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ECUADOR

SELECTED ISSUES

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INTERNATIONAL MONETARY FUND

ECUADOR

SELECTED ISSUES

December 9, 2024

Approved By
Western Hemisphere Department

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BOOSTING SUSTAINABLE GROWTH IN ECUADOR[1]

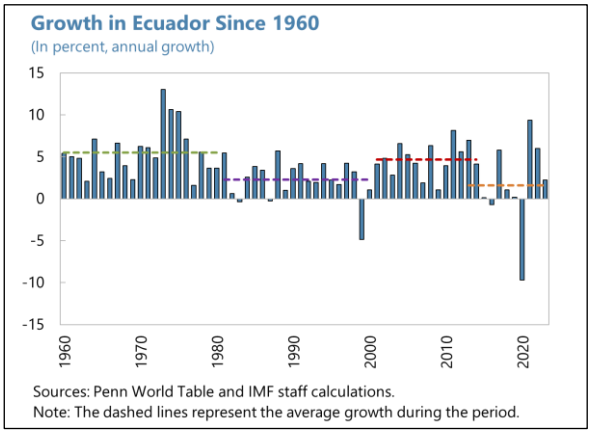
Ecuador's economic growth has slowed markedly since the 1990s, amid low investment, slowing employment growth, and anemic growth in total factor productivity (TFP) in the last decade. The security crisis poses additional risks to the growth outlook. To address these challenges, a comprehensive reform strategy should focus on: (i) improving the security situation and curbing the outflow of workers, including through job-rich opportunities for youth; (ii) revitalizing the business environment to attract investments; and (iii) implementing reforms that can boost TFP.

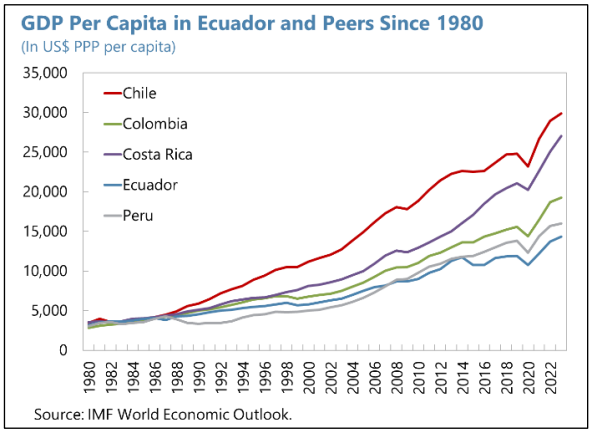
A. Introduction

1. Ecuador's economic growth has slowed over time. From 1960 to 1980, real GDP experienced robust growth, averaging 5.2 percent (Figure 1, left chart). The growth momentum faltered in the early 1980s during the Latin American debt crisis and again in the late 1990s during Ecuador's economic crisis, with growth averaging 2.9 percent from 1980 to 2000. Average growth rebounded to 3.7 percent during 2001-2014, and has slowed again since 2014, averaging only 1.6 percent.[2]

2. Ecuador's GDP per capita has fallen below other regional economies in recent years. This slowing growth trajectory has resulted in Ecuadorian GDP per capita falling below regional peers by 2023 (Figure 1, right chart). In 1980, Ecuadorian GDP per capita was above that of Colombia and Peru and only around 10 percent below those of Chile and Costa Rica. However, decades of relatively sluggish growth performance have left Ecuador behind: in 2023, Ecuador's GDP per capita was 25 percent below Colombia, 10 percent below Peru, and around 50 percent below Chile and Costa Rica.

Figure 1. Ecuador: Historical Growth





[1] Prepared by Niels-Jakob Hansen (WHD).

[2] To obtain a long perspective on growth in Ecuador, data from the Penn World Tables is used up to 2019. Thereafter data series are extrapolated using published data from the BCE. See further details in paragraph 5.

3. This paper assesses Ecuador's growth performance and discusses strategies to revitalize it. First, it analyzes the decline in growth using a production function framework. This approach reveals that the downturn in growth after 1980 is explained by a large decline in the contribution from TFP. Second, it illustrates how growth could accelerate to 2.5 percent over the medium term. Third, it emphasizes the need to pursue policies to (i) improve security and curb the outflow of workers (Selected Issue Paper on "Crime and Its Macroeconomic Impact in Ecuador"), including through securing job-rich opportunities for the youth; (ii) boosting labor supply, including through higher female labor force participation (Selected Issue Paper on "Tackling the Gender Gap in Ecuador's Labor Market"); (iii) revitalize the business environment to attract investments, which can help diversify exports (Selected Issue Paper on "Reducing Vulnerabilities to the Global Energy Transition towards a Low-Carbon Economy; and (iv) implement reforms that can boost TFP. In addition, it is key to find sustainable solutions to address electricity shortages (Selected Issue Paper on "Electricity Sufficiency and Reliability") and the challenges posed by climate change (Selected Issue Paper on "Climate Trends and Macroeconomic Impacts").

B. Why has Growth Slowed in Ecuador?

4. To assess why growth has slowed in Ecuador, this paper uses a production function framework. Specifically, it is assumed that actual GDP from the supply side can be represented using a simple Cobb Douglas production function:

$$Y = AK^{\alpha}L^{1-\alpha} \quad (1)$$

where Y denotes output, A denotes total factor productivity, K denotes capital, and L denotes labor. The subscript for time is omitted for simplicity. As is standard, the production function is assumed to have constant return to scale with $\alpha = 1/3$. Potential output can then be written as:

$$\bar{Y} = \bar{A}K^{\alpha}\bar{L}^{1-\alpha} \quad (2)$$

$$\bar{L} = \bar{a}WAP \quad (3)$$

where all variables at their potential level are denoted with an upper bar, WAP is the working age population (aged 16-64), and $\bar{a}$ is the potential ratio of the working age population employed (the employment ratio).[3]

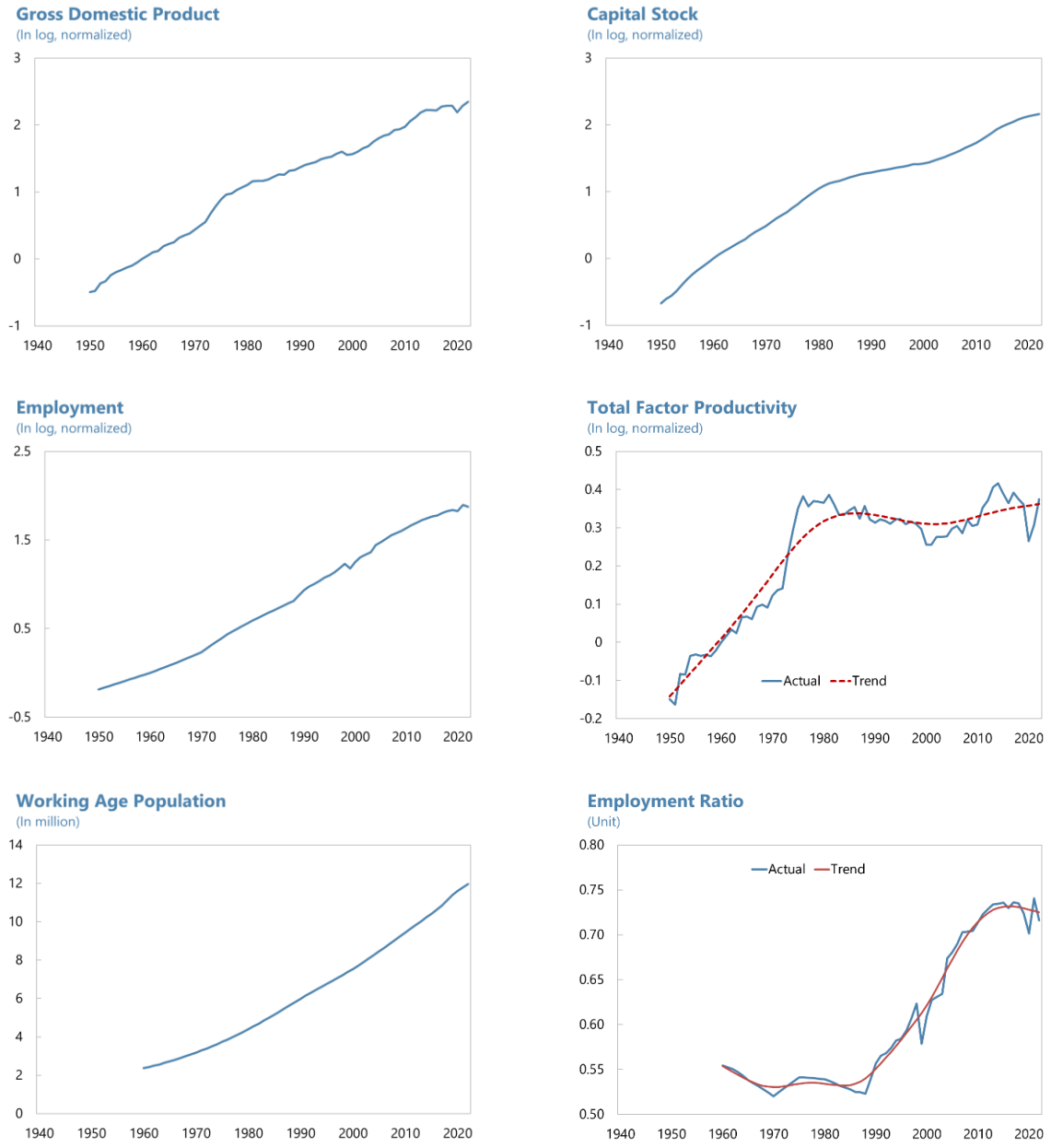
5. Annual data for real output, capital, and labor from 1950 to 2019 is sourced from the Penn World Tables. This dataset is extrapolated up to 2023 using data on employment, real GDP, and gross capital formation from the BCE and IMF staff.[4] Data on the working age population is

[3] A complementary method is "Business Cycle Accounting" which models economic fluctuations by introducing time-varying wedges resembling productivity, labor and investment taxes, and government consumption (Chari and others, 2007).

