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Resilience Through Inclusion: Women and Data-Driven Climate Policies in Rwanda

Maria Gelrud, Marina Marinkov (AFR), Jorge Mondragón Minero, and Daniela Viana Costa (SPR).

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Resilience Through Inclusion: Women and Data-Driven Climate Policies in Rwanda

Prepared by Maria Gelrud, Marina Marinkov, Jorge Mondragón Minero, and **Daniela Viana Costa**

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ABSTRACT: Climate shocks represent a recurrent macroeconomic risk for Rwanda, affecting growth, fiscal stability, and household welfare. Gender inclusion is macro-critical to Rwanda's growth and resilience strategy, shaping the effectiveness of adaptation and fiscal policy responses. Women are highly exposed to these shocks due to their concentration in agriculture and informal employment, as well as more limited access to finance, assets, and coping mechanisms. Using both micro- and macro-level analysis, this paper finds that climate shocks widen gender income disparities and that closing gender gaps enhances the effectiveness of adaptation policies and accelerates post-shock recovery. Rwanda's data-driven policy tools—climate budget tagging, gender budget tagging, and the dynamic social registry—offer a strong foundation for linking climate and gender objectives within fiscal policy. Strengthening these instruments and promoting women's participation in the green transition would help sustain resilience, inclusion, and long-term growth.

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SELECTED ISSUES PAPERS

Resilience Through Inclusion: Women and Data-Driven Climate Policies in Rwanda

Rwanda

Prepared by Maria Gelrud, Marina Marinkov (AFR), Jorge Mondragón Minero, and Daniela Viana Costa (SPR).[1]

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RWANDA

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November 14, 2025

Approved By
African Department

Prepared by Maria Gelrud, Marina Marinkov (both AFR), Jorge Mondragón Minero, and Daniela Viana Costa (both SPR) under the guidance of Albert Touna Mama.

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RESILIENCE THROUGH INCLUSION: WOMEN AND DATA-DRIVEN CLIMATE POLICIES IN RWANDA

Climate shocks represent a recurrent macroeconomic risk for Rwanda, affecting growth, fiscal stability, and household welfare. Gender inclusion is macro-critical to Rwanda's growth and resilience strategy, shaping the effectiveness of adaptation and fiscal policy responses. Women are highly exposed to these shocks due to their concentration in agriculture and informal employment, as well as more limited access to finance, assets, and coping mechanisms. Using both micro- and macro-level analysis, this paper finds that climate shocks widen gender income disparities and that closing gender gaps enhances the effectiveness of adaptation policies and accelerates post-shock recovery. Rwanda's data-driven policy tools—climate budget tagging, gender budget tagging, and the dynamic social registry—offer a strong foundation for linking climate and gender objectives within fiscal policy. Strengthening these instruments and promoting women's participation in the green transition would help sustain resilience, inclusion, and long-term growth.

A. Introduction

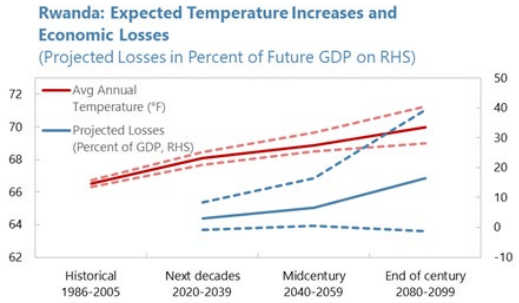
1. Rwanda's strong development record faces growing challenges from climate change and persistent gender gaps. More frequent floods, droughts, and landslides are already weighing on growth and livelihoods, damaging farmland and housing, and threatening to reverse hard-won progress (Figure 1). While women have been central to Rwanda's economic transformation—contributing nearly half of labor force growth over the past two decades—they remain underrepresented in higher-productivity and formal sectors and earn less on average than men. These gaps, rooted partly in barriers to access to higher-skills training, finance, and productive assets, weaken productivity and growth in their own right and heighten vulnerability to climate shocks, as women are disproportionately employed in climate-sensitive and informal activities. Together, climate vulnerability and gender inequality constrain potential growth and call for a coordinated, data-driven policy response.

2. Rwanda is recognized for its strong gender-inclusion agenda—an area that is macro-critical to the country's growth and resilience—supported by robust institutional frameworks and investments in women's skills and economic participation. Gender objectives are integrated into national planning, budgeting, and climate strategies through coordination led by the Ministry of Gender and Family Promotion (MIGEPROF) and the Gender Monitoring Office (GMO), with the Ministry of Finance and Economic Planning (MINECOFIN) ensuring alignment via gender- and climate-budget tagging. Complementary initiatives such as Ireme Invest, the Financial Sector Development Strategy, and the Technical and Vocational Education and Training (TVET) policy further embed gender priorities in the development and climate agenda (Table 1). The long-standing TVET policy has enhanced women's empowerment by equipping them with practical, entrepreneurial, and communication skills that improve access to traditionally male-dominated jobs and foster economic self-reliance (Minani and Sikubwabo, 2022). More recently, the Women Entrepreneurs Finance Code introduced gender-disaggregated financial reporting and the development of tailored financial

products to expand access for women-led MSMEs. Despite this progress, women remain over-represented in agriculture and informal employment—sectors that are lower-productivity and more exposed to climate shocks.

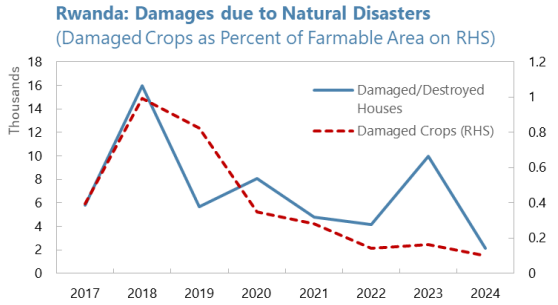
Figure 1. Rwanda: Macroeconomic Impact of Natural Disasters and Inclusive Growth

Rising temperatures are projected to cause significant economic damage in the coming decades by exacerbating the effects of natural disasters.



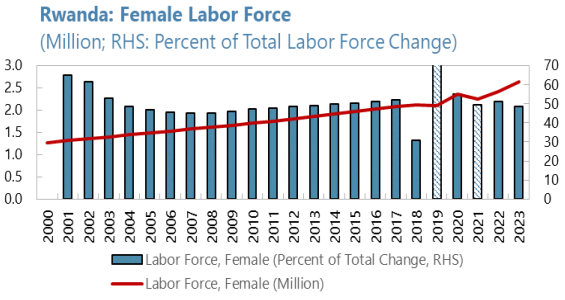
Source: Climate Impact Lab.
Note: Dashed lines represent 95% confidence intervals. Average annual temperature projections and projected losses correspond to scenarios SSP2 and SSP3, respectively.

Economic damages to farmland and housing are already substantial, although adaptation policies have mitigated some of the more severe impacts.



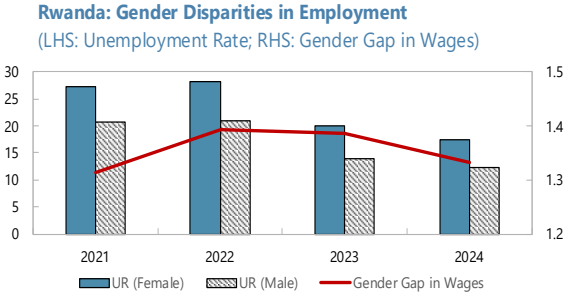
Source: Rwandan Authorities and IMF Staff Calculations.

