

Gender gaps in education and labor, human-capital efficiency and inclusive regional growth in Chile

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Abstract

Purpose – This study investigates whether reducing gender gaps in education and labor markets contributes to regional economic growth in Chile. It provides empirical evidence on the economic costs of gender inequality across the country's diverse sixteen regions, highlighting how tailor-made inclusive growth strategies can yield substantial growth dividends.

Design/methodology/approach – The research employs a dynamic panel-data model (system GMM). The framework identifies STEM graduation and labor force participation rates as the primary gender gaps drivers associated with regional growth. The specification incorporates macroeconomic controls and a mining-region interaction to capture structural heterogeneities.

Findings – The results reveal a statistically significant and negative association between gender gaps and regional GDP growth. A counterfactual “Minding the Gap” scenario estimates that a 25% reduction in these disparities yields a national growth dividend of up to 0.5% points. The impact is highly heterogeneous; the largest dividends are found in relatively poorer, non-mining regions, supporting regional convergence. While macro-level data limitations prevent capturing non-economic dimensions of inequality, the consistency across GMM specifications provides a robust basis for tailored policy interventions.

Originality/value – This paper provides novel subnational evidence on the economic impacts of gender inclusiveness within an emerging economy context. It suggests that persistent disparities restrict human capital efficiency, undermining regional productivity and long-run growth potential, thereby framing gender equality as a strategic lever for territorial development.

Keywords Gender gaps, STEM education and labor force participation, Human-capital efficiency, Inclusive regional growth, Dynamic panel data, Chile

Paper type Research article

1. Introduction

In recent decades, economic research has increasingly recognized the importance of social, institutional, and cultural factors in shaping development outcomes. Among these, gender inequality has emerged as a critical dimension influencing economic performance. A growing body of empirical evidence shows that reducing gender gaps—particularly in labor force participation and education—can significantly enhance economic growth and resilience, especially in the context of aging populations and labor market constraints (OECD, 2024; Baerlocher *et al.*, 2021).

International organizations have responded by integrating gender equality into their development agendas. The World Bank's Gender Strategy 2024–2030 frames gender equality as both an economic and moral imperative; the European Commission presents it as essential for competitiveness, democracy, and social fairness; and the United Nations emphasizes its



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role in achieving inclusive and sustainable development (World Bank, 2024; European Commission, 2025; UN Women, 2020; UNDP, 2024).

This study focuses on Chile, a country that experienced rapid economic growth for 3 decades, earning the nickname “the Jaguar of Latin America” in reference to the remarkable growth of the “East Asian Tigers” (Young, 1995). However, since 2014, Chile’s growth has slowed markedly, averaging just 1.9% annually (excluding the pandemic years). This stagnation, despite strong macroeconomic fundamentals, highlights the need to explore new drivers of regional economic performance. One such driver may be gender inclusiveness.

Chile ranks 45th on the Human Development Index (HDI) and 33rd on the Gender Inequality Index (GII), indicating room for improvement in both human capital utilization and gender equity (UNDP, 2024). According to UNDP (2025), the HDI captures average achievements in health, education, and income, with two of its core components—years of schooling and gross national income (GNI) per capita—closely related to the educational and economic dimensions examined in this study. The GII, in turn, reflects gender-based disadvantages across reproductive health, empowerment, and labor market participation (Figure 1) [1].

Notably, two of its indicators—educational attainment (measured as the share of women and men with at least secondary education) and labor force participation—directly align with the gender gap variables used in our analysis. Despite significant progress in women’s educational attainment, persistent disparities remain in labor force participation, income, and employment quality—particularly in urban areas and among highly educated women (OECD, 2021).

This paper investigates whether reducing gender gaps in education and labor markets can contribute to regional economic growth in Chile. Drawing on panel data from the country’s sixteen regions between 2010 and 2024, we use indicators of gender inequality in education and in the labor market, estimating a dynamic panel-data model to assess the relationship between these gaps and regional GDP growth, controlling for key macroeconomic variables.

By adopting a regional perspective, the analysis moves beyond aggregate national estimates and provides novel evidence on how gender disparities interact with heterogeneous economic structures across territories. In doing so, the paper contributes to the literature on

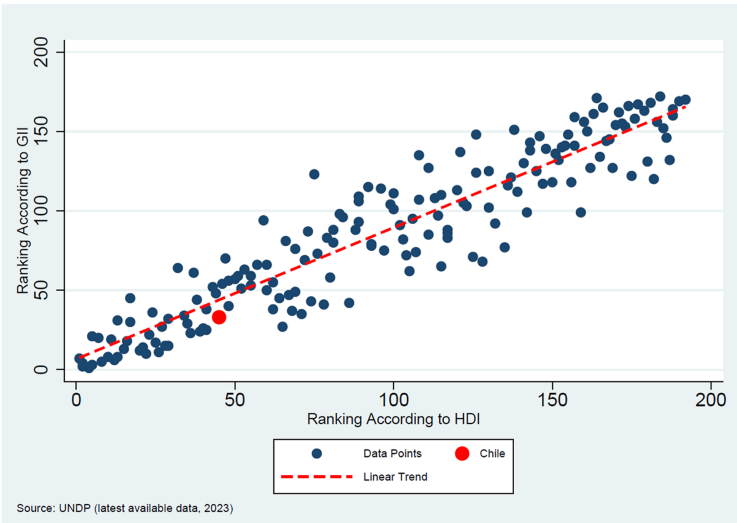


Figure 1. Gender Inequality (GII) and Human Development (HDI)

inclusive growth by highlighting gender inequality as a source of human capital misallocation and productivity losses at the subnational level.