[4] To augment the series for the capital stock, the accounting identity $K_{t+1} = (1-\delta)K_t + I_t$ is used. δ is calibrated such that the historical path for the capital stock can be replicated.

taken from the World Bank, which provides historical data back to 1960 and projections through 2050. TFP is computed as a residual, based on equation (1). HP-filters are used to extract the trend level of TFP ($\bar{A}$) and the trend level of employment to ratio ($\bar{a}$). All data is plotted in Figure 2.

Figure 2. Ecuador: Actual and Trend Variable for Use in Production Function



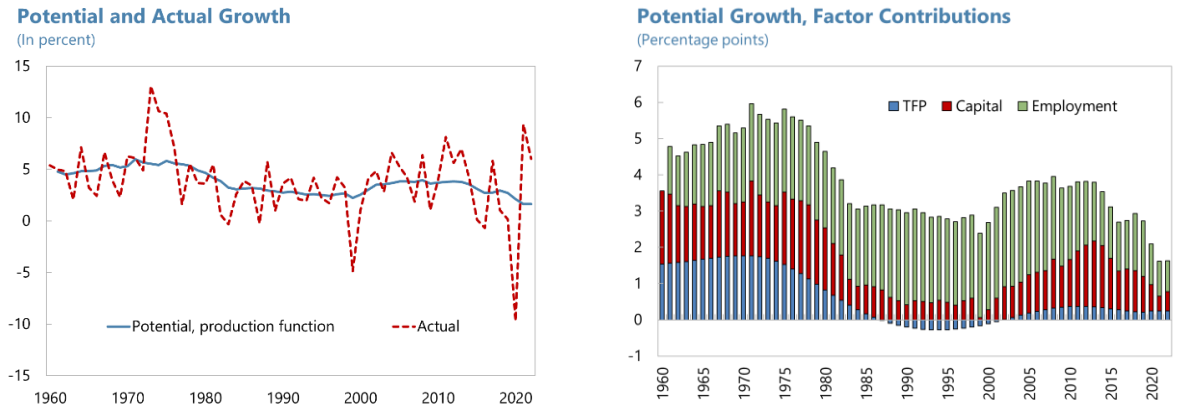
Sources: Penn World Table, BCE, and IMF staff calculations.

6. Potential growth has been slowing over time. Figure 3 (left panel) illustrates the trends in actual and potential GDP. As expected, potential growth exhibits less volatility than actual growth and has gradually slowed over time. During 1960-80, potential growth averaged 5.2 percent, and

slowed to 2.9 percent during 1980 to 2000. From 2001 to 2014, potential growth rebounded to 3.8 percent. However, since 2014, potential growth has slowed to 2.3 percent.

7. The contribution from TFP has significantly diminished over time, while capital accumulation and labor growth have also weakened. Until the early 1980s, potential growth was supported by contributions from TFP, employment, and capital (Figure 3, right panel). However, since then, the contribution from TFP has diminished significantly. The growth rebound in the early 2000s was primarily fueled by an increase in the contribution from capital. However, since 2012, these growth drivers have weakened, with the contribution from capital and especially labor declining.

Figure 3. Ecuador: Actual and Potential Growth, 1960-2020



Sources: BCE and IMF staff calculations.

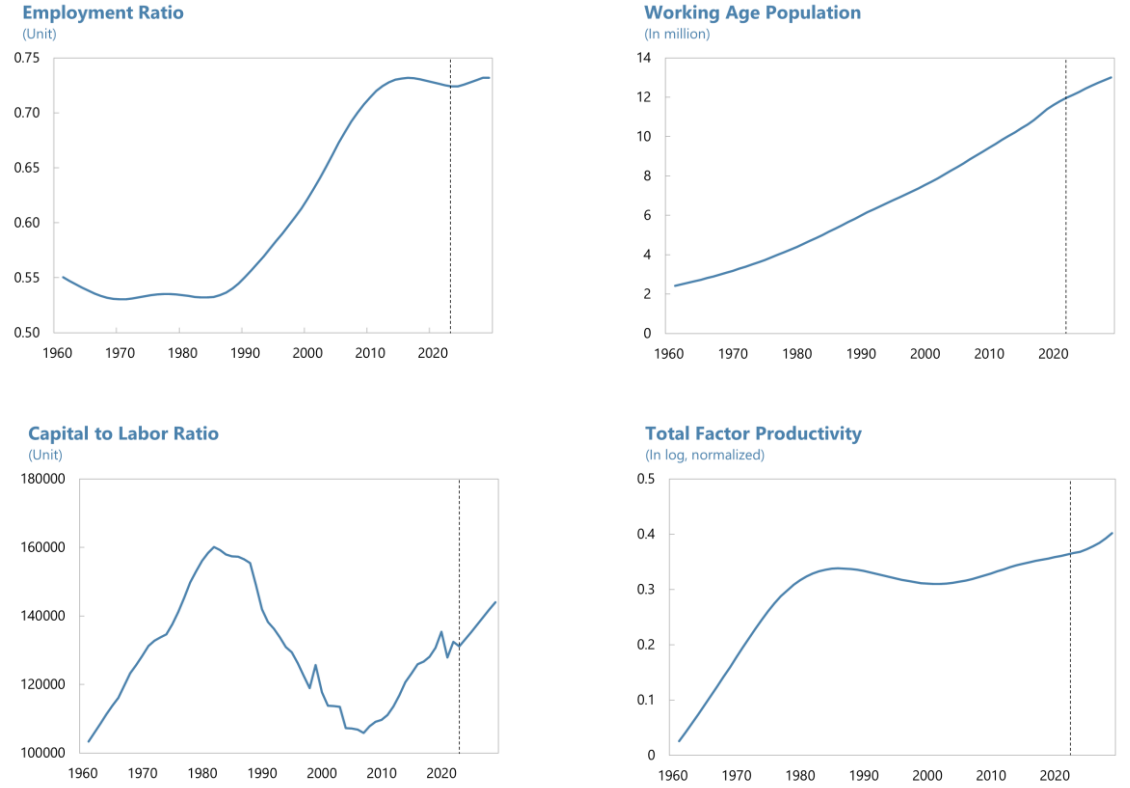
C. Factors Shaping Potential Growth Going Forward

8. The potential GDP growth projections rely on several assumptions. For labor, it is assumed that the employment ratio will gradually recover to its pre-pandemic level, while the working age population follows the population projection published by the World Bank.[5] Together, these factors provide a trajectory for structural employment. The ratio of capital to labor is assumed to return to its pre-pandemic growth rate. A constant growth rate in the K/L ratio is consistent with the Kaldor facts (1961).[6] Combining this ratio with the assumed increase in structural employment yields a path for capital accumulation. Trend TFP is assumed to gradually return to its long-run average. The assumptions are illustrated in Figure 4.

[5] Using the population projection from National Institute of Statistics and Censuses (INEC) yields very similar results.

[6] In 1961, Kaldor stated six "stylized" facts about economic growth: 1) Labor productivity has grown at a sustained rate; 2) Capital per worker has also grown at a sustained rate; 3) The real interest rate, or return on capital, has been stable; 4) The ratio of capital to output has also been stable; 5) Capital and labor have captured stable shares of national income; and 6) Among the fast-growing countries of the world, there is an appreciable variation in the rate of growth "of the order of 2–5 percent."

