Gender, Youth, and Growth: Unpacking the Productivity–Transformation Nexus in Rwanda

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Abstract

The relationship between labor productivity and economic transformation, and their combined impact on labor market dynamics, remains insufficiently understood and highly country specific. This study applies an economywide analytical framework, using Rwanda as a case study, to examine how youth and women's productivity influence economic growth and structural transformation, and how these transformation process, in turn, affects these groups. The results indicate that labor productivity gains—whether economywide or concentrated among youth—shift growth toward the industrial and service sectors, while agricultural employment stagnates. Women-targeted productivity improvements generate more balanced growth across sectors and substantially enhance women's industrial participation. Youth-focused productivity gains induce stronger structural shifts, as young workers move from agriculture to expanding industrial and service sectors, though this transition partially displaces adult workers. Further, labor income rises broadly in line with GDP, with youth and women benefiting most under targeted scenarios. Meanwhile, sector-specific growth strategies yield distinct distributional effects: industry-led growth benefits women and adults, while service-led growth favors the versatile youth. Overall, productivity-driven structural transformation in Rwanda fosters welfare gains, although potential trade-offs between inclusiveness across gender and age groups and aggregate economic performance warrant further investigation.

Key worlds: Transformation, productivity, labor market, gender, youth, inclusive, Rwanda

1. Introduction

Labor is by far the most significant factor input in production within developing countries. Early development literature placed labor markets and human capital at the center of theories of development and growth (e.g., Lewis 1954; Harris & Todaro 1970). Yet, the composition of the labor force—along gender and age dimensions—continues to shape the pace of economic growth and structural transformation, particularly in developing economies. Similarly, growth and development, in turn, are accompanied by marked shifts in the structure of labor markets. However, these transformations are often facilitated or constrained by factors such as access to capital, technological innovation, and government policy (Gollin & Kaboski 2023; Agte et al. 2024).

Labor markets in poorer countries are often characterized by low levels of human capital and wage employment, alongside frictions such as wage rigidity and missing markets. A substantial body of research identifies low human capital as a binding constraint on economic growth and job creation in developing economies, as it affects firm profitability (Ofori et al., 2024; Santos & Hani, 2021). Meanwhile, wage rigidity contributes to labor misallocation by preventing the efficient matching of workers to suitable jobs. Furthermore, the absence of well-functioning information, credit, and commodity markets can suppress employment levels and encourage informality (Breza & Kaur, 2025; Fields, 2011). Low labor supply in low-income economies may itself be a consequence of underdevelopment, where existing job opportunities are insufficiently attractive to workers. Addressing all these constraints can therefore play a crucial role in stimulating growth.

These countries also face segmented labor markets and persistent gender gaps in labor force participation and wages, which ultimately reduce aggregate employment outcomes. Women and youth are particularly disadvantaged (Agte et al., 2024; Gottlieb et al., 2025; Heckert et al., 2020; Breza & Kaur, 2025), often earning lower wages and being more likely to work in low-paying or informal sector jobs. These gendered gaps are further intensified by education attainment gaps (Ganguli et al., 2014; Heckert et al., 2020). Evidence also suggests that short-term experiences—such as unemployment during youth—can have long-lasting adverse effects on future earnings (Mroz & Savage, 2006). Given the uneven participation of workers by gender and age across sectors, policies and interventions targeting specific segments of the labor force can produce heterogeneous effects on welfare and economic outcomes.

In practice, two aspects of the nexus between labor productivity and structural transformation in developing countries are worth exploring further. The composition and productivity of labor are central to structural transformation, as they underpin growth and the reallocation of workers from low-productivity sectors such as agriculture to higher-productivity sectors such as manufacturing and services. Men and women, as well as youth and adults, allocate their time differently across sectors and over time but also among economies at similar development levels (Gottlieb et al., 2025; Heckert et al., 2020). Such differences, together with variations in productivity, shape both the pace and pattern of structural transformation. Enhancing women's and youth labor force participation requires investment in human capital, changes in institutional and social norms, and reductions in labor market discrimination. Collectively, these efforts can improve talent allocation, raise productivity, and foster more inclusive economic growth and transformation.

Conversely, growth and structural transformation also shape labor market outcomes by gender and age group. Early research (Alvarez-Cuadrado, 2011; Boehlje, 1999) on structural

transformation primarily focused on shifts in the sectoral composition of GDP—from agriculture to manufacturing and services. In developing countries, however, transformation can also occur within the dominant agri-food system, as production shifts from traditional to more market-oriented segments. The pace of this shift can be accelerated or slowed by a variety of factors, including sectoral policy bias, resource endowments, and infrastructural constraints (Romano and Trau, 2017; Martins, 2018).

Despite this substantial body of work, much of the research on economic transformation continues to overlook implications for individuals' well-being, particularly those related to the quality and distribution of employment. Understanding how structural change affects employment opportunities—and how these effects differ across gender and age groups—remains essential for developing countries. In this regard, the source of transformation plays a critical role (Boundi-Chraki and Perrotini-Hernandez, 2025; Walsh, 2004). *Demand-driven growth* typically expands employment because rising demand for goods and services prompts firms to hire more workers. By contrast, *productivity-driven growth* produces more complex labor effects: it may reduce employment as fewer workers are needed to produce the same output, but it can also generate new jobs through lower prices, increased demand, and emerging tasks linked to new technologies.

Persistent productivity differences across sectors further shape the trajectory of economic restructuring (Samaniego & Sun, 2016). As countries develop, resources tend to move toward sectors with faster productivity growth, and this reallocation affects employment prospects as labor-intensive and capital-intensive sectors expand at different rates. Consequently, economic transformation has distinct implications for men's and women's labor market transitions—both for youth and adults (Heckert et al., 2020). For example, although findings are mixed, rural transformation may increase employment opportunities for adults, particularly men, given their greater access to productive assets both within and outside agriculture. Nonetheless, while economic growth can help narrow certain gender gaps, it does not eliminate them automatically (Agte et al., 2024), underscoring the need for context-specific and carefully considered evaluations of alternative development pathways.

These broader patterns are also evident in Rwanda. Despite an overall employment-to-population ratio of just 62.9 percent nationwide, men's employment rates exceed women's by 15.5 percentage points (NISR, 2024). Moreover, women remain disproportionately concentrated in agriculture, where they access around 85 percent of farmland—25 percent individually and 60 percent jointly (ROR, 2019—while men are more heavily represented in industry and services, with considerable differences across sub-sectors. Age-based disparities further shape these outcomes: Rwandan data show that a worker's age strongly influences their likelihood of employment in specific sectors, reflecting differences in education, financial resources, and social capital across age groups.

Against this background, this study employs an economywide analytical framework, using Rwanda as a case study, to address two central questions: (i) *How do youth and women's productivity influence economic growth and structural transformation?* and (ii) *How different patterns of structural transformation, in turn, affect youth and women?* To explore these questions, the analysis considers changes in labor productivity across different worker categories as well as alternative sectoral growth pathways, following a productivity-driven growth approach vs a

demand-driven growth. By jointly evaluating these channels, the study contributes to a deeper understanding of how gender and youth dynamics interact with productivity improvements and the broader process of structural transformation in Rwanda.

The remainder of the paper is organized as follows. Section 2 provides the foundation for the analysis by mapping Rwanda's labor market structure, with particular emphasis on the employment patterns of men, women, youth, and adults. Section 3 presents the modeling approach and outlines the scenario design developed to address the research objectives. Section 4 discusses the model results, and Section 5 concludes with key policy recommendations.