Our findings show a statistically significant and negative association between gender gaps in education and in the labor market with regional economic growth. These results suggest that “*Minding the Gap*” policies aimed at reducing gender inequality—particularly in STEM education (Conde-Ruiz *et al.*, 2024; ECLAC, 2023a) and labor market participation—can yield substantial growth dividends. Importantly, the effects are not uniform across regions, underscoring the need for place-based strategies that address local labor market conditions, educational access, and institutional barriers. In this sense, our results support the rationale for investment-oriented cohesion policies—such as those implemented by the European Union—to reduce regional disparities and enhance territorial competitiveness (Molica *et al.*, 2025). This aligns with recent findings about Chile by Pérez Silva (2025), who shows that local development levels influence the interregional migration patterns of highly skilled workers, reinforcing regional inequalities in human capital and economic performance.

In sum, this paper contributes to both the gender and regional development literatures by providing robust, regionally disaggregated evidence on the economic costs of gender inequality in Chile. It supports the case for integrating gender considerations into regional development planning and offers empirical insights to inform inclusive growth strategies tailored to Chile’s diverse regional contexts.

The remainder of the paper is structured as follows. Section 2 develops the conceptual framework. Section 3 describes the data, econometric methodology and results. Section 4 discusses the implications of the findings, with particular attention to regional heterogeneity. Section 5 concludes by outlining policy implications, broader societal impacts, and avenues for future research.

2. Conceptual framework

Considering Chile’s economic geography, which is marked by significant disparities in productivity, labor market structure, and access to education and infrastructure, a regional perspective is essential (Peña-Cortés *et al.*, 2025). These regional differences shape the opportunities and constraints faced by women and men, influencing how gender gaps manifest and affect economic outcomes. For instance, mining-intensive regions (M) may offer high-paying jobs that remain male-dominated, facing significantly deeper labor participation gaps than both service-oriented (S) and Agriculture, Service and Fishing (AFF) regions. On the other hand, service-oriented regions exhibit relatively larger gaps in STEM graduation. Although educational institutions are most heavily concentrated in these urban service hubs, their large population size generates a substantial gap between potential demand and actual educational supply (Tables A2 and A3 in Appendix).

Therefore, by focusing on regional data, this study contributes to a growing literature that emphasizes the spatial dimensions of inclusive growth. It complements cross-country analyses by offering context-specific insights into how gender inequality interacts with regional economic structures, contributing to emerging work on subnational inequalities in Latin America and other developing contexts (ECLAC, 2023b). For instance, countries such as Mexico, Brazil, and Peru exhibit similar patterns of structural heterogeneity, labor market segmentation, and persistent gender disparities, reinforcing the relevance of analyzing gender gaps within territorially diverse economies. Empirical evidence from Latin America further supports this perspective: Gasparini and Marchionni (2015) document persistent gender gaps in labor income and participation across the region, while Atal, Nopo and Winder (2009) shows that a significant share of wage inequality in countries such as Peru and Mexico remains unexplained by observable characteristics, pointing to structural and institutional constraints (see also Hoyos and Nopo, 2010). In a related strand of literature, Espina and Zhao (2015) find that gender segmentation in civic participation in Latin America is linked to gender differences

in political engagement, demonstrating that gender inclusiveness—or the lack thereof— affects all dimensions of civil society.

Other country-specific studies have explored the relationship between gender inequality and regional development. For instance, [Nandan and Mallick \(2020\)](#) find that gender equality fosters economic growth and that interstate differences in gender equality contribute to disparities in per capita income across Indian states. A similar point is made by [Steinberg and Nakane \(2012\)](#) for the case of Japan. These findings reinforce the broader argument that gender disparities in labor and education are not only social concerns but also structural constraints on economic performance.

Consistent with endogenous growth theory, gender inequality affects economic performance through several interrelated mechanisms ([Zhang et al., 1999](#)). Building on foundational literature that includes the empirical evidence provided by [Barro and Lee \(1994\)](#) regarding sources of economic growth, the gender-gap model of [Glor and Weil \(1996\)](#), the Schumpeterian growth framework of creative destruction proposed by [Aghion and Howitt \(1992\)](#), among others, as well as international policy frameworks pushed by several organizations including UNDP and OECD, unequal access to education and employment limits the efficient allocation of human resources, reduces the overall talent pool, and constraints innovation and knowledge diffusion. As argued by [Klasen and Santos Silva \(2018\)](#), these distortions generate human-capital inefficiencies and labor misallocation, ultimately lowering productivity and long-run economic growth. These effects are particularly pronounced within heterogeneous regional contexts, where structural conditions shape both the magnitude and transmission of these inefficiencies.

Another key aspect of our paper is its emphasis on the macroeconomic relevance of policy actions oriented towards closing gender gaps. To this regard, our research question aligns with [Stotsky \(2006\)](#), who argues that reducing gender inequality and improving the status of women can enhance macroeconomic stability—an outcome closely linked to long-term growth performance ([De Long and Summers, 1992](#); [Harting, 2021](#)). In a similar vein, [Seguino \(2010\)](#) argues that government macroeconomic management policies are necessary to support progress toward gender equality. More recent macroeconomic models show that gender gaps in labor force participation and entrepreneurship can lead to substantial losses in aggregate productivity and income, reinforcing the broader macroeconomic costs of inequality ([Cuberes and Teignier, 2014, 2016](#); [Cuberes et al., 2021](#)).