Women accounted for about a half of the increase in the labor force in the last 20 years, which has been a significant contributor to Rwanda's economic success.



Sources: World Bank and IMF Staff Calculations.
Note: Dashed columns show years in which the change in labor force was negative.

Yet, a sizable gender gap remains, hindering productivity and opportunities for further economic growth.



Sources: Rwandan Authorities and IMF Staff Calculations.
Note: Gender gap in wages is expressed as male-to-female ratio of average hourly wages.

3. This paper examines how Rwanda's data-driven policy frameworks support inclusive and climate-resilient development. Climate Budget Tagging (CBT), Gender Budget Tagging (GBT), and the dynamic social registry have strengthened the integration of climate and gender considerations into budget allocation, monitoring, and social protection. Together, these frameworks underpin the National Strategy for Transformation (NST2) and Rwanda's Green Growth and Climate Resilience Strategy, positioning Rwanda as a global frontrunner in aligning adaptation, inclusion, and fiscal management. By improving the targeting and efficiency of public spending, these frameworks help strengthen fiscal resilience and reduce macroeconomic and external imbalances arising from climate shocks.

Table 1. Rwanda: Institutional Framework for Gender and Climate Integration

Pillar	Policy Focus	Institutional Anchors / Instruments	Recent Reforms and Key Documents	Gender–Climate Relevance
Policy Coordination and Oversight	Gender mainstreaming across national development and climate policy	Ministry of Gender and Family Promotion (**MIGEPROF**): policy lead on gender equality Gender Monitoring Office (**GMO**): oversight and accountability for gender mainstreaming **National Women's Council**: community engagement and advocacy Ministry of Finance and Economic Planning (**MINECOFIN**): integration of gender objectives into budgets and macroframeworks	**GMO five-year plan (2024–29)**: strengthens gender-mainstreaming and monitoring systems, providing an institutional anchor for integrating gender priorities into national development and climate policies **Revised National Gender Policy (2021)**: updated framework for gender mainstreaming across sectors **Laws & Policies for Gender – GMO repository**: Official reference for gender legal and institutional framework	Provides overarching coordination ensuring that gender equality goals are embedded in climate, economic, and social policies. Strengthened oversight helps align national gender objectives with Rwanda's Green Growth and Climate Resilience Strategy, ensuring accountability for gender-responsive climate action.
Financing and Implementation Tools	Gender-responsive and climate-smart budgeting and investment	**MINECOFIN**: GBT and CBT integrated in the PFM system **Development Bank of Rwanda** (**BRD**), **FONERWA**, and **Ireme Invest**: green-finance facilities supporting private-sector climate investment **Financial Sector Development Strategy (FSDS)** and **WE Finance Code (2025)**: expanding MSME and women-led business access to credit	**Financial Sector Development Strategy 2024–29**: emphasizes inclusive finance for women, youth, MSMEs, and agriculture **Financial Sector Development Strategic Plan 2018–24**: foundational framework still in effect pending rollout of FSDS 2025–30 **FinScope 2024 Gender Thematic Report (BNR)**: key data source for tracking progress on women's financial inclusion and informing gender-responsive financial-sector reforms	Directs resources toward green sectors and ensures that women entrepreneurs benefit from climate-finance flows. GBT and CBT integrate gender and climate objectives in budget allocations, while Ireme Invest and FSDS help expand green employment opportunities for women.
Capacity and Inclusion Enablers	Skills, technology, and data systems for inclusive participation	**Rwanda TVET Board (RTB)**: oversees technical and vocational training **Dynamic Social Registry**, **VUP**, and **Ejo Heza**: delivery and data tracking platforms **National Bank of Rwanda (BNR)**: monitors financial and digital inclusion **MINECOFIN**: oversees data-driven fiscal tools (CBT, GBT)	**RTB Strategic Plan 2021–24**: modernizes curricula, expands access, and integrates ICT skills into TVET programs **National FinTech Strategy 2024–29**: prioritizes digital financial inclusion and cybersecurity for women and MSMEs **National Employment and Skills Strategy**: aligns education and labor-market needs	Builds human capital for green and digital economies while reducing climate vulnerability. Expanding TVET and digital skills enables women to participate in resilient, higher-productivity sectors and supports the use of data tools (CBT, GBT, social registry) to target climate adaptation policies more effectively.

4. The paper is diagnostic rather than prescriptive. It examines the broader relationship between climate risks, gender gaps, and macroeconomic resilience—and how Rwanda's data-driven systems can be leveraged to amplify policy effectiveness. The remainder of the paper is organized as follows. Section II discusses the economic impact of climate shocks on women, underscoring the macro-critical nature of climate risks and the structural factors that heighten women's vulnerability. Section III presents empirical evidence based on microdata, quantifying how climate shocks affect

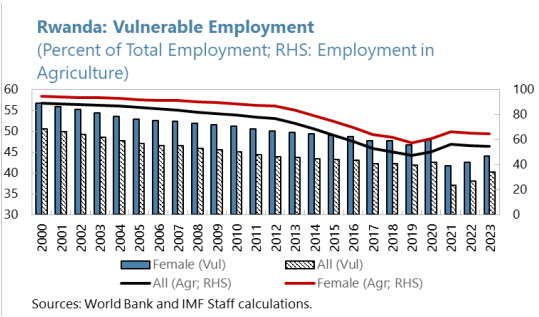
women's labor-market outcomes and household resilience. Section IV develops the complementary macroeconomic analysis using a general equilibrium model, showing how closing gender gaps can enhance the effectiveness of adaptation investment and accelerate post-shock recovery. Section V examines Rwanda's data-driven policy instruments—Climate Budget Tagging (CBT), Gender Budget Tagging (GBT), and the dynamic social registry—and explores opportunities and risks in the green transition, with a focus on women's participation in emerging sectors. Section VI concludes with policy priorities to strengthen linkages across these initiatives and further integrate gender and climate considerations into policymaking.

B. The Economic Impact of Climate Shocks on Women

5. Climate shocks have tangible macroeconomic and social consequences in Rwanda, with disproportionate effects on women. Structural inequalities increase women's exposure to disasters shocks and slow their recovery (Figure 2). Women's concentration in agriculture and informal employment makes them particularly vulnerable to weather-related shocks, while heavier care responsibilities constrain their ability to adapt and rebuild. Limited access to credit and productive assets further hampers recovery and exacerbates existing inequalities.

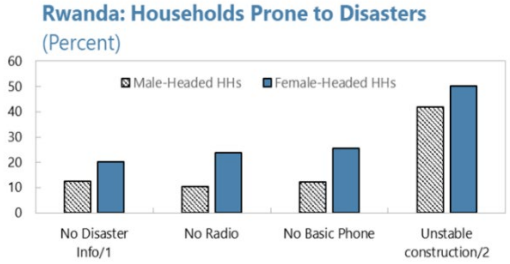
Figure 2. Rwanda: Drivers of Women's Exposure to Natural Disasters

Agriculture is the main source of employment, particularly for women, who are often engaged in vulnerable, informal work lacking decent conditions.