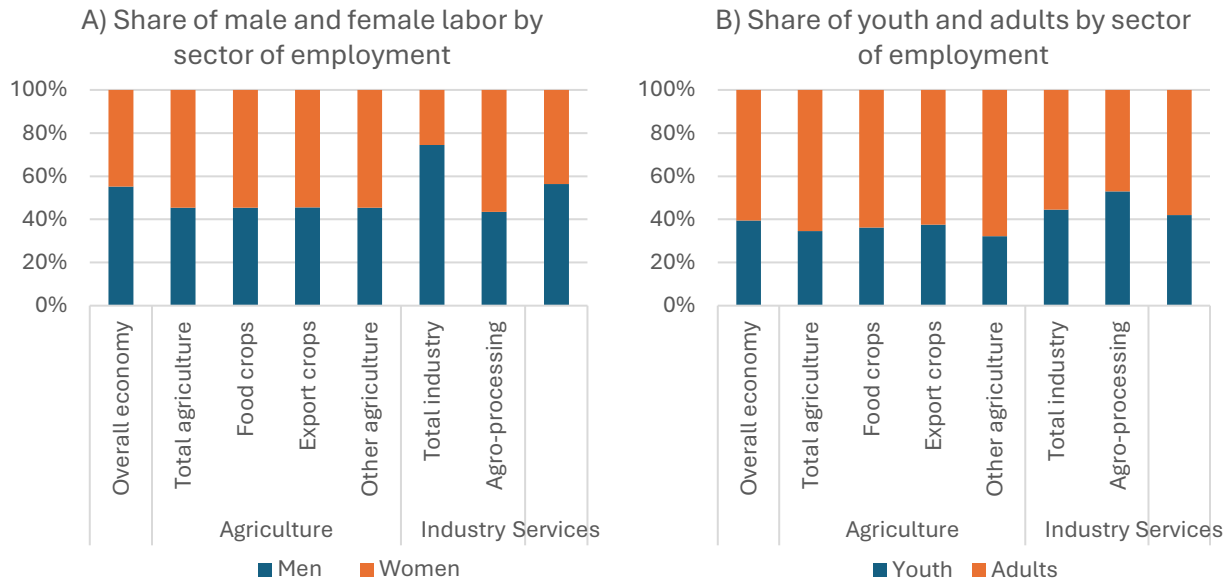
2. Labor market structure in Randa

Contributing 52 percent and 24 percent to the economy, respectively, the services and agriculture sectors have been the main drivers of Rwanda's economic growth in recent years. Although the importance of agriculture has declined with the expansion of the services sector, it continues to provide employment and livelihoods to approximately 40 percent of the labor force, making it a cornerstone of Rwanda's economic transition. With a poverty headcount rate of 38 percent in 2016/17 (NISR, 2018), alongside persistent undernourishment and limited dietary diversity, enhancing labor productivity and fostering sustainable economic transformation—both within and beyond agriculture—remain essential for broad-based and inclusive development.

With a population of over 14.7 million, Rwanda's demographic profile mirrors that of many African nations, characterized by a relatively fast-growing population, increasing at an annual rate of over 2.5 percent (NISR, 2025). Approximately 27 percent of the population falls within the 16–30 age range, representing the country's youth demographic. According to the recent Labor Force Survey (LFS) (NISR, 2024), Rwanda's employment-to-population ratio reached 63 percent, with an estimated 5.2 million active members in the labor force, of which 4.4 million were employed. The proportion of the working age population participating in the labor force has been steadily increasing since 2022. Despite gradual improvements in access to education, the workforce remains largely low-skilled and less productive, showing a limited alignment with the country's economic development needs.

According to the 2024 Rwanda LFS (NISR, 2024), overall, men dominate Rwanda's labor force, accounting for over 55 percent of all workers. They are disproportionately represented in the industry and services sectors, where they comprise 75 percent and 56 percent of the workforce, respectively (Figure 1, Panel A). However, gender disparities vary across specific sub-sectors. For instance, while men constitute 75 percent of industrial employment, the agro-processing subsector exhibits a more skewed gender distribution towards women, highlighting the increasing opportunities it provides for women. In contrast, women remain dominant in agriculture, where they represent 55 percent of the labor force and has access to about 85 percent of farmland either jointly or individually (ROR, 2019).

Figure 1: Employment share by labor type and sector in Rwanda



Source: Rwanda Labor Force Survey 2024 (NISR, 2024).

Likewise, Panel B presents the distribution of youth and adults in employment across different sectors of the economy. Contrary to the youth's substantial share in the overall population, adults consistently dominate employment in all sectors, largely due to youths' limited experience, lack of networks, resources, and access to capital needed to start or sustain businesses. At the economywide level, youths account for 40 percent of the labor force. Their representation is lowest in agriculture (35 percent)—reflecting challenges such as restricted access to land and a growing preference among youth to exit the sector—and highest in industry (45 percent), particularly in agro-processing.

Table 1 presents the distribution of each labor type by sector of employment in Rwanda. Men are predominantly employed in the services sector (44 percent), which the Government of Rwanda identifies as a key driver of growth by building knowledge-based economy (Behuria and Goodfellow, 2017). Consistent with its contribution to GDP, agriculture employs approximately 33 percent of men in the workforce. Women display a different sectoral pattern: agriculture is their larger source of employment (48 percent), followed by services (42 percent). Although women are less represented in industrial activities, particularly in physically demanding sectors such as mining and construction, they have a higher share of employment in agro-processing compared to men (2.5 percent versus 1.5 percent for men).

The Rwanda LFS also highlights distinct employment patterns between youth and adults across sectors. The services sector employs the largest share of both young men and women (approximately 46 percent). In addition, a higher proportion of youth are engaged in industrial activities, including agro-processing, compared to adults. In contrast, a substantial share of men and women adults remains employed in agriculture and related activities, reflecting the sector's continued importance for older segments of the labor force.

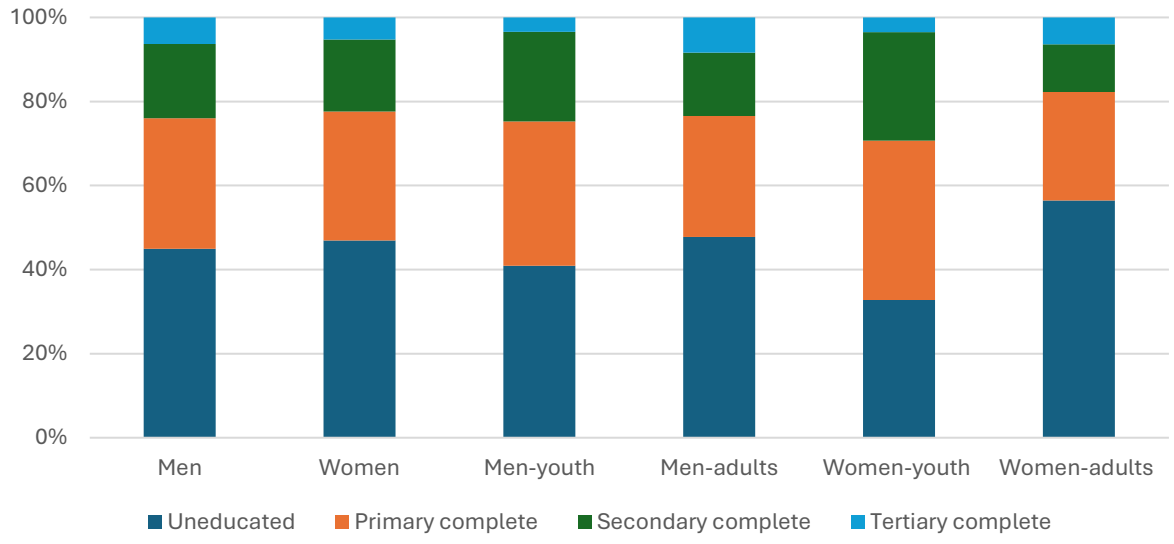
Table 1: Allocation of labor by sector of employment (%)

