30TH INTERNATIONAL POPULATION CONFERENCE
13-18 JULY 2025
BRISBANE, AUSTRALIA

Occupational Trajectories of Women in STEM in Brazil

Mariana Eugenio Almeida
Simone Wajnman

1. Introduction

Despite significant advances in women's educational attainment over recent decades, gender disparities persist in science, technology, engineering, and mathematics (STEM) fields. Women remain underrepresented in both STEM education and STEM-related occupations, particularly in high-status and leadership roles. While a growing body of international literature has investigated gender inequalities in STEM, research focused on women's career paths in developing countries, including Brazil, remains scarce.

This paper seeks to contribute to the understanding of gender inequalities in the Brazilian labour market by examining the occupational trajectories of women with STEM backgrounds. Drawing on longitudinal administrative data from RAIS (Relação Anual de Informações Sociais), we adopt a life-course perspective to explore the heterogeneity of women's career paths and the structural barriers that limit their progression in STEM occupations.

Methodologically, the study combines sequence analysis and cluster analysis to construct a typology of occupational trajectories over a 14-year period. We then estimate a multinomial logistic regression model to assess how individual, occupational, and firm-level characteristics are associated with the probability of following each trajectory type. The findings provide new insights into the dynamics of gendered career mobility in STEM and highlight key factors associated with retention, mismatch, and exit from formal employment.

2. Theoretical focus

2.1. Gender and the labour market

In the second half of the 20th century, significant changes in gender relations had a profound impact on various dimensions of social life. In the world of work, the sharp increase in women's participation in the productive sphere brought new challenges to understanding the sexual division of labour—one of the most relevant transformations of the past century. The revolutionary nature of these changes, although incomplete and uneven, has been widely recognized in the literature, with implications that go beyond the economic, political, and demographic spheres, affecting gender ideals at a symbolic level as well (Goldin, 2006; Esping-Andersen, 2009; England, 2010; Goldscheider, Bernhardt & Lappegård, 2015).

Goldin (2006) characterizes this process in the U.S. context as a "quiet revolution," occurring in four phases—three evolutionary and one truly revolutionary. The transition from evolution to revolution marked a shift from static decision-making with limited or intermittent horizons to dynamic, long-term decision-making. The concept of "career" thus emerged in place of "job," with long-term planning and investment in human capital becoming central.

Esping-Andersen (2009), in turn, describes the gender revolution as "incomplete." He highlights the integration of women into the public sphere and identifies three major challenges for the new century: the ability of institutions to adapt to women's new roles; the preparation of children for a post-industrial economy; and demographic shifts, particularly low fertility and population ageing. However, this gender revolution remains incomplete and stratified, as it has primarily benefited highly educated, wealthier women.

Changes in gender relations affected not only the productive but also the domestic sphere. According to Goldscheider, Bernhardt, and Lappegård (2015), the first part of the gender revolution in industrialized countries began when women moved from the domestic sphere into the public sphere. This process was driven not only by growing demand for female labour but also by demographic changes that reshaped women's lives. The first part of the gender revolution, then, was marked by a dramatic rise in women's labour force participation, which weakened traditional family structures. The second part, in contrast, is defined by the increasing involvement of men in domestic and caregiving tasks, fostering greater gender equality in unpaid work.

Despite advances in women's participation in paid work, the idea that women's activities are less valuable remains largely unchanged. While women have been encouraged to take on "male" jobs, men have not been similarly encouraged to perform "female" tasks. Thus, gender egalitarianism is largely limited to women's upward mobility, with little impact on men (England, 2010).

This progress in female labour force participation has occurred in parallel with rising levels of women's education. International data show consistent increases in female enrolment, completion rates, and academic performance, particularly in higher education (OECD, 2017; UNESCO, 2018). In many countries, women now outperform men in educational indicators, a phenomenon that has reversed traditional gender gaps in some contexts.

However, educational gains have not automatically translated into better labour market outcomes for women (Goldin, 2024). Wage disparities persist, women remain concentrated in lower-status occupations, and face obstacles in accessing leadership positions. These barriers—though less visible—continue to operate forcefully, especially in the most valued, technical, and hierarchical fields, such as STEM.

While the literature on the gender revolution offers valuable insights, it remains limited in scope, often based on the experiences of industrialized countries. In Brazil, it is crucial to consider the specific historical context of labour market formation and structural inequalities that have shaped gender relations and women's work.

Brazil's labour force developed rapidly, driven by both population growth and rising female participation (Paiva, 1986; Guimarães, Brito & Barone, 2016). Women's economic engagement intensified in the 1970s and consolidated in the 1980s and 1990s. This process coincided with demographic changes that facilitated transformations in the private sphere (Bruschini, 1998; Lavinas, 1997; Oliveira, Vieira & Marcondes, 2015).

One key shift was the decline in fertility rates, which began before the 1930s and intensified in the 1970s with the introduction of birth control pills (Carvalho, Paiva & Sawyer, 1981). By the 1980s, a restrictive fertility pattern was established, falling below replacement level in the early 21st century. At the same time, Brazil experienced rapid urbanization, which profoundly altered people's lives. For women, urbanization extended their work beyond the family, individualizing their roles as workers and placing them centrally in care sectors like education and health, while services became the dominant sector in the labour market (Bruschini, 1994; Wajnman, 1998).

Women's growing participation in the labour market also transformed their profile. While the typical female worker in the 1970s was young, single, and childless, by the 1990s, the female labour force was mostly composed of older, married women with children (Hermeto, 2003). This generational shift reflects increased participation among married women.

Occupationally, Brazil's labour market saw a feminization of sectors such as education, health, and care work, while women's presence also expanded in traditionally male-dominated areas (Lavinas, 1997). Bruschini (1998) highlights women's increasing presence in management, particularly in administrative roles.

Bruschini and Lombardi (2000) described female employment in Brazil as "bipolar": concentrated at two extremes—low-wage, informal, precarious jobs on one side, and prestigious, well-paid, formal jobs on the other. Although more women have moved into the latter, many remain concentrated in undervalued sectors like domestic work, teaching, and care.

However, Lombardi (2006) later acknowledged that the bipolar model oversimplifies the diversity of women's labour market experiences and fails to capture contemporary dynamics such as the informalization of skilled jobs, symbolic exclusion within formal institutions, and persistent structural barriers to advancement.

Hirata (2002) offers the concepts of "double insertion" and "double presence" to describe how women, even as they enter higher-status occupations, remain burdened by unpaid domestic and care work. Similarly, Cavenaghi and Alves (2016) show that wage gaps, job instability, and career limitations persist even among highly educated women in qualified occupations—phenomena that elude binary classifications like the bipolar model.

Guimarães (2004) argues that Brazil's labour market is structured by "inequality frontiers"—a web of barriers that shape women's trajectories not only at the point of entry or in contractual terms, but through more subtle mechanisms of exclusion and segmentation, often operating within seemingly privileged occupational spaces.

2.2. Sexual Division of Labour and Occupational Segregation by Sex

The significant increase in women's labour force participation during the second half of the 20th century occurred in tandem with other processes, such as demographic changes, rising female educational attainment, and shifts in social values and gender norms (Guimarães, 2004). These developments have reshaped the contours of the sexual division of labour.