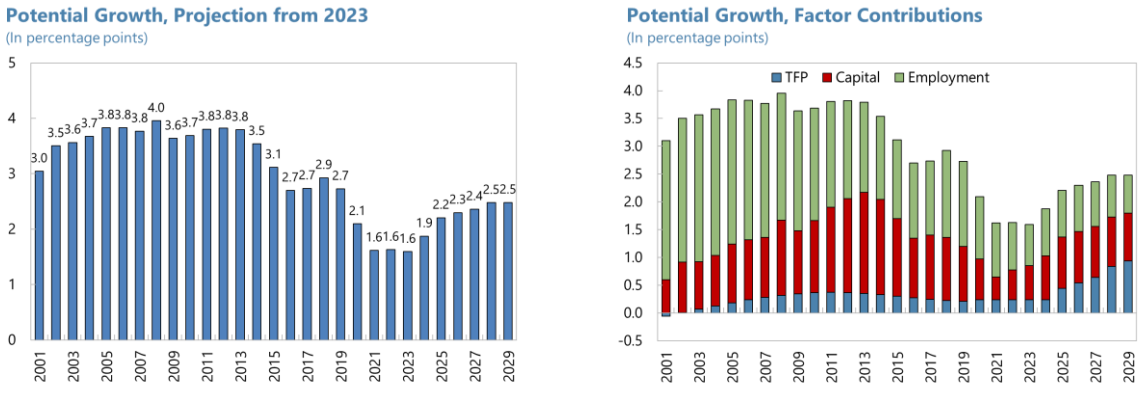
Figure 4. Ecuador: Assumptions Used in the Projection of Potential GDP towards 2030



Sources: Penn World Table, BCE, and IMF staff calculations.

9. The projection yields potential growth rate around 2.5 percent in the medium term. Potential growth is projected to increase from 1.6 percent in 2023 to 1.9 percent in 2024, before gradually rising to around 2.5 percent in 2028 (Figure 5, left panel). The increase in potential growth is delivered through a combination of (i) higher employment; (ii) more capital accumulation; and (iii) a pick-up in TFP growth to its long-run trend (Figure 5, right panel).

Figure 5. Ecuador: Projection of Potential Growth



Sources: Penn World Table, BCE, and IMF staff calculations.

D. Policy Options to Lift Potential Growth Further

10. Reducing crime and insecurity could enhance growth by increasing capital accumulation and TFP. As discussed in the Selected Issue Paper "Crime and Its Macroeconomic Impact in Ecuador," the surge in crime is negatively affecting economic activity in Ecuador. This reduction can operate through several channels, e.g., lower capital accumulation, reduction in labor force participation, and lower growth in total factor productivity (IMF, 2023). Specifically, the analysis shows that a 10 percent reduction in crime could boost economic activity by up to 5 percent. In terms of growth, this for example means that a 20 percent reduction in crime over 10 years would boost annual growth by 1 percent each year over the same period.[7]

11. Labor market reforms could significantly boost growth. As discussed in the Selected Issues Paper "Tackling the Gender Gap in Ecuador's Labor Market," closing the gap in employment rates between men and women could boost GDP by as much as 17 percent. If this happened over a period of 10 years, this would boost growth every year by up to 1.6 percent. Other economic and development policies, including reducing labor market rigidities; increasing educational attainment; and enhancing focus on access to job opportunities for the youth, are also important.

12. Financial sector reforms can enhance growth by increasing capital accumulation and allocation efficiency. Increasing capital deepening to incentivize sound capital accumulation is one of the structural transformations sought under the ongoing EFF-supported program. To this end, the authorities plan to implement financial sector reforms, including to revisit the system of interest rate caps, reduce financial repression, and develop domestic debt markets. Ecuador currently ranks among the emerging market economies with below average financial development according to IMF staff estimates (Sahay and others, 2015). These estimates suggest that, by achieving a level of financial development in line with the emerging market average, Ecuador could boost annual GDP growth by around 1.5 percent.

13. Finally, a range of other important reforms could also help boost potential GDP. These include lifting regulatory constraints in product and service markets, as well as addressing efficiency and governance problems within SOEs.[8] In addition, it is key to ensure sufficient and reliant access to energy as well as diversifying the economy for the climate transition.

[7] Analysis from IMF (2023) shows how crime dampens economic activity, primarily through total factor productivity and capital accumulation.

[8] See also World Bank (2024).

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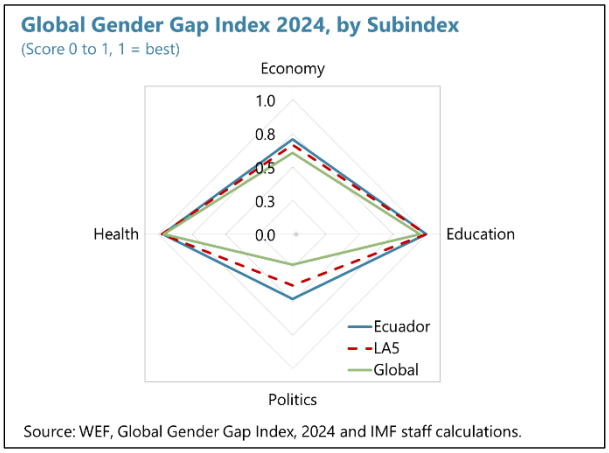
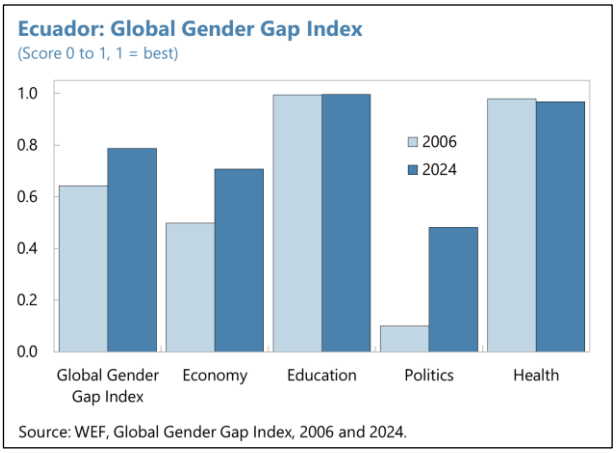
TACKLING THE GENDER GAP IN ECUADOR'S LABOR MARKET[1]

Ecuador has implemented significant reforms to address gender inequality, and the authorities have assigned utmost importance to policies that enhance prospects for women, especially to increase women's participation in the labor market. In line with these priorities, tackling informality, implementing family-friendly labor market policies, and promoting women's representation in technical fields are essential steps to significantly reduce labor market inequality, and boost Ecuador's productivity and growth potential, including by mitigating headwinds from aging population.

A. Introduction

1. Ecuador has made notable progress addressing gender inequality. According to the latest WEF's Global Gender Gap Report (WEF 2024), Ecuador ranks 16th globally, and 2nd in the region, surpassing both the average index of the LA5 countries[2] and the global average index. Specifically, the country has achieved strong outcomes in educational attainment, access to health services, and life expectancy (text figure). However, despite scoring better than other countries, macro-critical challenges persist in labor market participation and economic opportunity.





B. Gender-Focused Reforms in Ecuador

2. The 2023 Violet Economy Law (VEL) marked a crucial step in addressing labor market inequality. In recent years, successive governments have implemented significant reforms to combat gender inequality (text table). However, the 2023 VEL represents a turning point in promoting employment opportunities for women by directly addressing labor market barriers that

[1] Prepared by Paola Hidalgo and Giovanni Ugazio (WHD).

[2] The Global Gender Gap Index assesses the progress of 146 countries towards closing the gender gap. It is measured on a scale from 0 to 1, with 1 representing full gender parity, and is based on a combination of statistics from international organizations and survey data. LA5 countries include Brazil, Chile, Colombia, Mexico, and Peru.

have historically disincentivized women's participation. Among other initiatives, the law introduced flexible working hours, equal pay for men and women, provision of childcare services, shared parental leave, and the inclusion of women on company boards. To ensure these policies are implemented effectively, the law mandates that every company with more than 50 employees submit a four-year "Equality Plan" that includes specific strategies and actions to close gender gaps identified within each company, ensuring compliance with the VEL. Finally, the law introduced the Violet Seal, certifying companies that successfully adopt gender equality policies, aiming to foster an inclusive labor market.

Key Gender Equality Legislation in Ecuador

Legislation	Year Introduced	Key Features
Law to prevent and erradicate violence against women	2018	Comprehensive measures for prevention, protection, and reparation for victims. Specialized judicial units to address gender-based violence. Mandates care protocols coordination across sectors.
Organic Code of Democracy Reform	2019	50% gender parity in Assembly candidate lists by 2025. Presidential tickets must be male-female. Sanctions against gender-based political violence.
Violet Economy Law	2023	Sexual harassment prevention and equality plans in companies. Flexible working hours, equal pay, shared parental leave, and childcare services. Mandatory women inclusion on boards and hiring tax incentives.
Organic Law of the Right to Human Care	2023	Licenses for maternity, paternity, and caregiving that support both genders equally. Provides care facilities and lactation rooms at workplaces. Promotes shared caregiving responsibility and safeguards against caregiving discrimination.
Gender Pay Equality Law	2024	Mandates equal pay for equal work, regardless of gender. Sets up a system to monitor and enforce pay equality. Establishes penalties for non-compliance.

Source: Ecuador's Official Gazzette.

3. The VEL implementation is now overseen by a dedicated ministry that works closely with other relevant ministries. Since 2022, the responsibility for gender policies has been centralized within the Ministry of Women and Human Rights, which coordinates gender equality policies in collaboration with relevant ministries. The Ministry of Labor plays a fundamental role, as these policies aim to increase women's participation in the labor force. With the legal framework largely in place, the next key steps will involve establishing evaluation systems to ensure effective policy implementation, which could go a long way in addressing labor market participation challenges faced by women. Additionally, integrating the VEL with existing legislation will be crucial to addressing barriers affecting women's professional opportunities. Enhanced communication and outreach efforts with private sector stakeholders are needed to ensure buy-in for these reforms.