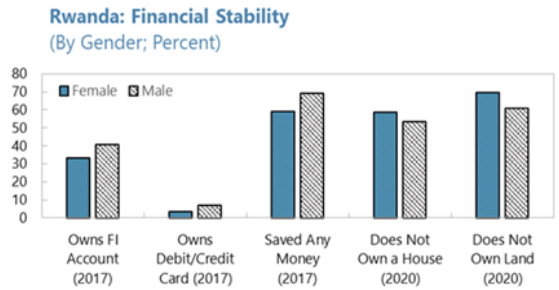
Sources: World Bank and IMF Staff calculations.

Female-headed households have limited access to disaster communications and early warnings, and their homes are more vulnerable to damage during disasters.



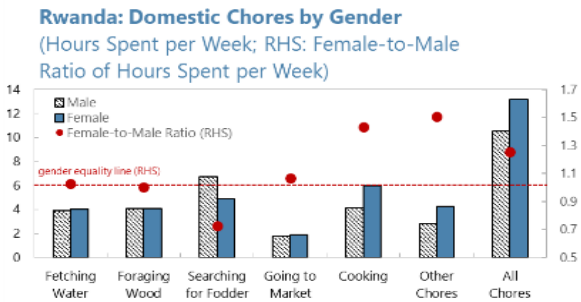
Sources: Rwandan authorities and IMF Staff calculations.
1/ Households that did not receive any environmental information in the last 12 months.
2/ Houses that have walls made of mud bricks without cement or tree trunks with mud without cement.

Women's ability to respond to shocks is limited by their restricted access to credit and financial buffers.



Sources: World Bank and IMF Staff Calculations.
Note: The year in brackets denotes the year with the latest available data.

Also, women's time poverty, higher due to household chores, makes them more vulnerable to disasters.

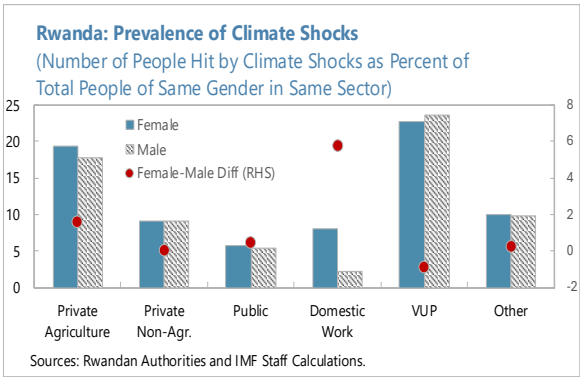


Sources: Rwanda Household Survey (EICV7) and IMF Staff calculations.

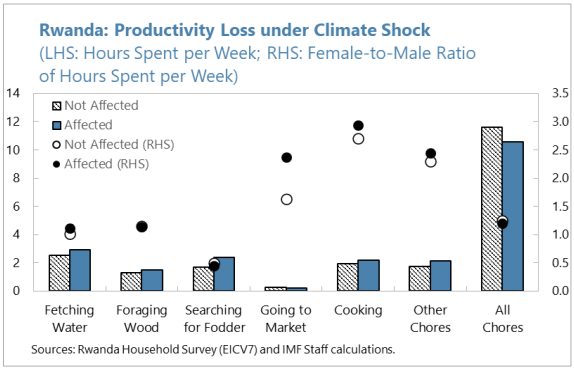
6. Microdata indicate that women in private agriculture and domestic work are among the most affected by climate shocks. Individuals hit by shocks report allocating more time to domestic responsibilities, reducing time available for productive work (Figure 3). In response to these shocks, households tend to work longer hours, reduce consumption, and draw down savings, yet most had not fully recovered at the time of the survey. Recovery is slower for female-headed households, highlighting how pre-existing vulnerabilities shape the distributional impact of climate events.

Figure 3. Rwanda: Response to Natural Disaster Shocks

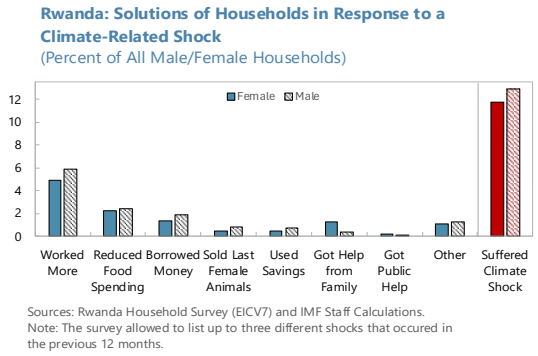
Women in private agriculture and domestic work were disproportionately hit by climate-related shocks.



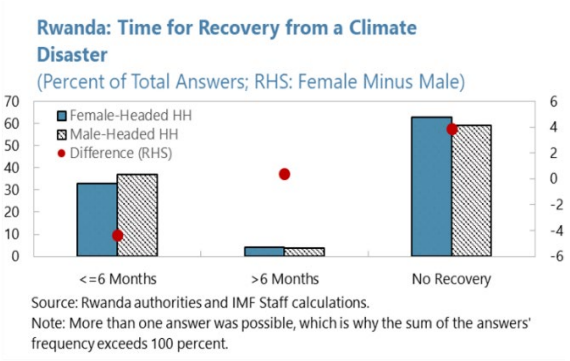
Individuals affected by climate shocks allocated increased time to domestic responsibilities, thereby diminishing their overall productivity potential.



In response to the shocks, households report working longer hours, decreasing their consumption and depleting savings.



The majority of households have not recovered from those shocks at the time the survey was taken.



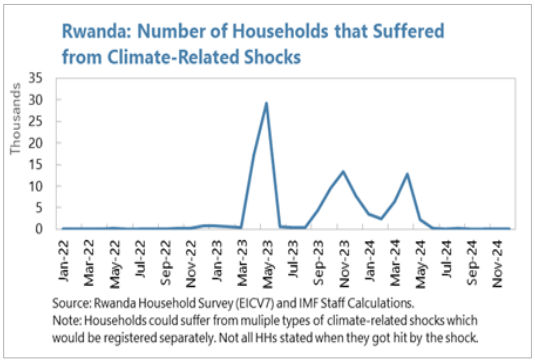
C. Micro-Level Evidence: How Climate Shocks Affect Women's Economic Outcomes

7. This section analyzes the impact of climate-related disasters on the gender wage gap. Drawing on micro-level data published by Rwanda's National Institute of Statistics (NISR), the analysis explores whether women are disproportionately affected by climate shocks relative to men. It also examines potential drivers underlying observed gender disparities in wage outcomes.

Data

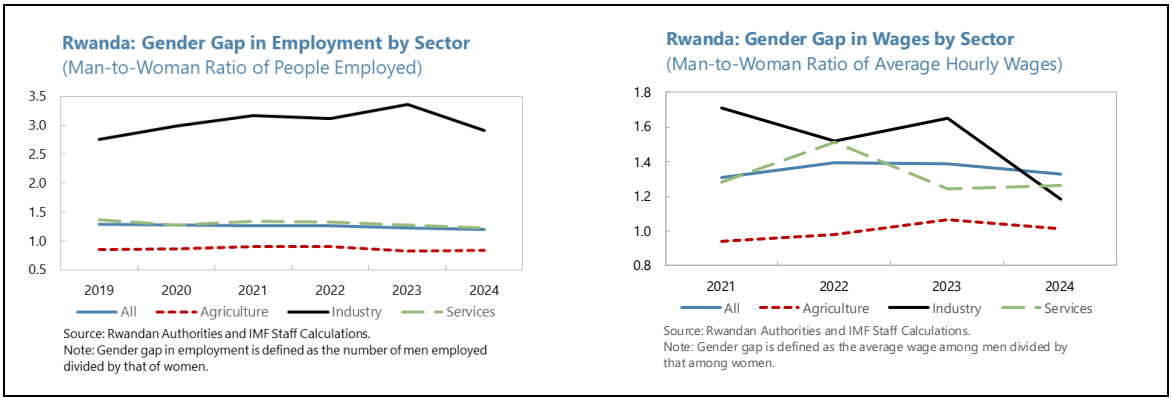
8. The primary data source for this analysis is the latest Integrated Household Living Conditions Survey (EICV7), conducted between October 2023 and October 2024, which provides comprehensive data at both the individual and household levels. Key variables include: (i) individual characteristics, such as gender, education level, and housing materials; (ii) socioeconomic indicators, including hourly wages, sector of employment, and receipt of government support; and (iii) a variable capturing exposure to climate-related disasters.