The French perspective introduced the concept of power and gender hierarchies as central to the analysis of inequality. Two core principles underpin this concept and guide research in the field: the idea that men's and women's work is divided, and the idea that this work is hierarchically ordered, with men's work considered more valuable (Kergoat, 2009).

In the productive sphere, these principles are expressed through occupational segregation, where men and women tend to concentrate in different occupations, jobs, and workplaces.

Hermeto (2003, p. 127) identifies four stylized facts regarding occupational feminization: 1. Men and women tend to be in different occupations; 2. Occupational segregation persists over time; 3. Wages decrease as the proportion of women in an occupation increases; 4. The negative relationship between wages and the proportion of women is stronger for men than for women.

A common explanation for the persistence of occupational segregation is the existence of gender stereotypes linked to specific occupations. These stereotypes, shaped by cultural beliefs about gender and work, define which tasks are deemed naturally suitable for men and women. Along with stereotypes about the skills required for specific jobs, they lead to the labeling of certain occupations as "male" or "female." This, in turn, reinforces occupational segregation and reproduces gender inequalities in the world of work (Hermeto, 1997). Gender stereotypes not only influence labour market entry choices but also shape long-term career trajectories.

Two primary mechanisms are generally used to describe the barriers women face in the labour market: horizontal segregation and vertical segregation.

- Horizontal segregation refers to the tendency of men and women to choose different fields of work. Social and environmental factors—such as family and schooling—reinforce the perception that girls are better suited to certain roles, especially care-related ones. This leads to a labour market strongly segmented by gender.
- Vertical segregation refers to the structural barriers that prevent women from rising to higher positions, keeping them in subordinate roles. The so-called "glass ceiling" is one such invisible barrier that privileges men's upward mobility while limiting women's career progression.

In STEM fields, both forms of segregation operate simultaneously: on one hand, women are underrepresented overall (horizontal segregation); on the other, when present, they tend to occupy lower-status or subordinate positions (vertical segregation). These barriers hinder women's full integration and advancement in scientific and technological careers. Even with significant educational gains, STEM remains a highly male-dominated occupational domain, suggesting that education alone does not guarantee equal opportunities in the labour market (Goldin, 2024).

The literature on occupational segregation is extensive and can be grouped, according to Anker (1998), into three main theoretical strands:

1. Neoclassical and human capital theories
2. Labour market segmentation theories
3. Feminist and sociocultural theories

Neoclassical approaches assume that labour markets are efficient and that the allocation of workers reflects individual productivity. Becker (1993), for example, developed the concept of human capital—the set of skills, knowledge, and experiences that increase an individual's productivity. From this perspective, gender inequality stems from women's lower investment in human capital, including lower levels of education, less work experience, and a preference for flexible jobs, given that women disproportionately bear the burden of unpaid care work. In this framework, career choices are seen as the result of individual decision-making on the supply side, but also reflect employer preferences on the demand side.

While these theories emphasize the importance of education, they overlook the fact that differences in human capital are largely socially constructed. Why do so few women pursue degrees in engineering or computing? Why are their employment histories more fragmented? The answers lie in structural processes of gender socialization, family and educational expectations, and institutional discrimination—factors ignored by neoclassical models. Moreover, these approaches fail to address both direct and indirect discrimination. Even when men and women have similar qualifications, wage gaps, hiring biases, and promotion barriers persist—especially in male-dominated fields like STEM (Anker, 1998).

Alternative perspectives, such as labour market segmentation theories, critique the notion of a single, efficient labour market. Instead, they argue that the labour market is divided into segments with varying degrees of stability, remuneration, and prestige. The primary sector includes formal, well-paid jobs with career opportunities, while the secondary sector includes precarious, low-wage, informal jobs.

The roots of segmentation are both economic and social—linked to gender, class, race, and education. According to Reskin and Roos (1990), gender segregation is shaped by a "dual queue" system: employers rank candidates by gender and race, while workers rank jobs by their aspirations and constraints. This interaction under unequal structures reinforces segregation.

Bergmann's (1986) crowding hypothesis argues that the forced concentration of women in a limited set of "female" jobs creates an oversupply of labour, driving wages down. This theory suggests that feminization leads to the devaluation of occupations, regardless of skill requirements or social importance.

Finally, feminist theories expose the patriarchal underpinnings of economic and social systems. These perspectives argue that "women's work" derives from gender stereotypes that associate women with qualities such as care, docility, or manual dexterity, while disqualifying them from roles linked to leadership, logic, or physical strength.

Anker (1998) categorizes these stereotypes as “positive” and “negative.”

- Positive ones (e.g., caring nature, honesty, appearance) channel women into roles like nursing, teaching, domestic service, and social work.
- Negative ones (e.g., aversion to risk, lower mathematical ability, reluctance to travel) justify their exclusion from engineering, physics, construction, and aviation.

These stereotypes not only shape men’s and women’s career choices but also inform hiring, promotion, and pay practices. In fields like STEM—long associated with masculinity, rationality, and technical competence—gender stereotypes are particularly entrenched, reinforcing structural exclusion.

2.3. Gender Inequality in STEM

Although the debate around STEM is relatively recent, the origins of the term date back to the late 19th century in the United States, with the enactment of the Morrill Act (1862), which established universities focused on agricultural science and later expanded to engineering programs. Over time, investments in STEM education extended beyond academia to shape the labour market.

In the 20th century, global events such as World War II and the Cold War accelerated scientific and technological progress, leading to increased international recognition of the strategic value of STEM fields. In 2001, the National Science Foundation (NSF) introduced the acronym SMET (Science, Mathematics, Engineering, and Technology), which was soon revised to STEM, a term that gained global acceptance. STEM fields have since been widely associated with innovation, inclusive growth, and sustainable development (UN Women, 2020).

In 2009, U.S. President Barack Obama launched the “Educate to Innovate” campaign to improve science and math achievement and strengthen the country’s global competitiveness. In his speech, Obama emphasized that reaffirming the United States' role as a global leader in science and innovation was essential to addressing the challenges of the 21st century (USA, 2009). Since then, STEM education has been a central pillar of American educational policy.

Gonzalez and Kuenzi (2012) argue that more recent concerns in the U.S. around scientific and technological skills reflect the growing importance of STEM education in securing long-term national prosperity. Since WWII, the U.S. has benefited from a highly skilled STEM workforce that supported both military and economic advancement. Today, STEM competencies are not just strategic but essential to global economic development and national competitiveness. However, the prestige and opportunities associated with these fields are unequally distributed—women remain underrepresented, particularly in high-status roles and leadership positions.

In OECD countries, aspirations to pursue careers in engineering or computing remain predominantly male. Fewer than 5% of 15-year-old girls say they want to work in these fields in the future. Boys express interest at almost four times that rate—meaning for every girl interested in a STEM career, there are about four boys (OECD, 2015). This signals a gendered divide in career expectations from an early age.

Globally, only 35% of STEM students are women (UNESCO, 2017). This underrepresentation is the result of cumulative disadvantages that begin with early socialization and schooling, continue through higher education, and are later reflected in labour market outcomes.