4. Ecuador has achieved advancements in the political empowerment of women. Women's representation in the National Assembly has increased from 32 percent in 2009 to 43 percent in 2023, surpassing the regional average of 36 percent, but still behind regional leaders like Bolivia, Costa Rica, and Mexico,[3] which have achieved equal representation. The current government's cabinet is the most gender-balanced in the country's history, predominantly held by

[3] Inter-Parliamentary Union (2024).

young women, reflecting significant progress towards gender parity in executive power compared to the regional average of 30 percent, as reported by UN Women. Key legislative reforms, mandating gender-balanced presidential tickets and requiring political parties to nominate at least 50 percent female candidates for the National Assembly, have been pivotal in these achievements and have boosted Ecuador's global ranking to 17th globally for this category (WEF 2024).

C. Human Capital and Labor Market

Labor Force, Educational Attainment, and Salary Gender Gap

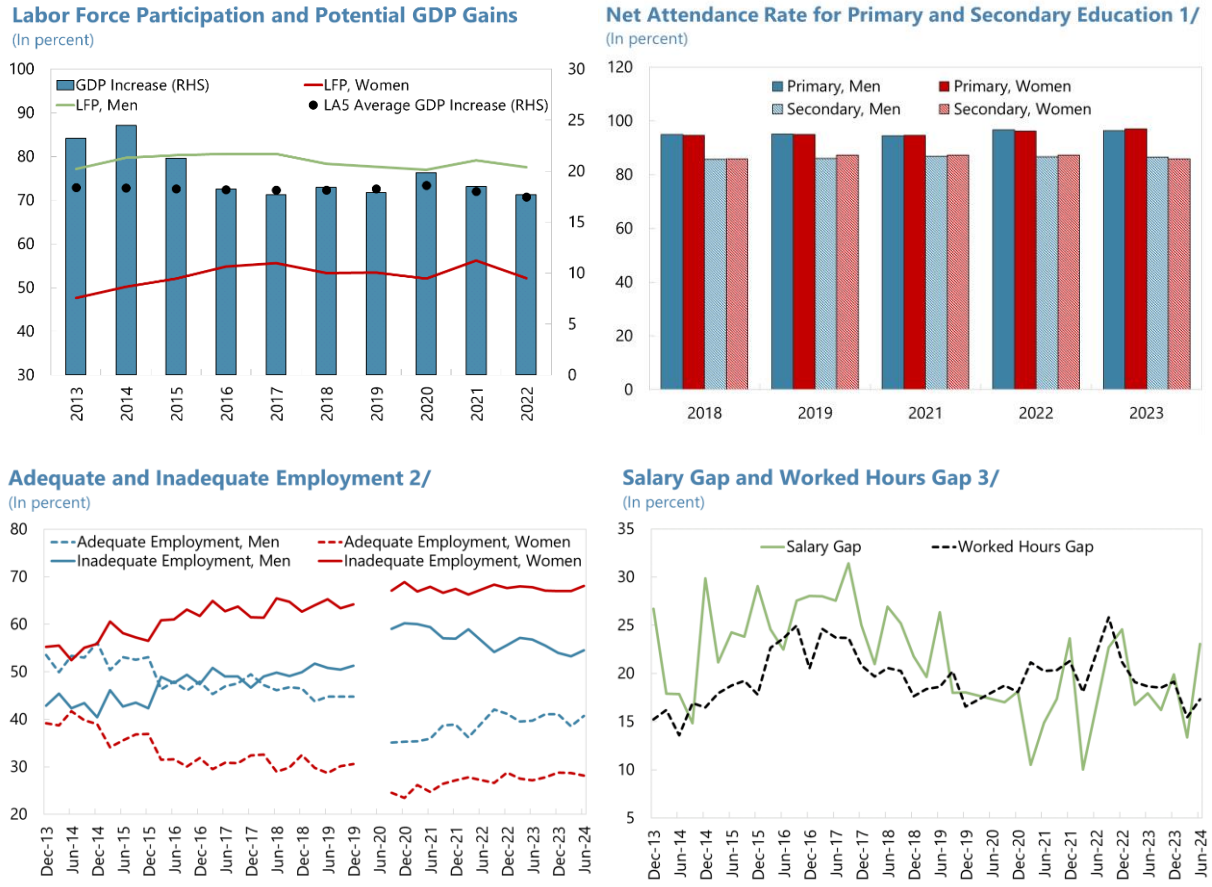
5. Despite similar educational attainment as men, women labor force participation in Ecuador is disproportionately low (Figure 1)**.** According to the National Employment Survey (ENEMDU),[4] Ecuador's female labor market participation in 2023 stood at only 53 percent for women, compared with 78 percent for men. Estimates based on Ostry et al. (2018) indicate that, assuming labor complementarity between males and females, fully closing this gap could over time increase GDP by up to 17 percent, broadly in line with estimates for the LA5 average. At the same time, equal levels of education highlight cultural and structural barriers women face to participate in the labor market. Traditional gender roles often assign women primary household responsibilities which, together with inadequate access to services such as childcare or elderly care, limit their professional integration and prevent women from fully leveraging their education to advance professionally. According to the ENEMDU, approximately 30 percent of women who do not work would like to do so but are unable because of household duties. A recent study covering selected Latin American economies (IMF 2024) found similar results for impediments to women labor market participation.

6. Women employment is largely characterized by inadequate jobs and a significantly lower average wage compared to men. Following a deterioration during the COVID-19 pandemic, adequate employment for women stood at below 30 percent in June 2024, with almost one-fifth of inadequately employed women reportedly working unpaid or less hours than men and less than 40 percent of employed women working withing a formal salaried position (World Bank 2024). A recent time-use survey (United Nations 2021) found that, like in most regional peers, Ecuadorian women work longer hours than men (55.8 hours per week as of 2012 compared to 49.6, respectively) with most of these additional hours being unpaid. This highlights the urgent need to implement the VEL focused on integrating women into the formal economy. In addition to facing lower quality jobs, women earn on average 23 percent less than men, compared with 11 percent on average in LA5 economies. A key factor explaining the salary difference, as highlighted in WEF's 2024 report, is that less than one-third of women graduate in technical fields, which usually offer comparatively higher salaries, compared to about 70 percent of men. Increasing women's participation in technical training and jobs is crucial for closing salary gaps, fostering women economic empowerment, creating a more skilled workforce, and boosting Ecuador's aggregate productivity and GDP growth.

[4] The ENEMDU is the National Survey of Employment, Unemployment, and Underemployment conducted monthly by the National Institute of Statistics and Census (INEC).

7. Ecuador has made progress with women-friendly work policies but areas for improvement remain. Flexible work arrangements, including teleworking, are increasingly available but are not yet fully regulated or widely adopted. For instance, while paternity leave has increased to 15 days as of 2023, broadly in line with most regional peers, Ecuador scored 40 out of 100 on the 2024 Parenthood Indicator (World Bank 2024),[5] indicating that the lack of robust family-friendly policies continues to contribute to low labor participation among women.

Figure 1. Ecuador: Labor Market and Education Attainment Indicators by Gender



Sources: INEC and IMF staff calculations. No data for March and June 2020 due to COVID-19.

1/ Percentage of children in the appropriate age group attending primary or secondary school.

2/ Adequate employment refers to earning at least the minimum wage and working more than 40 hours per week or fewer without wanting more work. Inadequate employment includes earning below the minimum wage and/or working less than 40 hours weekly, covering underemployment and unpaid work, and other types of non-full employment.

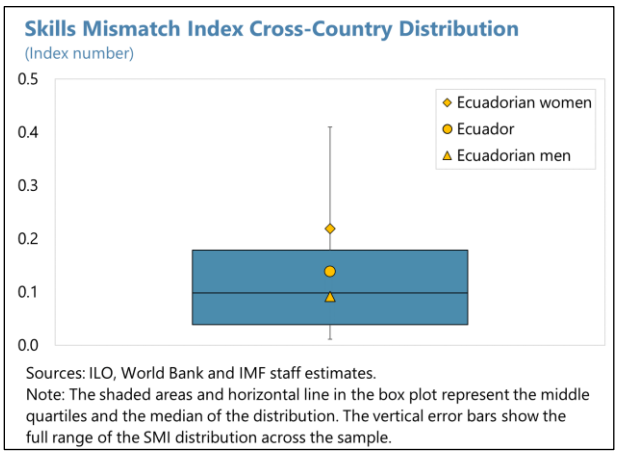
3/ The salary gap is the ratio of men's average monthly income to women's average monthly income. The worked hours gap is the ratio of men's average monthly hours worked to women's average monthly hours worked.