9. The climate disaster variable is derived from self-reported responses. Each household in the survey was asked whether it had experienced any problems affecting the household in the preceding 12 months. Among the listed options were climate-related events, including heavy rainfall, floods, droughts, and landslides or mudslides. A household is classified as having experienced a climate-related shock if it reported at least one of these events.



10. Government support is captured through the Vision Umurenge Program (VUP), a flagship social protection initiative aimed at alleviating extreme poverty. The program comprises several components, including Direct Support (DS); Classic Public Works (cPW) and Expanded Public Works (ePW), which provide employment opportunities for individuals from extremely poor and labor-constrained households; and Nutrition-Sensitive Direct Support (NSDS), which offers cash transfers to households with pregnant women and/or children under the age of two. The EICV7 dataset includes information on whether a household receives any of these forms of VUP assistance.

11. To complement the main analysis, micro-level data from Rwanda's Labor Force Survey (LFS) are also utilized. While the survey has been conducted annually since 2017, wage data are available from 2021 onward. By aggregating the data at the district-year level, a repeated cross-section dataset was constructed, capturing average wages for men and women across employment sectors in each of Rwanda's 30 districts over time.



12. The aggregated LFS dataset was merged with annual disaster reports published by the Ministry in Charge of Emergency Management (MINEMA). These reports provide district-level information on the number of houses and hectares of crops damaged by natural disasters. To facilitate comparability across districts, the number of houses destroyed was scaled by district population, and crop losses were scaled by the corresponding farmland area. A composite "disaster damage" index was then constructed by normalizing these scaled indicators and computing their equally weighted average.

Methodology

13. The analysis based on the EICV7 dataset employs a cross-sectional regression at the individual level. The empirical specification is as follows:

$$\log(Wage_i) = \alpha + \beta_C Climate_i + \beta_W Woman_i + \beta_{CW} Climate_i \times Woman_i + \sum_{m=1}^{M} \beta_{Vm} VUP_{im} + \sum_{m=1}^{M} \beta_{CVm} Climate_i \times VUP_{im} + \sum_{m=1}^{M} \beta_{WVm} Woman_i \times VUP_{im} + \sum_{m=1}^{M} \beta_{CWV} Climate_i \times Woman_i \times VUP_{im} + \sum_{k=1}^{K} X_{ik} + \epsilon_i \ ,$$

where $\log(Wage_i)$ is the natural logarithm of the hourly wage of an individual i, $Climate_i$ is a dummy indicating whether the individual suffered from a climate-related disaster, $Woman_i$ is a dummy indicating whether the individual is a woman, VUP_{im} is a dummy for the type of VUP support (among M options) the individual is receiving, $\{X_{ik}\}_{k=1}^{K}$ is a set of additional control variables, and ϵ_i is the error term.

14. The main coefficient of interest is the interaction term between the climate shock and gender indicators, denoted as β_{CW}. This parameter captures the differential impact of climate-related shocks on women's wages compared to men's. Specifically, it reflects the additional effect on hourly wages experienced by women, relative to men, when both are exposed to a climate-related disaster, holding other factors constant. Standard errors are clustered at the district level to account for potential intra-district correlation.

15. Control variables capture individual and socio-economic characteristics. These include binary indicators for the area of residence (urban or rural), household position (household head or not), level of educational attainment, employment sector, housing materials, and province of residence (Rwanda comprises five provinces). Including these variables in the regression mitigates potential omitted variable bias. For instance, an individual affected by a natural disaster may earn lower wages because inexpensive housing materials—associated with lower income—are less resilient to shocks. In this case, low wages, rather than disaster exposure, would explain the observed outcome, underscoring the importance of controlling housing characteristics.

16. The regression is estimated for various population subsets. These include groups defined by employment sector—agriculture, industry, and services—and by educational attainment, distinguishing between primary and secondary education levels. A final specification restricts the sample to household heads.

17. For the analysis based on the LFS dataset, a repeated cross-section regression is estimated at the year–district level. The empirical specification is as follows:

$$\log(Wage_Gap_{jt}) = \alpha + \beta_D Climate_Damage_{jt} + \epsilon_{jt} ,$$

where $\log(Wage_Gap_{jt})$ is the natural logarithm of the gender wage gap in district j in year t, $Climate_Damage_{jt}$ is the "disaster damage" index defined above, and ϵ_{jt} is the error term. The gender wage gap is measured as the ratio of the average hourly wage of men to that of women.

18. The coefficient of interest, β_D, captures the relationship between natural disaster damages and the gender wage gap. The regression includes year and district fixed effects. In addition, the specification is estimated for subsamples defined by employment sector—agriculture, industry, and services.

Results

19. At the individual level, based on the EICV7 dataset, results are mixed. As expected, climate disasters are generally associated with lower hourly wages across most population subsets (Table 2). However, no additional adverse effect is observed for women in agriculture and industry, while in services the estimated effect is positive—suggesting that women's wages increase relative to men's following natural disasters. Given the counterintuitive nature of these findings, further analysis was conducted to explore the underlying mechanisms.

Table 2. Rwanda: Hourly Wage Regressions, EIVC7 Data

	(1) All	(2) Agr	(3) Ind	(4) Ser	(5) Prim ED	(6) Sec Ed	(7) HH Head
Climate	-0.13**	0.01	-0.12**	-0.20***	-0.11**	-0.20**	-0.10
	(0.05)	(0.08)	(0.05)	(0.06)	(0.05)	(0.09)	(0.06)
Woman	-0.21***	-0.06**	-0.45***	-0.18***	-0.21***	-0.25***	-0.42***
	(0.02)	(0.03)	(0.05)	(0.03)	(0.03)	(0.04)	(0.03)
Climate × Woman	0.13***	-0.06	-0.03	0.27***	0.13**	0.20**	0.11*
	(0.05)	(0.06)	(0.09)	(0.08)	(0.05)	(0.10)	(0.06)
VUP_NSDS	-0.11**	0.01	0.04	-0.34***	-0.06	-0.29***	-0.08*
	(0.04)	(0.06)	(0.06)	(0.07)	(0.05)	(0.08)	(0.04)
Climate × VUP_NSDS	-0.09	-0.14	-0.34***	0.12	-0.11	0.11	-0.13*
	(0.07)	(0.09)	(0.11)	(0.16)	(0.09)	(0.15)	(0.08)
Woman × VUP_NSDS	0.08	-0.10	-0.17	0.39**	0.10	0.18	0.16
	(0.08)	(0.07)	(0.12)	(0.16)	(0.08)	(0.13)	(0.15)
Climate × Woman × VUP_NSDS	0.22*	0.29***	0.52**	-0.25	0.16	0.11	0.50**
	(0.12)	(0.10)	(0.20)	(0.25)	(0.11)	(0.21)	(0.22)
Rural	-0.15***				-0.12***	-0.09**	-0.20***
	(0.02)				(0.03)	(0.03)	(0.03)
HH Head	0.39***	0.16***	0.29***	0.59***	0.35***	0.46***	
	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)	
Const	10.64***	8.89***	9.69***	9.41***	9.15***	11.68***	10.25***
	(0.32)	(0.06)	(0.10)	(0.05)	(0.05)	(0.07)	(0.54)
Other Controls							
Other VUP Programs	+	+	+	+	+	+	+
Education Level	+	+	+	+	-	-	+
House Materials	+	+	+	+	+	+	+
Employment Sector	+	-	-	-	+	+	+
Clustering at District Level	+	+	+	+	+	+	+
N	3,645,043	1,159,063	749,206	1,734,122	2,449,499	899,516	1,839,861
Adj. R^2	0.48	0.15	0.43	0.45	0.27	0.29	0.54