STEM occupations offer substantially higher wages than other fields. According to the U.S. Bureau of Labor Statistics (2025), the median annual salary for STEM professions exceeds USD 103,000, while non-STEM occupations average less than USD 50,000. This “wage premium” is largely appropriated by men. In the workforce, women make up only 29% of STEM professionals worldwide (World Economic Forum, 2023), a gap even larger than that seen in STEM education.

As described by UNESCO (2017b), the STEM population can be classified into two main groups:

1. Individuals who have formal education or training in STEM but are not working in STEM occupations;

2. Individuals who work in STEM occupations but lack formal education in STEM. The intersection of these groups comprises those who both studied and work in STEM.

Thus, gender inequalities in STEM span both educational and occupational trajectories, shaping the entire lifecycle of women's participation in science and technology. The following sections will examine the key factors that influence these trajectories—from early education through to labour market integration.

STEM Education

A range of factors influence girls' and women's participation, performance, and progression in STEM education, resulting in persistent gender gaps from early schooling to higher education. According to UNESCO (2017a), these factors can be grouped into four key dimensions: individual, family and peers, school environment, and broader societal norms.

1. Individual Factors

On the one hand, biological factors influence learning, cognition, and behaviour. However, neuroscience research shows minimal structural or functional brain differences between girls and boys that would explain distinct academic outcomes (Eliot, 2013). Evidence suggests that the brain's plasticity and environmental influences are far more important in shaping learning and educational achievement than any innate sex-based differences (UNESCO, 2017a). Genetic studies on linguistic and spatial abilities—key competencies for future STEM careers—have also pointed to environmental determinants, with no solid evidence of sex-linked genetic differences in cognitive ability.

On the other hand, psychological factors—such as self-concept and attitudes toward science—can affect educational and career choices. According to the OECD (2016), participation in science is partly shaped by how girls and boys perceive themselves and their attitudes toward scientific disciplines. Many studies cite self-selection bias as the main explanation for girls' lower representation in STEM. However, these choices are deeply influenced by socialization and gender stereotypes. Evidence shows that cultural messaging portraying STEM as a masculine domain discourages girls from entering these fields and negatively affects their academic and career trajectories (UNESCO, 2017a).

The 2012 PISA results showed a performance gap of 49 points in math and 37 points in science between boys and girls. In 2015, the OECD found that girls had lower self-efficacy in math and science than boys. Girls who internalize gender stereotypes tend to show lower confidence in their abilities, which in turn affects their performance and aspirations. Motivation, self-efficacy, and a sense of belonging are thus key determinants of STEM participation and persistence. Research also shows that girls' interest in STEM tends to decline with age, underscoring the importance of early interventions (UNESCO, 2017a).

2. Family and Peer Environment

Parental influence plays a major role in shaping children’s educational choices. Parents' beliefs, goals, values, and the environments they foster can strongly impact girls’ and boys’ engagement in STEM. Socioeconomic status and parental education levels are also major predictors of children’s performance in math and science. Additionally, having family members in STEM increases the likelihood that girls will consider similar career paths. Ethnicity, language, immigration status, and family structure are also relevant sociocultural factors. Finally, peer groups can influence girls’ motivation and sense of belonging in STEM environments.

3. School Environment

Three main factors stand out in the school context. First, teachers play a pivotal role in shaping student choices. Teachers who specialize in math and science can positively influence students' interest in STEM. For girls, having female teachers can be particularly empowering, as they serve as role models and help challenge gender stereotypes (UNESCO, 2017a).

Second, curricula and learning materials matter. The way textbooks depict male and female characters can reinforce or challenge gender stereotypes. Inclusive curricula that reflect shared interests and provide equal opportunities for investigation and practice are key to promoting equity.

Third, assessment practices often reflect and reproduce gender biases. Evaluation tools and processes may implicitly favour certain student profiles or perpetuate discriminatory assumptions, impacting girls' academic confidence and achievement.

4. Societal Norms and Culture

Social norms and cultural expectations play a central role in shaping how girls perceive their roles, abilities, and aspirations. According to UNESCO (2017a), the more gender-equal a society is, the more likely girls are to participate and succeed in STEM. Public policies and national legislation—such as financial incentives or affirmative action—can foster greater inclusion. Finally, media and social networks play an ambivalent role: they can either reinforce gender stereotypes or help dismantle them. The way women and men are represented in science-related content can shape children's and adults' beliefs about who belongs in STEM.

The STEM Labour Market

The factors that lead men and women to achieve different outcomes in the labour market—especially in STEM—are complex and vary across social, cultural, and economic contexts. Moreover, some factors play a greater role at certain life stages, affecting men and women differently over time.

Research on the evolution and dynamics of the STEM labour market has gained importance due to the growing demand for specialized workers in these fields. Therefore, beyond examining gender disparities that emerge during education, it is necessary to understand the specific characteristics of STEM employment and the mechanisms that contribute to gender segregation.

According to Xie (2006), gender gaps in the STEM labour market tend to be larger than those observed in education. Reducing disparities in higher education may only slightly narrow the gender gap in the STEM workforce. This suggests that the most significant barriers women face in STEM occur at the point of labour market entry and throughout their careers. In other words, women face not only challenges in entering STEM occupations but also in remaining in them.

In the U.S. context, using a longitudinal approach, Glass et al. (2013) identified distinct patterns of occupational mobility for men and women in STEM. Women were significantly less likely to remain in STEM careers, not because they left the workforce altogether, but because they transitioned to other fields and rarely returned to STEM. Retention challenges were found to be more intense early in women's careers. Family formation and education were major predictors of exit. Marriage had a negative effect on women's retention in STEM—except when women were married to someone also working in STEM, in which case the effect was positive. Surprisingly, greater investment in STEM education was associated with lower retention, increasing the likelihood of leaving STEM jobs.

Also in the U.S., Xu (2015) examined wage differences between men and women with higher education and found a significant relationship between women's past earnings and future gains in STEM. However, women's salaries plateaued roughly ten years after graduation—a phenomenon known as the glass ceiling, which often coincides with the reproductive phase of life.

Michelmore and Sassler (2016) investigated whether gender wage gaps in STEM careers in the U.S. stem from cohort effects or from the glass ceiling. Their results provided evidence for the glass ceiling effect in technology fields, but not in other STEM areas like life sciences, physical sciences, or engineering.

The workplace environment also plays a key role in explaining gender disparities in STEM. Glass et al. (2013) found that factors such as work hours, wages, and parental leave policies affect women's retention in both STEM and non-STEM fields. However, job satisfaction, employment stability, and age were stronger predictors of retention in non-STEM fields.

In terms of organizational culture, gender stereotypes often translate into prejudice and discrimination—especially in male-dominated environments like STEM. In these spaces, women are often seen as outsiders, which subtly undermines their performance and motivation, leading to long-term disadvantages (Sheridan, 1998).

Although STEM occupations generally offer higher wages, the gender wage gap persists. Michelmore and Sassler (2016) found that while the wage gap is smaller in STEM than in the broader labour market, differences still exist, particularly in engineering and technology—fields with the lowest female participation and the largest wage disparities.

