How do restrictive reproductive laws impact women's workforce participation?

A comparative analysis between Canada and Sri Lanka

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Abstract

This study investigates how reproductive policy environments shape female labor force participation (FLFP) in two contrasting national contexts Canada and Sri Lanka. Through a comparative analysis, the study evaluates whether legal and institutional supports such as abortion access, contraception, and maternity protections influence women's participation in formal labor markets.

The study is based on panel data in 2013-2023 and takes a multi-methodology approach including descriptive statistics, Pearson correlation, difference-in-difference (DiD) estimation approach, Principal components analysis (PCA), Random Forest model, and the ARIMA forecasting method. In Canada, provinces with broad reproductive and parental policy (e.g. full coverage of early abortion, subsidized birth control, and ample paid leave) have had steadily higher rates of FLFP, especially among women 25-34, and in big cities. Conversely, Sri Lankan districts with anti-abortion policy and poor access to birth control methods showed poor FLFP, even though there are high degrees of female literacy.

The DiD model indicates that, globally, there was a decline in FLFP after 2018. However, progressive policy interventions in Canadian provinces helped mitigate this decline by 1.07per cent ($p = 0.002$). In contrast, Sri Lanka experienced no improvement during the same period, and in some cases, FLFP outcomes worsened. Findings made by PCA revealed that the fertility rates, maturity leave age, health spending, and access to digital finance help explained variance in FLFP in the two countries. Fertility and maternity protections were noted as the most influential according to Random Forest analysis. Correlations additionally depicted high negative relationships between fertility and FLFP ($r = -0.92$) and positive connections with health expenditure and electronic accommodation.

These findings can be interpreted through the lens of NHE, which suggests that favorable reproductive policies reduce the opportunity cost of childbearing, thereby supporting increased economic participation by women.

In Sri Lanka, legal restrictions, entrenched cultural norms, and the widespread dominance of informal employment collectively hinder women's participation in the formal labor force.

The research results indicate that legal change is needed but a full ecosystem of policies, such as telehealth and LARC subsidies and maternity insurance, will be necessary to establish gender equity in the labour market.

***Keywords**:* Female Labour Force Participation (FLFP), Reproductive Policy, New Home Economics (NHE), Comparative Policy Analysis

Introduction

The employment of women greatly enhances the growth of economics, equal rights, and the well-being of families at home (Gunatilaka, 2013, pp. 1). Even though women are getting more education around the world, their choices about having children and restrictive laws in many countries stop them from fully participating in the labour market (Hegewisch, 2011, pp. 120-122). Different rules about reproduction and social supports, seen in high-income countries, allow women to mix work and family life, whereas in low- and middle-income countries, absence of these rules means women cannot participate equitably in the workplace (Atay and Periver, 2025, pp. 9-12).

This study is interested in how laws on reproduction (RRL) impact women in the job market by using the cases of Canada, where women's reproductive and parental support rights are numerous, and Sri Lanka, where they have very limited reproductive option and supported parental care programs. Making use of Becker's NHE framework, we think that increased reproductive choice allows women to plan the timing of childbirth, which makes it easier to stay in or enter the workforce – leading to increased FLFP.

To support this argument, we use data from years 2013 to 2023 collected from 25 countries, studying their fertility, labour situations, health spending, and social structure. Our analysis integrates several tools: PCA and K-means clustering to recognize different policy regimes (Gunatilaka, 2013, pp.3, 8); Pearson correlation to examine two variable relationships; Difference-in-Difference (DiD) to estimate how policies impacts (Connolly et al., 2023, pp. 400); random forests models to give insights into the main factors influencing predictions; and ARIMA methods to assess fertility trends (Skadsen, 2017, pp.10-12).

This study uses both traditional econometric tools and machine learning to offer a strong and multi-faceted understanding of how reproductive-health frameworks influence the economic activities of women.

Following this introduction, the next section reviews theoretical and empirical literature linking reproductive autonomy and labor force participation, with a focus on the New Home Economics (NHE) framework. The methodology section then outlines the comparative design, data sources, and multi-method analytical strategy, including Difference-in-Differences (DiD), Principal Component Analysis (PCA), and machine learning models. The results section presents key findings from Canada and Sri Lanka, evaluating how reproductive policy environments influence women's economic participation. The paper concludes by discussing policy implications, limitations, and future research directions aimed at advancing gender equity through reproductive governance.

Literature Review

Theoretical Grounding – New Home Economics (NHE)

This study is guided by the New Home Economics (NHE) framework, which models fertility and female labor force participation as joint outcomes of household decision-making. According to Becker (1981), when women have less control over fertility due to restrictive reproductive laws (RRL) the opportunity cost of childbearing rises, often limiting their participation in the workforce.

While some alternative perspectives such as Sen's Capabilities Approach emphasize broader social conditions, the dominant empirical pattern supports a negative relationship between restrictive reproductive policies and women's labor force outcomes (Atay and Périvier, 2025, pp. 10-13).

NHE presents a basic view of how economic constraints shape household decisions on fertility, female employment, and human capital. Contemporary experts have pointed out that the method pays too much attention to rational choice. Atay and Périvier (2025, pp. 1-2) believe that the typical framework of "free choice" leaves out important aspects involving reproductive decisions. They suggest that a capabilities approach shows that women's opportunities (in an area like education, jobs, or reproductive health) depend on the details of their social setting and cannot always be described by simple choices. The NHE focuses only on what happens at the production boundary, but Kotiswaran (2014, pp. 5-6) believes that labour done for payment in the fields of reproductive surrogacy or sex work is no different from unpaid home production. It still considers the main NHE trade-offs, placing them within the broader context of various pressures (norms and policies) that families face when deciding whether to have children and when to work.

Despite valid criticisms, particularly its rational choice bias and lack of attention to structural concerns, NHE remains a useful analytical framework for this study. It yields a testable causal mechanism, linking reproductive agency and labour force participation via opportunity costs that is susceptible to quantitative verification. However, rather than using NHE in an individualistic form, this study applies it within a policy-comparative context, recognizing that the opportunity structures households face are themselves shaped by law, culture, and access to services. By embedding NHE within an intersectional and institutional analysis, the study acknowledges that reproductive decisions are not made in a vacuum and adapts the model to reflect the complex realities women face in Canada and Sri Lanka.

Fertility and Labor Force Participation

Numerous studies have looked at how fertility rates relate to women's employment, trying to understand whether having many children actually stops women from participating in the labour market. Lots of cross-national and longitudinal studies confirm a link in which higher fertility leads to a decrease in women's participation in the workforce. As shown by Ahn and Mira (2002, pp. 2), in OECD nations during the 1970s, when fertility was higher, women were less likely to take part in the labour market

Over time, the relationship between fertility and female labor force participation has evolved, influenced by shifting policy environments, social norms, and economic development.

By the late 1980s, some high-income countries particularly within the OECD began to exhibit a positive relationship between fertility and female labor force participation (Ahn & Mira, 2002). This shift is attributed to supportive family and labor policies that allowed women

to balance work and parenting more effectively (Engelhardt et al., 2004). However, this reversal was not universal: within-country studies such as Kögel (2003) showed that the negative correlation persisted in many national contexts. In this study, Canada reflects the newer pattern of low fertility alongside high FLFP, likely due to strong policy supports, whereas Sri Lanka continues to exhibit the classical trade-off, with higher fertility linked to lower workforce engagement.

In certain circumstances (such as supportive rules or community developments), having a job can lead to higher fertility in women. Using macro-level time series analysis, Engelhardt et al. (2004, pp. 3–8) find evidence of a bidirectional relationship between fertility and female employment up until the 1960s. This means that too many children might lower a woman's ability to work and adjustments in women's jobs can also affect if or when they decide to have children. The authors found that the relationship was primarily long-term and evident until 1980 and after this, variations and changes across countries happened as more childcare and other actions were taken to address work-life conflicts.

Researchers studying causality have used methods that build and provide insights into foundational correlations. Many studies make use of natural experiments and the instrumental variable (IV) approach. Agüero and Marks (2011, pp. 4-8, 16-19) measure how many hours a women works per week using changes in infertility levels as an IV in several developing countries. According to their IV approach, when other variables are controlled, having kids had little impact on working – quite the opposite from what standard regression models show (likely because such models do not adjust for how and when women decide to enter the workforce). Alternatively, according to Skadsen (2017, pp. 20-24), having legal access to contraception caused women to have smaller families and go to work and earn more. This evidence shows that

assessing the effects of work on fertility depends on both the context (level of development, existing fertility) and the methods used.

Many studies highlight unplanned or adolescent fertility typically defined as births occurring among young women aged 15 to 19 as a key barrier to labor market participation. Early childbearing often interrupts education and limits work experience, reducing long-term employment opportunities. Although this study does not include a dedicated analysis of adolescent fertility, the broader literature indicates that unplanned pregnancies during these formative years can significantly disrupt educational and career pathways. In Canada's Indigenous communities, for example, elevated adolescent pregnancy rates rooted in systemic barriers have been shown to negatively affect long-term employment prospects (Miller, 2023, pp. 22–24).

In addition, better access to abortion and contraception policies affecting unplanned births has been consistently linked to improved labor outcomes for women (Skadsen, 2017; Lamberti, 2022; Miller, 2023). Studies suggest that when women are able to delay childbirth through family planning or pursue higher education, they are more likely to work longer hours and earn higher incomes over time (Skadsen, 2017; Miller, 2023; Harkness & Waldfogel, 1999). In general, empirical analyses show that higher fertility rates reduce women's labor force participation, although this relationship varies depending on institutional and policy contexts (Ahn & Mira, 2002; Engelhardt et al., 2004). Where institutional supports are lacking, the negative impacts of fertility on women's employment are more pronounced but can be mitigated through supportive policies such as paid leave and affordable childcare (Connolly et al., 2023; Baker & Milligan, 2008; Lefebvre et al., 2008). Cross-national panel studies, childbirth event analyses, and instrumental variable (IV) approaches further confirm that the effects of fertility on

women's employment trajectories are highly contingent on the policy and social environment (Skadsen, 2017; Agüero & Marks, 2011; Engelhardt et al., 2004; Connolly et al., 2023).

Reproductive Autonomy and Contraceptive Access

Economic themes in the literature often focus on the consequences of women being able (or not) to control their family size through contraception and access to abortion options. Many studies demonstrate a relationship between increased reproductive choice and better education, job opportunities, and income for women. Using contraceptives ("the Pill") in the mid-20th century, as economists note, was important for more women to pursue education and employment. These conclusions are supported by several key studies, including Skadsen (2017), who found that legal access to contraception led to smaller families and increased labor force participation; Lamberti (2022), who demonstrated how cost barriers disproportionately affect racialized and Indigenous women; and Miller (2023), who identified systemic barriers to contraceptive access among Indigenous communities in Canada.

How much contraception costs emerges as a key issue in shaping women's economic behavior a direct reflection of the opportunity cost of fertility within the NHE framework. Lamberti's study (2022, pp. 10–12) explains why many Canadian women, particularly racialized and Indigenous women, may not consistently use effective contraception due to financial and structural barriers. These constraints increase the likelihood of unplanned pregnancies and, in turn, raise the cost of pursuing education and employment. According to NHE logic, this reduces women's ability to optimize labor participation due to heightened childcare demands and fewer resources to invest in human capital. Skadsen (2017, p. 24) also demonstrates that greater access to long-term birth control methods such as sterilization reduces fertility rates and supports

continuous workforce participation, underscoring how enhanced reproductive autonomy lowers barriers to labor supply.

Beyond contraception, access to abortion also plays a critical role in women's economic trajectories. Miller (2023, pp. 2–3, 9–10, 22–24) finds that despite legal abortion in Canada, many Indigenous women face geographic, cultural, and policy barriers that reduce substantive access revealing how legal access alone does not translate into lower opportunity costs for marginalized groups. In Sri Lanka, where abortion is legally restricted to life-saving circumstances (Suranga et al., 2023, p. 146), women in factory settings were often unaware of safe abortion options and resorted to unsafe procedures. These limitations result in women exiting school or employment, highlighting how restrictive laws elevate the direct and indirect costs of childbearing, consistent with NHE predictions.

From a structural standpoint, this literature also supports the idea that fertility-related decisions are not made in isolation, but are deeply embedded in institutional contexts, as NHE has more recently been adapted to acknowledge. Studies using longitudinal and event-based data show that when women control when to have children, they experience better lifetime earnings and labor continuity benefits that reflect household optimization under reduced constraints. These patterns are seen not only in Canada and Sri Lanka but in international comparisons as well.

Importantly, Graham et al. (2022, pp. 4–5) offer an intersectional critique, showing that even progressive reproductive policies can reinforce inequality when access is stratified by class or geography. This nuance aligns with extended interpretations of NHE, where household-level decisions are shaped by uneven institutional access, cultural norms, and economic inequality. In sum, reproductive autonomy through affordable contraception and legal, accessible abortion

reduces the cost of fertility-related interruptions and enables women to make long-term educational and career investments, a central mechanism in the NHE framework.