	Men	Women	Men		Women	
			Youth	Adult	Youth	Adult
Agriculture	32.6	48.1	29.2	34.9	41.7	52.1
Food crops	15.3	22.6	14.1	16.1	20.8	23.7
Export crops	3.0	4.4	2.8	3.1	4.2	4.5
Other agriculture	14.3	21.1	12.2	15.7	16.7	23.9
Industry	23.1	9.7	25.0	21.9	12.0	8.3
Agro-processing	1.5	2.5	1.7	1.4	3.8	1.6
Services	44.3	42.2	45.9	43.2	46.3	39.6
All sectors	100.0	100.0	100.0	100.0	100.0	100.0

Source: Rwanda Labor Force Survey 2024 (NISR, 2024).

The sex and age composition of the labor force, combined with its skill profile, plays a crucial role in shaping the impact of labor market interventions on Rwanda's structural transformation process. The country's workforce comprises 45 percent uneducated men and 47 percent uneducated women (Figure 2). The share of workers declines sharply as educational attainment increases, with only 6.3 percent of men and 5.2 percent of women having completed higher education. Most youth—both men and women—occupy the middle levels of the education ladder, while adult workers, particularly women, are disproportionately represented in the uneducated category, which has potential implications for the average productivity of sectors where they are concentrated. Conversely, the share of adults with tertiary education is notably higher than that of youth, reflecting the cumulative benefits of education and skills development opportunities acquired over time in the labor force.

Figure 2: The distribution of labor by level of education



Source: Rwanda Labor Force Survey 2024 (NISR, 2024).

3. Method of Analysis

3.1. Rwanda economywide model

This study applies IFPRI's standard computable general equilibrium (CGE) model. CGE models are widely utilized for economic policy formulation and analysis (Dixon and Parmenter, 1996; Devarajan and Robinson, 2010). They offer a simulation laboratory and capture the interlinkages between sectors, households, and rural-urban economies, making them well-suited for assessing the economywide effects of policy and external shocks. IFPIR's CGE model has recently been used to inform policy analysis in Rwanda, including agri-food investment prioritization (Aragie et al., 2022) and COVID-19 impact and recovery analysis (Aragie et al., 2024).

The Rwanda model used in this study is calibrated to a modified version of the 2022 Social Accounting Matrix (SAM) for the country (IFPRI, 2024). The model represents the economy through a set of disaggregated sectors, encompassing 33 agricultural sub-sectors, which include 24 individual crops or groups of crops, six livestock production sectors, as well as forestry and fisheries. The model also incorporates 36 industrial sectors—including 17 agro-processing activities—and 12 service sectors, which include food-related areas such as trade, transport, and restaurant services. This detailed representation of both the on-farm and off-farm components of the broader agrifood system permits detailed analysis of agrifood value chains, from primary producers to processors and traders to final consumers.

To accurately reflect the structure of the labor market and address the research objectives, the initial eight labor categories—disaggregated by rural-urban location and education level—are further subdivided by gender and age group, resulting in a detailed 32-type labor classification. Each rural and urban labor type is classified by gender (men and women) and age group (youth and adult), in addition to the four education levels ranging from no formal education to tertiary completion. This additional disaggregation by gender and age is essential for policy analysis, as it highlights disparities in wages, sectors of employment, and productivity levels. Moreover, this classification enables a more precise assessment of targeted interventions and their impacts on labor market dynamics and sectoral performance.

The Rwanda model also distinguishes 15 representative households, each of which is an aggregation of a group of households captured in the 2016/17 Fifth Integrated Household Living Conditions Survey (EICV5) (NISR, 2018). These households are categorized into rural and urban, with rural households further divided into farm and non-farm groups based on their reliance on agriculture as a primary source of income. These households are categorized into rural and urban household groups, with rural households further classified into farm and non-farm groups based on their reliance on agriculture as a primary source of income. Finally, each household group is further disaggregated by per capita expenditure quintiles. In the model, households earn labor income and receive returns on their assets, which include land and capital, as well as domestic or foreign transfers.

To monitor changes in poverty headcounts, the CGE model is linked in a top-down manner with a poverty microsimulation module. Following the methodology of Arndt et al. (2012), changes in poverty are estimated by connecting the microsimulation module to key CGE model outcome variables—household income, prices, and consumption. The changes in real consumption across commodities, generated by the RIAPA model, are applied to corresponding households from the

2016/17 EICV5 survey (NISR, 2018), which are mapped to 15 representative household groups within the CGE framework. Subsequently, the updated poverty status is computed for all sampled households.

3.2. Scenario design

The nexus between labor productivity and economic transformation, and their ultimate impact on the labor market requires a set of carefully designed counterfactual experiments. To uncover this, two main sets of policy scenarios were designed. The first set examines labor productivity interventions across different worker categories: (a) all-workers, (b) youth, and (c) women. The second set explores alternative pathways of structural change, namely: (a) agriculture-led growth, (b) industry-led growth, (c) services-led growth, and (d) neutral or balanced growth. Unlike the first set of scenarios, which focus on increases in labor productivity, this set assumes an increase in total factor productivity in the targeted sectors, driven by productivity-enhancing policy reforms and investments. In each scenario, either labor or sectoral productivity is increased—depending on the type of scenario—until overall GDP rises by an equivalent rate of 1 percent. This assumption of a comparable growth rate across scenarios allows for meaningful comparison of their respective sectoral compositions and labor market outcomes. Through this approach, the study contributes to a deeper understanding of how gender and youth dynamics interact with and are influenced by productivity changes and patterns of structural transformation.

Labor productivity scenarios

All labor: This scenario is labor-type neutral, assuming productivity gains across all categories of labor regardless of gender or age. Labor productivity is increased until overall GDP rises by 1 percent. Such gains can result from investments in education, skills development, and process improvements. Despite its labor-neutral nature, the scenario may still induce sectoral shifts in employment and production, depending on the distribution of labor types across sectors and the strength of intersectoral linkages—thereby influencing the pace and pattern of economic transformation.

Youth only: Youth productivity is vital for economic development, as it enables young people to realize their potential and contribute fully to economic growth. In this scenario, productivity-enhancing interventions are assumed to target both young men and women across all sectors of the economy.

Women only: Figures 1 and 2 illustrates differences in women's participation across sectors. Enhancing women's productivity can strengthen their contribution to economic growth, improve overall human capital, and expand employment and economic opportunities for women. In this scenario, women's labor productivity is increased to a level that yields a one-percent rise in total GDP.

Transformation scenarios

Agriculture-led growth: This scenario reflects a slowed structural transformation in Rwanda, where agriculture remains the primary driver of economic growth. Like many developing countries,

Rwanda continues to promote agricultural development to ensure domestic food security and sustain food availability. The sector also serves as the foundation for the gradually emerging agro-processing industry. Consequently, Rwanda has a strong rationale for anchoring its gradual economic transformation in a robust agricultural sector. In this scenario, agricultural productivity is increased to achieve a one-percent rise in overall GDP.