Aguirre, Matta, and Montoya (2022) studied the effects of higher education in technology and engineering versus humanities and social sciences (HASS) in Chile. Their findings show that STEM degrees increase men's wages and employability significantly (by 81% and 30%, respectively), but do not have significant effects for women. The authors propose three possible explanations:

1. Women are less likely to graduate from STEM programs.
2. STEM education gives men greater access to high-paying male-dominated sectors, such as mining and construction.
3. The motherhood penalty is more severe in STEM fields than in HASS fields.

Lastly, employability in STEM can also be assessed through the lens of mismatch rates. Mismatch occurs when individuals work in occupations that do not match their field of study (horizontal mismatch) or for which they are over- or underqualified (vertical mismatch). According to Vecchia et al. (2023), STEM education is often highly specialized, which can make it harder for graduates to find jobs aligned with their training. As a result, specialization may increase the risk of horizontal mismatch (Skjelbred & Nesje, 2022).

Women in STEM in Brazil

Despite Brazil's economic growth during the 2000s and the expansion of higher education driven by public programs, few studies have addressed the STEM workforce in the country—particularly from sociological, demographic, and gender perspectives.

Maciente, Pereira, and Nascimento (2014) examined the spatial distribution of STEM-trained professionals in Brazil, using demand indicators to map the scientific labour force. Their data showed a concentration of STEM graduates in more populous mesoregions and in the Southeast and South of the country. Conversely, several regions in the Northeast, North, and parts of the South and Southeast became less specialized in

STEM professionals, possibly due to fewer public investments in higher education in those areas during the study period.

Although higher education expanded in Brazil between 2000 and 2010, STEM degrees grew at a slower pace than overall degrees (Maciente et al., 2014). Gusso and Nascimento (2014) found that from 2001 to 2010, engineering, production, and construction degrees grew faster than average, indicating a potential relative increase in the STEM labour force. The main economic sectors employing STEM professionals were construction, industry, agriculture, information and communication services, and public utilities (Maciente et al., 2014).

Schwartzan (2018) analyzed STEM education and employment in Brazil and identified three main features:

1. STEM-related jobs make up only a small share of the skilled labour force.
2. Only a portion of the education system prepares individuals for STEM careers.
3. Many STEM graduates end up working outside their trained fields.

From a gender perspective, the author highlighted stark inequalities. In 2014, women were the majority in higher education, especially in teaching, health, and social sciences—but they remained a minority in STEM, particularly in technical and managerial roles.

Schwartzan (2018) also observed that STEM graduates made up less than 10% of all higher education graduates in Brazil. Given the service-based structure of the Brazilian economy, this relatively low share is not unexpected. However, the expansion of higher education has not been accompanied by increased diversity or meaningful changes in the distribution of qualifications—most students are still concentrated in "social professions" (e.g., law, business, social sciences), with limited participation in STEM.

Bonini et al. (2020) analyzed STEM education and labour market trends using data from Brazil's Higher Education Census and RAIS. They found a 65.3% increase in STEM graduates from 2009 to 2017, compared to 17.7% growth in non-STEM fields. Women's participation in STEM degree programs rose from 30.8% to 35.4% in that period. However, women made up only about 20% of the STEM workforce, and STEM occupations represented just 0.79% of the total formal labour market in 2017.

These studies describe STEM in Brazil through the lenses of education and employment, while also highlighting gender disparities. Yet the evidence suggests a need for deeper analysis of women's participation in STEM, especially from a longitudinal and life-course perspective.

Lombardi (2006) explored gender boundaries in engineering in Brazil using data from the Higher Education Census and RAIS. In 2002, women represented just 15% of engineering jobs and 20% of engineering students. The author argued that engineering reproduces a gender order that classifies and ranks fields and roles according to gender, assigning different values accordingly.

She identified several informal "rules" that govern the gendered division of labour within engineering:

- Production and factory environments remain predominantly male.
- Women are more present in non-production labs, while men dominate labs involved in production.
- Women are more likely to work in technical assistance, consultancy, and client-facing roles.
- Fewer women hold executive and senior management positions.
- When in leadership, women are more likely to work in R&D, product development, and marketing.
- In production management and factory leadership—even in industries traditionally employing women, such as cosmetics—women are underrepresented (Lombardi, 2006: 199–200).

This suggests a horizontal and vertical resegregation of labour within engineering, echoing broader patterns in female employment.

Olinto (2011) emphasized the enduring gender gaps in scientific and professional fields in Brazil. Using data from the 2009 PNAD, she found clear gender segmentation: men dominated exact sciences, while women were concentrated in life sciences—indicating that women's gains in science and technology remained limited and targeted. Furthermore, gender wage gaps were larger in STEM than in the overall labour market, confirming that inequality widens with occupational hierarchy.

Tonini and Araújo (2019) used data from the Higher Education Census to demonstrate strong horizontal segregation, with women concentrated in humanities and social sciences, gender parity in biological and health sciences, and male dominance in engineering. The authors highlighted the underrepresentation of women not only in the STEM labour market but also in STEM academia, and stressed the importance of national policies—such as those promoted by CNPq since 2005—to reduce these gaps.

Miranda (2021) analyzed female underrepresentation in STEM using data from the Continuous PNAD. Results confirmed persistent gender inequalities in labour market participation and earnings. Survival analysis showed that women in STEM tend to leave the field earlier than men, and that this disparity is more pronounced in STEM than in non-STEM areas. Interestingly, STEM professionals overall were less likely to experience unemployment than those in other fields.

Machado et al. (2021a) explored Brazil's STEM labour market through a gender lens using RAIS and Continuous PNAD data. They found that Brazil's STEM workforce is eight times smaller than that of the U.S., with no significant growth between 2003 and 2019. However, gender disparities were similar: women represented 24% of the U.S. STEM workforce and 26% in Brazil.

In Brazil, STEM workers are more educated—67% held higher education degrees in 2019, compared to 22% among all formal workers (Machado et al., 2021a). The authors found no major changes in women's overall participation in STEM but noted growth in some fields (e.g., architecture, engineering, physical and life sciences) and declines in others (e.g., education, mathematics). This heterogeneity is often masked by aggregate data.

They also observed a widening gender gap in formal employment, but a narrowing gender wage gap. Machado et al. (2021b) conducted qualitative interviews with 12 women in STEM at different career stages. Key barriers included the double burden of work and care, male-biased performance evaluations, and gender stereotypes that limit women's progression.

Machado et al. (2022a) analyzed STEM wage premiums over the life cycle using Brazil's 2010 census. They found a 12.2% wage premium for STEM graduates—lower than other fields like medicine (75.5%) and law (36.6%), and lower than in countries like the U.S. and Canada. STEM subfields were also unequal: graduates in engineering and architecture earned a 35% premium, while those in computing, mathematics, and life sciences earned just 4.8% and –15.7%, respectively. These differences reflect a fragile school-to-work transition in Brazil's STEM pipeline. Gender gaps in educational returns were minimal, but female STEM workers had shorter career durations.