New economic perspectives also stress the importance of considering the social and institutional contexts in which economic policies are implemented, ensuring that they address the specific needs and challenges faced by women in different regions. Among them, feminist economics has long emphasized the significance of unpaid care work, intra-household dynamics, and structural discrimination ([Benería, 1999](#); [Benería et al., 2016](#); [Folbre, 2002](#); [Perrons, 2005](#); [Seguino, 2021](#)). This line of research further acknowledges that gender gaps are not merely additive but interact in complex and cumulative ways, shaping women's economic opportunities and life trajectories ([Sen, 1990](#); [Nelson, 2006](#)). These dynamics are closely linked to institutional environments, including the prevalence of informality, access to social protection, and regional economic structures, all which condition women's participation in labor markets and their access to economic opportunities. As [Seguino \(2000\)](#) emphasizes, the impact of gender dynamics on growth is likely to depend on the structural characteristics of each economy, including labor market segmentation, institutional arrangements, and social norms.

[Figure 2](#) summarizes the conceptual framework guiding our analysis. Gender gaps in education and labor markets generate human-capital inefficiencies and labor misallocation, which in turn constrain productivity, innovation, and the effective utilization of talent. These mechanisms are shaped by regional economic structures and institutional conditions, ultimately leading to lower and more unequal regional growth outcomes. This framework integrates insights from endogenous growth theory, feminist economics, and the empirical literature on gender inclusiveness, highlighting the importance of incorporating gender

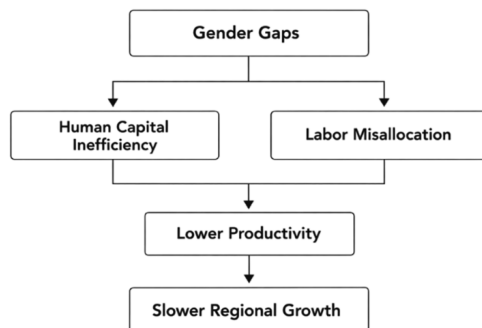


Figure 2. Conceptual framework: Gender gaps and regional economic growth. Source: Authors' own work

considerations into regional development strategies and providing policy-relevant evidence for promoting more inclusive and balanced economic growth.

3. Data, econometric methodology and results

We use data for Chile's sixteen regions over the period 2010–2024 to assess how gender disparities in education and labor markets influence economic performance. Our dependent variable is the annual growth rate of real GDP by region (*gr_gdp_reg*), whereas our independent variables of interest are three indicators of gender gaps: (1) the gaps in graduation rates from technical and professional STEM careers (*gg_stem*), representing gender gaps in education; (2) the gaps in terms of the labor force participation rate (*gg_pr*); and (3) the gaps in the combined rate of unemployment and involuntary part-time employment (*gg_cruipte*). These latter two variables stand for gender gaps in the labor market [2].

For illustrative purposes, we also compute the percentage gap between regional and national real per capita GDP. Summary statistics for this variable, the annual growth rate of regional GDP, and the three gender gap indicators are presented in [Tables A2 and A3](#) in the [Appendix](#).

As shown in [Table A3](#) in the [Appendix](#), which categorizes regions by their primary economic activity (Mining, Services, and AFF), the descriptive statistics reveal important nuances that informed our modeling choices. To statistically ground this typology, we conducted an ANOVA with post-hoc Bonferroni tests, revealing significant regional heterogeneities. For example, the positive gap relative to national GDP indicates that mining regions are, as a group, among the richest. Conversely, although AFF-oriented regions exhibit a higher point estimate for GDP growth, the tests reveal no statistically significant differences across groups ($p > 0.10$). This result reinforces the finding illustrated in [Figure 3](#) regarding the absence of a regional convergence process in Chile, contrary to the conditional convergence hypothesis of [Barro and Sala-i-Martin \(1992\)](#). While a formal test of the convergence hypothesis would require a broader dataset—such as that used for Mexican states in [Rodríguez Benavides et al. \(2022\)](#)—we focus instead on the hypothesis that reducing gender disparities may serve as a potential driver of faster regional economic growth.

Our baseline results are presented in [Table 1](#), while [Table A1](#) in the [Appendix](#) provides detailed variable definitions and sources. The five specifications reported in [Table 1](#) include three macroeconomic controls that affect all regions symmetrically: the lagged monetary policy rate (*L.mpr*), changes in bank lending standards (*ls_smle*)—capturing the transmission of monetary policy through the banking channel—and changes in economic policy uncertainty (*g_epu*). These specifications differ in their inclusion of the *gg_simce* indicator, the use of interpolated data points, and the inclusion of the *dmining* dummy interacted with *gg_pr*. For all models, we report *p*-values for the Arellano-Bond AR(2) test for second-order autocorrelation

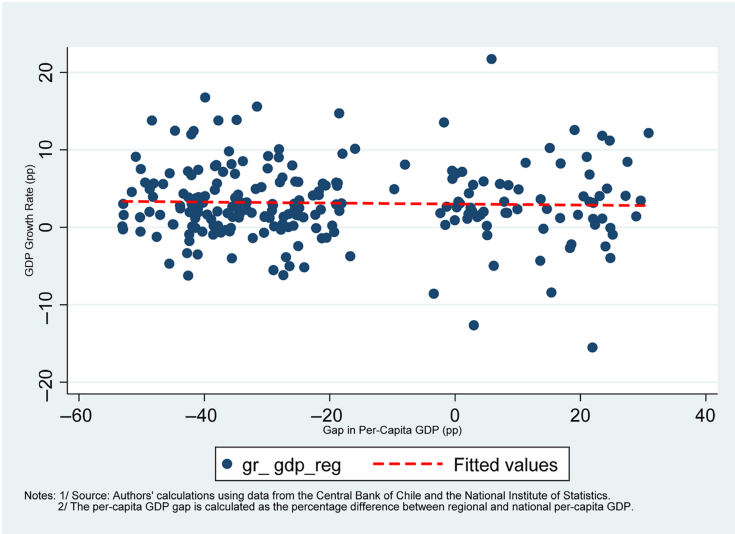


Figure 3. GDP Growth Rates vs Gaps in Per Capita GDP

and the Hansen/Sargan tests for instrument validity, confirming the internal consistency of our GMM approach. As discussed in Footnote 2, Specification (5) is our preferred model due to its superior theoretical consistency and econometric efficiency.