[5] *The Women, Business and the Law Index* evaluates the impact of legal frameworks on women's economic opportunities in 190 countries, covering eight indicators. The *Parenthood Indicator* assesses laws and regulations supporting maternity leave, paternity leave, and the legality and availability of childcare, with scores ranging from 0 (least favorable) to 100 (most favorable), reflecting the extent of parental rights and benefits in the country.

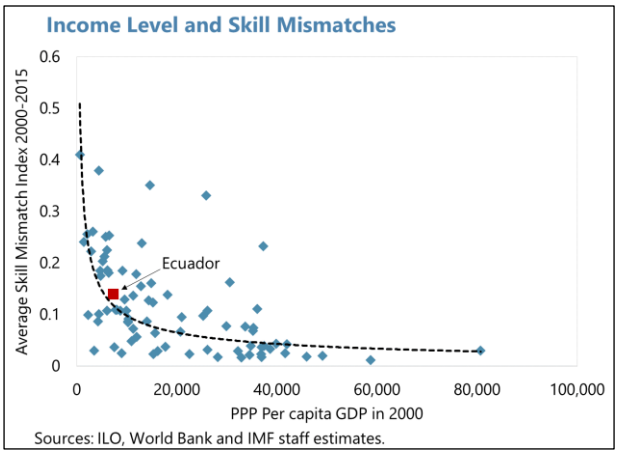
Skills Mismatches

8. The skills mismatch in the Ecuadorian labor market is particularly acute for women. Calculating a simplified skills mismatch indicator (SMI) that approximates the distance between labor supply and demand by skill level,[6] Ecuador's SMI based on 2023 survey data ranked in the third quartile of the cross-country distribution. As the SMI tends to be a decreasing function of GDP per capita, Ecuador's aggregate mismatches are average when compared to countries in the same income group. However, disaggregating the SMI by gender reveals a significant disparity, with the SMI increasing substantially when focusing on women only (right and left text figures).

9. The mismatch for women is driven by a combination of lack of opportunity in high-skilled segments and excessive informality in low-skilled sectors. In the case of Ecuadorian women, the SMI result is driven by (i) the very low level of adequate employment for women in low-skilled sectors, especially agriculture and production of flowers, where informality is prevalent and women cannot afford household help and have to tend to household chores often by themselves; and (ii) the relatively few women employed in high-skilled jobs compared to the significant number of women with higher educational attainments, indicating a probable mismatch between the field of study chosen by many women graduates compared to job opportunities for women.



Sources: ILO, World Bank and IMF staff estimates.
Note: The shaded areas and horizontal line in the box plot represent the middle quartiles and the median of the distribution. The vertical error bars show the full range of the SMI distribution across the sample.



Sources: ILO, World Bank and IMF staff estimates.

D. Way Forward

10. Reducing informality would significantly improve the standing of women in the Ecuadorian labor force. Although the country as a whole stands to gain from a fairer labor market with greater access to adequate employment, even partial reforms to tackle unpaid work and informality could bring a substantial number of women in the formal labor force, boosting their access to adequate employment in those sectors where women employment already exists *de facto* as well as into higher quality jobs. Reducing informality would also promote better access to

[6] The SMI is calculated as in Estevao and Tsounta (2011), extended by Stepanyan and others (2013) and Melina (2016) to measure mismatches in 82 countries. The SMI is measured as the sum of distances of the share of labor force with a given skills level and the share of employees with the same level of skill. The SMI ranges between 0 and 1, with 0 indicating no skill mismatch and 1 absolute skill mismatch.

financial services and greater financial independence for women, further strengthening their economic empowerment.

11. Implementing comprehensive family-friendly policies and promoting women participation in technical sectors are crucial steps to enhancing women's labor market participation. Expanding affordable childcare options and providing adequate parental leave remain vital policies for supporting women's career advancement in Ecuador. Moreover, policies aimed at attracting and training girls for technical jobs that offer higher incomes would further support their economic independence and improve gender equality overall.

12. Promoting women's labor market participation and expanding their opportunities in high-quality jobs would support Ecuador's productivity and growth potential. In a context of decelerating population growth, reforms to increase labor force participation would mitigate the demographic headwind to potential growth (IMF 2024). Expanding access to high-quality jobs for women would further enhance productivity and foster inclusive economic growth. Building on the authorities' achievements and priorities in advancing gender equality, continuing to reduce the labor force participation gap between men and women remains a macro-critical priority, with the potential to deliver a significant growth dividend.

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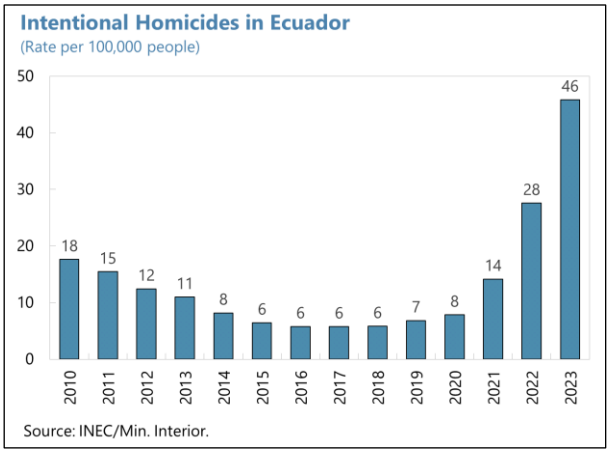
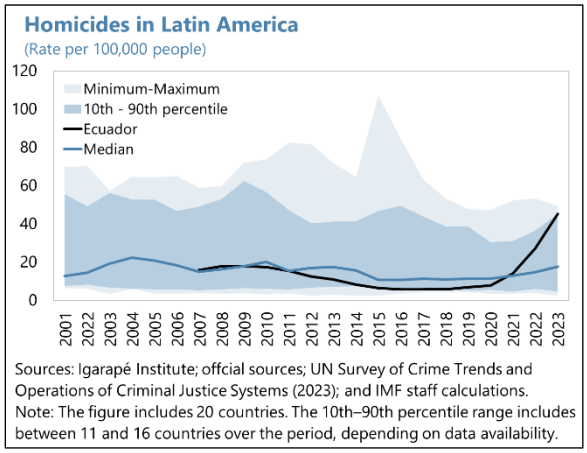
CRIME AND ITS MACROECONOMIC IMPACT IN ECUADOR[1]

Ecuador faces significant challenges related to a security crisis linked to organized crime and drug-related violence. The security crisis has adverse economic effects, with Fund staff estimates suggesting that a 1 percent increase in the local murder rate is associated with a decline in the level of economic activity of up to 0.5 percent. Continued efforts to reduce crime are critical, including by strengthening citizen security, tackling illicit financial flows, promoting job-rich growth, and reducing inequality.

A. Overview

1. Ecuador has declared an "internal armed conflict" in response to a surge in violent crime. The escalation of crime and its human toll are underlined by a significant increase in the homicide rate between 2020 and 2023, from 8 to 46 per 100,000 people (left text figure). As a result, Ecuador has become one of the countries with the highest homicide rates in Latin America (right text figure). On January 9, 2024, in response to severe threats from organized crime jeopardizing Ecuador's territorial security and sovereignty, the authorities declared an "internal armed conflict," 22 criminal groups were classified as terrorist organizations and non-state belligerent actors (Executive Decree No. 111), and temporary curfews and mobility restrictions were imposed in many locations. In a referendum held in April 2024, the majority of the population backed several measures to address the security crisis.

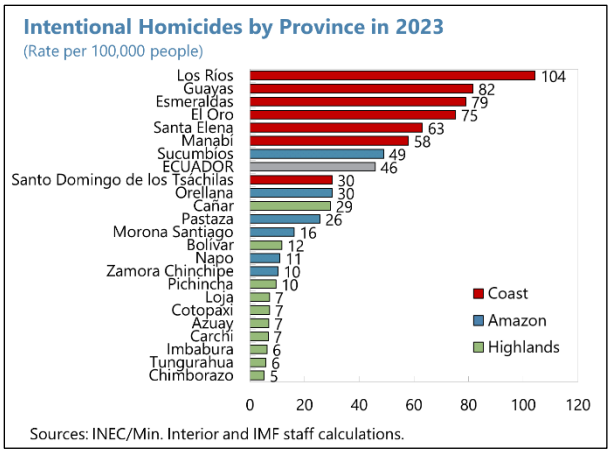


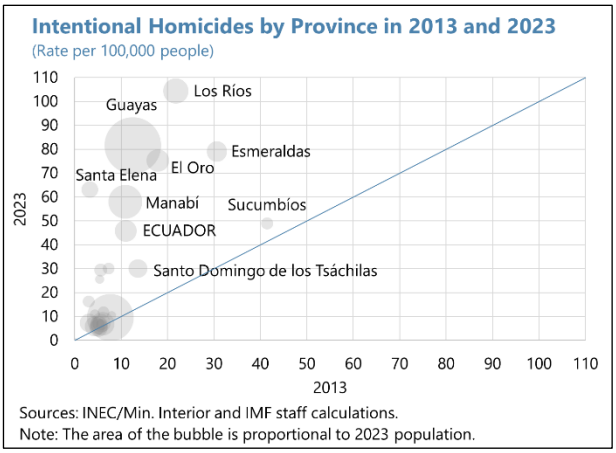


2. The national rate of homicides masks significant disparities across locations. Ecuador's coast is the region worst affected by the security crisis. Six out of the seven coastal provinces report homicide rates that surpass the national average and, in some cases, even double it. In contrast, provinces in the Amazon and especially in the highlands (including Pichincha, where Ecuador's capital Quito is located) have considerably lower homicide rates (left text figure). Moreover, the