Finally, Machado et al. (2022b) found that Brazil's gender wage gap in STEM has declined across generations, mirroring trends in the broader labour market. However, occupation and firm characteristics explain about 35% of the STEM wage gap—a higher share than in the formal labour market overall.

In summary, the Brazilian literature on women in STEM is still emerging, but it reveals important insights:

1. Women's participation in STEM—both in education and work—is low and grows only in specific fields like engineering.
2. STEM careers in Brazil offer smaller wage premiums, suggesting a weak transition from education to employment.
3. STEM fields are highly heterogeneous, requiring disaggregated analysis.
4. There is a lack of longitudinal evidence focusing on women's trajectories over time.

3. Data and research methods

This study relies on longitudinal data from the Brazilian Annual Social Information Report (RAIS), covering the period from 2010 to 2023. We restrict the sample to individuals who were aged between 21 and 24 years old in 2010. The analysis is conducted separately for men and women in order to explore gendered patterns of occupational trajectories of individuals who started working in STEM areas.

We develop an occupational classification that allows measuring the STEM workforce in Brazil, based on the Brazilian Classification of Occupations. We also classificate the others higher level occupations in the three groups: Care; Humanities and Others (Box 1). The remaining occupations are classified as Technical and Basic level occupations.

Box 1: Classification of high level occupations

General category	**Specific category**
STEM	Natural sciences Technology Engineering Mathmatics
Care	Education Health Services
Humanities	Human sciences Applied social sciences Linguistics, letters and arts
Others	Agriculture, forestry, fishing and veterinary Air, sea and river navigation Business and administration Services

Our empirical strategy consists of two main stages. In the first stage, we apply sequence analysis to map and describe individuals' occupational trajectories over a 14-year span. Each trajectory is represented as a sequence of yearly states, corresponding to the individual's main occupational position in a given year. States are defined based on occupational categories coded using the Brazilian Classification of Occupations (CBO-2002) and aggregated into broader groups, such as STEM occupations, care-related jobs, humanities, technical positions, and informal or no labor market attachment.

We compute dissimilarity measures between sequences using the Optimal Matching (OM) algorithm with transition-rate-based substitution costs and an indel cost of 1. Based on these distances, we perform a cluster analysis using the CLARA (Clustering Large Applications) algorithm to derive a typology of occupational trajectories, identifying recurring patterns of career mobility. The number of clusters is chosen based on quality metrics such as the Average Silhouette Width, the Davies-Bouldin index, and cluster stability measures.

In the second stage, we estimate a multinomial logistic regression model in which the dependent variable is the trajectory type (cluster) obtained in the first stage. The model examines how individual characteristics, such as educational level, race, motherhood, region of residence, and job characteristics, such as firm size, legal status, sector, and wages, are associated with the probability of following each trajectory type. The model allows us to assess the extent to which social and labor market factors shape distinct career pathways for women in Brazil. All analyses are conducted using R, particularly with the TraMineR, WeightedCluster, and nnet packages.

4. Results

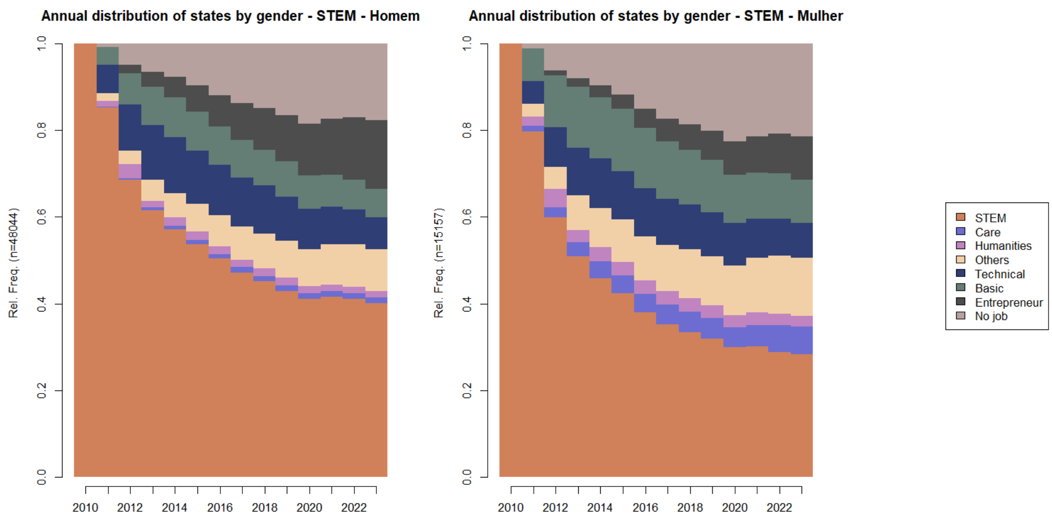
Figure 1 presents the annual distribution of occupational states from 2010 to 2023 for men and women who were initially working in STEM occupations. The charts display the relative frequencies of each occupational category over time, highlighting gendered differences in career dynamics.

Among men, there is a dominant persistence in STEM occupations, with a gradual decline from near-total prevalence in 2010 to about 45% in 2023. As time progresses, transitions to technical and entrepreneurial activities become more common, along with some increase in movement to basic-level occupations and non-employment. Nonetheless, a relatively high proportion of men remain in STEM throughout the period.

In contrast, the panel for women shows a more pronounced exit from STEM fields. The proportion of women in STEM occupations falls to below 35% in 2023. Concurrently, there is a significant increase in transitions to care-related, humanities, and basic-level occupations, reflecting horizontal and vertical occupational mismatches. Women's trajectories are also marked by higher shares in entrepreneurship and non-employment, particularly in the later years.

These results illustrate substantial gender asymmetries in career persistence within STEM. While men are more likely to sustain a trajectory in STEM or transition to similar technical fields, women more frequently move into occupations traditionally coded as female or exit the formal labor market altogether. This divergence reflects structural gender inequalities in occupational mobility and retention in scientific and technological careers.

Figure 1: Annual distribution of occupational states by gender, Brazil – 2010 to 2023