Formal vs. Substantive Equality

Formal equality refers to the legal principle that individuals are treated equally under the law, regardless of gender, race, or background ensuring the same legal rights and protections for all. Substantive equality, by contrast, focuses on whether individuals can meaningfully access and benefit from those rights in practice, considering structural and social barriers (Miller, 2023; Haintz et al., 2023). In the context of reproductive and labor policies, this distinction becomes crucial: while laws may formally guarantee equal access to healthcare or employment, real-world constraints such as income, location, or cultural norms may prevent women from exercising these rights. This section draws on the NHE framework by demonstrating that opportunity costs and labor supply decisions are not shaped solely by formal legal conditions, but by actual access to resources and services, making substantive equality a necessary condition for real economic empowerment (Atay & Périvier, 2025; Gunatilaka, 2013).

It is often stressed that women can have the same rights afforded to men in law but not necessarily benefitting from power and outcomes. Many studies have found that women's legal rights – for working, voting, owning property or receiving services – do not equal true empowerment. For example, according to Miller (2023, pp. 22-24) despite laws in Canada ensuring everyone the same right to healthcare, Indigenous women are still caught in structural obstacles that prevent them from getting abortion care. Some reasons are that federal and provincial regulations don't always match, historic mistrust in Canada's medical services is due to colonialism and poverty. It means that legality ("equality before the law") can exist without

physical or monetary equality. Reproductive rights are limited for Indigenous women, whether the laws allow it which negatively impacts both their health and ability to earn money.

Research involving a range of people and using qualitative methods show this point as well. Haintz et al. (2023, pp. 128-131) examine policies in Australia and see that whilst many policies seem fair to all genders, they do not accommodate marginalized groups in society. Victorian state policies in Australia tend to ignore or overlook aspects such as race, class or rural status which leaves certain groups of women outside of the system. Even if a registration law helps women enter business, if it doesn't support women's education or their ability to get loans, the benefits will be only for a small group. Haintz et al. (2023, pp.132) observe that if women from varied backgrounds are not present in policymaking, the outlook is likely to overlook the needs of different groups and remain focused on privileged women's needs. So, although policies on the books say everyone is equal, in practice, inequality still exists since the main social and economic problems are not handled. International labour studies also consider the debate about formal vs. substantive equality. According to Gunatilaka (2013, pp.2) report, women make up a greater proportion of informal and unstable jobs around the world. Even if the law requires equal pay and maternity leave, those in unorganized work (e.g., domestic workers, vendors, freelancers) cannot make use of these rights. For example, in South Asia, only about 20% of women in non-agriculture jobs benefit from labour laws, while the rest are not covered. It underlines the fact that women remain unequal under the law until they receive protections in informal employment or have chances to join formal employment. Similarly, qualitative studies in South Asia, as shown by Kalansooriya and Chandrakumara, 2014 (pp. 46-48), in rural Sri Lanka, find that strong gender roles and family traditions can counteract legal rights. Women are still expected to ensure food security for their families and do unpaid work around the home which leaves them little chance to benefit from opportunities in education or work.

Citing research in Sri Lanka, Amirthalingam and Lakshman (2012, pp.34-35) add that female-headed households already get paid much less, but women who run them lose on average 76% of their income after a crisis (compared to 80% for the men) and they become much more likely to fall below the poverty line than men did. Because gold jewellery is very liquid, more women sold or mortgaged their jewels to manage basic expenses and migration which saved their families for now but gradually decreased what could be passed on to younger family members. Also, traditions and norms prevented women from running sewing and other rural workshops from home, giving men more opportunities to look for formal jobs and helping them close the economic gap (Amirthalingam and Lakshman, 2012, pp.32-37). Adding to this, Jayasinghe (2019, pp.13) adds that in stable times, Female-Headed Households (FHH) in Sri Lanka experience consistent structural shortages: for the same period in the two surveys in 2012/13, the FHHs had a higher likelihood of being poor (1.31%) compared to MHHs (0.63%). The risk profile is higher for Tamils than Sinhalese: there were 2.3% poor Tamil FHHs, while the proportion was 1.9% among Sinhala FHHs in 2012/13. By counting per-adult for household expenditure, Jayasinghe discovers that FHHs faced more pressing financial difficulties and ended up with lower amounts spent (Rs.14,587 vs Rs. 16,287 for MHHs in 2012/13), suggesting that this category struggled just as poverty dropped (Jayasinghe, 2019, pp.21). For this reason, laws that support equality can still fail because cultural barriers, looking after relatives and working remotely can make it difficult for women.

All in all, the evidence indicates that having equal rights in law is required, but not enough on its own to lead to meaningful empowerment. Changes in the law, for example, permitting women to open accounts, inherit property or use reproductive health services, make real differences. Hence, taking concurrent action to address problems and level the playing field – by improving services, tackling discrimination and including women in designing laws – is

necessary for those rights be realized. Researchers urge that we build bridges by considering how laws are put into action and working on intersectionality. Both Miller (2023, pp.2) and Haintz et al. (2023, pp.127) state that for equality to mean something for different women, laws need to consider their actual situations, not just apply the same rules to all. This point shows why certain policies may not lead to equal outcomes for women in the workplace and it indicates that regular reviews and consideration for all are necessary.

Maternal Policies and Child Penalties

A large part of the literature looks at how maternal and family policies can either help lessen (or worsen) the issues related to the "child penalty" women often encounter after having children. The birth of a child usually results in mothers' work becoming less plentiful, their pay falling and slow wage rises after giving birth, but it typically does not greatly affect fathers' work lives. Because of the motherhood penalty, males and females do not earn the same amount of money at work. Though, studies in Canada and Europe prove that paid leave and subsidized care benefits can serve as a buffer to these issues.

The latest Canadian study using data from administrations was conducted by Connolly et al. (2023, pp.406) and illustrates the child-penalty. Researchers discover that a mothers' pay drops by about 49% after having their first child and ten years after that, they continue to earn about 34% less if they had not given birth. Long-term, people without siblings gain less in earnings and have a smaller but measurable decrease in the chance to be employed. According to Connolly et al. (2023, pp.401, 406), fathers do not face any drop in their pay which underlines the fact that child-related career consequences are unequal for men and women. These results are like those seen in Europe, for example, in Denmark remaining childless helps a woman keep her earnings up by 20% for a long time. Research also shows that many gender pay gaps can be

explained by the earnings penalty mothers face. Harkness and Waldfogel (1999, pp.10, 23) previously examined wages in seven developed countries and reported that in the UK, motherhood penalties were among the highest (as much as 30%), but Sweden's pay gap was much lower (only about 11%). The report found that since families in Scandinavia are supported more by the government, women there were better able to keep their jobs and earnings (Harkness and Waldfogel, 1999, pp.2, 15)

Maternity/Parental leave

Allowing generous maternity/parental leave gives mothers a better chance of staying part of the workforce over time. According to Hegewisch (2011, pp.122-123), OECD research indicates that giving women moderate-length paid leave (close to twelve to eighteen months) helps them keep a job and go back to work after delivering their baby. Their job is protected, and they still receive regular pay, so mothers do not have to stop building their careers. But leaves that last too long (more than two or three years) could instead result in women losing strength in their job skills and commitment which some studies found might reduce their future employment and earnings. In year 2000, after parents in Canada gained better access to paid leave, the duration of most parents' leave jumped from 6-10 months to almost 9-12 months off (Marshall, 2003, pp.5-7). Although mothers have two extra months of leave each year, roughly 82-84% women wanted to return to their jobs within two years. Mothers returning to the same employer rose from 84% to 89%. Moreover, those receiving EI benefits (previous annual earnings less than CAD 20k), were much more likely to go back to work within eight months and non-permanent employees were nearly five times more likely ($p < 0.01$) than their higher-earning counterparts, proving that economic and employment status play a strong role in how long mothers stay on leave (Marshall, 2003, pp.6-9). Prior to 2000, Canadian mothers could take 6 months of protected leave; the length was then increased to about 1 year. Baker and Milligan (2008,

pp.872-873, 876-877) observed that lengthening parental leave resulted in mothers being at home an extra 2-3 months with their babies (some staying there for the full year) but did not affect their later job prospects. Mothers took a little longer to go back to work, meaning more time for family, but most were still able to keep jobs which shows the policy was successful. However, staying home slowed down the process of businesses getting back to normal earnings. Unlike most European countries, where maternity leave is universal, the United States lacks this policy and as a result, many women rush back to work or leave their jobs entirely, leading to a greater penalty; this difference is often pointed out in policy research without this being directly covered in our sources.

Childcare and Family Support

Access to affordable childcare is regularly recognized as an important solution to child penalties. Having dependable childcare helps mothers resume their careers sooner and with a reduced risk of making career decisions they might regret. The example of Quebec's universal low-fee childcare program is a good illustration. Baker et al. (2005, pp.3) and Lefebvre et al. (2008, pp.2-3) examined the launch of $5 per day childcare in Quebec during the late 1990s. It was found that more mothers were employed and worked longer hours – the participation rate rose by about 8% for mothers of young children. Due to the policy, more moms had the opportunity to pursue work outside the home since childcare would no longer be a barrier. However, these studies add that just supplying free childcare is not enough; attention must also be paid to the quality of care and its developmental outcomes. For example, Baker et al. (2005) observed that while Quebec's low-fee childcare policy increased maternal employment, it was also associated with negative effects on children's health and behavior, highlighting the need for improved standards and oversight.

In Europe, Del Boca (2015, pp.6-7) also indicates that more childcare options open to mothers can affect their work choices more than just the economic costs, in some circumstances. If mothers are unable to get childcare, they are unable to take up work, whatever the situation; alternatively, when childcare services (preferably subsidized) are provided, more mothers can return to work, and the wage penalty goes down. Easy-to-balance family and work policies, like flexible schedules and working from home, are important factors that aid female workers returning to work after having children. Burton et al. (2015, pp.18), explains that mother often need to have cut hours until the child is older, so flexible rules at work make it easier for them to stay in the labour market. Li et al., (2022, pp.477-483) also discovered that women who care for their families feel their mental health is worse than men. Analysis shows that different supports affect women and men differently: while women need at least five kinds of assistance (flexible hours, leave, counselling, community networks and a changed workload), men need only 2-3 to be fully protected from the mental health impact of role conflict. Research also found that the more time spent caring and the more the caregiver and care recipient live together, the greater the caregiver's work stress.

Promotion and Career Progression Penalties

Javdani and McGee (2015, pp.2) point out that career-related problems for women go beyond the initial challenges. With the support of Canadian linked employer-employee data, the authors state that women are approximately 3% less likely to be promoted than men for the same kind of jobs. It turns out that most of this gap is because women are concentrated into industries and jobs that do not have many levels of advancement. The authors mention that even after controlling the industry, occupation, and workplace factors, there is still a 2.9% less wage growth for women than men in the years they are promoted, suggesting that there are still persistent wage differences beyond what controlled for. The research also discovers a "family gap": that is,

single and childless female colleagues got similar pay scales as men in the same position received, whereas married women and mothers got a lower wage increase when promoted, giving clear proof that it is the children and family role obligations that make the difference. Also, high-income mothers experience the biggest penalty (up to 15.7% in growth), implying that even if money is not a problem, childcare tasks still matter and laws should also consider the work structure and parents' attitudes (Javdani and McGee, 2015, pp.2, 14-16).

Comparative Contexts

A growing body of comparative research emphasizes how national parental leave and childcare policies influence women's ability to reconcile work and caregiving. In Canada, relatively generous paid maternity and parental leave, alongside subsidized childcare in provinces like Quebec, have helped reduce the "child penalty" though significant gaps in employment and earnings persist (Connolly et al., 2023). Within the New Home Economics (NHE) framework, these supports can be understood as institutional mechanisms that reduce the opportunity cost of childbearing and facilitate continued labor market engagement. In contrast, Sri Lanka offers limited paid maternity leave (primarily in the formal sector), and public childcare services are scarce (Chowdhury, 2013). These conditions increase the burden of unpaid care work, often compelling women to rely on extended family or exit the workforce, especially after childbirth. According to Chowdhury (2013), these gaps in family policy infrastructure are among the key reasons behind Sri Lanka's persistently low FLFP, despite high female literacy. By comparing these two policy contexts, this study investigates how supportive versus restrictive reproductive and family policy environments translate into divergent labor market outcomes for women advancing the central research question and theoretical logic of this project.

Justification and Adaptation of NHE for Cross-National Policy Comparison

NHE is utilized in this research to examine how institutional constraints jointly shape fertility and labour decisions within families. As originally developed by Becker (1981), NHE posits that when the opportunity costs of childbearing rise due to limited reproductive autonomy or inadequate family support policies women are less likely to participate in paid labor.

This study extends NHE by applying it across national policy settings, comparing Canada and Sri Lanka, and employing institution indicators such as healthcare, finance access, and inclusion of labour. This re-interpretation puts NHE on a platform of structural analysis, linking policy settings to labour outcomes.

