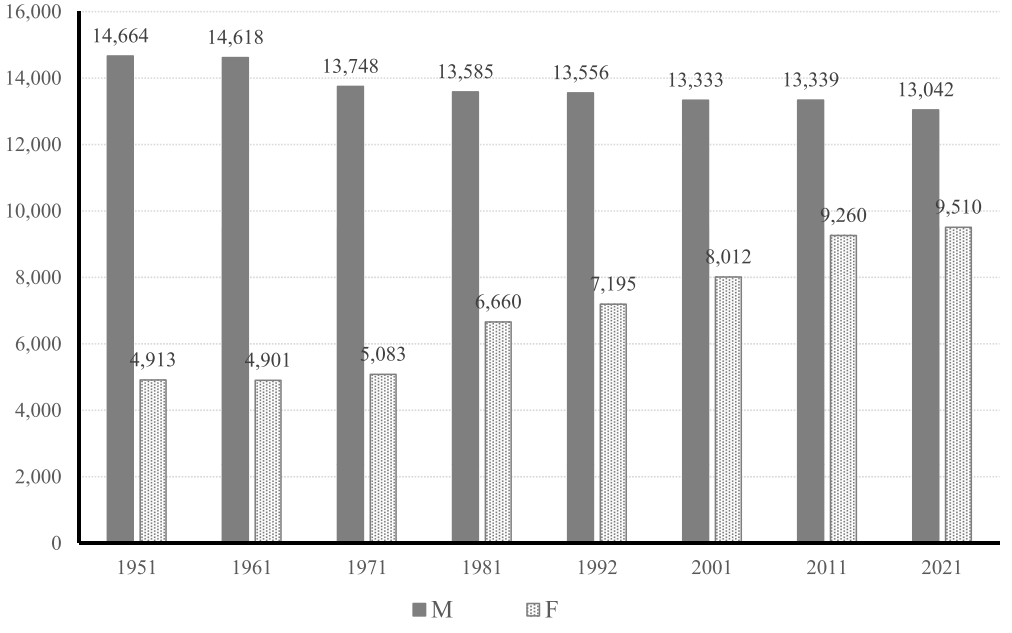

Figure A2. Active population/employment by gender. Source: Istat (Census data) for 1951, 1961, 1971, 1981 and Eurostat (Labour Force Survey) for the remaining. Note: The active population comprises the employed and the unemployed and excludes individuals seeking for their first employment. In the 1951 and 1961 Censuses the data on the active population pertained to individuals aged 10 years and over. From 1971 to 1992 the data referred to those aged 14 years and over. From 2001 onwards, the data pertains to individuals aged 15 years and over.