Industry-led growth: Industrialization is a central component of economic restructuring that transitions a country from an agrarian base to a more modern and developed economy. Industry-led growth is driven by productivity-enhancing investments in high-potential industrial sectors, supported by improvements in infrastructure, technology, and effective public policy. In this study, this scenario is modeled by proportionally increasing productivity across all industrial sub-sectors until the overall GDP rises by 1 percent.

Service-led growth: This growth strategy drives economic transformation by sustaining expansion in the services sector, particularly when manufacturing competitiveness and opportunities decline. Rwanda, in fact, promotes service-led growth as a key driver of economic development, with a primary focus on tourism, information and communication technology (ICT), and finance—areas in which it has achieved notable success. For simulation purposes, under this scenario, productivity in the services sector is assumed to increase further, such that—through its linkages with other sectors of the economy—it becomes the main engine of overall economic growth.

Neutral growth: This represents a balanced growth scenario in which productivity-enhancing investments are distributed across all sectors of the economy without preferential treatment. The ultimate contribution of each sector to overall growth depends on its backward and forward linkages with other sectors and the specific growth opportunities it faces. As sectors expand at varying rates, they exert differing impacts on the labor market, potentially creating employment and income opportunities for certain segments of the workforce—such as women or youth—more than for others.

3.3. Model closure rules

The model closure rules and market-clearing conditions adopted in this study are as follows. Regarding savings and investment, a standard savings-driven investment closure is applied—an assumption typically appropriate for developing countries where financial markets remain underdeveloped. This implies that the level of savings determines the level of investment. With respect to Rwanda's participation in international trade, the country is treated as a price taker in both import and export markets. The exchange rate is assumed to be flexible to ensure current account balance.

A fixed internal balance is also assumed, meaning that government savings are held constant while government expenditures adjust accordingly. In the labor market, full employment is assumed for simplicity and ease of tracing model results, although we acknowledge that unemployment—particularly among uneducated workers—remains a significant development challenge in Rwanda. We also considered a slightly upward sloping labor supply curve subject to elasticity of labor supply to capture the possibility of change in labor hours as wage rates change. Further, to test the

robustness of model results to labor market assumptions, a sensitivity analysis was conducted allowing for unemployment among uneducated labor in both rural and urban areas. The results remain broadly consistent with those under the full employment assumption, with only a slightly larger magnitude of change observed in the economic variables discussed when unemployment is introduced.

4. Results

4.1. How does youth and women's productivity affect economic growth and transformation?

4.1.1. Sectoral level effects

In this section, we examine the impact of youth and women's labor productivity on the sectoral composition of the economy and its growth. This allows us to assess how the economy transitions when productivity-enhancing policies and investment interventions target different segments of the labor force. Table 2 shows that an increase in productivity—whether economywide or among youth only—shifts growth primarily toward the industrial and service sectors. For instance, a targeted 1 percent increase in overall GDP through increased labor productivity under these two scenarios is largely driven by a 1.3–1.4 percent rise in industrial GDP, while agricultural growth remains limited to 0.9 percent.

The strong performance of the industrial sector reflects not only direct labor productivity gains but also indirect benefits, such as cheaper agricultural inputs, increased domestic demand from import substitution, and enhanced export potential given the tradable nature of most industrial goods. Within agriculture, the export crops subsector grows disproportionately faster (up to 1.2 percent) compared to the rest of the sector, benefiting from foreign demand due to its tradable nature. The similar overall impact observed under both youth-focused and broad-based labor productivity growth scenarios arises from the comparable contribution patterns of men—who constitute 55 percent of the labor force—and youth (see Figure 2).

By contrast, increasing women's productivity generates more modest and balanced growth across agriculture and industry. Among industry, agro-processing expands at a faster rate of 1.4 percent. This strong performance of the agro-processing sector is driven by robust growth in primary agriculture and the relatively active participation of women in this segment of the economy.

Table 2: Changes in sectoral GDP under labor productivity scenarios (%)

	Initial value (bil. $)	Percentage change from baseline		
		All labor	Youth only	Women only
Total GDP	12.7	1.00	1.00	1.00
Agriculture	3.4	0.78	0.90	1.05
Food crops	2.3	0.70	0.82	0.94
Export crops	0.3	1.08	1.21	1.41
Other agriculture	0.8	0.72	0.84	0.92
Industry	3.1	1.35	1.34	1.22
Agro-processing	0.9	1.12	1.18	1.24
Services	6.2	0.94	0.88	0.86

Source: Rwanda CGE model results

4.1.2. Factor market effects

This section discusses impacts on employment and incomes from the various labor productivity scenarios. An increase in productivity across all labor types leads to a robust rise in employment within the industrial sector, while employment in agriculture and services stagnates or slightly declines. This expansion in industrial employment aligns with the sector's relatively faster GDP growth (see Table 2). Moreover, as productivity gains in agriculture reduce labor demand, the released workers are absorbed by the expanding industrial sector. This reallocation of labor contributes to the rapid increase in industrial employment, indicating a strong potential for accelerated structural transformation in Rwanda if labor productivity continues to improve. Women's employment in industry in particular increases more markedly—by up to 1.4 percent—compared to a 1.1 percent increase for men. The results also show a slightly faster gain in employment among adults, who account for about 56 percent of total industrial employment.

Increases in youth and women's labor productivity have markedly contrasting impacts on employment across the economy. Consistent with the effects of economywide productivity gains, most of the employment expansion occurs in the industrial sector. However, the employment response within the targeted labor segments varies substantially. Under the youth productivity scenario, employment for youth men and women in industry rises by 2.6 and 1.4 percent, respectively, accompanied by a significant decline in youth employment in agriculture—2.5 percent for youth men and 2.2 percent for youth women —as they transition to the expanding industrial sector. Youth employment in services also increases (by 1.3–1.6 percent). However, this shift toward industry and services displaces some adult employment, as more productive youth become relatively more attractive to employers. Conversely, the reduction in youth employment in agriculture is partly offset by increased adult participation, contributing to the sector's modest growth (see Table 2).

By contrast, productivity targeting women shift their employment composition toward industry and services, with agricultural employment declining by more than 1.6 percent. The increase in women's employment in industry and services is particularly strong among adults, at 4.4 and 1.2 percent, respectively. Overall, the employment effect of these interventions at the national level

remains limited since we assume near-full employment labor market for ease of tracking the labor productivity-driven changes on the economy and factor markets in Rwanda.

Table 3: Changes in employment by sector and labor type under labor productivity scenarios (%)

			Initial value ('000)	Percentage change from baseline		
				All labor	Youth only	Women only
Agriculture	Men	Youth	289.4	-0.1%	-2.5%	0.9%
		Adult	513.7	-0.1%	1.0%	1.0%
	Women	Youth	322.1	-0.1%	-2.2%	-1.6%
		Adult	642.4	0.0%	0.8%	-1.4%
Industry	Men	Youth	247.4	1.0%	1.4%	1.3%
		Adult	321.9	1.1%	-0.1%	1.3%
	Women	Youth	92.5	1.3%	2.6%	3.6%
		Adult	102.8	1.4%	-0.4%	4.4%
Agro-proces.	Men	Youth	37.8	0.5%	1.3%	0.1%
		Adult	48.4	0.6%	-0.4%	-0.1%
	Women	Youth	49.3	0.7%	2.3%	2.9%
		Adult	46.1	0.8%	-0.9%	3.5%
Services	Men	Youth	454.8	-0.2%	1.3%	-1.1%
		Adult	636.2	-0.2%	-0.5%	-1.2%
	Women	Youth	357.7	-0.1%	1.6%	0.8%
		Adult	487.9	0.0%	-0.7%	1.2%
Total	Men	Youth	991.5	0.1%	0.3%	0.1%
		Adult	1471.8	0.1%	0.1%	0.1%
	Women	Youth	772.2	0.1%	0.1%	0.1%
		Adult	1233.0	0.1%	0.1%	0.1%

Source: Rwanda CGE model results

Table 4 presents changes in labor income under the three productivity scenarios. The results indicate that labor income growth is broadly proportional to GDP growth, particularly under the all-labor productivity scenario. In this case, men and adults experience slightly higher incomes gains than other groups, reflecting their relatively larger shares in the total labor force and their stronger involvement in the rapidly expanding industrial sectors.