As shown in Table 1, the variables related to gender gaps in both education and the labor market are negative and statistically significant across all three alternative specifications. This indicates that regions with larger gender disparities tend to grow more slowly than their more gender-equal counterparts.

While the magnitude and statistical significance of the gender gap coefficients vary across these specifications—which is expected given the sensitivity of dynamic panel models to the inclusion of different independent variables—the coefficients are consistently negative whenever significant. This consistency also holds under alternative macro control variables and when estimated using either Difference GMM or System GMM (see Tables OA.1 and OA.2 in the Online Appendix). Furthermore, for all System GMM specifications, the AR(2) and Hansen tests satisfactorily confirm the validity of our instruments and the absence of second-order serial correlation. The isolated case where the AR(2) test is less robust (Specification #4 in Table OA.2 in the Online Appendix) further validates our decision to prioritize the macroeconomic controls reported in Table 1, which exhibit a broader and more exogenous impact across regions [3].

It is worth noting that all gender gap variables are measured in percentage points; consequently, the magnitude of the estimated coefficients is directly comparable among them. This consistency in measurement is key for the growth dividend exercise reported in the next section, which is based on our preferred Specification (5) from Table 1.

4. Discussion

To provide a policy-oriented discussion of our results, we conduct a counterfactual quantitative analysis labeled the “Minding the Gap” scenario borrowing from the concept discussed in Young et al. (2023). Specifically, we utilize the statistically significant coefficients from Specification (5) to quantify the potential GDP gains from a realistic policy

Table 1. Baseline results - system GMM method (*xtabond2*)

Specification # Variables	(1) gr_gdp_reg	(2) gr_gdp_reg	(3) gr_gdp_reg	(4) gr_gdp_reg	(5) gr_gdp_reg
L.gr_gdp_reg	-0.173 (0.232)	-0.246 (0.538)	-0.130 (0.262)	-0.154 (0.309)	-0.102 (0.311)
<i>Gender gaps in education</i>					
gg_simce	0.972 (0.988)	1.443 (1.592)		0.932 (0.926)	
gg_stem	-0.623** (0.277)	-0.616 (0.707)	-0.538 (0.312)	-0.622* (0.342)	-0.382*** (0.0949)
<i>Gender gaps in labor market</i>					
gg_pr	-1.102* (0.536)	-0.946 (0.761)	-1.194** (0.495)	-1.185* (0.632)	-1.068*** (0.331)
gg_cruipte	-0.537 (0.336)	0.105 (0.817)	-0.814 (0.504)	-0.572* (0.281)	-0.824 (0.525)
<i>Macro control variables</i>					
L.mpr	-0.714*** (0.164)	-0.388 (0.230)	-0.813*** (0.195)	-0.683*** (0.153)	-0.714*** (0.133)
ls_smle	0.165*** (0.0240)	0.0513 (0.0818)	0.175*** (0.0398)	0.167*** (0.0229)	0.181*** (0.0389)
g_epu	-0.0609** (0.0226)	-0.0619 (0.0932)	-0.0579* (0.0285)	-0.0582** (0.0232)	-0.0445*** (0.0125)
<i>Dummies and interaction</i>					
1.d_mining				5.889 (14.19)	4.636 (6.108)
1.d_mining#c.gg_pr				0.323 (0.510)	0.322 (0.258)
Constant	-45.01* (22.41)	-46.68 (52.57)	-42.59 (26.35)	-46.16 (30.80)	-30.41*** (9.157)
AR2-test	0.672	0.675	0.632	0.686	0.603
Hansen-test	0.277	0.629	0.253	0.518	0.454

Note(s): Robust standard errors in parentheses (*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$). All models include macroeconomic controls (*L.mpr*, *ls_smle*, *g_epu*) and are estimated using [GMM/Fixed Effects]. Specification (1) includes the full sample (2010–2024) and all four gender gap indicators. Specification (2) excludes the 2019–2021 period (interpolation years for *gg_simce*). Specification (3) includes the full sample but excludes *gg_simce*. Specification (4) adds the interaction term between the mining dummy and the participation gap (*dmining* · *gg_pr*). Finally, Specification (5) is our preferred model, which utilizes the full sample, excludes *gg_simce* to avoid measurement bias, and incorporates the *dmining* · *gg_pr* interaction

scenario: a 25% reduction in regional gender gaps. This exercise employs linear combinations of parameters (using the *lincom* command) to estimate regional and national growth dividends. This approach provides robust GDP gain estimates by reporting point estimates, standard errors, and 95% confidence intervals to ensure full transparency regarding the magnitude and precision of the impacts. These results are presented in Table 2, which reports the national growth dividend—calculated as the weighted average of regional results based on their GDP shares—and Figure 3, a Forest Plot that visualizes the growth dividend for each of the 16 regions, including their respective confidence intervals.