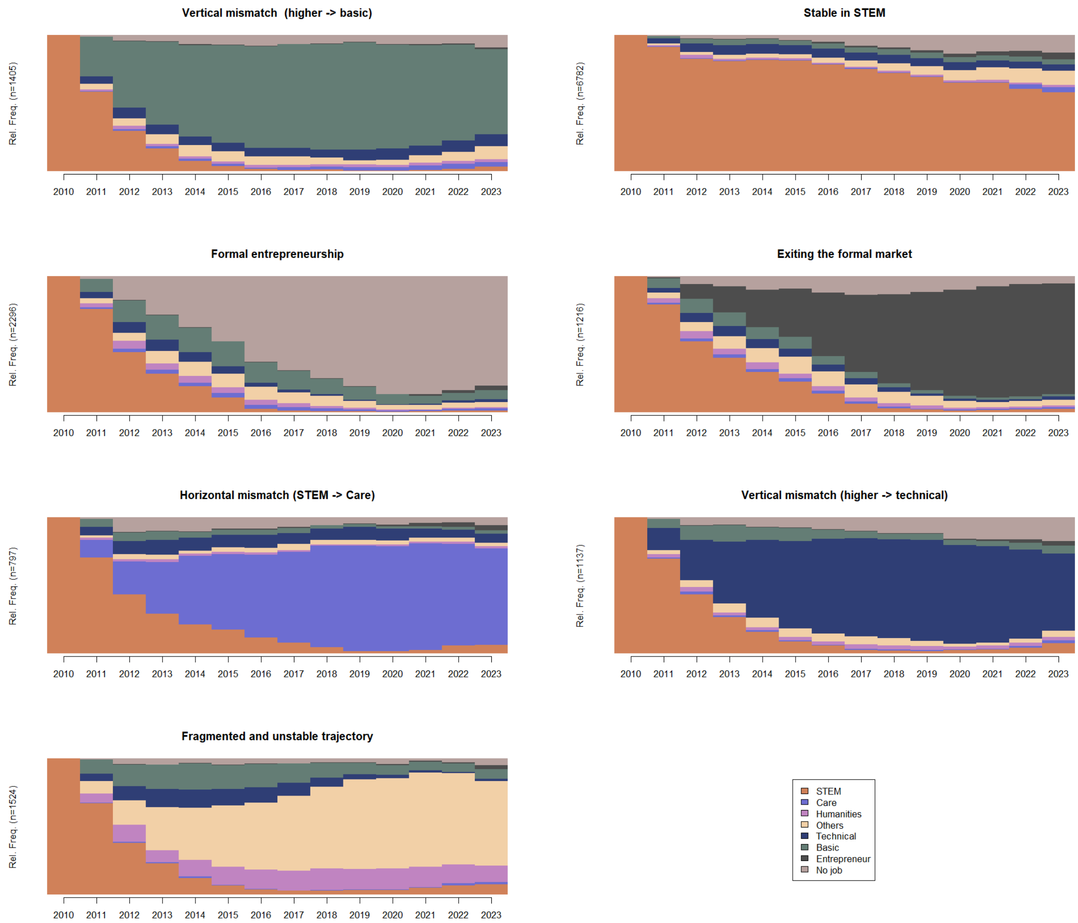
Source: RAIS/MTE. Self-elaboration.

Figure 2 displays the annual distribution of occupational states from 2010 to 2023 across the seven trajectory types identified through sequence and cluster analysis. These clusters represent distinct patterns of occupational mobility and (in)stability among women who began their careers in STEM.

- **Stable in STEM:** This cluster comprises women who maintained continuous employment in STEM occupations throughout the period. While some transitions to other states occur over time, particularly to technical or entrepreneurial roles, the majority remain in STEM, indicating a trajectory of professional stability and retention in the field.
- **Vertical mismatch (higher → basic):** Women in this group experienced early exits from STEM and moved into basic-level jobs, often characterized by lower skill requirements and earnings. From 2013 onward, the share of women in this group working in STEM declines sharply, replaced mostly by basic and informal employment.
- **Vertical mismatch (higher → technical):** These women transitioned from higher education-level STEM occupations into technical roles, which typically require fewer qualifications. Although technical work becomes the dominant state over time, a portion of individuals also experience transitions to entrepreneurship or basic occupations.
- **Horizontal mismatch (STEM → Care):** This trajectory is marked by a progressive shift from STEM into care-related occupations, traditionally feminized sectors such as education, health, and social work. The shift is gradual but consistent, and by the end of the period, the majority are employed in care roles.
- **Formal entrepreneurship:** Women in this group transition out of formal employment in STEM early in their careers and increasingly engage in entrepreneurial activities, including formal self-employment or provision of services as legal entities. This trajectory reflects a search for autonomy or escape from structural barriers in traditional employment.
- **Exiting the formal market:** This group is characterized by increasing detachment from the formal labor market. Over time, many women in this cluster are either without formal employment or in informal arrangements, highlighting a process of marginalization and potential discouragement.
- **Fragmented and unstable trajectory:** These women experience frequent transitions across different labor market states, with no dominant occupation over time. The trajectory is marked by instability, high volatility, and movement between informal

work, care, and other low-status occupations, revealing precarious and discontinuous labor market insertion.

Figure 2: Annual distribution of occupational states by clusters for women, Brazil – 2010 to 2023



Source: RAIS/MTE. Self-elaboration.

Taken together, these patterns reveal a complex and unequal landscape of occupational mobility among women in STEM. While a subset maintains stable careers in science and technology, a significant share experiences downward or lateral mobility, often into sectors that are undervalued or unstable. These findings underscore the intersection of gender and occupational structures in shaping career paths and highlight the need for targeted policy responses to support women's retention and advancement in STEM fields.

Table 1 provides a descriptive overview of the distribution of women across the identified trajectory types. The total analytical sample includes 14,077 women who graduated from higher education in 2009. Among them, 6,782 (48.2%) followed a trajectory of persistence in STEM occupations, while the remaining were distributed among other patterns such as horizontal and vertical mismatch, unstable careers, entrepreneurship, or exit from the formal labor market.

Women who followed STEM-persistence trajectories tend to have higher levels of education. While only 0.3% of this group had completed primary education or less, nearly 68% had completed higher education. In contrast, trajectories characterized by vertical mismatch or instability showed higher proportions of women with secondary education or incomplete tertiary education.

Among the women who experienced a horizontal mismatch (i.e., movement from STEM to care-related occupations), 12.5% had only a high school diploma, and 49.5% held a college degree. This type of trajectory often reflects occupational redirection towards gender-typed sectors. Vertical mismatch trajectories, where women moved from higher education-level jobs to technical or lower-skill positions, were also frequent: 1,137 women experienced a vertical mismatch to technical occupations, and 1,405 transitioned to basic-level jobs. These patterns indicate an underutilization of educational credentials in the labor market.

The “fragmented and unstable trajectory” cluster included 1,524 women (10.8% of the sample), with 13% of them having a college degree. These women frequently alternated between employment in other high education occupations and periods without labor market attachment. Similarly, 1,216 women were categorized under formal entrepreneurship or self-employment, and an equal number were classified under exit from the formal labor market.

These findings suggest substantial heterogeneity in career outcomes among women, even among those with similar levels of education. Educational attainment alone does not guarantee access to stable, well-matched STEM employment, pointing to the importance of other social and structural factors in shaping occupational trajectories.