Productivity increases targeting youth substantially boost their incomes—by 1.9 percent at the national level, and by 2.3 and 1.5 percent for young men and young women, respectively. The faster income growth among young men reflects their greater participation in industry (74.5 percent for men versus 25.5 percent for women; see Figure 2) and services (56.3 percent versus 43.7 percent), both of which expand more rapidly than agriculture under this scenario. In contrast, adult labor incomes rise at a slower pace, as more productive youth increasingly replace adults or capitalize on newly created employment opportunities in the growing economy.

Similarly, productivity-enhancing investments targeting women yield notable income gains for women, with women's labor income rising by 1.3 percent—0.5 percentage points higher than the

overall labor income growth of 0.8 percent. Interestingly, despite stronger growth in adult women's employment under this scenario (see Table 3), young women's incomes increase at a faster rate. This reflects the relatively higher concentration of young women in the rapidly expanding industrial sector (Table 1), compared to adult women.

Table 4: Changes in labor income by labor type under labor productivity scenarios (%)

	Initial value (bil. $)	Percentage change from baseline		
		All labor	Youth only	Women only
Men	4.54	1.0	0.9	0.5
Youth	1.30	1.1	2.3	0.8
Adult	3.23	0.9	0.3	0.4
Women	2.46	0.7	0.9	1.3
Youth	0.89	0.8	1.5	1.5
Adult	1.56	0.7	0.5	1.2
Total labor	6.99	0.9	0.9	0.8
Youth	2.20	1.0	1.9	1.0
Adult	4.80	0.8	0.4	0.7

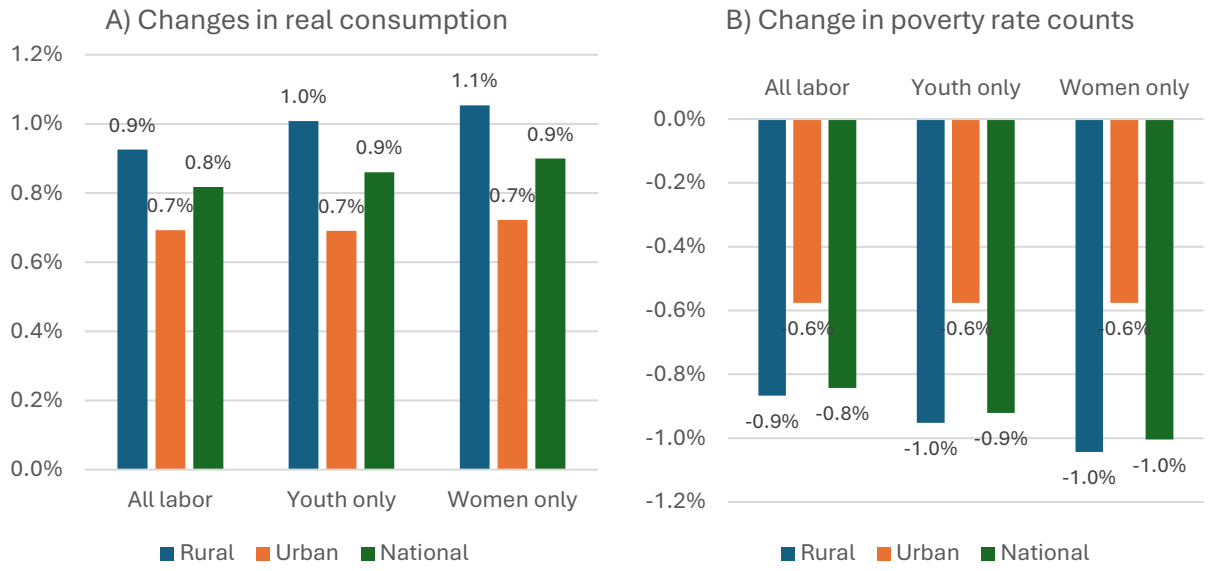
Source: Rwanda CGE model results

4.1.3. Household level effects

We also assessed the household-level impacts of the various labor productivity scenarios, focusing on changes in real consumption expenditure and poverty. Panel A of Figure 3 shows a stronger increase in consumption among rural households across all productivity scenarios, with real consumption in rural areas rising by 0.9 to 1.1 percent. This relatively stronger effect occurs despite faster growth in urban-based industries and services. The more pronounced rise in rural real consumption likely reflects price effects rather than income effects, as rural households benefit from declining prices of food and agricultural products—items that constitute a larger share of their consumption basket.

This price effect is further reinforced under the women's labor productivity scenario, where relatively faster agricultural GDP growth produces a modest yet meaningful income gain, amplifying the consumption effect in rural areas and showing the added benefit of investing on women. In contrast, under the other productivity scenarios, consumption effects in both rural areas and at national level remain broadly comparable but somewhat weaker than those observed under the women's productivity scenario.

Figure 3: Changes in real consumption and poverty headcounts under labor productivity scenarios



Source: Rwanda CGE model results

Panel B of Figure 3 shows a pattern of change in the poverty headcount that closely mirrors the observed changes in real consumption. Poverty declines across rural, urban, and national levels are broadly proportional to the corresponding increases in consumption. The reduction in poverty is more pronounced in rural areas—by about 0.3 percentage points compared to urban areas—resulting in a 0.8–1.0 percentage point decrease in the national poverty headcount.

Consistent with the consumption effects, interventions that enhance women's labor productivity lead to a relatively faster reduction in poverty, particularly in rural areas. This outcome reflects the increased employment of women in industry under this scenario and their gradual shift out of agriculture (see Table 3 on employment effects).

4.2. How does the process of structural transformation affect youth, women and the economy?

4.2.1. Sectoral level effects

In contrast to Section 4.1, where we assessed the effects of labor-specific productivity gains on the economy and labor market, this section focuses on the impacts of alternative structural transformation scenarios on sectoral growth, employment outcomes, and household welfare. We start this task by analyzing effects on sectoral GDP.

The agriculture-led growth scenario—representing a delayed transformation path in which agriculture remains the main driver of growth—shows a robust 3.5 percent expansion in agricultural GDP, sufficient to generate the targeted 1 percent increase in overall GDP, even as the industrial and service sectors remain stagnant under this growth pathway (Table 5). Accompanying

the acceleration in agriculture, the agro-processing sub-sector grows modestly by 1.3 percent. Overall, agriculture-led growth reinforces the sector's formidable contribution to the economy, as its relative share expands further compared to other sectors.

The industry-led growth scenario exhibits stronger linkages with the service sector. Under this scenario, industrial GDP rises by 2.8 percent, contributing significantly to the 1 percent overall GDP growth, mainly driven by rapid expansion in the agro-processing sub-sector. This growth in agro-processing stimulates non-food agricultural activities, including export-oriented crops, resulting in a modest 0.3 percent growth in the overall agricultural sector.

Under the service-led growth scenario, service sector GDP increases by 1.3 percent, with notable spillover effects on industry, which grows by 1.1 percent, while agriculture expands only marginally. Industry performs well in this scenario due to the strong demand for industrial inputs that support service sector expansion, as well as the effective functioning of trade and transport services that facilitate industrial activities.