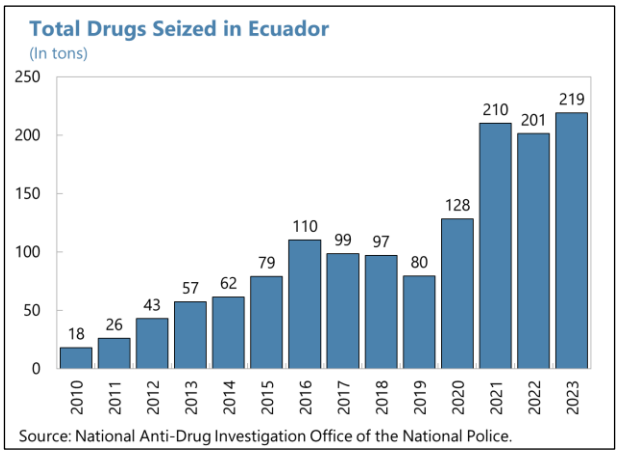
[1] Prepared by Juan Pablo Erráez, Niels-Jakob Hansen, Paola Hidalgo, and Jorge Salas (WHD), with contributions by Chady El Khoury and Ivana Rossi (LEG), and with support from Mauricio Amaya (WHD).

surge in homicides has been largely driven by a deteriorating situation in the coast (right text figure). Municipalities with a higher urban population share, higher share of youth, and lower education levels have seen higher murder rates.



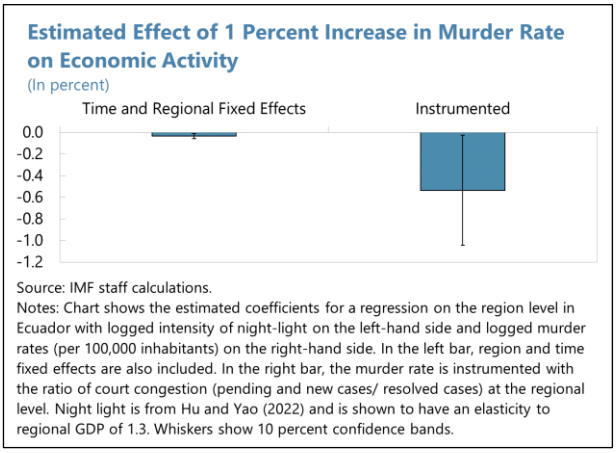


3. According to the UN Office on Drugs and Crime (UNODC), the security crisis is linked to organized crime, as well as gang- and drug-related violence. According to UNODC (2023), the rise in violence is attributed to clashes between rival transnational and local drug factions, including conflicts over lucrative cocaine routes. In 2023, Ecuadorian authorities confiscated a record 219 tons of illegal drugs (text figure), mainly cocaine. Criminal groups have increasingly engaged in other activities, such as firearms and human trafficking, illegal mining, and trafficking in timber and wildlife. Extortion has also surged, often targeting small business owners, with some sources pointing to nearly 22,000 cases recorded in 2023. As a result, illegal proceeds generated by domestic and cross-border activities of organized crimes are likely implying a higher money laundering threat to the economy.



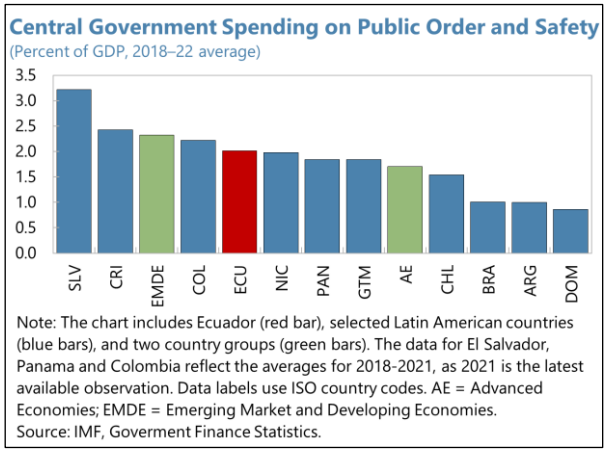
B. Macroeconomic Impact of Crime and Fiscal Spending on Security

4. Staff empirical analysis suggests that the surge in crime has taken a significant toll on the economy. To study the impact of crime on the economy, regional data on murder rates are combined with data on night-light intensity,



which is shown to have a strong correlation to regional GDP (Hu and Yao, 2022). The statistical analysis in the text figure illustrates how a 1 percent increase in the local murder rate is associated with a decline in the level of economic activity of up to 0.5 percent. This reduction can operate through several channels, e.g., lower capital accumulation, reduction in labor force participation, and lower growth in total factor productivity (IMF, 2023.)

5. Ecuador's spending on public order and safety has been stable over 2018-22, reaching on average 2 percent of GDP. Central government expenditure data indicates that around 60 percent of those resources were devoted to the police, nearly 10 percent to law courts, about 5 percent to prisons, and the remainder to other items.[2] Compared to other Latin American countries, Ecuador's spending on public order and safety appears to be relatively high, though it is below the average of emerging market and developing economies (text figure).[3]



6. In general, money laundering by organized crimes can have negative macroeconomic impacts through several channels. Money laundering activities could increase the perceived risks of doing business. Illicit funds may also distort prices of some physical and financial assets, reducing market efficiency and inducing misallocation of resources. The proceeds of crimes circulating in the economy (usually cash) could deepen the informal sector, potentially impeding financial inclusion. Ultimately, money laundering may contribute to higher inequality and social disparities.[4]

C. Implications

7. Reducing crime is a priority for boosting economic growth. Along with actions to strengthen citizen security, the literature (see Bisca et al., 2024) highlights the relevance of measures that promote macroeconomic stability and reduce inequality coupled with improvements in governance (e.g., the rule of law). Other economic and development policies, including access to education and enhanced focus on job opportunities, notably for youth, are also important. Continued efforts to make Ecuador a more robust and diversified economy will help reduce its vulnerability to crime. Since crime manifests locally, granular data, monitoring, and policy coordination between national and local authorities is critical in addressing insecurity effectively. Moreover, as violent crime manifests in "pockets of fragility" (e.g., the education level is lower or

[2] These items exclude military expenditure. According to the Ministry of Economy and Finance's budget information, spending on "national defense" has hovered around 1.3 percent of GDP in recent years.

[3] See also IMF, 2023, Regional Economic Outlook: Western Hemisphere and Online Annex 4.

[4] See IMF, 2023, Review of the Fund's Anti-Money Laundering and Combating the Financing of Terrorism Strategy, and its accompanying background papers on macroeconomic impact of illicit financial flows, and the impact of financial integrity failures on financial stability.

where the share of youth is higher), it is key to systematically monitor and enhance the efficiency of resources allocated to citizen security.

8. A deeper understanding of organized crime activities and how their profitable illegal activities are laundered would support Ecuador's efforts in fighting crime. Such an in-depth understanding of organized crime dynamics can help inform actions aimed at reducing their profitability and disrupting the associated illicit financial flows. Additionally, it is vital to uphold the integrity of the financial sector and persist in efforts to mitigate vulnerabilities to corruption, given that organized crime and corruption typically feed on each other (see Box 5 in IMF, 2018). These goals require ensuring the effective implementation of the Anti-Money Laundering and Combating the Financing of Terrorism (AML/CFT) framework.

9. AML/CFT policy priorities can focus on measures with the strongest impact in detecting and deterring the laundering by organized crimes. Efforts could center on AML/CFT risk-based supervision of high-risk sectors, coupled with actions that help reduce the use of cash and informality more broadly. It is also important to facilitate coordination and exchange of information across relevant institutions, as well as to continue strengthening cross-border cooperation with foreign counterparts (such as neighboring countries where organized crime groups with links to Ecuador operate, and destination countries for illicit drugs).

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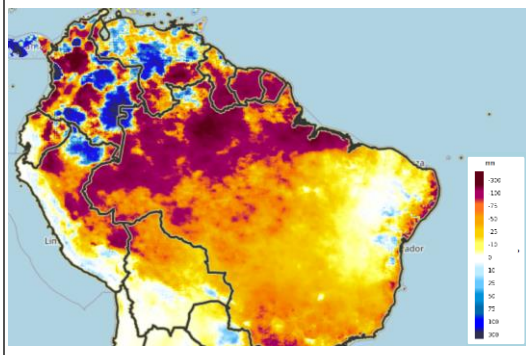
SECURING ELECTRICITY SUFFICIENCY AND RELIABILITY[1]

Ecuador started seeing nationwide blackouts in late September 2024, as was also the case in 2023, amid a historic drought exacerbating a structural deficit in electricity generation. The electricity imbalance for October 2024 was estimated at around 500 GWh (19 percent of usual demand), significantly larger than the maximum gap observed in 2023. The large gap this year is caused by an 18 percent drop in domestic electricity production amid the dry season and a temporary suspension of imports from Colombia in October. The energy crisis highlighted Ecuador's electricity sector's vulnerability to climate change, particularly due to its large reliance on hydropower. As climate change increase hydrological variability, it will be crucial to build resilience in the sector and diversify the energy mix beyond hydropower.