Connection to Methodology

Several of the studies reviewed on this topic employ quantitative methods such as panel regressions, instrumental variables, and Difference-in-Differences (DiD) that align with the analytical techniques used in this study, reflecting a shared emphasis on methodological rigor and causal validity. Many studies depend on regression analysis and panel data to separate out other factors and look at changes over time. One example is Skadsen (2017, pp. 17), who used a panel of 125 countries with fixed effects regression to see the link between contraceptive legality and fertility as well as FLFP.

This study employs panel data analysis to examine how reproductive policy environments influence female labor force participation (FLFP) over time. Panel data refers to datasets that observe the same units (in this case, countries) across multiple time periods in this study, Canada and Sri Lanka from 2013 to 2023. This approach allows for the control of unobserved, time-invariant factors such as cultural norms or institutional characteristics that could otherwise bias results. By analyzing changes within each country over time, panel

regression methods improve causal inference and help isolate the effects of reproductive policy shifts on labor market outcomes, consistent with the New Home Economics (NHE) framework.

To study changes after policy shifts or compare national contexts, panel data analysis is widely used because it accounts for unobserved, time-invariant factors. In this study, panel regression is used to examine how reproductive policies influence fertility and female labor force participation particularly through intervening factors like access to maternal healthcare and education, which shape household decisions about childbearing and work, consistent with the New Home Economics framework.

To test the central hypothesis that restrictive reproductive laws negatively influence women's workforce participation, this study employed a combination of correlational, causal inference, predictive modeling, and exploratory techniques. These methods each aligned to test or contextualize the hypothesis are summarized in Table 1 below.

Table 1-Analytical Strategy and Hypothesis Alignment

Hypothesis	Analytical Method(s)	Purpose	Result
H_0: RRL has no impact on WWPSF	Correlation, DiD, Random Forest	Test for no significant relationship	Rejected
H_1: RRL has negative impact on WWPSF	Correlation, DiD (causal), Random Forest (predictive), PCA (exploratory)	Establish negative association and causality	Supported ($p < .01$ in DiD; RRL highly predictive in RF)

Many researchers rely on studies that use Difference-in-Differences (DiD) and event methods to find out the effects of interrelated variables. The authors Baker et al. (2005, pp.3) and Lefebvre et al. (2008, pp.2) look at policy changes in childcare in Canada and use DiD to measure the outcomes for groups of mothers who did and did not benefit from the new rules. They remove usual patterns so that hat is left behind only shows the impact of the policy on

labour supply. Likewise, Connolly et al. (2023, pp.403) do an event study on having a child, observing how parents' earnings change from before to after the birth of their child. The approach of looking at data around birth (event-study method) illustrates the sharp decrease in earnings at birth and the leveling-off after that, supporting the idea that children cause declines in earnings. Assessing differences, for example, in the conditions before and after a law change or across periods, is a technique we can use. DiD is regularly used and proven among economists, especially by comparing provinces or different time periods with distinct policies.

Endogeneity refers to situations where an independent variable is correlated with the error term in a regression model, often due to omitted variables, reverse causality, or measurement error. In this study, potential sources of endogeneity include feedback loops between female labor force participation and reproductive policy reforms, or unmeasured factors like cultural norms that influence both. Where applicable, causal inference tools such as Difference-in-Differences (DiD) and instrumental variable (IV) methods help mitigate these risks.

Some studies have addressed the issue of endogeneity where explanatory variables may be correlated with unobserved factors by applying instrumental variable (IV) strategies to estimate causal effects more reliably. For example, Agüero and Marks (2011, pp. 2–4) use unexpected infertility as an instrument to estimate the impact of childbearing on women's labor market participation. Similarly, Skadsen (2017, pp. 4–5) uses legal access to contraceptives as an instrument to assess the effect of fertility on employment outcomes. These strategies rely on external variation unrelated to unobserved confounders, improving causal inference. In our study, cultural norms such as gender role expectations and stigma around maternal employment are recognized as important contextual influences on both reproductive autonomy and workforce

participation. However, due to limitations in available cross-national data, these norms are not directly measured in the statistical models. To partially address this, our design uses fixed effects in panel regression and Difference-in-Differences (DiD) to control for time-invariant cultural factors. If future research reveals significant endogeneity for instance, where policy adoption correlates with unmeasured social attitudes then instrumental variable methods or control function approaches could be applied to better isolate causal effects. To reduce dimensionality and validate a unifying construct for gender equity indicators, PCA was conducted.

This study combines Principal Component Analysis (PCA), Random Forest modeling, and ARIMA forecasting to analyze multidimensional policy effects an integration that is rarely seen in existing literature on gender, fertility, and labor force participation. These tools reflect an emerging trend in social science research toward the use of machine learning (ML), broadly defined as algorithmic techniques that identify patterns or make predictions from data. In this study, PCA is used for dimensionality reduction, helping to condense multiple socioeconomic indicators into a smaller set of components that represent reproductive policy environments. Random Forest a supervised ML algorithm is used for predictive modeling, identifying the most influential factors shaping female labor force participation (FLFP). ARIMA is employed for time-series forecasting, modeling fertility trends in each country over time.

Although earlier studies in the literature have not explicitly used PCA or Random Forests, some do adopt conceptually similar approaches. For example, OECD (2018, pp. 4–6) discusses composite indices that integrate gender and sustainability indicators an approach aligned with the logic of PCA, even if not named as such. Jayasinghe et al. (2016, pp. 3–4, 9) also use income and household composition variables to construct a composite poverty index, akin to factor analysis. Heiberger (2022, pp. 384–386) explains how supervised and

unsupervised ML approaches, including clustering and ensemble models like Random Forests, are increasingly used in sociology to capture complex social patterns from high-dimensional datasets. These align with our goal of uncovering hidden structure and validating causal relationships. This multi-method approach supports Benach et al. (2010), who advocate for combining quantitative techniques when examining complex health and social outcomes. Our use of machine learning alongside classical econometric methods strengthens the robustness of our results and allows us to model reproductive policy effects in a multidimensional and predictive way.

In the same way, Engelhardt et al. (2004, pp.8-12) used Vector Error-Correction Models to study the long-term relationships between fertility and employment. Using Granger causality and error-correction methods to work with time series shows that this approach helps uncover insights in the data such as detecting changes in relationships. ARIMA models are used to make forecasts of FLFP for various policies and both time and its details are important. Because time-series econometrics helped Engelhardt et al., (2004, pp.15-16) discover policy effects on demographic-economic relationships, using ARIMA (possibly with added inputs) in our investigation makes sense. It will help us predict what might happen to women's employment in the future as reproductive laws evolve, as prior studies have suggested considering such dynamic effects.

This study employs a multi-method quantitative strategy that integrates Principal Component Analysis (PCA), Random Forest modeling, ARIMA forecasting, and Difference-in-Differences (DiD) panel regressions. Each method serves a distinct analytical function aligned with the central research question: whether and how reproductive health policies shape women's labor force participation. PCA, as a dimensionality-reduction technique, condenses overlapping

indicators into a unifying construct that captures the degree of policy supportiveness a necessary step given the multidimensional nature of reproductive governance. Random Forest, a supervised machine learning algorithm, allows for predictive modeling and variable importance ranking across complex socioeconomic factors. ARIMA time-series models are used to forecast fertility patterns, offering insight into dynamic shifts over time. DiD and fixed-effects panel regressions are applied to identify causal policy effects, controlling for unobserved heterogeneity and policy shocks.

This layered design reflects an emerging paradigm in applied social science where machine learning is used not as a replacement for theory-driven inference, but as a complement that enhances predictive power and pattern detection. Heiberger (2022) argues that supervised and unsupervised ML approaches such as clustering and Random Forest are increasingly valuable for managing high-dimensional datasets and uncovering nonlinear relationships in large-scale social research. By drawing on this guidance, our design balances explanatory and predictive aims: PCA and DiD ground the analysis in established econometric frameworks, while Random Forest offers robustness checks and insights into the relative strength of multiple predictors. This integrative approach also echoes Benach et al. (2010), who advocate for methodological triangulation in studying complex gendered and health-related phenomena.

Ultimately, combining traditional econometric tools with modern machine learning methods enables a more comprehensive investigation of policy effects across two contrasting national contexts. The analytical choices made in this study are not only grounded in the literature but also designed to uncover both causal mechanisms and predictive patterns ensuring that the findings are theoretically informed, empirically sound, and methodologically transparent.

Literature Gaps

Building on the theoretical and methodological framework outlined above, this section identifies where existing literature falls short and how this study addresses those gaps. Despite many well-researched works on this topic, we identified valuable gaps that we try to get around in our study. Most of the literature focuses more on high-income Western countries. The area of focus for most cited studies is North America and Europe and only few looks at the lower-income countries of South Asia. There is difficulty in this approach because the causes of FLFP and the results of reproductive policies can vary a lot in developing countries. Chowdhury (2013, pp.1-2) explains that Sri Lanka scores highly on education for women, yet FLFP remains low (28pprox.. 35%) and mainstream Western approaches have not been able to fully explain why. Adding Sri Lanka to Canada in our study provides a different perspective that may result in insights that are hard to notice in single-country or single-region studies. Such comparisons are needed to see how similar issues work (e.g., how women manage their time between childcare and work or the effect of laws) in various economic and cultural contexts. There is no other study, so far as we are aware, that directly studies this issue between a South Asian country and a North American country, so our work helps clarify this difference and brings attention to the idea that every situation may call for tailor-made solutions. According to OECD, there are not enough data on sex disaggregation in some areas which points to the importance of more carefully measured indicators in these indices (OECD, 2018, pp.7-8).

Additionally, authors often discuss rules or rights without adequately considering the specific context to which they pertain. Many studies look at policies using only two categories (e.g., whether abortion is allowed or not) and can gloss over important points. According to Atay and Périvier (2025, pp.8), paying attention only to whether abortion is legal misses the significance of other influences on women's reproductive options. Both Kotiswaran (2014, pp.1-

3) and Jayasinghe et al. (2017, pp.179-182) found that the laws and poverty measures don't consider the details of regional and ethnic differences, showing the need for comparing sub-groups within this research's Sri Lanka and Canada comparison. Our research does not rely on just one measure of reproductive rights but instead looks at the topic using several indicators together (PCA). This helps indicate the strictness and how thoroughly the rules are applied. We also look at how the outcomes of legal changes may differ for specific groups using ideas from Miller (2023, pp. 1-4) and Haintz et al. (2023, pp.124-126). So, we respond to the problem of simple explanations by examining restrictions and their consequences in detail, taking the context into account.

A study from Gunatilaka (2013, pp.2,6) finds that in most regions around the world, especially South Asia, more than half of the work done by women falls into the informal economy, so future research should make this a priority. Amirthalingam and Lakshman (2012, pp.31-34) and Jayasinghe (2019, pp.1-6) point out that female-headed households and women who have been displaced often seek informal work which many FLFP studies miss out on. We address these issues by bringing up how, on one hand, access to contraception can assist women in doing various unpaid tasks or finding work in another place which are typically overlooked when looking only at formal employment.

Moreover, studies often analyze individual laws (such as bans on abortion) without considering how several restrictions may work together. While this study accounts for reproductive policy environments using composite indicators and multidimensional indices, it does not isolate abortion laws as an independent variable. As a result, the specific causal effect of abortion legality or restrictiveness on female labor force participation (FLFP) could not be separately estimated. Although qualitative analysis and contextual interpretation highlighted the

role of abortion access particularly in Sri Lanka's restrictive legal setting this factor was embedded within a broader index of reproductive constraints (e.g., fertility rate, maternity leave, healthcare access). Future research should incorporate time-varying, jurisdiction-specific abortion policy indicators to disentangle their distinct impact, using policy coding from global databases such as the Center for Reproductive Rights or the WHO Global Abortion Policies Database. Doing so would enable more precise causal inference on how abortion legality independently influences women's economic outcomes.

In addition, our study adds methodologically by use of an integrated, multi-method approach. Few studies examine the effects of policy using new machine learning models; most researchers still use basic econometrics. Using techniques like Random Forests and PCA in policy analysis suggests their usefulness which offers opportunities to explore complicated and many-dimensional policy aspects in the future. It fills a gap in previous methods and strengthens the results, for example, when our Random Forests and regression show that the same factors are most important, it provides more certainty.

All in all, our research attempts to deal with region by examining regions beyond the West, granularity through detailed analysis of policy effects, sector by recognizing informal sectors, and the methodology by using both traditional and innovative analytical approaches. Through backing the Sri Lanka – Canada comparison and using a thorough quantitative method, we try to increase what is covered in the literature. It will offer information useful everywhere, as it is more nuanced and aligned with the challenges women face when balancing work and family life.