As seen in Table 2, if the “Minding the Gap” scenario is implemented—i.e. a 25% reduction in the *gg_stem* and *gg_pr* gaps across all regions—the overall growth gain would range between 0.2 and 0.5% points, with a more pronounced impact in non-mining regions. Econometrically, this differentiation is captured by the interaction between *dmining* and *gg_pr*. Although the interaction term itself is not individually significant, the total marginal effect

Table 2. Minding the gap scenario estimated national growth dividend from a 25% regional gender gap reduction

Weighted averages based on 2024 regional GDP shares							
	Baseline (2024)	Minding the gap scenario (95% CI)			Growth gain (percentage points)		
		LB	Point estimate	UB	LB	Point estimate	UB
Overall	2.9	3.0	3.2	3.3	0.2	0.3	0.5
Mining	2.2	2.3	2.4	2.5	0.1	0.2	0.3
Non-Mining	3.1	3.3	3.5	3.6	0.2	0.3	0.5

Note(s): Authors calculations based on Specification (5). The “Baseline” represents the weighted average of the 2024 regional GDP growth rates. While the official national GDP growth for 2024 was 2.6%, our synthetic baseline of 2.9% is derived from the aggregation of official regional-level data from the Central Bank of Chile, which excludes extra-regional GDP. The counterfactual “Minding the Gap” scenario columns—Lower Bound (LB), Point Estimate, and Upper Bound (UB)—represent the projected growth rates following a simultaneous 25% reduction in regional gender gaps for participation (*gg_pr*) and STEM graduation (*gg_stem*). The “Growth Gain” column signifies the percentage point increase over the baseline. Standard errors and confidence intervals are derived via linear combination tests (*lincom*) to account for parameter covariance and ensure statistical robustness

Source(s): Authors’ calculations

for mining regions—calculated as the linear combination of the base and interaction coefficients—remains statistically significant, albeit lower in magnitude than in other regions [4]. This lower sensitivity likely reflects structural constraints and the fact that mining-intensive areas start from significantly deeper participation gaps, as shown in Table A3 ($p < 0.05$) in the Appendix.

To better illustrate the economic impact in terms of GDP per capita, we apply the well-known “Rule of 70” (see, for example, Jones and Vollrath, 2013). According to this rule, an economy growing at 3% per year doubles its per capita GDP in approximately 23 years. However, if that growth rate increases by 0.5% points (i.e. to 3.5%), the doubling period is reduced to 20 years. This 3-year acceleration represents a non-trivial impact when considered over the long run (for instance, within a century, which is an appropriate horizon to evaluate structural growth policies).

Last but not least, Figure 4 illustrates that the growth impact is highly heterogeneous across regions. The top three most positively impacted regions are AFF-oriented (Ñuble, Los Lagos, and Maule), followed by a service-oriented region (Biobío). These four regions are relatively poor, with an average GDP per capita gap (Regional vs. National) of −36.6%. This figure represents a substantial economic disparity compared to the average gaps of −18.4% and −32.2% for service- and other AFF-oriented regions, respectively (see Tables A2 and A3 In Appendix). This pattern suggests that closing gender gaps could act as a powerful tool for regional convergence, providing the largest economic dividends to the territories facing the most acute structural lags. To that extent, Chile’s diverse economic geography underscores the need for tailored, place-based policy responses that reflect the unique economic structures, institutional capacities, and social dynamics of each territory.

These results align with recent macroeconomic analyses showing that gender inequality hampers development through reduced labor force participation and missed entrepreneurial potential (Ostry *et al.*, 2018; World Bank, 2024). Chile’s case is emblematic: despite considerable gains in educational attainment for women, substantial gender gaps persist in employment outcomes and job quality. Our findings of a consistent negative association between gender gaps (in both education and the labor market) and regional economic growth reinforce the idea that persistent gender disparities restrict the full utilization of human capital, thereby undermining regional productivity and long-term growth potential. Furthermore, they

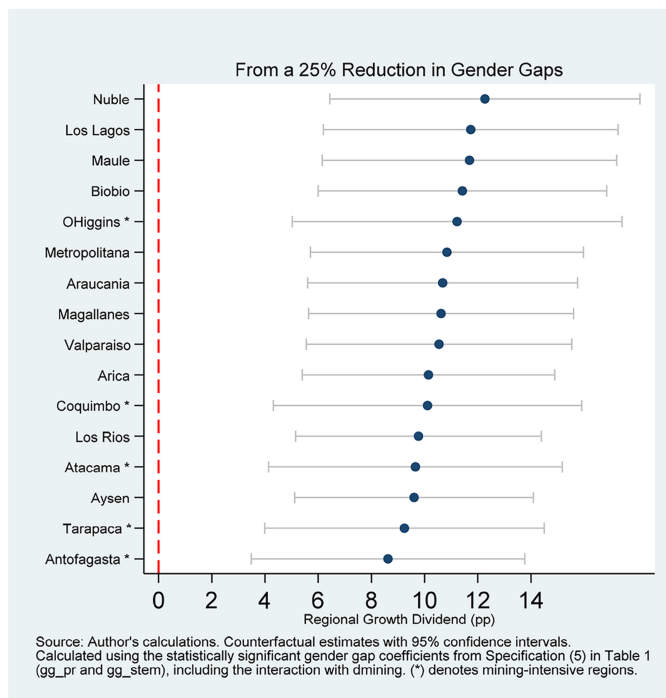


Figure 4. Minding the gap. Estimated regional growth dividend. Counterfactual estimates with 95% confidence intervals

suggest that without addressing the structural barriers that limit women's full participation in the economy—such as occupational segregation, inadequate childcare, and unequal access to quality employment—these disparities will continue to constrain growth.