A. Introduction

1. In the fall of 2024, Ecuador experienced nationwide daily blackouts, amid severe drought conditions affecting hydroelectric power generation. Starting in late September 2024, Ecuador started to see nationwide blackouts, as was also the case in late 2023. These come on the back of a historic drought period (text figure), affecting the water flows in rivers feeding the country's hydroelectric power plants. The problem has been worsened by similar drought conditions in neighboring countries, impeding Ecuador's ability to rely on electricity imports.

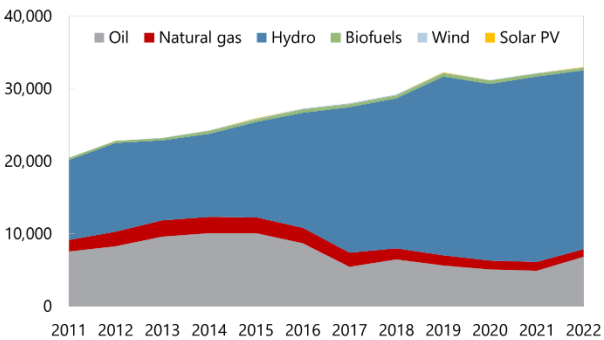
Rainfall During July-September 2024
(Deviation from long run average)



Source: United States Geological Survey.

2. The energy crisis highlighted the vulnerability of Ecuador's electricity sector to climate change. Hydropower generation accounts for about three-quarters of electricity generation in Ecuador, contributing to the country's low electricity costs and green energy mix, while other renewables make up only a small fraction (text figure). Despite the sustainability of hydropower, Ecuador's large reliance on it makes the country vulnerable to droughts (see Selected Issue Paper "Climate Trends and Macroeconomic Impacts"). With climate change

Electricity Generation by Source
(In kWh)



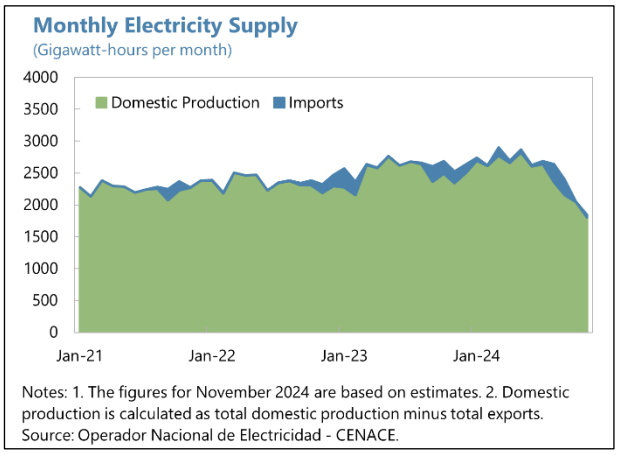
Sources: IEA, IMF staff calculations

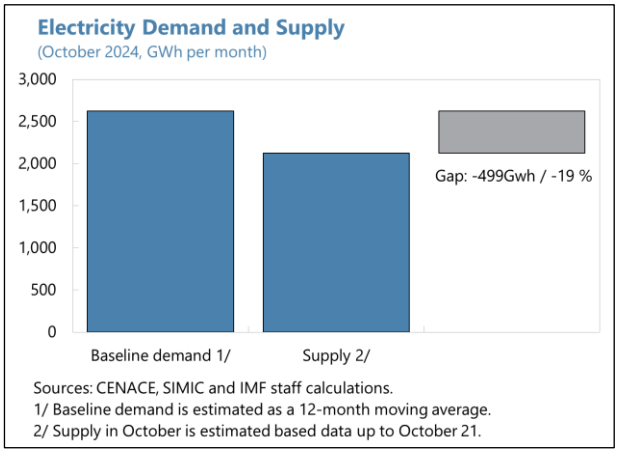
[1] Prepared by Mauricio Amaya, Niels-Jakob Hansen, and Ilya Stepanov (WHD).

and the intensification of El Niño phenomenon, Ecuador's electricity supply will become even more vulnerable to hydrological variability.[2]

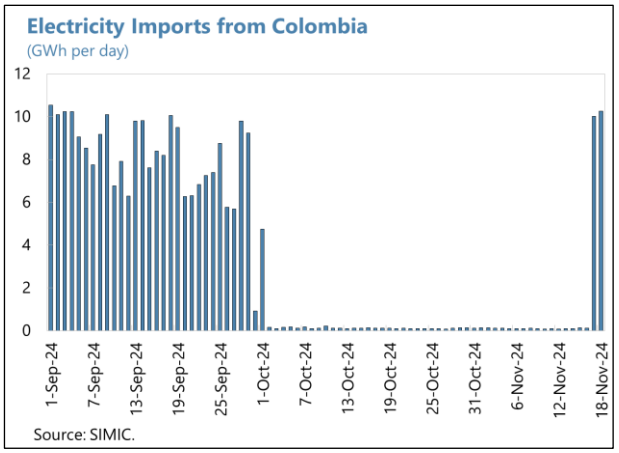
B. Causes of Electricity Crisis

3. The drought conditions exacerbated a structural deficit in Ecuador's electricity generation. In recent years, Ecuador has seen a gap between domestic electricity production and demand at the end of each year (text figure). This happens as electricity production drops after the dry season when rivers and water reservoirs run low. However, in 2024, the situation was especially precarious, with an 18 percent drop in domestic production from peak summer levels to October, which is larger than in previous years (the drop was 12 percent in 2023). Even in the spring and summer of 2024, when electricity production usually is ample, Ecuador exported little electricity, suggesting that capacity was already strained during the peak production period.





4. The estimated electricity imbalance in October 2024 was around 500 GWh, significantly larger than what was observed in 2023. The trend electricity demand (production net of exports + imports) per month is around 2,600 GWh. In October 2024, the supply of electricity (domestic production + imports) was only around 2,100 GWh (text figure), leaving a deficit of 500 GWh (19 percent). This estimated gap was significantly larger than the maximum gap observed in 2023. Moreover, the nationwide blackouts in 2024 started a full month earlier than those in 2023.



5. Ecuador was unable to fill the gap in domestic electricity production with imports from Colombia. In previous years, Ecuador has broadly been able to mitigate the shortfall in

[2] World Bank (2024) Ecuador Country Climate and Development Report.

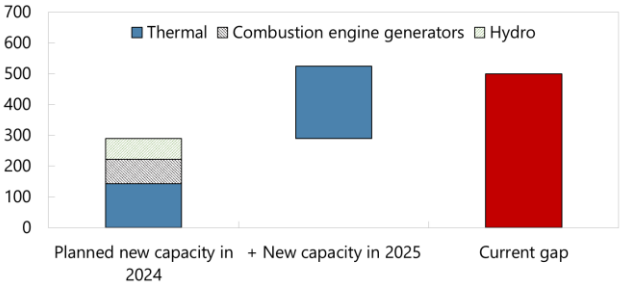
domestic electricity production through higher electricity imports from Colombia. Meanwhile, Ecuador has typically exported energy to Colombia and Peru during months with ample production. However, Colombia stopped exporting electricity to Ecuador at end-September 2024 to safeguard relatively low reservoir levels (text figure). Indeed, in September reservoir levels in Colombia stood at 50 percent compared to 74 percent on the same day in 2023. Since then, reservoir levels in Colombia have increased somewhat to 54 percent at end-October 2024 but remain well below 2023 levels. Electricity imports from Colombia resumed in mid-November 2024.

6. The droughts' impact on hydropower production are exacerbated by the operational instability of generation capacities, amid growing demand for electricity. Coca Codo Sinclair, Ecuador's largest power plant, which supplies around 29 percent of the country's electricity, does not rely on a water reservoir and, hence it depends on the influent water flow for its generation at full capacity. Furthermore, the plant is undergoing repairs that have been hindering its ability to operate at full capacity. The plant faces potential mid-term shutdown risks due to structural instability. Existing electricity supply do not meet demand needs given the upward trend in electricity consumption, particularly by the industry, unless power capacities are increased.[3]

C. Going Forward

7. The authorities have announced plans to add electric capacity of up to 1.6 GW in the short run. As a first step, the government is adding 0.434 GW in thermal capacity (0.1 GW coming from a barge and 0.334 GW from seven reactivated power plants). In November 2024, 0.241 GW is slated to be gradually added from combustion engine generators running on fuel oil. In December 2024, this would be augmented with 0.204 GW in hydroelectric capacity. Moreover, the government is working to secure an additional 0.715 GW at existing power plants, expected to come on stream by May 2025. Whether this additional capacity would be sufficient to avoid future blackouts depends crucially on how effectively it is utilized (text figures).[4] If utilized at 20 percent (the average for existing capacity), the new capacity would be insufficient. However, if utilization exceeds 45 percent, the new capacity would be able to cover the current gap.