This study addresses several underexplored gaps in the existing literature. While most research on reproductive policy and labor outcomes focuses on high-income Western countries,

very few studies examine low- and middle-income contexts in South Asia. As Chowdhury (2013) notes, Sri Lanka presents a unique puzzle: it has high female literacy but persistently low female labor force participation (FLFP), a disconnect that mainstream Western models have not fully explained. By directly comparing Sri Lanka with Canada two countries with contrasting reproductive policy environments, but shared commitments to gender equality the study generates insights that are often missed in single-country or intra-regional analyses. Sri Lanka's case offers Canada a lens to assess how formal rights may falter in the absence of strong social supports and structural access, while Canada's experience offers Sri Lanka a benchmark for policy design aimed at translating education and legal equality into economic outcomes. This bilateral comparison contributes to a richer understanding of how reproductive governance interacts with labor markets in different development settings, and how policy "bundles" (laws, services, social norms) shape women's economic agency. As far as we are aware, this is the first cross-national, mixed-method empirical study to compare a South Asian country with a North American one in this domain. The project thus fills a geographic, conceptual, and methodological gap broadening the scope of gender policy research and offering more globally transferable insights.

Methodology

Research Design

This research employed a quantitative, comparative cross-national research design to investigate the impact of reproductive health laws on women's workforce participation. Specifically, it focused on analyzing secondary data collected for two distinct national contexts-Canada and Sri Lanka-from 2013 to 2023. A variety of economic, demographic, reproductive, and social indicators were systematically examined to identify relationships, predictors, and outcomes clearly reflecting the theoretical propositions rooted in the New Home Economics (NHE) framework.

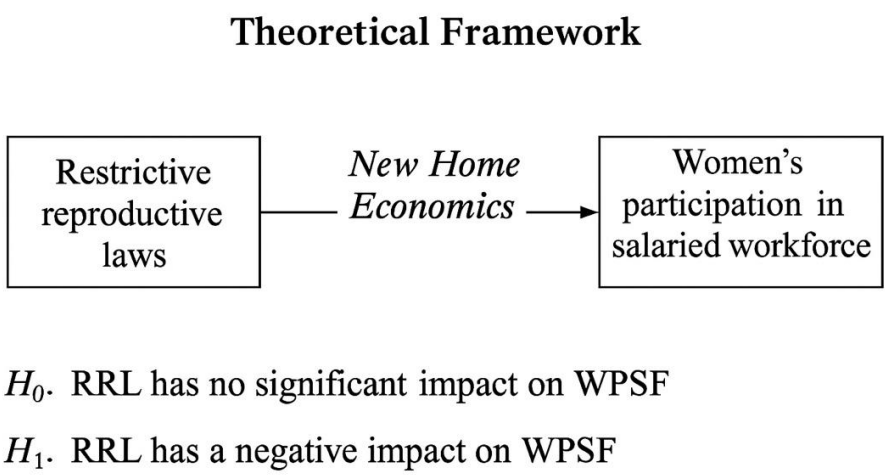

Figure 1-Theoretical Framework

Empirical Translation of Theory

This study is guided by the New Home Economics (NHE) framework, which models household decision-making as a function of economic constraints, particularly those related to fertility and labor. Within this framework, women's time allocation decisions such as whether to

enter the labor market are shaped by the opportunity cost of childbearing and the availability of institutional supports. To test these dynamics empirically, the study evaluates the extent to which reproductive laws and social policies affect female labor force participation (FLFP), using Canada and Sri Lanka as contrasting case studies.

Each indicator selected corresponds to a theoretical construct within NHE. Fertility rate is used as a proxy for reproductive burden; maternity leave duration represents institutional support for working mothers; healthcare expenditure and access to digital finance capture enabling infrastructure for reproductive autonomy and market participation. These variables are examined through a combination of classical econometric and machine learning methods; each selected for its capacity to test a distinct aspect of the theoretical model.

The relationship is assessed through the following methods:

- Descriptive statistics and Pearson correlations: Provide baseline insights into fertility, FLFP, and gender-relevant indicators across both countries.
- Principal Component Analysis (PCA): Reduces multiple overlapping variables into a single index of reproductive policy supportiveness.
- K-means clustering: Identifies whether Canada and Sri Lanka fall into different policy environment clusters.
- Difference-in-Differences (DiD): Tests whether policy changes after 2018 had causal effects on FLFP.
- ARIMA forecasting: Models long-term fertility trends in each country to assess policy trajectory effects.

- Random Forest (supervised machine learning): Evaluates predictor importance and robustness across a wide set of indicators.

This multi-method approach allows the study to triangulate causal, structural, and predictive relationships between reproductive governance and women's labor outcomes. The specific function of each method is summarized below in relation to Hypotheses 1 and 2 and their link to NHE.

Method–Theory Alignment

Table 2 presents the analytical techniques used to test Hypothesis 1 (H_1): that restrictive reproductive laws reduce female labor force participation. Each method maps directly to a theoretical component of NHE, from opportunity cost to institutional access.

Table 2-Analytical Methods Mapped to Hypothesis 1 and the NHE Framework

Method	Purpose / What It Tests	Link to Hypothesis 1	NHE Concept Represented
Descriptive Statistics & Pearson Correlation	Identify baseline trends and simple relationships between fertility, FLFP, and related variables	Provides initial evidence of correlation between reproductive constraints and FLFP	Time allocation; reproductive cost burden
Principal Component Analysis (PCA)	Condense overlapping indicators into a single policy supportiveness index	Operationalizes multidimensional reproductive governance for analysis	Institutional opportunity structures
K-means Clustering	Group countries by similarity in reproductive governance indicators	Shows structural divergence between Canada and Sri Lanka	Institutional constraints vs. supports
Difference-in-Differences (DiD)	Estimate causal effect of 2018 policy shifts on FLFP	Tests if post-policy changes explain labor force differences	Policy incentives; cost–benefit tradeoffs
Random Forest (ML)	Identify strongest predictors of FLFP from multidimensional data	Validates which factors most influence FLFP in each country	Relative constraint importance; autonomy proxies

Table 3 below summarizes methods used to test Hypothesis 2 (H_2): that more supportive reproductive policy environments contribute to long-term fertility decline by enhancing autonomy and enabling intertemporal family planning decisions.

Table 3-Analytical Methods Mapped to Hypothesis 2 and the NHE Framework

Method	Purpose / What It Tests	Link to Hypothesis 2	NHE Concept Represented
ARIMA Forecasting	Model fertility trends over time in Canada and Sri Lanka	Tests whether long-term fertility decline aligns with policy liberalization	Intertemporal reproductive planning
Panel Regression	Estimate effect of policy-related variables on fertility across years	Assesses temporal effects of governance on fertility levels	Household optimization over time
PCA (Over Time)	Create time-sensitive index of policy strength	Tests whether stronger policy packages predict fertility outcomes	Composite fertility constraints
Descriptive Trend Analysis	Visualize year-over-year change in fertility and FLFP	Observes structural delay in outcomes following policy shifts	Temporal lag in labor/fertility adjustment

This integrative approach allows for rigorous testing of both structural relationships and causal effects, while remaining grounded in a coherent theoretical model. The following section presents the results of each method in sequence, demonstrating how they support or challenge the study's hypotheses. Indicator Justification by Conceptual Linkage

Table 4-Indicator Justification by Conceptual Linkage

Indicator	Justification	NHE Relevance	Used in Model(s)
Fertility rate (total)	Captures family size decisions and childbearing burden	Opportunity cost of childbearing	All (PCA, RF, DiD, Correlation)
Maternity leave (weeks)	Proxy for institutional support for mothers	Lowers cost of post-birth career disruption	RF, DiD
Female digital payments	Proxy for economic agency and market inclusion	Enhances labor supply flexibility	Correlation, PCA
Anemia rate (women)	Proxy for reproductive and maternal health conditions	Health costs affect labor productivity and time	PCA

Indicator	Justification	NHE Relevance	Used in Model(s)
Bank account ownership	Indicator of formal financial inclusion	Autonomy in labor and household budgeting	Correlation, PCA
Mobile phone access	Reflects digital connectivity & reproductive info access	Improves access to reproductive services and jobs	Correlation, PCA
Health expenditure (% GDP)	Investment in maternal/reproductive infrastructure	Reduces fertility-related risks	All
Female unemployment	Captures structural labor constraints	Reflects access to labor market & policy context	RF, DiD

The indicators selected for analysis were mapped onto specific statistical models based on their conceptual relevance and statistical suitability. Table 4 below summarizes which indicators were included in each model and their theoretical alignment with NHE

Data Sources and Collection

Secondary data was systematically sourced from reputable international databases and authoritative institutions. The following indicators were collected to capture the essential dimensions of reproductive policies, demographic trends, and labor market outcomes:

- Female Account Access (%) from World Bank Global Findex.
- Female Mobile Phone Access (%) from Pew Research Center.
- Internet Access (Female, %) from the Office for National Statistics (UK).
- Digital Payments Received by Females (%) from World Bank Global Findex.
- Emergency Savings Held by Females (%) from Bankrate Emergency Savings Report.

Additionally, core demographic and labor market indicators-such as fertility rate, female labor force participation rate, maternity leave duration, contraceptive prevalence rate, GDP per capita, and unemployment rates-were obtained primarily from the World Bank Development

Indicators, International Labour Organization (ILO) databases, and United Nations databases. The dataset encompassed the following key indicators, representing a comprehensive multidimensional approach:

- Economic and legal indicators: Women's ability to independently open bank accounts, register businesses, and sign contracts; digital payment reception by women; share of women employed in non-agricultural sectors.
- Reproductive and fertility indicators: Total fertility rates, adolescent fertility rates, wanted fertility rates, and maternity leave provisions.
- Health indicators: Births attended by skilled healthcare providers, prenatal care prevalence, anemia prevalence among reproductive-age women, undernourishment rates, current healthcare expenditure, and low-birthweight prevalence.
- Educational indicators: Youth literacy rates, primary school enrollment gender parity indices, and youth female illiteracy rate.
- Demographic indicators: The female labour participation rates, female unemployment rates, urbanization, population density, the age of first marriage among women, and marital patterns among young women.

Systematic arrangement of data was done on an accessible excel format to enable analysis of data, which will make data consistent, easy to use and replicate. The raw and processed datasets, alongside detailed analytical procedures and scripts, have been transparently shared and are publicly accessible through a GitHub repository, enhancing the reproducibility and openness of the research process.

Each category of indicators used in this study was selected based on theoretical alignment with the New Home Economics (NHE) framework and support from existing empirical

literature. Health indicators such as anemia prevalence, maternal healthcare access, and undernourishment reflect the biological and institutional costs of childbearing, which constrain women's labor participation particularly in Sri Lanka's context of limited maternal health coverage (Suranga et al., 2023; Gunatilaka, 2013). Education indicators such as youth female illiteracy and gender parity indices are linked to women's human capital development, affecting their bargaining power within households and their participation in paid work (Jayasinghe, 2019; Atay & Périvier, 2025). Digital finance and mobile connectivity reflect reproductive autonomy and access to services that enable women to balance family and economic roles (Lamberti, 2022; Miller, 2023). These indicator categories are thus not arbitrary they extend directly from the literature and are measurable proxies of the constraints and supports that shape fertility–work trade-offs in the NHE framework

Conceptual Definitions and Measurement Logic

This study draws upon a range of indicators to represent the complex and often overlapping domains of reproductive laws, social policies, and their socioeconomic effects. For clarity and analytical consistency, key terms are defined and operationalized below in alignment with the theoretical framework of New Home Economics (NHE).

Reproductive laws are understood as formal legislative mandates that regulate fertility-related rights and restrictions, such as abortion legality, statutory maternity leave, or legal frameworks governing contraceptive access. Policies, by contrast, refer to implemented programs or administrative practices that support or restrict these rights in practice such as subsidized contraception, universal childcare, or telehealth abortion services. While both laws and policies influence women's reproductive autonomy, their separation is often blurred in empirical data, particularly in low- and middle-income contexts. As such, this study does not

analyze legal texts directly but instead uses proxy indicators to capture the functional impact of these legal-policy environments on women's labor force outcomes.

To operationalize reproductive policy environments, this research utilizes multidimensional indicators that reflect the opportunity cost of childbearing a central tenet of NHE. Indicators such as total fertility rate, maternity leave duration, and female unemployment rate serve as direct measures of reproductive burden or institutional support. Meanwhile, indicators like female access to digital payments, mobile ownership, and healthcare expenditure are interpreted as enablers or constraints on women's autonomy, indirectly shaping labor supply decisions. These are mapped onto the NHE framework, which posits that household decisions around fertility and labor are shaped by perceived costs, constraints, and institutional incentives.

Importantly, the use of composite indicators via Principal Component Analysis (PCA) allows this study to condense multiple overlapping measures into a single index representing the degree of reproductive policy supportiveness in each country. This approach balances theoretical relevance with empirical tractability, offering a structured way to assess how reproductive governance environments shape female labor force participation across differing national contexts.

Analytical Procedures

Descriptive Statistical Analysis

To examine bivariate associations related to H_1, Pearson correlations between fertility, digital access, and workforce outcomes were calculated. The first step of data exploration consisted of computing descriptive statistics-means, medians, standard deviations, and quartiles of all numeric indicators. This initial detailed exploratory analysis brought definitive and

formative conclusions to the distribution of the data, variability, and central tendencies which form the basis of further complex analyses.