Methodologically, the use of dynamic panel data and macroeconomic controls—specifically the monetary policy rate, bank lending standards, and economic policy uncertainty—strengthens the reliability of our results by minimizing confounding influences. However, as with most panel regressions that rely on macro-level data, this study cannot fully address all sources of endogeneity or capture the non-economic dimensions of gender inequality, such as agency, empowerment, and well-being. Nevertheless, the consistency of our results across various GMM specifications provides a robust basis for our policy-oriented discussion.

5. Policy implications, societal impacts, and directions for future research

5.1 Macroeconomic dividends and broader societal gains

This study provides robust empirical evidence that gender inequality—manifested in educational and labor market gaps—negatively affects regional economic growth in Chile. Using dynamic panel data from 2010 to 2024 across the country's sixteen regions, we find that both educational and labor-related gender gaps are negatively and significantly associated with regional GDP growth. Specifically, our study contributes to the growing literature showing that gender inclusiveness positively influences economic performance, reinforcing the idea that persistent gender disparities restrict the full utilization of human capital, thereby undermining regional productivity and long-run growth potential.

Against this background, the study supports gender equality as a strategic lever for fostering inclusive regional development. Our findings highlight that regions with more equitable access to education and labor market opportunities for women tend to grow faster, suggesting that closing these gaps can yield substantial economic dividends. However, the benefits extend beyond GDP growth. Reducing gender inequality can enhance economic resilience, foster innovation through more diverse talent pools (e.g. [Bandiera et al., 2018](#); [Hsieh et al., 2019](#)), and contribute to demographic sustainability by supporting women's long-run participation in the labor market ([Bloom et al., 2009](#)). These broader societal gains reinforce the importance of integrating gender equality into development strategies.

Ultimately, advancing gender equality is not only a localized regional challenge but also a core tenet of the United Nations 2030 Agenda for Sustainable Development ([UN, 2015](#)). Progress toward closing these disparities directly aligns with SDG 5 (Gender Equality) and acts as a catalyst for achieving SDG 8 (Decent Work and Economic Growth) and SDG 10 (Reduced Inequalities), providing a strategic global framework for fostering long-run, inclusive growth in Chile.

5.2 Theoretical limitations of traditional growth accounting

According to [Knowles et al. \(2002\)](#), [Solow's \(1957\)](#) seminal framework to account for the (proximate) sources of economic growth—i.e. growth accounting—is not well-equipped to explain how gender inequality translates into inefficiencies, even when extended to include gender disparities in education. Because of the assumption of competitive factor markets, the empirical applications of this framework typically assume that labor inputs are gender-neutral and they fail to incorporate unpaid care work, intra-household dynamics, and the unequal distribution of economic power, among other dimensions ([Folbre, 2021](#); [De Henau and Himmelweit, 2021](#)). Consequently, policies that do not account for these structural and institutional dimensions of gender inequality systematically underestimate their macroeconomic consequences.

5.3 A territorial policy roadmap for Chile

Building on the analysis, the results underscore the urgent need for an integrated and context-sensitive policy agenda. In line with recent empirical research ([IMF, 2022](#); [Cuberes et al., 2021](#)), this study supports the view that inclusive growth requires dismantling barriers to women's economic participation. To this end, investing in female education—particularly in STEM fields—and boosting women's labor force participation and employment quality should be prioritized.

In the Chilean context, these findings are directly relevant to ongoing national and regional policy efforts, including decentralization strategies aimed at strengthening regional development capacities. Furthermore, they closely align with the strategic guidelines of the Ministry of Women and Gender Equality, specifically its focus on strengthening women's economic autonomy and mainstreaming the gender perspective across territorial public policies ([MinMujerEG, 2024](#)). By providing concrete evidence on how localized disparities restrict productivity, our study directly supports institutional efforts aimed at eliminating barriers in the labor market, promoting formal employment, and implementing care-system frameworks that reduce the disproportionate burden of unpaid domestic work on regional female labor supply ([Acuña and Bravo, 2025](#)). Aligning these gender-equality policies with territorial development strategies can enhance their effectiveness and ensure that interventions respond to region-specific constraints.

Against this background, reducing gender gaps in the labor market and education systems can unlock underutilized human capital, foster innovation, and strengthen regional economies. Importantly, increasing labor force participation is insufficient if women remain concentrated in precarious, low-wage sectors with limited mobility or social protection—as documented in the Chilean context by [OCEC-UDP et al. \(2026\)](#). Policies must therefore go beyond mere

access to employment by addressing job quality, representation in leadership (Franceschet and Thomas, 2015), and care infrastructure. Support for working parents, investments in technical and vocational training, and targeted initiatives to close regional educational gaps can significantly amplify these efforts.

Furthermore, the analysis affirms that gender gaps constitute a significant constraint on regional economic growth in Chile. Therefore, these regional disparities underscore the importance of territorialized policy responses. Specifically, the effects of gender inequality on growth are mediated by local economic structures, institutional capacities, and prevailing social norms (Budig and England, 2001; Kabeer and Natali, 2013; Seguino, 2021). This underlines the need for region-specific diagnostics to inform targeted interventions. A “one-size-fits-all” approach is unlikely to succeed; instead, locally tailored strategies are essential to effectively reduce gender inequality and foster better economic outcomes.

5.4 Implications for higher education and curriculum design

Considering the need for promoting civil society engagement on gender issues (Htun and Weldon, 2012; World Bank, 2023), our study offers important implications for teaching and knowledge dissemination in gender economics and development studies. By providing regionally disaggregated empirical evidence and integrating macroeconomic, institutional, and social perspectives, the paper can serve as a valuable case study for illustrating how gender inequality operates as a constraint on economic performance in real-world contexts. Consequently, it can inform curriculum design by linking theoretical frameworks—such as endogenous growth theory and feminist economics—to applied policy challenges in emerging market economies.