Table 1: Descrptive statics by clusters, women

Variable>	Total		Stable in STEM		Horizontal mismatch (STEM -> Care)		Vertical mismatch (higher -> technical)		Vertical mismatch (higher -> basic)		Fragmented and unstable trajectory		Formal entrepreneurship		Exiting the formal market	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Total	**14.077**	**100**	**6.782**	**100**	**797**	**100**	**1.137**	**100**	**1.405**	**100**	**1.524**	**100**	**1.216**	**100**	**1.216**	**100**
Education																
Elementary or less	89	0,6	18	0,3	7	0,9	14	1,2	30	2,1	8	0,5	6	0,5	6	0,5
Complete or incomplete high school	1.594	11,3	435	6,4	100	12,5	169	14,9	449	32,0	201	13,2	120	9,9	120	9,9
Complete or incomplete higher education	12.334	87,6	6305	93,0	674	84,6	952	83,7	926	65,9	1309	85,9	1084	89,1	1084	89,1
Postgraduate	60	0,4	24	0,4	16	2,0	2	0,2		0,0	6	0,4	6	0,5	6	0,5
Race/color																
White/Yellow	11.767	83,6	4919	72,5	477	59,8	984	86,5	970	69,0	1.575	103,3	745	61,3	2.097	172,5
Black/Mixed/Indigenous	3.223	22,9	1187	17,5	139	17,4	323	28,4	385	27,4	367	24,1	195	16,0	627	51,6
Not identified	1.469	9,6	676	10,6	135	18,0	133	9,2	154	10,2	138	6,6	65	6,5	254	8,5
Children																
Yes	6.096	43,3	2.595	38,3	390	48,9	627	55,1	699	49,8	959	62,9	201	16,5	625	51,4
No	9.210	65,4	2.948	43,5	361	45,3	813	71,5	810	57,7	1.121	73,6	804	66,1	2.353	193,5
Region																
Southeast	10.307	73,2	3.866	57,0	411	51,6	980	86,2	935	66,5	1.553	101,9	622	51,2	1.940	159,5
South	2.151	15,3	762	11,2	140	17,6	216	19,0	207	14,7	239	15,7	180	14,8	407	33,5
Northeast	1.438	10,2	422	6,2	112	14,1	140	12,3	198	14,1	152	10,0	94	7,7	320	26,3
Central-West	990	7,0	350	5,2	45	5,6	82	7,2	131	9,3	99	6,5	86	7,1	197	16,2
North	420	3,0	143	2,1	43	5,4	22	1,9	38	2,7	37	2,4	23	1,9	114	9,4
Sector																
Services	10.994	78,1	4.078	60,1	620	77,8	957	84,2	1.057	75,2	1.500	98,4	665	54,7	2.117	174,1
Industry	2.323	16,5	830	12,2	72	9,0	306	26,9	213	15,2	322	21,1	143	11,8	437	35,9
Commerce	1.225	8,7	348	5,1	43	5,4	128	11,3	183	13,0	180	11,8	77	6,3	266	21,9
Construction	762	5,4	286	4,2	16	2,0	49	4,3	56	4,0	78	5,1	119	9,8	158	13,0
Size of firm																
Micro	2.302	16,4	690	10,2	120	15,1	234	20,6	235	16,7	276	18,1	232	19,1	515	42,4
Small	3.473	24,7	1.227	18,1	153	19,2	353	31,0	340	24,2	453	29,7	257	21,1	690	56,7
Medium	3.991	28,4	1.547	22,8	162	20,3	330	29,0	360	25,6	569	37,3	249	20,5	774	63,7
Large	5.540	39,4	2.079	30,7	316	39,6	523	46,0	574	40,9	782	51,3	267	22,0	999	82,2
Legal nature																
Private Company	12.786	90,8	4.478	66,0	419	52,6	1.223	107,6	1.331	94,7	1.887	123,8	884	72,7	2.564	210,9
State Company	352	2,5	279	4,1	6	0,8	8	0,7	6	0,4	17	1,1	11	0,9	25	2,1
Non-Profit Entities	1.079	7,7	384	5,7	134	16,8	121	10,6	66	4,7	106	7,0	70	5,8	198	16,3
Other	1.063	7,6	394	5,8	192	24,1	88	7,7	101	7,2	65	4,3	37	3,0	186	15,3
Individuals and other Legal Organizations	26	0,2	8	0,1		0,0		0,0	5	0,4	5	0,3	3	0,2	5	0,4
Type of employment relationship																
Private employee	14.195	100,8	5.157	76,0	576	72,3	1.349	118,6	1.384	98,5	2.010	131,9	961	79,0	2.758	226,8
Public employee	727	5,2	321	4,7	101	12,7	52	4,6	76	5,4	47	3,1	25	2,1	105	8,6
Other	384	2,7	65	1,0	74	9,3	39	3,4	49	3,5	23	1,5	19	1,6	115	9,5

Table 2 presents the results from a multinomial logistic regression model assessing the probability of women following alternative occupational trajectories, relative to the baseline category of stability in STEM. The results are reported as odds ratios, with significance levels indicated.

Educational level is strongly associated with trajectory outcomes. Compared to women with postgraduate degrees, those with incomplete or complete secondary education are significantly more likely to follow downward or mismatched paths, including vertical mismatch (to technical or basic), fragmented trajectories, and exits from the formal labor market. Women with only primary education are particularly overrepresented in vertical mismatch to basic jobs (OR = 3.71***) and formal entrepreneurship (OR = 2.73***), indicating educational underutilization.

Race does not show statistically significant effects across most trajectories. However, motherhood is associated with higher odds of horizontal mismatch to care (OR = 1.18**) and vertical mismatch to basic jobs (OR = 1.17**), and notably lower odds of entrepreneurship (OR = 0.31***) and leaving the labor market (OR = 0.28***), possibly reflecting constraints or preferences for job stability among mothers.

Regional variations emerge, with women in the North significantly more likely to experience vertical mismatch to technical jobs (OR = 0.36***), while those in the South and Center-West show lower odds of entering fragmented or mismatched paths. Employment in the industry and construction sectors is positively associated with vertical mismatches, whereas working in agriculture or commerce increases the odds of exiting the formal labor market.

Women employed in large companies are more likely to follow stable or upwardly mobile paths, while those in micro-enterprises face higher odds of labor market exit. Public sector jobs are consistently associated with lower odds of all alternative trajectories, signaling a protective effect. Meanwhile, other legal entities, such as informal or loosely regulated employers, are associated with higher risks of instability and mismatch.

Specific occupational fields also matter. For example, women trained in natural sciences and mathematics are more likely to stay in STEM or shift laterally, while those in technology are more prone to mismatch or instability. Occupations such as teaching in professional education or university lecturing are linked to higher odds of mismatch and entrepreneurship. Employment in managerial or research roles shows mixed associations, suggesting that even high-skilled jobs do not fully protect against instability.

Higher wages and longer job tenure significantly reduce the likelihood of non-STEM trajectories. The log of wages has a strong negative association across all alternative clusters, particularly for vertical mismatch to basic jobs (OR = 0.18***) and entrepreneurship (OR = 0.42***). These findings emphasize the role of economic incentives in career persistence.