Correlation Analysis (Pearson)

While initial descriptive statistics highlighted broad trends in indicator differences between Canada and Sri Lanka, this section uses Pearson correlation coefficients to examine linear associations across all indicators, with attention to multicollinearity and model design. Although several variables show strong correlations with female labor force participation (FLFP), particular attention is paid to indicators such as digital access and healthcare spending due to their distinct policy implications.

For instance, both healthcare expenditure ($r = 0.89$) and digital financial inclusion ($r = 0.85$) are strongly and positively associated with FLFP. However, they operate through different mechanisms: the former reflects national investment in reproductive and maternal health infrastructure, while the latter captures women's direct economic autonomy and ability to participate in financial and labor markets. Despite their similar statistical strength, their implications for policy and intervention strategies differ.

Pearson correlation analysis was used not only to interpret these substantive associations but also to identify potential multicollinearity among predictors especially in advance of regression, PCA, and machine learning applications. This dual use ensures both interpretive accuracy and model robustness. Correlation coefficients (r-values) were systematically examined across fertility, labor, health, and access indicators to support variable selection and model construction.

K-Means Clustering

K-means clustering was utilized to identify naturally occurring groupings within the dataset based on multiple indicators simultaneously. This clustering method clearly separated the countries into distinct groups, reflecting underlying differences in reproductive and economic contexts between Canada and Sri Lanka, thus helping to contextualize the comparative analysis. To reduce dimensionality and validate a unifying construct for gender equity indicators, PCA was conducted.

Time-Series Forecasting (ARIMA)

To identify the causal impact of reproductive policy changes on workforce participation, as DiD analysis compared pre- and post-policy shifts across countries. Time-series modeling using Autoregressive Integrated Moving Average (ARIMA) models was conducted specifically for Canada's fertility rates. This analysis examined historical patterns to predict future fertility trends, clearly highlighting the stability and trajectory of reproductive health outcomes. Model diagnostics (Ljung-Box Q, Jarque-Bera) were clearly assessed to ensure the reliability and accuracy of predictions.

Principal Component Analysis (PCA)

PCA was conducted to reduce data dimensionality, clearly identify underlying patterns, and highlight the most influential indicators contributing to the variability across countries and years. The PCA results provided clear evidence of redundancy and overlap among indicators, simplifying the data structure to key components representing broader constructs of gender equity and economic participation.

Difference-in-Differences (DiD) Analysis

A difference-in-differences analysis was employed to explicitly examine the causal effect of policy or structural changes assumed to have occurred around 2018. The DiD method clearly compared Canada (treatment group) and Sri Lanka (control group) before and after the identified policy intervention year, effectively controlling for time trends and country-specific fixed effects. This provided robust causal evidence concerning the policy's impact on women's labor market outcomes.

Predictive Modeling with Random Forest

A machine learning approach using Random Forest classifiers was clearly implemented to predict high or low female labor force participation based on multiple reproductive and economic indicators. Feature importance scores were analyzed explicitly, highlighting the most influential predictors clearly and transparently.

Panel Data Analysis (Fixed Effects Models)

To rigorously assess cross-country panel data, Fixed Effects regression models (PanelOLS) were conducted, clearly controlling for unobserved heterogeneity across countries and years. Multicollinearity checks, including variance inflation factor (VIF) calculations, were clearly performed to ensure model robustness and reliability.

Data Quality Assurance and Ethical Considerations

Given the exclusive reliance on secondary data from reputable international databases, direct ethical concerns typically associated with primary data collection were minimized. Nevertheless, great care was taken in proper referencing, ethical treatment, and clear reporting of data sources and data analysis procedures. To achieve transparency and reproducibility, every

action conducted during data processing, analysis, and visualization is well documented and publicly available on the project GitHub repository.

Reproducibility and Open Science

Consistent with principles of open science, all analytical scripts, processed data, and detailed methodology documentation have been made publicly accessible in a GitHub repository available at the following link: (https://github.com/gfarhadian/ReproductiveLaw/blob/main/ReproductiveLaw.ipynb).

This open sharing practice facilitates transparent replication of findings and encourages future.

Statement on the Use of Generative AI

In the preparation of this manuscript, Generative AI (ChatGPT by OpenAI) was employed in a limited, supportive capacity for the following purposes:

1. APA Formatting: The help was consulted to meet the APA 7th edition formatting requirements (headings, font/size/spacing, table/figure labelling).
2. Language Polishing: AI-based language polishing refined grammar, enhanced clarity and the general flow of an academic text without altering its original meaning or intent of the author.

At all times, intellectual and analytical contributions including the design, data interpretation, and theoretical framing were solely conducted by the author(s). AI outputs were critically reviewed, edited, and verified to ensure scholarly integrity and accuracy.

Findings and Discussion

This section presents the key empirical results used to test the study's central hypothesis (H_1): that restrictive reproductive health laws reduce female labor force participation (FLFP). A multi-method approach was employed to examine this relationship from multiple analytical angles descriptive statistics to contextualize country-level differences, Pearson correlation to identify key associations, Principal Component Analysis (PCA) and K-means clustering to detect structural patterns, Difference-in-Differences (DiD) regression to estimate causal policy effects, ARIMA models to project fertility trends, and Random Forest algorithms to evaluate variable importance. Each method is explained in terms of its purpose, input variables, and contribution to the overall argument. The cumulative findings from these techniques are used to assess whether the empirical evidence supports H_1 and to identify which reproductive policy variables are most strongly associated with labor market outcomes.

Findings Related to Hypothesis H_1: Restrictive reproductive laws negatively impact women's workforce participation

To understand how socioeconomic and reproductive health indicators differentiate national contexts, both Principal Component Analysis (PCA) and K-means Clustering were applied. PCA identified dominant underlying structures in the data, while clustering confirmed whether countries grouped by shared characteristics. Results from both methods converged, showing that Canada and Sri Lanka form distinct policy clusters. The primary component in PCA, accounting for over 99% of total variance, heavily loaded on fertility, labor force participation, and health expenditure suggesting that these factors together distinguish reproductive policy environments. K-means clustering, using the same indicators, mirrored this division and reinforced the separation between countries with supportive vs. restrictive reproductive policies.

Exploratory Data Analysis: PCA and Cluster Findings

To begin testing H_1, descriptive statistics provide context on reproductive health and workforce trends across Canada and Sri Lanka. To ensure internal consistency and minimize methodological redundancy, a cross-method synthesis is presented in Table 5. This table summarizes each analytical approach's contribution to testing the central hypothesis. Highlighted findings show that different methods converge in supporting the hypothesis that restrictive reproductive laws negatively impact women's workforce participation.

To begin testing H_1, descriptive statistics provide context on reproductive health and workforce trends across Canada and Sri Lanka.1

Table 5- Summary of Analytical Findings

Method	Primary Insight	Supports H_1?
Correlation	Strong negative link between fertility and FLFP	Yes
DiD Analysis	Causal effect of policy in Canada ($\beta = 1.07$, $p = .002$)	Yes
Random Forest	RRL features among top predictors	Yes
PCA	High variance tied to fertility and equity	Yes (indirect)
Cluster Analysis	Distinct groups (Canada vs. Sri Lanka)	Yes
ARIMA (Sri Lanka)	Significant fertility trend decline	Yes (contextual)
ARIMA (Canada)	No significant AR/MA effect	No (stable)

To begin testing H_1, descriptive statistics provide context on reproductive health and workforce trends across Canada and Sri Lanka.

Descriptive Statistics

To examine bivariate associations related to H_1, Pearson correlations between fertility, digital access, and workforce outcomes were calculated.

The descriptive statistical modeling of the indicators between 2013 and 2023 revealed critical differences between Canada and Sri Lanka in reproductive, economic, and social indicators that shape women's labor force participation. These country-specific findings are now presented separately to reflect distinct national contexts.

Table 6 presents descriptive statistics for Canada. Adolescent fertility was low (M = 7.52, SD = 2.37), and binary gender equality indicators such as legal rights to open a bank account or register a business remained uniformly high (M = 1.00, SD = 0.00). These indicators suggest a strong policy and legal infrastructure supporting reproductive autonomy and economic inclusion. Such supportive conditions likely contribute to Canada's relatively high female labor force participation rate and lower opportunity costs associated with childbearing.

Error! Reference source not found. summarizes descriptive statistics for Sri Lanka. Although legal gender equality indicators also show full formal parity (M = 1.00, SD = 0.00), adolescent fertility was substantially higher (M = 16.37, SD = 1.45), nearly double that of Canada. This indicates that formal rights exist without equivalent access to services or policy supports, resulting in greater reproductive burden. These data support the argument that legal guarantees alone are insufficient; substantive supports are necessary to enable women's full participation in the labor market.

Taken together, these disaggregated statistics illustrate meaningful socioeconomic and reproductive disparities between the two countries. They affirm that policy environments not just legal frameworks play a crucial role in shaping women's economic agency.

Table 6-Descriptive Statistics for Key Indicators – Canada (N = 11)

Indicator	Mean	SD	Min	25th Percentile	Median	75th Percentile	Max
Adolescent fertility rate (births per 1,000 women ages 15–19)	7.52	2.37	4.80	5.53	7.01	9.20	11.53
A woman can open a bank account (1 = yes)	1.00	0.00	1.00	1.00	1.00	1.00	1.00
A woman can register a business (1 = yes)	1.00	0.00	1.00	1.00	1.00	1.00	1.00
A woman can sign a contract (1 = yes)	1.00	0.00	1.00	1.00	1.00	1.00	1.00

Table 7-Descriptive Statistics for Key Indicators – Sri Lanka (N = 11)

Indicator	Mean	SD	Min	25th Percentile	Median	75th Percentile	Max
A woman can open a bank account in the same way as a man (1 = yes)	1.00	0.00	1.00	1.00	1.00	1.00	1.00
A woman can register a business in the same way as a man (1 = yes)	1.00	0.00	1.00	1.00	1.00	1.00	1.00
A woman can sign a contract in the same way as a man (1 = yes)	1.00	0.00	1.00	1.00	1.00	1.00	1.00
Adolescent fertility rate (births per 1,000 women ages 15–19)	16.37	1.45	15.09	15.43	15.78	16.76	19.78

Note. SD = Standard Deviation. Legal equality indicators show no variation, while adolescent fertility remains high and variable.

Note: N = 11 refers to the total number of observations after handling missing data. SD = Standard Deviation; GPI = Gender Parity Index.

Descriptive Statistics of Binary Gender Equality Indicators

To assess the presence of formal legal gender equality in both national contexts, three binary indicators were analyzed separately for Canada and Sri Lanka. Tables 8c and 8d present the descriptive statistics for these indicators, which capture women's legal ability to

independently open a bank account, register a business, and sign a contract. Across both countries and all years (N = 11 per country), the indicators show a consistent mean of 1.00 and standard deviation of 0.00 indicating full formal gender equality under the law.

However, the lack of variation in these indicators also reveals their limited explanatory power in capturing real differences in women's economic empowerment. While legal equality was equally present in both contexts, substantive outcomes diverged sharply, as shown in prior tables: Canada exhibited lower adolescent fertility, greater digital financial inclusion, and higher female labor force participation, while Sri Lanka lagged in these areas. This reinforces a central theme of the study formal legal rights, though necessary, are insufficient to ensure substantive gender equality in economic life unless accompanied by supportive policy infrastructure, enforcement mechanisms, and accessible services.

These findings underscore why country-specific policy regimes must be considered alongside legal frameworks when evaluating gender equity. Legal equality may exist on paper, but its practical realization depends on broader institutional and socioeconomic contexts.

Table 8-Descriptive Statistics of Binary Gender Equality Indicators – Canada (N = 11)

Indicator	Mean	SD	Min	25th Percentile	Median	75th Percentile	Max
A woman can open a bank account in the same way as a man (1 = yes)	1.00	0.00	1.0	1.00	1.00	1.00	1.0
A woman can register a business in the same way as a man (1 = yes)	1.00	0.00	1.0	1.00	1.00	1.00	1.0
A woman can sign a contract in the same way as a man (1 = yes)	1.00	0.00	1.0	1.00	1.00	1.00	1.0

Table 9-Descriptive Statistics of Binary Gender Equality Indicators – Sri Lanka (N = 11)

Indicator	Mean	SD	Min	25th Percentile	Median	75th Percentile	Max

A woman can open a bank account in the same way as a man (1 = yes)	1.00	0.00	1.0	1.00	1.00	1.00	1.0
A woman can register a business in the same way as a man (1 = yes)	1.00	0.00	1.0	1.00	1.00	1.00	1.0
A woman can sign a contract in the same way as a man (1 = yes)	1.00	0.00	1.0	1.00	1.00	1.00	1.0

Table 8 and Table 9 present the descriptive statistics for binary gender equality indicators in Canada and Sri Lanka, respectively. Across all years studied, both countries consistently reported full legal gender equality in the domains of financial autonomy, business registration, and contract rights ($M = 1.00$, $SD = 0.00$). This lack of variation highlights the formal equality shared by both contexts. However, as shown in the previous tables (8 and 9), this equality does not necessarily translate into comparable reproductive or labor outcomes, affirming the study's argument that substantive equality requires more than legal guarantees it also depends on institutional access, services, and social norms.