5.5 Avenues for future research

Finally, this study highlights the need for further research into how gender gaps operate across different sectors of economic activity. Disaggregated sectoral analysis could provide deeper insights into the mechanisms through which gender inequality constrains productivity, thereby informing more precise and impactful policy interventions. While this paper accounts for regional heterogeneity through industry-based typologies, future research could benefit from spatial cluster analysis to better understand geographic spillovers.

Additionally, exploring other structural dimensions—such as access to credit, financial inclusion, and informal employment—represents a promising avenue, given increasing data availability. The exploration of potential non-linear effects or threshold levels in the relationship between gender gaps and regional growth—where economic penalties may intensify beyond certain levels of inequality—also remains an important direction for future research. Last, but not least, the role that generative AI may play in terms of gender gaps is a need that has recently emerged as a key priority issue.

Summing up, advancing gender equality is thus not only a matter of social justice but a strategic pathway for fostering resiliency, innovation, and long-run inclusive growth in Chile.

Data availability statement

The dataset and the Stata codes used for this research are available from the corresponding author upon request.

Declaration on the use of artificial intelligence

In accordance with the journal’s transparency guidelines and AI policies, the authors declare that a large language model (AI assistant) was utilized during the manuscript preparation stage solely to refine linguistic clarity, stylistic readability, and structural formatting of the revised sections. All underlying research conceptualizations, variables definition, econometric strategy specification, data processing, and

policy-simulation designs remain entirely the original work and intellectual responsibility of the human authors.

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Appendix

Table A1. Variables definition and sources

Variables	Definition	Sources
<i>Dependent variable</i>		
gr_gdp_reg	Annual growth rate of regional real GDP growth	Central Bank of Chile
<i>Gender gaps in education</i>		
gg_simce	Standardized math test scores (SIMCE, secondary education)	Ministry of Education
gg_stem	Graduation rates from technical and professional STEM careers	Ministry of Education
<i>Gender gaps in labor market</i>		
gg_pr	Labor force participation rate	National Institute of Statistics
gg_cruipte	Combined rate of unemployment and involuntary part-time employment	National Institute of Statistics
<i>Macro control variables</i>		
L.mpr	One-period lag of monetary policy rate	Central Bank of Chile
g_pcu_real	Annual percentage change in real copper price	Central Bank of Chile and US export price index for all commodities
g_ggc_real	Annual percentage change in real central government spending	Central Bank of Chile
inv_gdp	Investment-to-GDP ratio	Central Bank of Chile
g_ec	Annual percentage change in entrepreneurial confidence index (increase (+))	Instituto Chileno de Administración Racional de Empresas (ICARE)
ls_smle	Annual percentage change in lending standards to SMEs and large enterprises (loosening = increase)	Central Bank of Chile
g_epu	Annual percentage change in economic policy uncertainty index (increase (+))	Clapes-UC
<i>Dummies & interaction</i>		
dcovid	COVID-19 dummy that takes value 1 in 2020–2022	
1.d_mining	Mining Regions dummy that takes value 1 for regions 2, 3, 4, 5, and 8 (in north to south order)	
1.d_mining#c.gg_pr	Mining dummy interaction with participation rate	
Source(s): Authors’ own work		