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

20. In the individual-level regressions, a positive association emerges between wages and the triple interaction term capturing the joint effect of climate shocks, gender, and NSDS VUP support. This relationship is statistically significant for the full sample as well as for the agriculture and industry subsamples, but not for services. These findings suggest that NSDS support—targeting pregnant women and households with young children in poverty—may help explain the absence of an additional adverse effect of climate shocks on women's wages relative to men's. Such support likely cushions vulnerable women from income losses associated with climate shocks. However, the positive and unexplained relationship between the $Climate_i \times Woman_i$ interaction and wages in the services sector warrants further investigation.

21. At the aggregate level, based on the LFS dataset, results indicate a positive relationship between disaster damages and the gender wage gap. This relationship is statistically significant for the full sample and the services subsample, while the β_D coefficient not significant in agriculture and industry (Table 3). In other words, districts experiencing greater natural disaster damages tend to exhibit wider gender wage gaps among workers in the services sector. At first glance, this finding appears to contrast with the individual-level results, which suggested a positive association between women's wages and exposure to natural disasters.

Table 3. Rwanda: Hourly Wage Regressions, LFS Data

	(1) All	(2) Agr	(3) Ind	(4) Ser
Disaster Damage	0.06**	-0.00	0.14	0.13**
	(0.03)	(0.02)	(0.12)	(0.06)
Constant	1.39***	0.94***	2.07***	1.48***
	(0.06)	(0.02)	(0.25)	(0.12)
Year FE	+	+	+	+
District FE	+	+	+	+
N	106	106	105	106
Adj. R^2	0.06	0.09	0.04	0.08

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Taken together, the results from the two regressions suggest that the observed patterns may reflect the specific characteristics of the services sector. Natural disasters may damage infrastructure critical to service-related activities—such as roads for traders or business premises for hospitality workers—thereby reducing earnings indirectly. In this case, an individual's wages could decline due to disruptions in their work environment rather than direct exposure to a disaster. Consequently, the self-reported disaster variable in the EICV7 survey may not capture such indirect effects, while the aggregated LFS data at the district level would reflect them. At the same time, because women are more likely to be involved in vulnerable employment and in positions of lower seniority than men, disasters affecting workplaces may disproportionately impact women, helping to explain the positive relationship between disaster damages and the gender wage gap in the services sector.

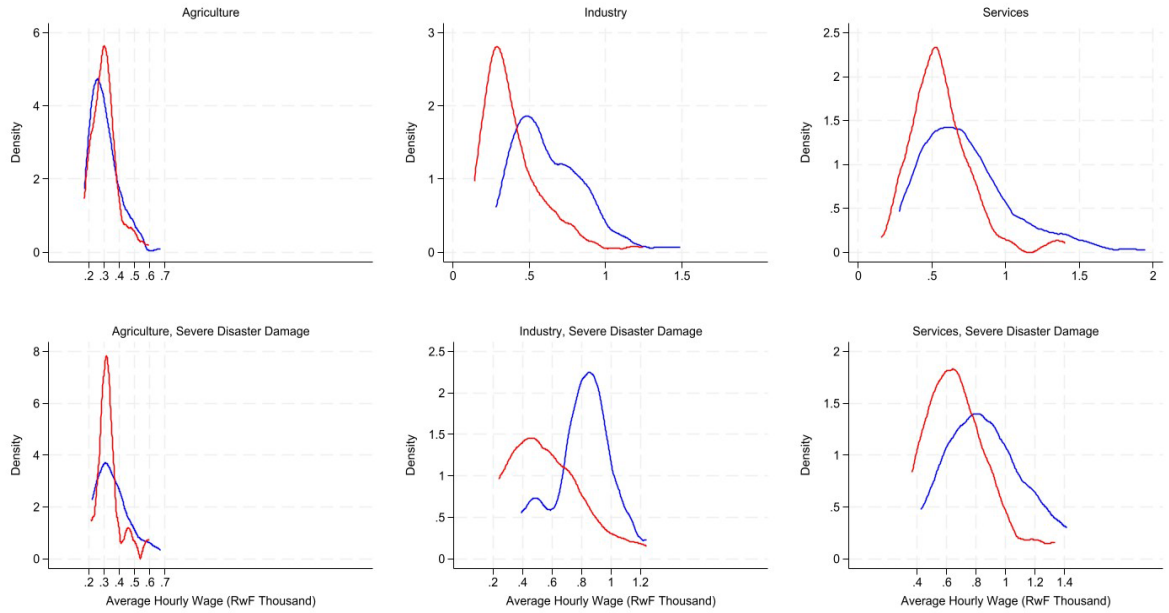
D. Macro-Level Evidence: How Gender Equality Enhances Climate Adaptation

22. With Rwanda's structural context in mind, this section introduces a small open-economy model to analyze the interplay between policies that mitigate the impact of natural disasters and those that foster female labor force participation. The model draws inspiration from the DIGNAD model, widely applied in IMF work,[1] while maintaining a simple and transparent

[1] See IMF (2023) for the latest DIGNAD application for Rwanda.

structure. A gender dimension is incorporated to explore two questions: (i) whether complementarities exist between disaster-resilience policies and women economic empowerment policies; and (ii) how the economy's recovery from a major flood would differ if resilient infrastructure were in place and the wage gap had been reduced ex ante.

Figure 4. Rwanda: Distribution of Hourly Wages by Gender, LFS Data



Sources: Rwandan Authorities and IMF Staff Calculations.

Note: Lines depict the distribution of average hourly wages for men and women across districts and years. The blue line represents male wages, while the red line corresponds to female wages. Severe disaster damage is defined as observations falling within the top quintile of the disaster damage index distribution.

23. In this model, the government can invest in standard infrastructure (e.g., roads) as well as in adaptation capital (e.g., flood defenses, resilient roads, drought-ready irrigation). Both raise the effective infrastructure available to firms (entering their production function) and improve productivity. In addition, adaptation capital depreciates at a lower rate and reduces the damages inflicted by natural disasters. In the model, these damages manifest as temporary losses of productivity. More adaptation capital means smaller losses when a disaster hits.