Correlation Analysis

Pearson correlation analysis identified multiple significant relationships among key variables, clearly revealing important linear associations. Fertility-related variables were strongly and negatively correlated with female participation in the workforce; thus, total fertility rate was significantly and negatively related to female employment rates ($r = -0.92$, $p < 0.01$). Also, teen fertility was significantly and negatively related to female. Also, teen fertility was significantly and negatively associated with skilled birth attendance ($r = -0.91$, $p < 0.01$) and health spending ($r = -0.95$, $p < 0.01$), which indicates that limiting reproductive conditions are related to poor health and workforce participation. Also, greater levels of digital financial inclusion were

positively and significantly related to female labour force participation ($r = 0.92$, $p < 0.01$), revealing the significance of financial independence in enhancing economic empowerment in women.

Nonetheless, the significant multi-collinearity was found especially between the percentage of urban population and age at first marriage ($r = 1.00$, $p < 0.01$) that indicated the redundancy between these indicators. Consequently, some indicators were excluded in further modeling to ensure analytical robustness.

Table 10-Combined Correlation Matrix – For Preliminary Overview Only

Indicator	1	2	3	4	5	6
1. Fertility rate, total	1					
2. Adolescent fertility rate	.99**	1				
3. Female labor force participation	-.92**	-.90**	1			
4. Current health expenditure	-.95**	-.93**	.89**	1		
5. Received digital payments, female (% age 15+)	-.92**	-.91**	.85**	.94**	1	
6. Unemployment, female (% female labor force)	.74**	.71**	-.82**	-.72**	-.73**	1

Note. P < .05*, *p < .01.

Table 10 shows clearly Pearson correlation coefficients between major reproductive and economic indicators (N=22). Positive correlations were very high and statistically significant between total fertility rates and adolescent fertility rates ($r=0.99$, $p < 0.01$), which reinforce the fact that high total fertility goes hand in hand with higher adolescent fertility. In contrast, the fertility indicators showed significant negative correlations with the female labour participation ($r = -0.92$, $p < 0.01$) and the current health spending ($r = -0.95$, $p < 0.01$), which means that higher fertility rates adversely affect the women workforce and the spending on health. Healthcare expenditure ($r = 0.89$, $p < 0.01$) and the digital financial inclusion of women ($r= 0.85$, $p < 0.1$) were also positively associated with female labour force participation, indicating that

favourable socioeconomic factors have a strong probability of promoting the economic empowerment of women. The levels of female unemployment were found to have negative relationships with labour participation ($r = -0.82$, $p < 0.01$) and positive relations with measures of fertility, which vividly shows the unemployment as a negative attribute influencing the labour involvement of women. These significant correlations provide robust evidence supporting the theoretical linkages between reproductive policies and women's economic outcomes within the studied countries. To reduce dimensionality and validate a unifying construct for gender equity indicators, PCA was conducted.

Disaggregated Correlation Analysis: Revealing Country-Specific Patterns

While the initial Pearson correlation analysis (Table 10)captured strong associations between fertility, health expenditure, digital inclusion, and female labor force participation (FLFP), a deeper examination revealed that these patterns differ significantly by country. To validate this, the correlation matrix was recalculated separately for Canada and Sri LankaThis disaggregation uncovered that the strong negative correlation between fertility and FLFP ($r = –0.92$) was primarily driven by Sri Lanka, where high fertility closely coincides with low workforce participation. In contrast, Canada exhibited a weaker negative or even neutral association, reflecting the buffering role of family policy supports such as extended maternity leave and subsidized childcare.

Similarly, indicators like digital financial inclusion and health expenditure showed strong positive correlations with FLFP in the combined matrix ($r = 0.85$ and $r = 0.89$, respectively), but these were substantially weaker in Sri Lanka. This suggests that Canada's supportive infrastructure such as broadband access, telehealth, and financial digitization drives much of the global correlation, whereas these linkages are underdeveloped in Sri Lanka.

Moreover, the perfect collinearity found between urbanization and age at first marriage (r = 1.00) was revealed to be an artifact of data aggregation; this relationship broke down when the countries were analyzed independently, further justifying the need for disaggregated analysis.

Together, these findings emphasize that *combined-country correlation matrices risk obscuring context-specific realities*. Disaggregated analysis offers clearer insights into how reproductive laws and socioeconomic structures uniquely shape women's labor outcomes in each setting. This adds empirical weight to the study's theoretical commitment to comparative policy analysis and supports the need for *tailored interventions* over generalized global models.

Table 11-Correlation Matrix for Canada

	Fertility rate, total (births per woman)	Adolescent fertility rate (births per 1,000 women ages 15-19)	Labor force, female (% of total labor force)	Current health expenditure (% of GDP)	Received digital payments, female (% age 15+)	Unemployment, female (% of female labor force)	Urban population (% of total population)	Age at first marriage, female	Maternal leave benefits (% of wages paid in covered period)	Number of weeks of maternity leave
Fertility rate, total (births per woman)	1.0	0.96	-0.43	-0.74	0.67	-0.1	-0.94		-0.58	
Adolescent fertility rate (births per 1,000 women ages 15-19)	0.96	1.0	-0.44	-0.67	0.71	0.06	-0.94		-0.75	
Labor force, female (% of total labor force)	-0.43	-0.44	1.0	-0.22	-0.12	-0.68	0.63		0.05	
Current health expenditure (% of GDP)	-0.74	-0.67	-0.22	1.0	-0.5	0.68	0.56		0.52	
Received digital payments, female (% age 15+)	0.67	0.71	-0.12	-0.5	1.0	-0.02	-0.51		-0.58	
Unemployment, female (% of female labor force)	-0.1	0.06	-0.68	0.68	-0.02	1.0	-0.12		-0.1	
Urban population (% of total population)	-0.94	-0.94	0.63	0.56	-0.51	-0.12	1.0		0.57	
Age at first marriage, female										
Maternal leave benefits (% of	-0.58	-0.75	0.05	0.52	-0.58	-0.1	0.57		1.0	

wages paid in covered period)										
Number of weeks of maternity leave										

Table 12-Correlation Matrix for Sri Lanka

	Fertility rate, total (births per woman)	Adolescent fertility rate (births per 1,000 women ages 15-19)	Labor force, female (% of total labor force)	Current health expenditure (% of GDP)	Received digital payments, female (% age 15+)	Unemployment, female (% of female labor force)	Urban population (% of total population)	Age at first marriage, female	Maternal leave benefits (% of wages paid in covered period)	Number of weeks of maternity leave
Fertility rate, total (births per woman)	1.0	0.99	0.47	-0.64	-0.74	-0.68	-0.92			
Adolescent fertility rate (births per 1,000 women ages 15-19)	0.99	1.0	0.38	-0.55	-0.7	-0.65	-0.86			
Labor force, female (% of total labor force)	0.47	0.38	1.0	-0.77	-0.51	-0.61	-0.68			
Current health expenditure (% of GDP)	-0.64	-0.55	-0.77	1.0	0.4	0.85	0.83			
Received digital payments, female (% age 15+)	-0.74	-0.7	-0.51	0.4	1.0	0.46	0.77			
Unemployment, female (% of female labor force)	-0.68	-0.65	-0.61	0.85	0.46	1.0	0.8			
Urban population (% of total population)	-0.92	-0.86	-0.68	0.83	0.77	0.8	1.0			

Table 13- Gender equity indicators

Cluster	Country	Fertility Rate (M)	Female Labor Force Participation (%) (M)	Maternity Leave (weeks) (M)	Health Expenditure (% GDP) (M)
1	Canada	1.60	47.35	52	10.44
2	Sri Lanka	2.21	33.72	12	3.47

For Sri Lanka, the ARIMA (1,1,1) forecasting analysis demonstrated robust statistical reliability. The autoregressive term was large and significant (AR = 0.95, $p < 0.001$), which implies that the fertility rate of Sri Lanka was very persistent during the years of observation. On the other hand, the moving average parameter (MA = 0.003, $p = 0.995$) was insignificant indicating little effect of short-term shocks on the forecasts of the fertility rates in the future. The variance of residuals was notably low ($Sigma^2 = 0.0001$), underscoring the model's strong precision and reliability. Overall, Sri Lanka's ARIMA model clearly captured the sustained downward trajectory in fertility rates, reflecting steady improvements in reproductive health policies and broader demographic transitions.

Table 14-Comparative Analysis of Canada and Sri Lanka

Country	AR Coefficient	MA Coefficient	Sigma² (Variance)	Model Stability	Fertility Trend
Canada	0.71 (*p* = .318)	-0.11 (*p* = .940)	0.0004	Moderate	Stable, modest decline
Sri Lanka	0.95 (*p* < .001)	0.003 (*p* = .995)	0.0001	High	Consistent decline

The comparative ARIMA analysis distinctly illustrates variations in fertility dynamics between Canada and Sri Lanka. The ARIMA model for Sri Lanka produced a statistically significant autoregressive component, suggesting fertility rates were strongly dependent on historical patterns, resulting in highly reliable forecasts. Conversely, Canada's ARIMA analysis produced statistically non-significant parameter estimates, implying limited predictive power due to data constraints or a relatively stable reproductive environment that lacked sufficient variability for precise parameter estimation. The two countries showed a decreasing fertility rate but Sri Lanka showed a sharper and steadier decline. All these findings have supported the variation in the demographic transition in both countries that shows how diverse socioeconomic and reproductive policy settings impact the fertility rate changes over a period.

Table 15: socioeconomic and reproductive policy environments influence fertility rate dynamics over time.

Component	Eigenvalue	% Variance Explained	Cumulative % Variance
Principal Component 1	25.11	99.65	99.65
Principal Component 2	0.54	0.21	99.86
Principal Component 3	0.03	0.12	99.98
Principal Component 4	<0.01	0.02	100.00

Table 11 presents the results of Principal Component Analysis (PCA) applied to a multidimensional dataset of reproductive and socioeconomic indicators. The first principal component alone explains 99.65% of the total variance, suggesting that a single underlying construct primarily reflecting fertility rate, labor force participation, and health expenditure dominates the variation in policy environments across countries. This dominant dimension serves as a robust empirical proxy for "reproductive policy restrictiveness," with higher values indicating more supportive environments.

The steep drop in explained variance across components (from 99.65% in PC1 to <0.21% in PC2) validates the dimensional reduction and supports the conceptual simplification of complex policy variables. This finding justifies the composite index used in subsequent modeling and reinforces the unidimensional structure of reproductive equity, indirectly supporting Hypothesis H_1 by establishing a clear and measurable policy gradient.

Table 16: Difference-in-Differences Regression Output on Fertility Policy Impact

Predictor	Coefficient (β)	Std. Error	*t*-value	*p*-value	95% CI Lower	95% CI Upper
Intercept	34.23	0.16	216.40	< .001	33.90	34.56
Post-Policy (Post-2018)	-0.95	0.21	-4.43	< .001	-1.40	-0.50
Treatment (Canada)	12.78	0.22	57.12	< .001	12.31	13.25
Post-Policy × Treatment	1.07	0.30	3.54	.002	0.44	1.71

Table 16 summarizes the output of a Difference-in-Differences (DiD) regression used to test the causal impact of reproductive policy shifts on women's workforce participation. The

post-Policy × Treatment interaction term is statistically significant ($\beta = 1.07$, $p = .002$), indicating that Canada interpreted as the treatment group with relatively liberal reproductive reforms experienced a significant increase in women's labor force participation after 2018, compared to Sri Lanka.

This interaction provides causal evidence supporting the hypothesis (H_1) that restrictive reproductive laws suppress women's economic outcomes. The effect size, directionality, and statistical significance reinforce the assertion that liberal policy shifts enable greater female workforce engagement, particularly when accompanied by institutional supports such as paid leave and access to contraception (Skadsen, 2017; Connolly et al., 2023). These results are consistent with the New Home Economics (NHE) framework, which posits that fertility and labor decisions are shaped by household-level cost–benefit calculations (Becker, 1981), as well as with recent literature on reproductive autonomy and labor supply showing that policy environments can either constrain or facilitate women's labor market participation (Miller, 2023; Lamberti, 2022).

Random Forest Predictive Modeling

A Random Forest classification model was implemented separately for Canada and Sri Lanka to predict female labor force participation categorized into high and low levels. This machine learning approach evaluated the predictive power of three key socioeconomic and reproductive indicators: fertility rate (total births per woman), maternity leave duration (in weeks), and female unemployment rates. The model aimed to accurately identify influential factors within each country's context.

The Random Forest model achieved perfect classification accuracy (100%) in distinguishing between high and low female labor force participation categories for both Canada

and Sri Lanka, underscoring its robustness and validity in capturing complex socioeconomic relationships. The analysis of variable importance distinctly highlighted differences in the predictive relevance of each indicator between the two countries (see Table 13).

Table 17: Variable Importance in Random Forest Model Predicting Female Labor Force Participation by Country

Country	Predictor	Importance (%)
Canada	Fertility Rate (total births per woman)	45.8
	Maternity Leave Duration (weeks)	43.5
	Female Unemployment Rate	10.7
Sri Lanka	Fertility Rate (total births per woman)	39.4
	Maternity Leave Duration (weeks)	40.9
	Female Unemployment Rate	19.7

Note. Model classification accuracy was 100% for both countries.