Finally, the neutral (balanced) growth scenario, which assumes comparable productivity growth across all sectors, results in faster growth in industry (1.3 percent), followed by agriculture, which grows at a rate comparable to overall GDP. Meanwhile, service sector GDP increases at a rate slightly below the 1 percent overall GDP growth, partly reflecting demand constraints as domestic market is the sole consumer for most sub-sectors.

Table 5: Changes in sectoral GDP under transformation scenarios (%)

	Initial value (bil. $)	Percentage change from baseline			
		Agric-led	Industry-led	Services-led	Neutral
Total GDP	12.7	1.00	1.00	1.00	1.00
Agriculture	3.4	3.47	0.28	0.29	1.07
Food crops	2.3	3.42	0.25	0.26	1.03
Export crops	0.3	4.06	0.71	0.48	1.34
Other agriculture	0.8	3.05	0.67	0.28	1.03
Industry	3.1	0.22	2.76	1.13	1.27
Agro-processing	0.9	1.29	2.98	0.60	1.15
Services	6.2	0.03	0.50	1.33	0.83

Source: Rwanda CGE model results

4.2.2. Factor market effects

In terms of employment effects, productivity growth in the agriculture-led growth scenario displaces labor from agriculture as the sector becomes more efficient, leading to a reallocation of workers toward industry and services (Table 6). This shift in labor composition indicates a potential diversification of employment patterns toward downstream sectors. The transition is particularly pronounced among women workers, whose employment in industry increases by 1.2 percent compared to just 0.3 percent for men. The rise in non-agricultural employment is especially notable in the agro-processing sub-sector, which expands by over 3 percent as it benefits from the released agricultural labor and lower-cost intermediate inputs.

Within the Industry-led scenario, higher industrial productivity reduces labor requirements in industry, thereby releasing workers to agriculture (up to 0.7 percent growth) and to services (up to 1.9 percent growth). The agro-processing sub-sector, despite robust output performance, experiences a contraction in labor demand of over 4.6 percent (Table 6). Women workers disproportionately affected by the decline in agro-processing, where they are more heavily employed compared to other industrial sectors such as mining and heavy manufacturing. Many of these displaced women transition to the services sector—including trade and other service activities—where they are more likely to find employment, consistent with their existing employment distribution (Table 1).

In contrast, service-led growth generates markedly different employment effects. By increasing the supply of labor to the industrial sector, it supports the sector's strong growth in output (Table 5). Employment in services declines by approximately 1.2 percent, while industrial employment rises by over 2.4 percent and agricultural employment increases by 0.5 percent.

Meanwhile, under the neutral growth strategy, employment in the service sector experiences a slight decline, reflecting the sector's slower growth under this scenario. This reduction is offset by modest increases in employment in both the agricultural and industrial sectors. Overall, the assessed growth strategies have limited effects on the age composition of employment in Rwanda, as youth and adult employment adjust at relatively comparable rates.

Table 6: Changes in employment by sector and labor type under transformation scenarios (%)

			Initial value ('000)	Percentage change from baseline			
				Agric-led	Industry-led	Services-led	Neutral
Agriculture	Men	Youth	289.4	-0.3	0.7	0.5	0.3
		Adult	513.7	-0.3	0.7	0.5	0.3
	Women	Youth	322.1	-0.3	0.4	0.6	0.3
		Adult	642.4	-0.3	0.3	0.6	0.3
Industry	Men	Youth	247.4	0.2	-3.9	2.3	0.6
		Adult	321.9	0.3	-4.1	2.4	0.7
	Women	Youth	92.5	1.2	-4.9	2.4	0.7
		Adult	102.8	1.1	-5.3	2.5	0.7
Agro-proces.	Men	Youth	37.8	3.2	-4.6	0.8	0.3
		Adult	48.4	3.3	-4.7	0.7	0.3
	Women	Youth	49.3	3.1	-5.9	1.2	0.3
		Adult	46.1	3.2	-6.1	1.2	0.3
Services	Men	Youth	454.8	0.3	1.9	-1.2	-0.2
		Adult	636.2	0.3	1.7	-1.2	-0.3
	Women	Youth	357.7	0.2	1.2	-0.9	-0.2
		Adult	487.9	0.4	1.2	-1.0	-0.2
Total	Men	Youth	991.5	0.1	0.1	0.2	0.1
		Adult	1471.8	0.1	0.1	0.2	0.1
	Women	Youth	772.2	0.1	0.1	0.1	0.1
		Adult	1233.0	0.1	0.2	0.1	0.1

Source: Rwanda CGE model results

Table 7 presents changes in labor income by labor type under the various structural transformation scenarios. Overall, we observe labor income growth slightly lower than the GDP growth suggesting a stronger increase in income for other factors of production, including land and capital. Under the delayed transformation scenario, i.e., agriculture-led growth, labor income effects are relatively balanced across gender and age groups, with income growth closely aligned with overall GDP growth. In contrast, the industry- and service-led scenarios produce divergent impacts on labor income by type. Under the industry-led growth, income gains are larger for women workers (1.2 percent) than for men (0.5 percent). Conversely, service-led growth tends to favor men, who experience income growth of 0.9 percent versus 0.7 percent for women.

These two scenarios also have contrasting effects by age-group. Adults benefit more from industry-led growth, reflecting the current dominance of adult employment (56 percent) in this sector. In contrast, service-led growth disproportionately increases incomes for youth, who are more likely to be absorbed in the industrial sectors and also benefit from increases in incomes in the expanding formal and informal trade and transport sectors in urban areas.

Under the balanced (neutral) growth scenario, labor income changes resemble those under agriculture-led growth, highlighting the continued importance of the agricultural sector as a major source of employment in Rwanda, even as its share of overall GDP gradually declines.

Table 7: Changes in labor income by labor type under transformation scenarios (%)

	Initial value (bil. $)	Percentage change from baseline			
		Agric-led	Industry-led	Services-led	Neutral
Men	4.54	0.9	0.5	0.9	0.9
Youth	1.30	0.9	0.3	1.2	1.0
Adult	3.23	0.9	0.5	0.8	0.9
Women	2.46	0.9	1.2	0.7	0.9
Youth	0.89	0.9	1.1	0.9	0.9
Adult	1.56	0.9	1.2	0.6	0.8
Total labor	6.99	0.9	0.7	0.9	0.9
Youth	2.20	0.9	0.6	1.1	1.0
Adult	4.80	0.9	0.8	0.8	0.8