24. Policies that promote women's economic empowerment enhance growth, foster stability, and reduce poverty and inequality. In this model, gender empowerment is captured through a reduction of the wage gap between men and women—the difference in their average hourly earnings.[2] Gender wage gaps often reflect structural barriers that constrain the full use of

[2] In the model, the wage gap is reduced mechanically by recalibrating the steady state—adjusting the parameters that pin down the gap to achieve a 50 percent reduction while holding all other parameters fixed. In practice, achieving such a decline would require a comprehensive policy package that both diagnoses the drivers of the gap and tackles the underlying frictions (e.g., improving access to education and expanding pathways into higher-productivity occupations).

human capital, with adverse effects on productivity and growth. Such barriers include unequal access to education, health care, and finance; occupational and sectoral segregation (e.g., women concentrated in lower-productivity activities and smaller firms); higher rates of informal employment with weaker protections; and limited representation in higher-paying or leadership roles. Narrowing these gaps encourages women to enter and remain in the labor force, unlocks underused talent, and improves job–skill matching, thereby supporting inclusive growth (see Gender Mainstreaming: Interim Guidance Note).

25. The model captures the sectoral distribution of male and female workers observed in Rwanda for the latest available data. The small open economy model features two production sectors: (i) an exportable agricultural sector, where women are over-represented, and (ii) a non-tradable sector that accounts for the remaining sectors (services, construction, and manufacturing). Both sectors employ men and women and are subject to a natural disaster, being partially shielded from its impact by public adaptation capital. Men and women decide how much to work in each sector in response to gender-specific wages. A smaller wage gap makes market work relatively more attractive for women and can shift labor toward sectors where their productivity is higher. Calibrated to match the following observations targets three salient facts from Rwandan data: (i) the average wage gap is 30 percent, that is, for every RWF 1,000 a man earns, women earn RWF 700; (ii) roughly half of the working men work in agriculture; and (iii) this figure jumps to 72 percent for female workers.

26. The model was calibrated to match features of the Rwanda economy using country-specific macroeconomic indicators, while parameters that determine the standard and resilient infrastructure are in line with the literature. The calibration of initial values and parameters, where possible, is based on historical averages so the model's steady state lines up with Rwanda's long-run data. Table 4 shows the matched moments along with the historical data targets. The natural disaster shock is calibrated to mimic an extreme flood event associated with a 7.5 percent reduction in total factor productivity. According to the EM-DAT international disaster database, Rwanda was affected by disasters almost every year, with floods being the most prevalent type of disasters. However, low probability but high impact shocks, such as the one calibrated in this simulation, are predicted to occur more frequently going forward.

Table 4. Rwanda: Historical Data and Model Moments Targeted in Calibration Strategy

Moment	Data	Model
Value-added in non-tradable sector	48.0%	41.6%
External private debt to GDP ratio	20.4%	20.5%
Domestic public debt to GDP ratio	15.7%	11.5%
Imports to GDP ratio	35.5%	35.5%
Public infrastructure investment to GDP ratio	13.1%	16.9%
Average wage gap between men and women	30.5%	29.8%

27. This setup enables transparent policy counterfactuals on resilience, empowerment, and their interaction. We quantify: (i) the payoff from resilient infrastructure in limiting output and income losses during floods; (ii) the payoff from narrowing the wage gap in normal times and

recovery; and (iii) whether these policies are mutually reinforcing —for example, whether a smaller wage gap helps the economy make better use of resilient infrastructure after a disaster. We implement two simulations: (i) a long-term steady state comparison between economies with the current level of wage gap versus a lower one, and (ii) a short-to-medium-term disaster scenario that traces recovery under alternative adaptation-capital stocks and wage gap settings.

Simulation 1: Long-Term Results

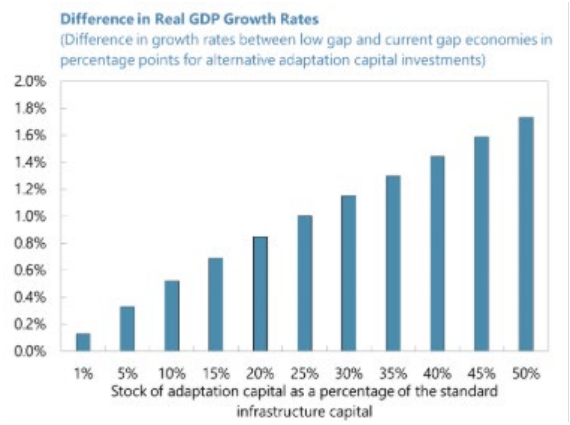
28. In the first simulation, we assess the gains from alternative adaptation capital paths under two wage-gap regimes and find sizeable complementary gains when resilience and gender equality advance together. In this experiment, two otherwise identical economies differ only in their gender wage gaps: a current gap scenario, which assumes no change in the observed wage gap, and a low gap scenario, with the observed gap cut by half. Both start with very low adaptation infrastructure. We then raise public investment so that the steady state stock of adaptation capital increases in 5-percentage-point steps up to a 50 percent increase. For each step, we recompute the balanced growth steady state and track macroeconomic outcomes. Higher adaptation capital augments the effective public capital bundle feeding firm productivity, while a lower wage gap improves labor allocation and average human-capital utilization. Together, these policies reinforce each other: the low-gap economy attains higher steady-state output at every resilience level. Quantitatively, a 1 percent increase in the adaptation capital stock yields GDP that is 0.13 percentage point larger in the low-gap economy; the advantage accumulates with bigger investments—for the same 30 percent increase in adaptation capital stock, the low-gap economy grows 1.15 percentage point higher, and for a 50% increase it reaches 1.73 percentage point larger GDP (Figure 5).

29. Adaptation investments pay more when wage gaps are lower because misallocation falls, external constraints ease, and the fiscal base strengthens. First, the misallocation channel is the strongest mechanism in our framework: with narrower gaps, firms draw more—and more appropriately—on women's and men's skills across sectors. This raises the effective labor input and amplifies the output response to any TFP-like boost, such as better public infrastructure and lower replacement needs after disasters (see Figure 5). Second, the external constraint channel improves adaptation investment requires imported inputs for its installation and must be financed by exports; with more equal wages, it is easier to attract both male and female labor into the tradable (agriculture) sector, expanding exports and relaxing the balance-of-payments bind. Third, the fiscal base channel widens as higher female earnings broaden the tax base, making public investment less fiscally "expensive" in general equilibrium (see Figure 5). For example, at a given 1 percent increase in adaptation capital, the tax-revenue-to-GDP ratio in the low-gap economy is about 4.25 percentage points higher than in the current-gap economy. Moreover, even with no additional adaptation, the low gap economy already raises roughly 4.1 percentage points more, indicating that most of the fiscal gain stems directly from narrowing the wage gap—which raises women's earnings and increases their labor force participation, both margins expanding the tax base. Finally, adaptation alone slightly narrows the wage gap through a composition effect: as adaptation protects the sector where women are over-represented, their wages and hours fall less when shocks hit, supporting their average earnings and moving it a bit closer to men's. In short, resilience investment and gender-equality

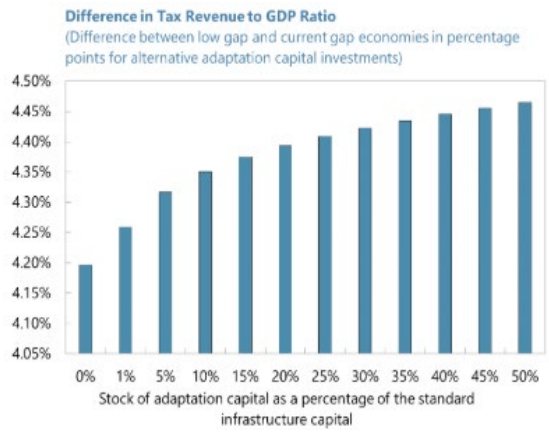
reforms are mutually reinforcing, with the productivity, external, and fiscal channels all pushing in the same direction.