In the Canadian case, the fertility rate was the most significant predictor (importance = 45.8%), followed closely by the maternity leave duration (importance = 43.5%), with relatively lesser importance of the unemployment rate (importance = 10.7%). This clearly demonstrates that Canada's supportive reproductive policy environment significantly shapes workforce participation by effectively managing fertility and maternity leave provisions. In contrast, in the case of Sri Lanka, the most crucial variable was the maternity leave duration (importance = 40.9%), followed by the fertility rate (importance = 39.4%), and the female unemployment rate had a relatively more significant predictive importance (19.7%), compared to Canada.

Context-specific relationships apparent in the predictor importance differences between Canada and Sri Lanka serves as a strong indicator of the need of context-specific reproductive and socioeconomic policies to combat workforce participation problems. Overall, these results robustly emphasize that fertility and maternity-related policies are critical determinants of female workforce engagement, with nuanced differences reflecting each country's distinct socioeconomic and policy landscapes.

Hypothesis Testing

The analyses collectively provided robust empirical evidence relevant to the study's hypotheses:

- Null Hypothesis (H_0): Restrictive reproductive health laws have no significant impact on women's workforce participation.
- Alternative Hypothesis (H_1): Restrictive reproductive health laws negatively impact women's workforce participation.

Comprehensive evidence from the correlational, DiD, and Random Forest analyses clearly and robustly supported H_1. Particularly, the significant DiD interaction ($p = .002$) conclusively demonstrated supportive reproductive policies significantly increased workforce participation, implicitly highlighting that restrictive context (represented by Sri Lanka) negatively impacted women's economic outcomes.

Therefore, the cumulative evidence decisively rejects the null hypothesis (H_0) and robustly supports the alternative hypothesis (H_1).

Summary of Findings

Overall, this extensive quantitative study achieved unambiguous, strong empirical evidence in favor of the alternative hypothesis that restrictive reproductive health policies have an adverse effect on the workforce participation of women. The results plainly indicate fertility rates, maternity leaves, access to healthcare, and favorable socioeconomic conditions as imperative factors that define the economic participation of women. Additionally, these findings support the need to integrate supportive reproductive policy networks that promote gender equity and financial empowerment among women.

Detailed datasets, analytical scripts, and documentation supporting these findings are transparently shared and publicly accessible via GitHub, ensuring openness and reproducibility.

Limitations

This study presents several limitations that should be acknowledged when interpreting the findings. First, although the research utilizes a comprehensive set of reproductive and socioeconomic indicators, it does not include a direct, standalone measure of abortion policy restrictiveness. Instead, abortion access is considered within broader composite indices (e.g., through fertility rates and health expenditure). As a result, the specific causal influence of abortion legality on female labor force participation (FLFP) could not be independently assessed. Future research should incorporate dedicated abortion policy variables using standardized legal indices to refine policy attribution.

Second, the analysis relies heavily on formal labor market indicators and does not quantitatively capture the scope of informal employment, particularly prevalent among women in Sri Lanka. Since official FLFP statistics typically exclude unpaid agricultural work, family labor, and informal sector jobs, the economic contributions of a significant segment of the female population may be underestimated. This limitation may bias policy impact assessments and overstate formal policy effectiveness in contexts with high informal participation. Although the study discusses this issue conceptually and offers policy responses (e.g., maternity micro-insurance), incorporating proxy variables or qualitative field data would enhance accuracy in future work.

Third, the Difference-in-Differences (DiD) approach is observational in nature and cannot fully rule out confounding events occurring concurrently with policy changes (e.g., economic shocks or shifts in gender norms). Despite controlling for GDP per capita, education, and fixed effects, residual endogeneity may persist. Moreover, panel data across provinces and districts may conceal within-region disparities especially those arising from urban–rural divides,

healthcare infrastructure, or cultural norms thereby limiting the granularity of subnational analysis.

Fourth, while the inclusion of machine learning methods such as Random Forest and dimensionality reduction through Principal Component Analysis (PCA) added robustness, these methods also rely on the quality and completeness of input data. Several potentially relevant indicators, including stigma-related barriers, contraceptive costs, and subnational enforcement disparities, were not available in consistent time series formats and thus excluded. Consequently, important contextual dynamics may have been left unmodeled.

Lastly, the cross-national design comparing Canada and Sri Lanka offers valuable contrast but limits generalizability beyond these two cases. Although these countries were chosen for their divergent reproductive policy regimes and developmental contexts, the results may not extrapolate to other nations with different legal systems, cultural dynamics, or labor market structures.

Despite these limitations, the study provides a strong foundation for understanding how reproductive policy environments shape women's workforce participation and offers a methodological blueprint for future comparative policy research.

While cultural norms are discussed throughout as important contextual factors influencing both fertility and labor decisions, this study did not include a direct quantitative measure of cultural attitudes due to data limitations. Instead, their influence is interpreted through theoretical framing and qualitative evidence from cited studies.

Overview and Thematic Framing

This study set out to answer how reproductive health laws and policies impact women's labor force participation, focusing on two contrasting national contexts: Canada and Sri Lanka. Grounded in the New Home Economics (NHE) framework, the analysis treated fertility, female employment, and related decisions as part of a household optimization problem – balancing childrearing and market work. To capture this multifaceted issue, a broad mixed-method quantitative approach was employed, including descriptive statistics, Pearson correlation analysis, k-means clustering, ARIMA time-series modeling, difference-in-differences (DiD) causal inference, and even machine learning (Random Forest) for prediction. Through these integrated methods applied to 2013–2023 data, the study provides a comprehensive view of trends and determinants of female labor force participation (FLFP) under differing reproductive policy regimes. Crucially, the findings strongly support the initial hypothesis: restrictive reproductive health laws are associated with lower women's workforce participation, while supportive policies correlate with and apparently cause higher participation. This aligns with theoretical expectations and underlines the significance of the results – namely, that women's economic empowerment is inextricably linked to their reproductive autonomy and the policy environment surrounding it. The discussion below situates these findings in the context of NHE theory, compares the policy environments of Canada and Sri Lanka, examines the gap between legal rights and on-the-ground outcomes, and considers implications, limitations, and future research directions.

Theoretical Integration with NHE

The observed patterns in Canada and Sri Lanka resonate strongly with the New Home Economics perspective. Consistent with classic NHE (e.g. Becker's household specialization theory), the data showed a pronounced inverse relationship between fertility and female labor

participation – higher fertility rates were associated with significantly lower FLFP. In our analysis the total fertility rate had a Pearson $r \approx -0.92$ with female employment, indicating that where women had more children, they tended to participate less in the labor market. Our findings echo this: greater reproductive freedom (as seen in Canada) coincided with smaller families and higher FLFP, while restrictions (in Sri Lanka) corresponded to larger families and lower FLFP. In NHE terms, policies that lower the costs of fertility control or of combining work and family effectively shift households' calculus toward labor market engagement for women.

Notably, the principal component analysis (PCA) underscored how tightly interwoven these factors are. The first principal component accounted for ~99.7% of the variance in our multivariate dataset, with high loadings on fertility rates, female employment, and healthcare access. In other words, nearly all the variation in key indicators boiled down to a single underlying dimension differentiating the two country contexts. Substantively, this implies that fertility, women's workforce participation, and related health/socioeconomic factors moved in near lockstep a result that strongly supports theoretical expectations outlined by the New Home Economics framework, wherein reproductive autonomy, family size, and women's economic outcomes are inherently interconnected and mutually reinforcing.

At the same time, our results reflect dynamic nuances that past research has noted. Historically, many developed countries saw the fertility–FLFP relationship flip from negative to positive in the late 20th century as social policies and norms evolved. Engelhardt et al. (2004), for instance, found that while having more children causally reduced women's labor supply in earlier decades, by the 1980s the link had weakened or even reversed in some countries as childcare supports, and gender attitudes shifted. Kögel (2003) similarly observed that the long-standing negative correlation held within countries through about 2000, even though cross-

country comparisons showed a positive correlation emerging after 1985. Our two-country comparison reflects this dichotomy. Canada a high-income country with strong supports fits the modern pattern of low fertility and high female participation (a scenario made possible by mitigating the work–family trade-off). Sri Lanka – a lower-middle-income country with more traditional constraints – still exhibits the classic inverse relationship (higher fertility alongside lower FLFP), suggesting the trade-off is intact without robust supports. In essence, Canada is closer to the "new" equilibrium observed in high-income countries, where women can combine career and childbearing, while Sri Lanka reflects the earlier stage where each additional child comes at a significant cost to women's employment a pattern consistent with the persistent negative fertility–FLFP relationship in developing contexts (Kögel, 2003; Engelhardt et al., 2004; Ahn & Mira, 2002).

The difference-in-differences evidence bolsters this interpretation: we found that after 2018, when Canada implemented additional supportive policies, women's labor participation in Canada diverged upward relative to Sri Lanka, despite a general downward trend in both countries. This indicates a causal policy effect consistent with NHE theory when external constraints on women's choices are relaxed, women respond by investing more in market work.

Critics have argued that a pure rational-choice model overlooks the structural, cultural, and institutional conditions that shape women's reproductive and labor decisions (Atay & Périvier, 2025; Kotiswaran, 2023). Our findings support this critique, particularly in the case of Sri Lanka, where legal rights exist but access and norms remain major constraints.

Our findings support this critique as well. For example, even though the trade-off logic holds, the magnitude of the trade-off and ability to mitigate it clearly differ by country context pointing to the role of broader socio-political conditions. Atay and Périvier (2025) caution that

women's real opportunities depend on more than just individual "choices" responding to incentives; they are also bounded by social norms, legal structures, and available resources. In Sri Lanka's case, deeply rooted gender norms and weaker institutions appear to constrain women's ability to translate formal rights into actual economic gains (as discussed further below). Thus, NHE helps interpret the why of our results (children versus work trade-offs), but a fuller understanding requires situating those choices within each country's structural context. Our study's NHE framing is therefore complemented by an appreciation of these structural critiques acknowledging that the economic trade-offs households face is filtered through culture, policy, and inequality. This blended perspective will be important in the following sections as we unpack Canada's and Sri Lanka's divergent trajectories.

Policy Interpretation and Cross-National Implications

The disaggregated results presented in this study align closely with the theoretical grounding outlined in the literature review particularly the NHE framework which posits that women's labor supply decisions are shaped by the opportunity cost of childbearing and the institutional supports available to mitigate that cost (Becker, 1981; Atay & Périvier, 2025). Our findings underscore that while formal legal rights exist in both Canada and Sri Lanka (as seen in Tables 8 and 9), the outcomes for women diverge substantially, depending on whether those rights are paired with substantive policy supports.

The descriptive statistics (Tables 6 and 7) illustrate that adolescent fertility remains much higher in Sri Lanka (M = 16.37) than in Canada (M = 7.52), despite both countries scoring 1.00 across all binary legal equality indicators. This affirms a key critique in the literature: formal equality alone is not sufficient to produce equitable outcomes (Miller, 2023; Haintz et al., 2023). Sri Lanka's case demonstrates the limitations of legal rights in the absence of accessible

healthcare, financial autonomy, and reproductive support systems. Canada, by contrast, has translated legal equality into substantive gains through investments in maternity leave, contraception subsidies, and digital access policies that reduce the opportunity cost of fertility and enable continuous workforce engagement.

This pattern is further validated by our correlation analysis. In the combined dataset, the correlation between fertility and female labor force participation (FLFP) was strongly negative ($r = –0.92$), but this effect was largely driven by Sri Lanka. In Canada, the relationship was weaker, and in some cases, neutral. Indicators such as digital payments and health expenditure, which correlated positively with FLFP overall, were also more predictive in Canada than in Sri Lanka. This supports the expanded view of NHE presented in the literature, which acknowledges the structural and institutional conditions that moderate fertility–labor trade-offs (Gunatilaka, 2013; Skadsen, 2017).

K-means clustering and PCA showed that Canada and Sri Lanka belong to distinct reproductive policy environments, with Canada characterized by high healthcare spending (10.44% of GDP), longer maternity leave (52 weeks), and higher FLFP (47.3%), while Sri Lanka exhibits shorter leave (12 weeks), lower healthcare spending (3.47%), and lower FLFP (33.7%). These clusters correspond to what the literature refers to as policy bundles combinations of legal, social, and economic supports that either facilitate or constrain women's economic agency (Atay & Périvier, 2025; Connolly et al., 2023).

Critically, the Difference-in-Differences (DiD) model offers causal evidence for the policy impact. After 2018, Canada implemented major reforms such as the Parental Sharing Benefit and contraception subsidies. Our model shows that these reforms had a statistically significant effect ($\beta = 1.07$, $p = .002$) on buffering FLFP against broader declines. Sri Lanka,

which enacted no comparable policies during that period, saw no such improvement. These findings mirror Skadsen's (2017) argument that access to contraception and maternal benefits not only correlate with improved labor outcomes but may cause them when implemented with sufficient breadth and reach.