Source: Rwanda CGE model results

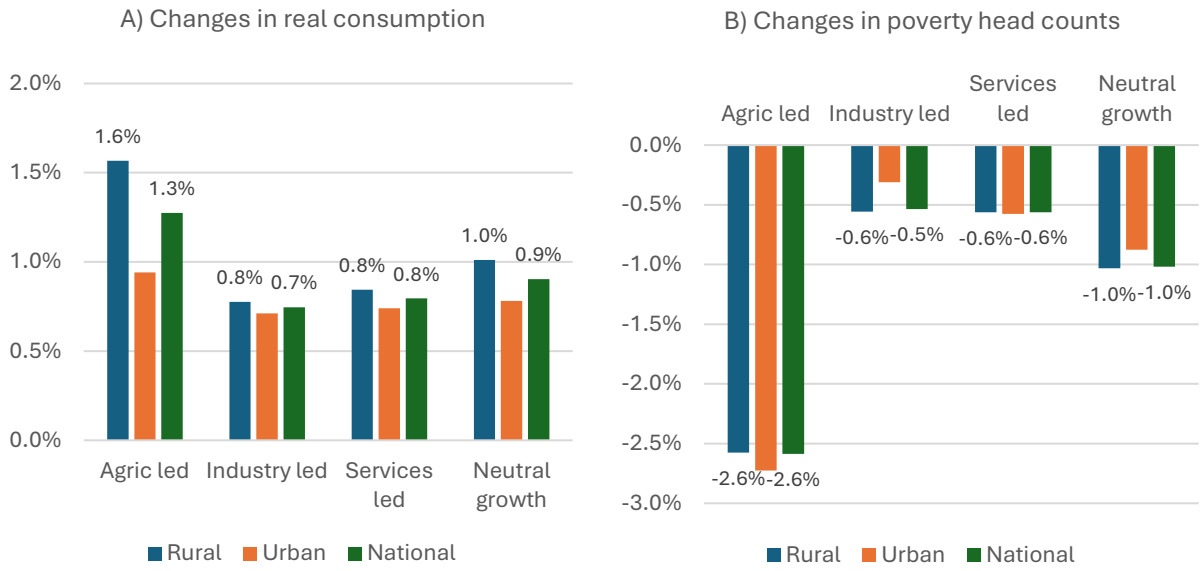
4.2.3. Household level effects

Similar to the effects observed under the labor productivity scenarios, the impacts of structural transformation on real consumption are particularly pronounced in rural areas. Under agriculture-led growth, rural consumption increases by 1.6 percent, while urban consumption rises by 0.9 percent, primarily due to improvements in the agri-food system, which enhances affordability and raises rural household incomes (Panel A, Figure 4). In contrast, industry- and service-led growth have more moderate effects on real consumption, reflecting relative stagnation in the agricultural sector under these scenarios (Table 5). Results indicate that sector-neutral productivity gains produce moderate improvements in consumption, though rural households continue to benefit more than urban households.

The effects of structural transformation on poverty vary across growth pathways and between rural and urban areas (Panel B, Figure 4). The agriculture-led growth scenario has the strongest impact on poverty, with reductions approximately double the gains in real consumption, highlighting the pro-poor nature of this growth strategy in Rwanda. Specifically, national poverty headcounts decline by 2.6 percent under this scenario. In contrast, the poverty-reducing effects of the other growth strategies are considerably smaller.

Under the agriculture-led growth, urban poverty declines faster than rural poverty, due to (i) more rapid employment growth in urban sectors (industry and services, Table 6), which raises urban incomes, and (ii) lower prices for agri-food products, which benefit urban consumers more directly than rural households through the income effect. Meanwhile, service-led growth has a marginal but relatively balanced effect on poverty in both rural and urban areas.

Figure 4: Changes in real consumption and poverty headcounts under labor productivity scenarios



Source: Rwanda CGE model results

5. Concluding remarks

Labor is by far the most significant and typically the most abundant factor of production in developing countries. The functioning of the labor market and the composition of the workforce—by gender, age, and education level—largely determine the pace and pattern of structural transformation. These factors also shape the distribution of gains and losses within the labor market and influence welfare outcomes for individuals during periods of growth and transformation. However, the interplay between labor productivity and structural transformation, and their combined implications on labor market dynamics, remains insufficiently understood and appears to be highly country-specific.

This study uses an economy-wide analytical framework for Rwanda to examine how productivity changes among youth and women interact with structural transformation and labor-market outcomes. Two sets of scenarios were considered: one focusing on targeted productivity shocks (all-labor, youth-only, and women-only) and another exploring alternative growth pathways (agriculture-led, industry-led, services-led, and balanced growth).

On the one hand, the model results show that broad-based increases in labor productivity—and productivity gains concentrated among youth—tend to shift growth toward industry and services, while the export-crop subsector within agriculture expands disproportionately due to foreign demand and tradable nature. By contrast, increases in women's labor productivity generate a more modest and relatively balanced expansion across both agriculture and industry.

An economywide rise in labor productivity boosts industrial employment, while employment in agriculture and services stagnates or slightly declines. This industrial expansion mirrors the

sector's faster GDP growth, signaling potential for structural transformation. Women's industrial employment grows more sharply (1.3 percent) than men (1.0 percent), with adults experiencing slightly higher overall gains. Productivity improvements targeted to youth and to women produce different reallocations Under the youth productivity scenario, industry employment among youth rises markedly, by 2.6 percent for young men and 1.4 percent for young women. This increase is accompanied by a sharp decline in agricultural jobs as youth transition into industry and services. This reallocation displaces some adult workers, as more productive youth become relatively attractive to employers. Similarly, women-targeted productivity interventions shift women's employment toward industry and services, reinforcing structural change but also altering the gender composition of sectoral labor shares.

Labor income growth broadly tracks GDP growth, especially under the all-labor productivity scenario. Productivity gains targeting youth substantially raise their incomes, with young men benefiting most because of their higher baseline participation in industry and services. Similarly, women labor productivity growth yields notable income gains, raising women's labor income by 1.3 percent—0.5 percentage points above the overall average.

Real consumption increases more strongly among rural households across all productivity scenarios, even though industry and services (largely urban) grow faster. This likely reflects declining food and agricultural prices, benefiting rural consumers who spend a larger share of income on these goods. The effect is reinforced under the women productivity scenario, where relatively faster agricultural GDP growth produces greater income gains, underscoring the added benefit of investing in women. Model results also indicate significant poverty reduction effects, particularly in rural areas and under higher women's productivity.

On the other hand, when examining how growth and structural change influence labor market outcomes, different sectoral linkages emerge. Agriculture-led growth reinforces the sector's central role but generates limited spillovers beyond agro-processing. In contrast, industry-led and service-led growth exhibit stronger cross-sector linkages—with industry stimulating services and vice versa.

In terms of employment effects, productivity growth in agriculture displaces labor as the sector becomes more efficient, encouraging a shift toward downstream industries and services. The transition is particularly pronounced among women, whose industrial employment rises by 1.2 percent compared with 0.3 percent for men. Conversely, industrial expansion releases some labor to agriculture (up to 0.7 percent) and services (up to 1.9 percent) despite strong output performance, with women workers—especially in agro-processing—most affected. Many of these displaced women find new employment in trade and other service activities. Productivity gains in services also release labor to industry, where employment rises by over 2.4 percent.

Labor income growth generally lags behind GDP growth, indicating stronger gains for other production factors, such as land and capital. Under agriculture-led (delayed transformation) growth, labor income effects are relatively balanced across gender and age groups. By contrast, industry- and service-led growth produce divergent effects: industry-led growth benefits women most, with women's income rising by 1.2 percent versus 0.5 percent for men, while service-led growth favors men (0.9 percent versus 0.7 percent for women). Adults benefit more from industry-

led growth due to their dominance in industrial employment, whereas youth gain more from service-led growth, reflecting their higher participation in expanding trade and transport sectors.

As in the labor productivity simulations, structural transformation strongly affects rural consumption and poverty outcomes, although the magnitude and distribution of these effects vary across the different growth scenarios. Agriculture-led growth generates the largest gains in real consumption and fastest reductions in poverty, driven by improvements in the agri-food system that enhance affordability and rural incomes. By contrast, industry- and service-led growth, have more moderate effects on consumption and poverty, reflecting relatively slower agricultural development under these strategies. Notably, agriculture-led growth also accelerates poverty reduction in urban areas, due to strong employment and price effects.