Figure 5. Rwanda: Simulation 1: Long-Term Results

Adaptation pays more when gaps are lower, yielding larger GDP growth rates and...



...higher tax-revenue-to-GDP ratios.

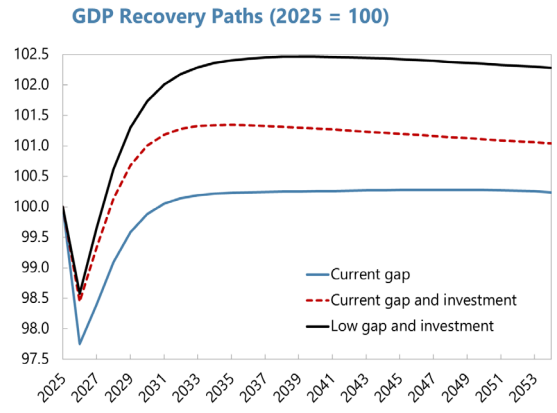


Simulation 2: Short-Run Recovery to Shocks

30. Pre-positioning resilience and narrowing the wage gap slightly reduce the peak-to-trough output loss and speed up the post-disaster recovery. We hit the two economies with the same natural-disaster shock—modeled as a temporary TFP drop that goes back to its previous level in an AR(1) fashion—and compare paths when, before the shock, the government has (i) low vs. higher adaptation capital and (ii) a current vs. a reduced gender wage gap. Higher adaptation capital raises the effective public capital bundle and, in the model, dampens the pass-through of the TFP shock to sectoral productivity; a lower wage gap improves labor allocation across sectors, so output, employment, and incomes fall by less and recover sooner. Three forces underpin these gains: (1) a smaller effective supply shock, because resilience lifts underlying productivity and attenuates the TFP hit; (2) faster reallocation, as a tighter wage gap improves incentives to supply labor—especially women—toward the higher return margin (notably tradables) exactly when the economy needs flexibility; and (3) stronger automatic stabilizers, since the broader tax base from higher female earnings cushions revenue shortfalls and lowers the required fiscal adjustment. The result is a milder output contraction and a steeper recovery of output and employment relative to the current-gap, low-resilience baseline (see Figure 6).

Figure 6. Rwanda: Simulation 2: Short-Term Results

Reducing the wage gap yields a quicker rebound and a slightly smaller output hit.



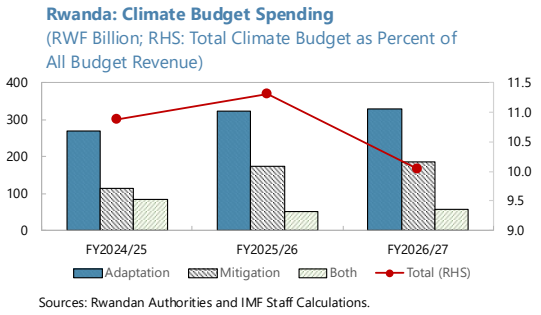
E. Policy Instruments for Inclusive Climate Resilience

Strengthening Data-Driven Policy Tools

31. Rwanda's data-driven policy systems provide a strong foundation for integrating climate and gender objectives into fiscal decision-making (Figure 7). CBT and GBT have improved the visibility of spending on climate adaptation and programs that benefit women, helping ensure that resources are aligned with the objectives of the NST2 and the Green Growth and Climate Resilience Strategy. These tagging frameworks enhance transparency in budget allocation and monitoring, enabling policymakers to track the share of public investment devoted to resilience and inclusion.

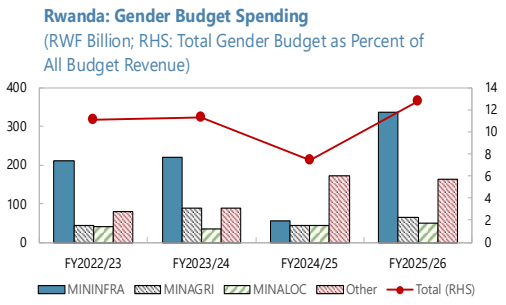
Figure 7. Rwanda: Policy Tools for Economic Resilience

CBT helps track and prioritize adaptation and resilience spending across sectors.



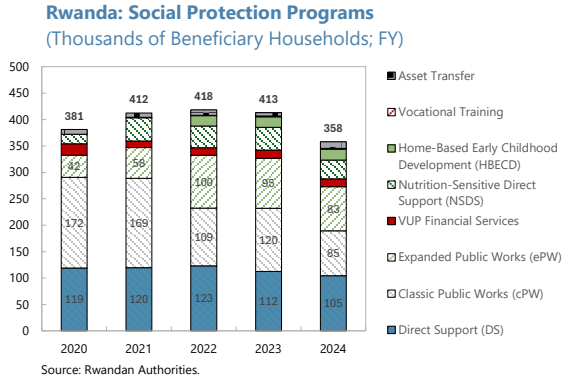
Sources: Rwandan Authorities and IMF Staff Calculations.

GBT aligns resource allocation with inclusion and empowerment objectives.



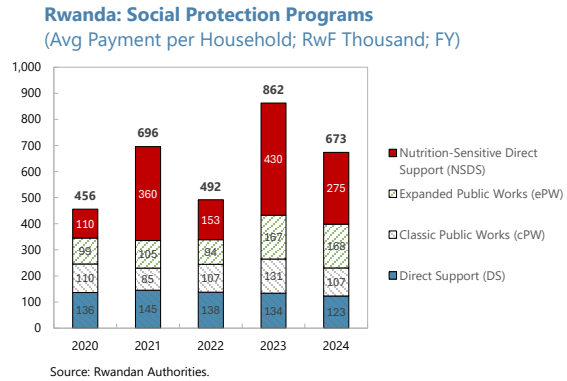
Sources: Rwandan Authorities and IMF Staff Calculations.

Rwanda's digital registry expands social protection coverage through real-time household data.



Source: Rwandan Authorities.

It enables rapid targeting of disaster-affected and female-headed households through VUP.

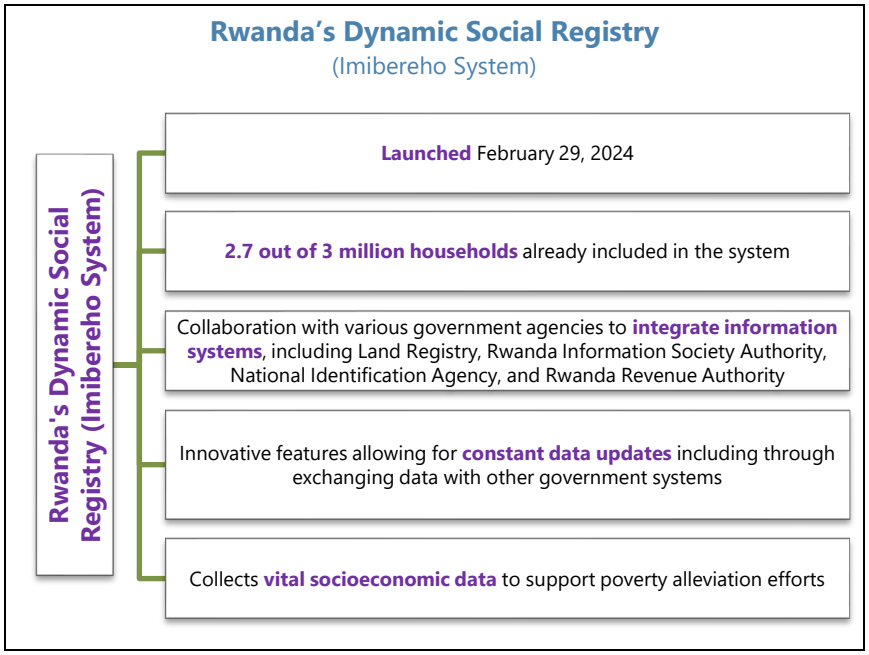


Source: Rwandan Authorities.