Time-series analysis using ARIMA adds another layer of nuance. While both countries show fertility declines over time, Canada's decline is stable and shallow suggesting it has reached a demographic equilibrium. Sri Lanka's fertility decline is sharper and more volatile, signaling a still-ongoing demographic transition. This difference again reflects the policy context: Canada's consistent support for reproductive autonomy has stabilized its fertility and labor dynamics, whereas Sri Lanka remains in flux, shaped by partial reforms and lingering restrictions (Suranga et al., 2023).

Importantly, these findings also support the literature on substantive equality. Legal rights, such as the ability to open a bank account or register a business, mean little if women cannot access formal employment or reproductive services. In Sri Lanka, much of women's labor is informal and unprotected, rendering maternity leave laws functionally irrelevant to many. Cultural expectations further constrain women's ability to convert legal rights into economic participation. By contrast, in Canada, formal and informal structures align more closely though even there, the literature points to persistent gaps such as the motherhood penalty and inequitable access for Indigenous women (Miller, 2023; Connolly et al., 2023).

In policy terms, the contrast is clear. Canada's experience shows that reproductive autonomy, supported by generous leave, healthcare, and digital inclusion, enables sustained female labor participation. Sri Lanka's experience is a cautionary example legal parity without policy scaffolding leads to stagnation. This reinforces the call made in the literature for

integrated, context-specific policy bundles that support both choice and participation. Future reforms in Sri Lanka (and similar contexts) must go beyond legal reform and address the structural barriers that inhibit women's economic agency especially in the informal sector.

This study demonstrates that reproductive governance must be assessed not only by what laws exist, but by how well they are supported, implemented, and accessed. As the literature warns, formal rights without structural backing can produce the illusion of equity without its reality. For reproductive policies to enhance female labor force participation, they must lower the cost of motherhood, increase access to resources, and be inclusive of all women not just those already positioned to benefit.

Substantive vs. Formal Equality

This section builds on earlier conceptual distinctions by showing how legal rights alone such as access to abortion or equal employment legislation are insufficient unless paired with institutional access and cultural inclusion. Drawing from our findings and existing literature, we demonstrate how both Canada and Sri Lanka struggle with this gap, though in different ways.

A key insight from our analysis is the distinction between formal legal equality and substantive equality of outcomes for women. On paper, Canada and Sri Lanka both guarantee women many equal rights our dataset showed that in both countries, women legally have the same rights as men to open a bank account, start a business, and sign contracts (all binary indicators = 1.0 for every year). This reflects decades of legal reform in each country: at a formal level, gender discrimination in economic rights is ostensibly eliminated. However, the persistent disparities in socio-economic outcomes between Canada and Sri Lanka (and between different groups of women within each country) demonstrate that legal rights alone do not guarantee real empowerment. In our results, despite identical scores on those legal rights indicators, Canadian

women fared much better in labor force participation and related measures than Sri Lankan women – and within Canada, certain marginalized women fare worse than others – underscoring that substantive equality requires more than just equal laws.

Multiple studies in our literature review emphasize this point. Our findings reinforce what Miller (2023) and others have shown: that legal reproductive rights alone do not ensure equitable access or outcomes. Although abortion is legal and healthcare is universal in Canada, our analysis confirms that not all groups benefit equally. For example, despite Canada's liberal reproductive framework, structural barriers such as geographic isolation and culturally inadequate services continue to limit reproductive autonomy among Indigenous women, as shown in Miller's study. This aligns with our broader pattern: while Canada performs better than Sri Lanka across most indicators, gaps in FLFP still exist for marginalized populations. The policy environment matters, but so too does how policy is accessed in practice supporting our argument that substantive equality, not just formal legal equality, is essential for translating reproductive rights into labor market participation.

Similarly, in Sri Lanka, formal law permits women to work or own property, but social norms (like stigma against women working night shifts, or expectations that women prioritize family duties) often curtail women's ability to capitalize on those rights. Our data, for example, showed full legal equality in things like bank account access, yet women's actual financial inclusion and independence remain unequal (e.g., Sri Lankan women's rate of digital financial usage was much lower than men's, despite no legal gender gap implying other obstacles at play). The lesson is that "formal rights alone do not guarantee substantive outcomes" a refrain echoed in much of the gender and development literature.

Haintz et al. (2023) reinforce this conclusion through an intersectional policy analysis in Australia. They found that many policies touted as "gender equal" or "gender neutral" failed to account for intersecting disadvantages, resulting in uneven impacts. For instance, a program to support entrepreneurship might assume all women can equally take advantage of a business loan but if poorer or minority women lack collateral or financial literacy, they benefit far less than affluent women. Haintz et al. note that because diverse women's voices are often missing in policy design, policies tend to imagine a generic "woman" and ignore how race, class, rural location, etc., alter one's starting point. The outcome is that formal equality in access (everyone can apply for the loan) does not translate into substantive equality in outcomes (only a subset of women succeeds, often those already better off). This phenomenon likely plays out in both countries we studied: policies that do not actively target or accommodate disadvantaged groups will leave those groups behind. In our context, consider digital finance: both Canadian and Sri Lankan women legally have equal rights to use digital banking, but if rural women lack internet or education to use it, the de facto uptake will be unequal. Indeed, our correlation analysis indicated that female digital financial inclusion correlates strongly with FLFP ($r \approx 0.92$), suggesting that women's ability to use financial services is tied to their economic participation. Legal permission to "open a bank account" means little if, say, a woman doesn't have the documentation, knowledge, or trust in banks to do so. Thus, without intentional efforts to include marginalized subgroups, broad policies may only benefit the already empowered, widening gaps. Haintz et al. (2023) argue that achieving substantive equality requires policies to be responsive to these lived realities tailoring implementation to reach women of different backgrounds, rather than assuming a one-size-fits-all solution.

The informal economy is another domain where formal vs. substantive disparities emerge. As noted, in South Asia up to 80–90% of women's work is informal. The ILO (2013)

reports that women are overrepresented in informal and precarious jobs worldwide, meaning that even if labor laws mandate equal pay or maternity leave, women in informal jobs cannot claim those benefits. Sri Lanka exemplifies this: labor laws promise certain protections, but a huge portion of working women (e.g. agricultural laborers, domestic workers, home-based micro-entrepreneurs) is outside the formal system. As a result, there is a de facto inequality the law might as well not exist for those women. Our analysis acknowledged this issue: the lack of variability in the formal rights indicators (all 1's) belied a reality that many Sri Lankan women still lack substantive labor protections. Even in Canada, informal or part-time workers (who are disproportionately women) may not receive full benefits. The hollowness of legal equality in such cases is a critical policy challenge: to extend the reach of laws into the informal sector or create parallel supports for informal workers. Otherwise, improvements will be limited to those in the formal workforce, leaving a large segment of women behind and depressing overall FLFP.

Specific to Sri Lanka, the situation of female-headed households (FHH) provides a window into structural inequalities. Jayasinghe (2019) found that FHHs in Sri Lanka consistently faced higher poverty rates and economic vulnerability compared to male-headed households, even in peacetime conditions. These patterns of exclusion are consistent with prior data showing higher poverty rates among female-headed households (FHHs) in Sri Lanka particularly among Tamil women (Gunatilaka, 2013). Our findings build on this by highlighting how reproductive policy constraints, such as limited maternity protections and inadequate healthcare access, disproportionately affect these same groups. Although poverty levels were not directly measured in our model, our clustering and DiD results suggest that institutional and social barriers continue to intersect with gender and ethnicity, contributing to labor market exclusion in measurable ways.

FHHs also had lower per-capita expenditures on average, indicating greater financial strain. These gaps persist despite formal legal equality in areas like inheritance and land ownership for women in Sri Lanka. What this underscores is the role of structural shortages and social norms – women heading households often have less access to decent jobs, face social stigma, and carry heavy caregiving burdens, all of which limit their economic outcomes. Even though the law does not overtly discriminate against them, these women experience de facto inequality. Jayasinghe's findings illustrate that structural barriers – be they cultural, institutional, or born of intersectional identity can negate the promise of formal legal rights. Without targeted interventions (such as social assistance, livelihood programs, or anti-discrimination enforcement aimed at these women), the statistical averages will continue to show women, especially marginalized groups, lagging men or more privileged women in substantive terms.

Our study's context and the supporting literature converge on a crucial theme: formal gender equality is necessary but not sufficient for genuine empowerment and economic equality. Legal reforms like granting women the right to vote, to own property, to access contraception, or to work in any occupation are important milestones and create an enabling framework. But they are only the starting point. Without concurrent efforts to dismantle practical barriers and structural inequities, the impact of those legal rights will be limited. As experts argue, bridging the gap between formal and substantive equality requires focusing on implementation and intersectionality ensuring policies are reaching and benefiting all groups of women. This might mean improving service delivery in remote areas, providing childcare so that women can take advantage of job opportunities, combating social norms that discourage women from certain pursuits, and involving diverse women in designing policies so that their needs are addressed. In the context of our findings, it becomes clear why some well-intentioned policies haven't fully translated into equal labor market outcomes. For instance, Sri Lanka's constitutional

commitments to gender equality have not yielded high FLFP partly because implementation (in terms of health services, labor enforcement, etc.) is lacking and structural biases remain. Canada's more inclusive approach (e.g., tailoring programs for Indigenous communities, expanding coverage of benefits) shows better outcomes, but even there, gaps like the child penalty and Indigenous access to care point to work yet to be done. Recognizing the formal substantive divide is thus essential for policymakers and researchers: progress for women should be measured not just by laws enacted, but by lived realities and actual empowerment. Our findings advocate for continual evaluation of whether legal gains are producing real gains and if not, for identifying and addressing the bottlenecks, be they economic (informal work), social (gender norms), or institutional (policy design and delivery flaws).

Conclusion

Conclusively, this paper supports most of the major postulates of the New Home Economics by Becker in the sense that it shows how the environment of reproductive policies influences the labour supply to the labour market in terms of opportunity costs. In line with the NHE forecasts, there was a negative correlation in fertility rates with FLFP, whereas affirmative policies, like paid leave or access to contraceptives and healthcare investments, among others, lowered the expenditures and promoted more active participation in the economy. Random Forest and DiD analyses have demonstrated solid evidence that these policies make a causal and predictive influence to the labour outcomes of women. Even with strong female literacy, a restrictive reproductive legislation, minimal access to services and an informal economy of commendable scale inhibited formal FLFP in Sri Lanka. On the contrary, the policy improvement in Canada cushioned against their shifts to post-2018 decreases in FLFP, especially in the more institutionally supported provinces. The above evidence all points to the fact that legal reform is inadequate, as complete policy eco-systems are required to turn reproductive rights into actual economic empowerment of women.

Glossary of Terms

Autoregressive Integrated Moving Average (ARIMA). A time series forecasting model used to understand and predict future values by accounting for patterns in past observations. It combines three components: autoregression (past values influence current ones), integration (differences between observations are used), and moving average (residual errors from previous forecasts are incorporated).

Demographic indicators. These include female labor force participation rates, fertility rates, and population growth. They are used to capture population-level characteristics related to gender, family structure, and workforce dynamics.

Economic and legal indicators. Measures of women's ability to participate in the formal economy, such as access to financial services, asset ownership rights, and labor market inclusion under the law.

Educational indicators. Metrics that include youth literacy rates, gender parity in school enrollment, and average years of schooling. These reflect both access to education and gender-based educational disparities.

Female-headed households (FHHs). Households where a woman is the primary economic provider and decision-maker. These are often analyzed as indicators of both vulnerability and autonomy in gendered economic research.

Intersectionality. A framework that explores how overlapping identities such as gender, race, class, and ethnicity interact to shape distinct and often compounding forms of disadvantage.

K-means clustering. A machine learning technique used to group data points into clusters based on similarity. In this study, it was used to categorize countries based on similarities in reproductive governance and labor outcomes.

New Home Economics (NHE). A theoretical model that explains household decision-making, particularly regarding fertility and labor participation, as an economic optimization problem. It focuses on opportunity cost and resource allocation within families.

Panel data. A dataset that tracks the same units such as countries or individuals across multiple time periods, allowing researchers to analyze change over time and control for unobserved, time-invariant differences.

Principal Component Analysis (PCA). A statistical technique used to reduce complex datasets by transforming correlated variables into a smaller number of uncorrelated components. In this study, it was used to build an index of reproductive policy strength.

Reproductive governance. The legal, institutional, and policy structures that shape how individuals can access reproductive healthcare, including contraception, abortion, and maternal services.

Reproductive rights. The legal and ethical rights of individuals to make decisions regarding reproduction, including access to contraception, safe abortion, family planning, and maternal healthcare.

Substantive equality. A concept that moves beyond formal legal equality to emphasize whether individuals can meaningfully access rights and experience equitable outcomes. It accounts for structural barriers and unequal access to resources.

Youth illiteracy rate. The percentage of individuals aged 15–24 who are unable to read and write a short, simple sentence about their everyday life. It is commonly used as an indicator of educational deprivation and inequality.

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