Overall, these findings deepen understanding of how gender and youth dynamics interact with productivity growth and structural transformation in developing economies. Targeted improvements for women and youth can enhance structural change and generate gains in employment, income, and poverty reduction, yet trade-offs across sectors and groups mean these benefits are not uniform. These results highlight the importance of complementary policies and point to a key question for future research: under what conditions can inclusive labor-force participation promote both efficiency and equity while minimizing potential losers? This remains an important avenue for future research.

References

Agte, P., Attanasio, O., Goldberg, P., Ratan, A.L., Pande, R., Peters, M., Moore, C.T. and Zilibotti, F. 2024. Gender Gaps and Economic Growth: Why Haven't Women Won Globally (Yet)? EGC Discussion Paper 1105, Yale University, New Haven.

Alvarez-Cuadrado, F. and Poschke, M. 2011. Structural Change Out of Agriculture: Labor Push versus Labor Pull. *American Economic Journal: Macroeconomics,* 3 (3): 127–58.

Aragie, E., Diao, X., Spielman, D.J., Thurlow, J., Mugabo, S., Rosenbach, G. and Benimana, G. 2022. Public investment prioritization for Rwanda's inclusive agricultural transformation: Evidence from rural investment and policy analysis modeling. Rwanda Strategy Support Program. Working Paper 03.

Aragie, E., Diao, X., Spielman, D.J. and Thurlow, J. 2024. The economywide recovery measures in Rwanda during the COVID-19 pandemic: How useful a lesson? *Journal of Policy Modeling*, 46(6): 1103-1124. https://doi.org/10.1016/j.jpolmod.2024.07.004.

Arndt, C., M. Hussain, E. Jones, V. Nhate, F. Tarp, and J. Thurlow. 2012. Explaining the evolution of poverty: The case of Mozambique. *American Journal of Agricultural Economics*, 9 (94): 854-872.

Behuria, P. and Goodfellow, T. 2017. *The Disorder of 'Miracle Growth' in Rwanda: Understanding the Limitations of Transitions to Open Ordered Development'*, Chapter 8 in Lant Pritchett, Kunal Sen, and Eric Werker (eds), Deals and Development: The Political Dynamics of Growth Episodes (Oxford, 2017; online edn, Oxford Academic, 21 Dec. 2017), https://doi.org/10.1093/oso/9780198801641.003.0008, accessed 29 Oct. 2025.

Boehlje, M. 1999. Structural Changes in the Agricultural Industries: How Do We Measure, Analyze and Understand Them? *American Journal of Agricultural Economics*, 81(5): 1028-1041. https://onlinelibrary.wiley.com/doi/10.2307/1244080

Boundi-Chraki, F. and Perrotini-Hernández,I. 2025. Re-examining the automation-employment nexus from a classical political economy approach. *Structural Change and Economic Dynamics*. 75: 32-51.https://doi.org/10.1016/j.strueco.2025.05.001

Breza, E. and Kaur, S. 2025. Labor Markets in Developing Countries. *Annual Review of Economics*, 17:747-776. https://doi.org/10.1146/annurev-economics-091124-051650

Devarajan, S. and Robinson, S. 2010. Contribution of Computable General Equilibrium Modeling to Policy Formulation in Developing Countries. In Handbook of Computable General Equilibrium Modeling, Peter B. Dixon, Dale W. Jorgenson (ed), 1: 277-301.

Dixon, P. and Parmenter, B.R. 1996. *Computable general equilibrium modelling for policy analysis and forecasting*. Chapter 01 in Handbook of Computational Economics, 1: 3-85.

Fields, G. 2011. Labor market analysis for developing countries. *Labor Economics*, 18(S1): S16-S22. https://doi.org/10.1016/j.labeco.2011.09.005

Ganguli, I., Hausmann, R. and Viarengo, M. 2014. Closing the gender gap in education: What is the state of gaps in labour force participation for women, wives and mothers? *International Labor Review*, 153(2): 173-207.

Gottlieb, C., Doss, C., Gollin, D. and Poschke, M. 2024. The Gender Division of Work Across Countries. Working Papers hal-04556343, HAL.

Harris JR, Todaro, MP. 1970. Migration, unemployment and development: a two-sector analysis. *American Economic Review*, 60:(1):126–142. https://www.aeaweb.org/aer/top20/60.1.126-142.pdf

Heckert, J., Pereira, A., Doss, C., Myers, E. C. and Quisumbing, A. 2020. Structural Transformation and Gendered Transitions to Adulthood among Rural Youth: Cross-National Evidence from Low- and Middle-Income Countries. *The Journal of Development Studies*, 57(4), 614–634. https://doi.org/10.1080/00220388.2020.1808196

IFPRI (International Food Policy Research Institute). 2024. 2022 Social Accounting Matrix for Rwanda: A Nexus Project SAM. Data Paper. Washington, DC: International Food Policy Research Institute. handle: 10568/155102.

Lewis WA. 1954. Economic development with unlimited supplies of labour. *The Manchester School*, 22:(2):139–91. https://onlinelibrary.wiley.com/doi/10.1111/j.1467-9957.1954.tb00021.x

Martins, P.M.G. 2018. Structural change: Pace, patterns and determinants. *Review of Development Economics*, 23(1): 1-32. https://doi.org/10.1111/rode.12555

Mroz, T.A. and Savage, T.H. 2006. The Long-Term Effects of Youth Unemployment. *The Journal of Human Resources*, XLI(2): 259-293.

NISR (National Institute of Statistics of Rwanda). 2025. The Seventh Integrated Household Living Conditions Survey (EICV7): 2023/24 Rwanda Main Indicators Report. Kigali: National Institute of Statistics of Rwanda (NISR).

NISR (National Institute of Statistics of Rwanda). 2024. Labor Force Survey. Annual Report 2024. Kigali: National Institute of Statistics of Rwanda (NISR).

NISR (National Institute of Statistics of Rwanda). 2018. The Fifth Integrated Household Living Conditions Survey (EICV5): 2016/17 Rwanda Poverty Profile Report. Kigali: National Institute of Statistics of Rwanda (NISR).

Ofori, P. E., Kuuwill, A. and Quaye, B. 2024. Effect of human capital development and institutional quality on inclusive growth in African countries. *Cogent Economics & Finance*, 12(1). https://doi.org/10.1080/23322039.2024.2357155

Romano, L. and Traù, F. 2017. The nature of industrial development and the speed of structural change. *Structural Change and Economic Dynamics*, 42: 26-37. https://doi.org/10.1016/j.strueco.2017.05.003

ROR (Republic of Rwanda). 2019. The State of Gender Equality in Rwanda. From Transition to Transformation. Kigali. https://e-ihuriro.rcsprwanda.org/wp-content/uploads/2023/06/THE-STATE-OF-GENDER-EQUALITY-IN-RWANDA-FROM-TRANSITION-TO-TRANSFORMATION.pdf

Samaniego, R.M. and Sun, J.Y. 2016. Productivity growth and structural transformation. *Review of Economic Dynamics*, 21: 266-285, https://doi.org/10.1016/j.red.2015.06.003.

Santos, M.A. and Hani, F. 2021. Diagnosing Human Capital as a Binding Constraint to Growth: Tests, Symptoms and Prescriptions. Working Paper No. 144. Center for International Development at Harvard University. https://growthlab.hks.harvard.edu/sites/projects.iq.harvard.edu/files/growthlab/files/2023-03-cid-fellows-wp-144-constraints-human-capital.pdf

Walsh, C.E. 2004.The Productivity and Jobs Connection: The Long and the Short Run of It. FRBSF Economic Letter, 2004-18. https://www.frbsf.org/wp-content/uploads/el2004-18.pdf

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