32. CBT and GBT have strengthened the evidence base for fiscal decisions by tracking how public spending supports resilience and inclusion. The CBT framework identifies and classifies expenditures that contribute to climate mitigation and adaptation. By tracking these flows across sectors such as agriculture, energy, and infrastructure, it allows policymakers to assess whether fiscal priorities are consistent with resilience targets and to adjust resource allocations accordingly. In

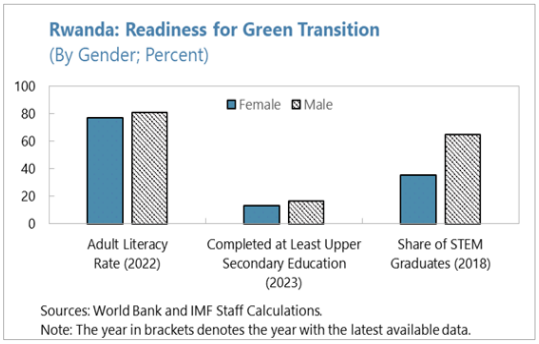
parallel, the GBT framework provides information on how public spending supports women's economic participation and welfare outcomes, strengthening gender-responsive budgeting practices. The combination of these two systems creates scope for cross-analysis—linking adaptation spending with gender impacts—to better evaluate the inclusiveness of climate investment.

33. Complementing these tools, the dynamic social registry has become central to adaptive social protection. It integrates household-level data from multiple sources, enabling rapid identification of vulnerable households during shocks and improving the efficiency of fiscal responses. Its linkages with programs such as the VUP allow temporary scaling-up of assistance to those most affected, including women and informal-sector workers. This data infrastructure supports timely, well-targeted, and fiscally sustainable responses to climate events.



Opportunities and Risks in the Green Transition

34. Rwanda's green transition presents opportunities to advance both resilience and inclusion, but realizing these benefits will require deliberate policy design. Investments in renewable energy, climate-smart agriculture, and the circular economy can generate employment and productivity gains, yet women remain under-represented in many of these emerging sectors. Without targeted interventions, the transition could widen existing labor-market gaps.



35. Expanding access to TVET and strengthening MSME finance initiatives can help women participate more fully in green industries. The RTB Strategic Plan 2021-24 and recent investments in TVET centers of excellence aim to modernize curricula, integrate ICT skills, and build stronger links with employers, yet gaps remain in digital infrastructure and female enrolment in technical fields. On the finance side, the 2025-29 Financial Sector Development Strategy and the FinScope 2024 Gender Report highlight ongoing efforts to close credit gaps for women-led MSMEs, including commitments to dedicate at least half of microfinance and SACCO lending to women. Integrating gender criteria

into green-investment facilities such as Ireme Invest would ensure that new financing channels support women entrepreneurs and employment creation in sustainable sectors. As Rwanda accelerates digitalization; however, risks of digital exclusion persist: women remain less likely to own smartphones, access the internet, or possess digital literacy skills needed to benefit from e-finance, e-commerce, and online training. Continued investment in data systems like CBT, GBT, and the social registry will be critical to track outcomes, inform course corrections, and ensure that Rwanda's climate and gender agendas reinforce each other.

F. Policy Priorities and Conclusions

36. Rwanda's case study illustrates that closing gender gaps and building climate resilience are mutually reinforcing goals that strengthen macroeconomic stability and inclusive growth. Microdata analysis shows that women's concentration in agriculture and informal employment heightens their vulnerability to climate shocks and slows household recovery. Macroeconomic simulations further demonstrate that reducing gender wage gaps amplifies the growth and fiscal benefits of adaptation investment. These findings underscore that policies promoting inclusion are not only socially desirable but also macro-critical for sustaining resilience and long-term development.

37. Rwanda's data-driven policy frameworks already provide a solid foundation for aligning climate and gender objectives. The integration of CBT, GBT, and the dynamic social registry has enhanced fiscal transparency, improved targeting, and strengthened adaptive social protection. Deepening coordination across these systems would enable systematic tracking of how adaptation spending affects women's livelihoods and resilience outcomes.

38. Building on these achievements, the following priorities can help deepen inclusive climate resilience:

- Strengthen the integration of CBT and GBT. Establish consistent cross-analysis of adaptation and gender-related expenditures, supported by clear institutional responsibilities and regular reporting by MINECOFIN, sector ministries, and the Rwanda Gender Monitoring Office.
- Expand adaptive social protection through the social registry. Continue improving coverage, interoperability, and real-time updating to allow programs—particularly the VUP—to scale up efficiently during shocks while maintaining fiscal discipline.
- Promote women's participation in the green transition. Facilitate access to green finance, technical and vocational training, and digital skills to ensure women benefit from employment opportunities in renewable energy, sustainable agriculture, and the circular economy. Integrate gender criteria into green-investment facilities such as Ireme Invest.
- Enhance access to productive assets and finance. Broaden financial inclusion, strengthen women's property and land rights, and expand tailored support for women-owned MSMEs to raise productivity and resilience.

- Invest in data and evaluation. Expand the use of gender-disaggregated and climate-tagged data to assess the effectiveness of adaptation and inclusion programs and guide evidence-based policy refinement.

Together, these measures would help Rwanda consolidate its progress toward a resilient, low-carbon, and inclusive economy. The country's experience highlights how institutional innovation, data-driven policymaking, and sustained attention to gender equality can reinforce both economic resilience and fiscal sustainability.

Table 5. Rwanda: Largest[1] CBT and GBT Projects in FY25/26

Sector	CBT/GBT	Description	Budget (RWF Billion)
Agriculture	GBT	Improved access to farm inputs for women	53.9
	CBT	Climate-smart agriculture and input access	71.0
Employment	GBT	Job creation and training for women	84.7
	GBT	Employment in housing/construction for women	48.1
	GBT	Employment in road construction for women	97.4
Energy	GBT	Expansion of electricity access for women	128.0
	CBT	Renewable energy and energy efficiency	169.9
	CBT	Resilience-focused energy infrastructure	44.6
Environment	CBT	Integrated environmental protection	67.9
Transport	CBT	Road rehabilitation and resilient transport	88.1
Social Protection	GBT	Direct VUP support to women	36.3
	GBT	Support to female genocide survivors	16.4
	CBT	Support to households affected by climate shocks	39.1
Education	CBT	Climate-resilient schools; awareness programs	15.3
Health	GBT	HIV prevention and treatment for women	15.0
Water and Sanitation	GBT	Improved access to water/sanitation for women	55.7
	CBT	Expansion of water and sanitation infrastructure	47.1
	CBT	Improved water treatment and sanitation systems	34.3

[1] Projects larger than USD10 million.

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