Table A2. Summary statistics by region

Primary sector of economic activity	Mining (M)				Services (S)				Agric., Forest., Fish. (AFF)			
	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max
<i>Variables region</i>	<i>Tarapaca</i>				<i>Arica y Parinacota</i>				<i>Maule</i>			
Gap in GDP per-cápita (Regional vs. National)	28.7	15.5	18.3	74.7	-39.8	2.3	-42.6	-34.8	-46.2	3.7	-53.1	-41.2
Growth Rate of Real GDP (gr_gdp_reg)	1.5	6.6	-15.5	12.2	2.9	6.0	-6.2	16.8	3.4	4.9	-3.3	13.8
STEM T&P Careers Graduates Gender Gap (gg_stem)	-55.7	7.7	-67.5	-41.5	-60.0	8.3	-70.8	-44.9	-57.1	7.7	-68.6	-45.5
Labor Participation Rate Gender Gap (gg_pr)	-21.7	2.7	-27.0	-17.8	-21.1	3.4	-24.8	-14.1	-26.2	2.4	-30.7	-21.8
	<i>Antofagasta</i>				<i>Valparaíso</i>				<i>Nuble</i>			
Gap in GDP per-cápita (Regional vs. National)	150.5	24.4	113.7	197.6	-25.2	2.5	-28.1	-20.6	-31.8	3.8	-37.4	-24.9
Growth Rate of Real GDP (gr_gdp_reg)	1.7	4.7	-6.1	9.9	2.3	3.9	-6.2	10.1	3.2	4.7	-5.5	15.6
STEM T&P Careers Graduates Gender Gap (gg_stem)	-46.2	6.7	-53.8	-33.8	-54.4	5.1	-60.3	-44.0	-60.4	4.7	-69.5	-52.9
Labor Participation Rate Gender Gap (gg_pr)	-27.2	4.8	-34.6	-21.0	-22.2	2.4	-26.1	-17.4	-23.4	2.7	-28.2	-19.6
	<i>Atacama</i>				<i>Metropolitana</i>				<i>La Araucanía</i>			
Gap in GDP per-cápita (Regional vs. National)	23.0	4.0	13.6	29.6	0.2	1.9	-3.4	2.7	-48.2	3.9	-53.0	-42.0
Growth Rate of Real GDP (gr_gdp_reg)	3.2	5.4	-4.3	12.6	3.1	4.7	-8.6	13.5	3.7	4.0	-4.7	12.5
STEM T&P Careers Graduates Gender Gap (gg_stem)	-50.2	8.9	-64.8	-34.2	-60.9	2.4	-64.2	-56.8	-53.8	4.5	-61.2	-47.9
Labor Participation Rate Gender Gap (gg_pr)	-26.1	4.5	-34.3	-19.6	-21.0	1.9	-25.1	-18.3	-23.4	3.3	-28.9	-18.7
	<i>Coquimbo</i>				<i>Biobío</i>				<i>Los Ríos</i>			
Gap in GDP per-cápita (Regional vs. National)	-26.0	4.7	-30.5	-16.0	-36.6	3.4	-41.9	-30.9	-39.3	3.3	-43.9	-34.6
Growth Rate of Real GDP (gr_gdp_reg)	2.8	5.2	-5.0	14.7	3.6	4.5	-1.4	13.8	3.3	3.3	-4.0	9.8
STEM T&P Careers Graduates Gender Gap (gg_stem)	-53.7	8.2	-64.4	-40.5	-61.0	7.2	-75.3	-47.8	-55.1	6.4	-65.2	-45.1
Labor Participation Rate Gender Gap (gg_pr)	-25.2	2.8	-31.4	-22.0	-25.8	3.2	-31.7	-20.0	-23.8	3.3	-28.8	-16.5
	<i>O'Higgins</i>				<i>Magallanes</i>				<i>Los Lagos</i>			
Gap in GDP per-cápita (Regional vs. National)	-19.5	1.6	-22.3	-16.7	4.8	3.4	-0.5	10.1	-31.9	7.2	-44.9	-24.1
Growth Rate of Real GDP (gr_gdp_reg)	2.6	3.6	-3.7	9.5	2.4	4.7	-12.6	7.3	4.3	4.3	-5.2	12.4
STEM T&P Careers Graduates Gender Gap (gg_stem)	-62.4	10.6	-75.3	-42.8	-59.2	6.5	-72.7	-50.1	-59.0	6.2	-70.1	-48.3
Labor Participation Rate Gender Gap (gg_pr)	-26.1	2.5	-31.0	-21.5	-21.4	4.2	-27.2	-15.4	-24.9	3.5	-30.1	-18.9
									<i>Aysén</i>			
Gap in GDP per-cápita (Regional vs. National)									8.9	8.3	-9.7	16.8
Growth Rate of Real GDP (gr_gdp_reg)									4.0	7.0	-8.4	21.7
STEM T&P Careers Graduates Gender Gap (gg_stem)									-45.6	13.2	-63.6	-21.7
Labor Participation Rate Gender Gap (gg_pr)									-17.6	3.2	-25.1	-12.9
Note(s): Gender gaps are measured by the percentage difference between males and females for the specific variable												
Source(s): Authors' calculations based on data from the original sources indicated in Table A1												

Table A3. Mean by primary sector of economic activity

Variable	Primary sector			Test of means (Bonferroni)		
	M	S	AFF	S vs. M	AFF vs. M	AFF vs. S
Gap in GDP per-capita (Regional vs. National)	31.3	−18.4	−32.2	***	***	***
Growth Rate of Real GDP (<i>gr_gdp_reg</i>)	2.4	2.8	3.7			
STEM T&P Careers Graduates Gender Gap (<i>gg_stem</i>)	−53.6	−59.0	−55.3	***		***
Labor Participation Rate Gender Gap (<i>gg_pr</i>)	−25.3	−21.8	−23.6	***	**	***
Note(s): *** <i>p</i> < 0.01, ** <i>p</i> < 0.05, * <i>p</i> < 0.1						
Mining (M): Tarapacá, Antofagasta, Atacama, Coquimbo, O'Higgins						
Services (S): Arica y Parinacota, Valparaíso, Metropolitana, Biobío, Magallanes						
Agriculture, Forestry, Fishing (AFF): Maule, Ñuble, La Araucanía, Los Ríos, Los Lagos, Aysén						
Source(s): Authors' calculations						

Notes

1. For an alternative Gender Equality Index, see [European Institute for Gender Equality \(2024\)](#).
2. We originally included another gender gap in education (*gg_simce*) measured by standardized math test scores (SIMCE). However, due to the social unrest in 2019 and the COVID-19 pandemic in 2020–2021, the SIMCE test was not administered. Instead of interpolating these years, we decided to exclude it in our preferred specification (Specification # 5 in [Table 1](#)), since the impact of early educational gender gaps is effectively captured by STEM graduation rates. By streamlining the model, we avoid potential measurement error issues without sacrificing the theoretical core of the study. Nevertheless, for completeness, Specifications # 1 and # 2 in [Table 1](#)—as well as several models in [Tables OA.1 and OA.2](#)—report results including *gg_simce*, confirming that its exclusion does not alter the main findings.
3. A more detailed discussion of why the alternative specifications face specific econometric challenges that justify their placement in the [Online Appendix](#) is provided there.
4. In Specification (5), the interaction term between *dmining* and *gg_pr* is not individually significant. However, following standard econometric practice for interaction models, we evaluate the total impact for mining regions using linear combination tests (*lincom*). These tests confirm that the combined effect of the gender participation gap is statistically significant for both mining and non-mining regions, though the growth dividend is numerically larger in the latter.

Supplementary material

The supplementary material for this article can be found online.

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