Table 2: Results from a multinomial logistic regression model, women

Variable	Horizontal mismatch (STEM -> Care)	Vertical mismatch (higher -> technical)	Vertical mismatch (higher -> basic)	Fragmented and unstable trajectory	Formal entrepreneurship	Exiting the formal market
Intercept	469.69***	445.6***	22533.09***	0.91	373.12***	4.38***
Education						
Postgraduate	2.1*	0.48	0.05	1.76	2.2**	1.39
Complete or incomplete high school	1.07	1.44***	2.73***	1.41***	1.82***	1.46***
Elementary or less	1.5	2.29**	3.71***	1.19	2.73***	1.66
Raça/cor						
Black/Mixed/Indigenous	1.07	1.03	1.05	0.92	0.95	1.05
Not identified	0.81	1.03	1.04	0.92	0.93	0.8
Children						
Yes	1.18**	0.99	1.17**	1.07	0.31***	0.28***
Region						
South	0.86	0.82**	0.87	0.68***	0.86*	1.31***
Central-West	1.03	0.84	1.37**	0.68***	1.12	1.39***
Notheast	1.1	0.85	0.9	0.94	1.07	1.12
North	1.12	0.36***	0.78	0.73	1.47***	0.83
Sector						
Agriculture	0.04	1.92	2.33**	1.6	1.51	3.19***
Commerce	1.1	1.05	1.38***	1.17	1.16	0.99
Construction	1.08	1.09	1.31	0.78	1.2	1.96***
Industry	1.06	2.16***	1.4***	1.07	1.27***	0.95
Size of firm						
Large	1.17	1.1	1.73***	1.43***	1.21**	0.81**
Medium	0.95	0.9	1.34***	1.29***	1.23***	0.85*
Micro	1.09	0.99	0.82*	0.96	1.11	1.36***
Legal nature						
State Company	0.43*	0.19***	0.26***	0.22***	0.21***	0.25***
Non-Profit Entities	1.6***	0.97	0.79	0.63***	0.83*	0.98
Individuals and other Legal Organizations	0.11	0.03	0.63	1.42	1.04	0.52
Other	2.35***	0.78	0.41***	0.36***	0.4***	0.35***
Type of employment relationship						
Public employee	0.9	0.96	2.04**	1.09	1.51	1.67
Other	1.63*	1.23	1.68*	1.31	2.72***	2.34***
Specific occupational category						
Natural sciences	2.23***	1.39***	0.85	0.72**	0.75***	0.86
Mathematics	1.79**	1.35	2.67***	3.54***	1.54**	1.28
Technology	0.48***	0.69***	0.89	1.2*	0.68***	0.54***
Occupation type						
Managerial	2.52***	1.49**	2.66***	4.32***	3.11***	3.12***
Research	1.5*	1.66**	1.36	1.29	1.45**	0.56*
Teacher in vocational education	3.84***	2.3***	1.34*	3.24***	1.9***	0.83
Teacher in higher education	4.15***	1.09	0.79	1.7*	1.47*	1.52
Technologist	0.83	5.49***	2.77***	2.23*	1.73	1.13
Log of employment time	0.96	1	1.1***	1.02	0.9***	0.96
Log of remuneration	0.36***	0.36***	0.18***	0.71***	0.42***	0.77***
Number of contractual hours	0.98***	1	1.01**	1.02***	1	0.99*
R^2 McFadden	0,1053	0,1053	0,1053	0,1053	0,1053	0,1053
N	15.157	15.157	15.157	15.157	15.157	15.157

Conclusion

This study examined the occupational trajectories of women in STEM in Brazil, revealing substantial heterogeneity in their career paths and significant barriers to long-term retention in STEM occupations. Using sequence analysis, we identified distinct trajectory types that include vertical and horizontal mismatch, unstable employment, formal entrepreneurship, and exit from the formal labour market. These trajectories reflect not only the structural challenges faced by women in reconciling work and care responsibilities, but also the persistent influence of occupational segregation and gendered organizational cultures.

The results from the multinomial regression model underscore the relevance of factors such as education level, employment sector, firm size, and occupational type in shaping women's career outcomes. While higher education and managerial roles increase the likelihood of stable careers, care responsibilities and work in smaller or informal organizations are associated with greater instability and early exits from STEM.

Our findings reinforce the need for targeted public policies and institutional reforms to promote gender equity in STEM. These include expanding access to quality childcare, ensuring transparency in recruitment and promotion, supporting women's leadership in science and technology, and combating gender stereotypes throughout the educational and professional pipeline.

Ultimately, fostering inclusive STEM environments is not only a matter of justice and representation, it is also essential for leveraging the full potential of scientific and technological innovation in Brazil.

References

BONINI, P., CUSTÓDIO, C. F., DA SILVA, F., & OKAWATI, G. A. A. Formação e atuação profissional nas áreas STEM no brasil: Ainda temos pouco? In W. L. Linhares (Ed.), Desafios da educação técnico-científica no ensino m´médio (Vol. 2, pp. 252–263). Atena Editora, 2020.

BRUSCHINI, C. "Gênero e trabalho feminino no Brasil: novas conquistas ou persistência da discriminação? Brasil, 1985 a 1995". Comunicação apresentada no seminário "Trabalho e gênero: mudanças, persistências e desafios", Abep/Nepo, Campinas, 14-15 abr, 1998.

BRUSCHINI, C; LOMBARDI, M. R. A bipolaridade do trabalho feminino no Brasil contemporâneo. Cad. Pesqui. [online]. N.110, pp.67-104, 2000.

GUIMARÃES, N. A.; BRITO, M. M. A.; BARONE, L. S. Mercantilização no Feminino: a Visibilidade do Trabalho das Mulheres no Brasil. Rev. bras. Ci. Soc. [online]. Vol.31, n.90, pp.17-38, 2016.

LAVINAS, L. "Emprego feminino: o que há de novo e o que se repete". Dados, 40 (1): 41-67, 1997.

LOMBARDI, Maria Rosa. "Engenheiras brasileiras: inserção e limites de gênero no campo profissional". Em: Cadernos de Pesquisa 36.127, pp. 173–202, 2006.

MACIENTE, A. N., PEREIRA, R. H. M., & NASCIMENTO, P. A. M. M. A distribuição de profissionais técnico-científicos pelo território brasileiro em 2000 e 2010. Ipea, Texto para Discussão n 1927, 2014.

MACHADO; RACHTER; STUSSI; SCHANAIDER. Women in the STEM Labor Market in Brazil. Fundação Getúlio Vargas, 2021.

MACHADO; RACHTER; STUSSI; SCHANAIDER. LIFE-CYCLE WAGE PREMIUMS AND STEM IN BRAZIL. Fundação Getúlio Vargas, 2022.

OLINTO, G. A inclusão das mulheres nas carreiras de ciência e tecnologia no Brasil. Inclusão Social, v.5, n.1, p.68-77, 2011.

OLIVEIRA, Maria Coleta; VIEIRA, Joice Melo; MARCONDES, Glaucia dos Santos. Cinquenta anos de relações de gênero e geração no Brasil: mudanças e permanências. In: ARRETCHE, Marta (Ed.). Trajetórias das desigualdades: como o Brasil mudou nos últimos cinquenta anos. São Paulo: Editora Unesp; Centro de Estudos da Metrópole, 2015.

PAIVA, Paulo de Tarso A. Cinquenta anos de crescimento populacional e absorção da mão-de-obra no Brasil: de 1950 a 2000. Revista Brasileira de Estudos Populacionais, Campinas v.3, n.1, p. 63-86, jan/jun, 1986.

SCHWARTZMAN, S. Educação t´técnico científica no Brasil: Desafios e perspectivas. In: D. Foguel & M. Scheuenstuhl (Eds.), Desafios da educação técnico-científica no ensino médio (Vol. 1, pp. 11–20). Academia Brasileira de Letras, 2018.