Planned New Electric Capacity and Current Gap, 50 Percent Utilization
(GWh per month)

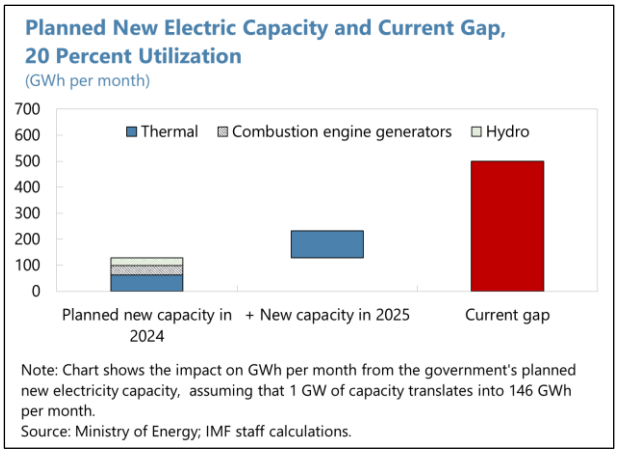


Note: Chart shows the impact on GWh per month from the government's planned new electricity capacity, assuming that 1 GW of capacity translates into 365 GWh per month.
Source: Ministry of Energy; IMF staff calculations.

[3] The Ecuador's Electricity Master Plan 2023-2032 projects increase in electricity consumption by 35.6-69.0 percent by 2032 relative to 2023 depending on the scenario.

[4] To convert MW capacity to GWh per month, an assumption is made about how well the capacity is utilized. If 1 GW is utilized for 100 (50) percent of all hours in the month, it will generate 730 (365) GWh over the month. On average, existing capacity in Ecuador is utilized at 21 percent (Electricity Master Plan, 2023-2032).

8. The electricity gap is likely to close early next year with the new capacity and as hydroelectric production increases. Going into 2025, river flows are expected to eventually increase and ramp up hydroelectric production. Together with the planned capacity, this should allow the government to phase out the blackouts by early next year.



Note: Chart shows the impact on GWh per month from the government's planned new electricity capacity, assuming that 1 GW of capacity translates into 146 GWh per month.
Source: Ministry of Energy; IMF staff calculations.

9. In the longer run, the authorities plan to expand installed capacities, with substantial emphasis on other renewable energy sources besides hydro. According to the 2023-2032 New Master Electricity Plan, the authorities plan to expand generation capacity by 7,404 MW (from the existing capacity of 8,864 MW). Compared to the 2021 Plan, which focused on private hydroelectric projects, the 2023 Plan relies more heavily on other renewable energy sources, which will cover 22 percent of added generation capacity in 2023-2032.[5] Integrating renewables other than hydro would help diversify the energy mix, ensure energy security, and contribute to lower emissions.[6]

10. Successful implementation would involve further strengthening of the regulatory framework and encouraging private investment. As plans to expand the generation capacity require significant investment, financing is expected to come from both public and private sources.[7] A recent law, which revises the current 10 MW limit on private generation project to 100 MW, is a step forward in creating the enabling environment for private investment. For projects up to 100 MW not included in the Electricity Master Plan, the private sector may develop them at its own risk, with prior express authorization from the Ministry of Energy and Mines, so long as they stay within this capacity limit. The law also allows legal entities in electricity distribution and marketing to sign long-term Power Purchase Agreements with private generators, covering various generation technologies. In accordance with the law, special benefits will be offered to private investors participating in the public selection process. Going forward, regulatory frameworks could consider measures to ensure aligned incentives, especially cost recovery for private investment given the relatively low electricity prices.[8]

11. Beyond building new capacities, water resource management and ensuring resilience of existing power plants will be necessary to address climate-related challenges. Improving

[5] In recent years, several contracts have been signed for the installation of over 650 MW of solar and wind capacity.

[6] Icaza and others (2022) suggests a system of combined hydro, solar, and wind energy which could make Ecuador's energy matrix into a fully renewable one by 2050.

[7] Expanding generation capacity is expected to cost US$9.95 billion over the next decade. Transmission and distribution expansion would require additional US$1.75 billion and US$5.65 billion, respectively.

[8] According to CPAT, in 2021, the average industrial electricity price in Ecuador was 9.0 cents (U.S. dollar) per kWh, lower than the price levels in Peru (9.4 cents), Uruguay (11.5 cents), Brazil (12.7 cents), Chile (12.9 cents), Mexico (17.4 cents), and Colombia (17.4 cents), but higher than that in Paraguay (5.2 cents).

water resource and basin management could help reduce vulnerability to hydrological events. The World Bank Country Climate and Development Report (CCDR) for Ecuador also listed potential actions. These include converting existing hydropower plants into pumped storage facilities, preventing sediment accumulation, and investing in enhanced reservoir and turbine capacity, among others.

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CLIMATE TRENDS AND MACROECONOMIC IMPACTS[1]

Rising temperatures, more frequent extreme heat days, increasing frequency of high-intensity rainfall, and sea-level rise (SLR) can incur large economic costs in Ecuador. Without adaptation, climate change can reduce growth and lead to lower GDP per capita in the long run. An effective and efficient adaptation roadmap could prioritize adaptation policies with positive externalities, removing market imperfections and policies that hinder efficient private adaptation, and ensuring a just transition.

A. Climate Trends and Projections

1. Ecuador's climate is highly diverse due to its varying altitudes and geographic regions. The country is home to four distinct climate regimes: the coastal lowlands, which experience a tropical climate with wet and dry seasons; the Amazon basin, characterized by year-round high temperatures and heavy rainfall; the Andean highlands, where temperatures are cooler and vary by altitude; and the Galápagos Islands, which have a subtropical climate with minimal seasonal variation. This diversity results in a wide range of weather patterns, from humid rainforests to dry savannas and temperate mountain zones.

2. In recent decades, the country has seen a steady rise in temperatures and an increase in extreme weather events, including more frequent heat waves and floods. Average annual temperature is estimated to have increased by 0.2°C in 1985-2014 and by 0.5°C by 2021 from the average in 1901-1930 (a proxy for pre-industrial level temperature).[2] Average annual rainfall has remained stable in most of the country during the past four decades (Climatic Research Unit data (Harris et al., 2020), shown in text figure), but some regional changes have been recorded (Ecuador 2015).

3. Ecuador's temperatures are projected to continue rising and intense heat episodes will become more frequent. Median estimates of additional warming in Ecuador by mid- and late-century, relative to average temperature in 1985-2014, range between 1.2°C and 3.2°C depending on future emissions scenarios (top text figure).[3] The number of hot days—defined as days with

[1] Prepared by Emanuele Massetti and Filippos Tagklis (FAD).

[2] FADCP Climate Dataset (Massetti and Tagklis, 2024), using CRU data (Harris et al., 2020). 2021 temperature estimated using a linear trend fitted on the last thirty years of annual temperature observations.

[3] This analysis uses three core emissions scenarios. SSP1-2.6 is in line with the Paris goal to keep global mean temperature increase below 2ºC with respect to pre-industrial times. SSP2-4.5 represents continuation of present trends. SSP3-7.0 is a high emission scenario. For each scenario the analysis considers the median projection among all climate models. To provide a worst-case scenario of high emissions and fast warming, macroeconomic impacts are calculated also using the 90th percentile of temperature projections for the SSP3-7.0 scenario. Projected global mean temperature with this pessimistic scenario is similar to the median projection for the extreme SSP5-8.5 emissions scenario, which is used by Ecuador authorities for adaptation planning (https://spracc.ambiente.gob.ec/geovisor-web-s-pracc/frontend/). This emissions scenario is omitted in this analysis because it is increasingly seen as unlikely. For a discussion, see Bellon and Massetti (2022a).

maximum daily temperature above 35°C—is expected to increase significantly in the coastal and Amazon regions (middle text figure). Marine heatwaves and ocean acidity are expected to increase.[4]

4. Total annual precipitations are not projected to significantly change, but intense rainfall events are likely to become more frequent. All scenarios project a moderate increase in total annual precipitation (top text figure), but uncertainty across models is large, and the projected change is small relative to substantial natural interannual variability driven by El Niño. There is instead a more robust trend towards more intense rainfall events. Coastal and highland areas could see an increase in extreme rainfall events, with up to 7-15 mm more rainfall in a single day, leading to potential flood and landslide risks (middle text figure).

5. Sea-level is increasing. Median projections for Ecuador using a moderate emission scenario indicate that by the end of the century sea-level will increase by 0.55 meter with respect to its level in 2000 (bottom text figure). With an emission scenario in line with the 2°C Paris Agreement goal, sea-level is projected to increase by 0.45 meter.[5] With a very high emission scenario, sea-level is projected to increase by 0.71 meter (bottom text figure). Thanks to trends in coastal vertical movement and other factors, sea-level is projected to increase less than the global mean in Ecuador (bottom text figure).

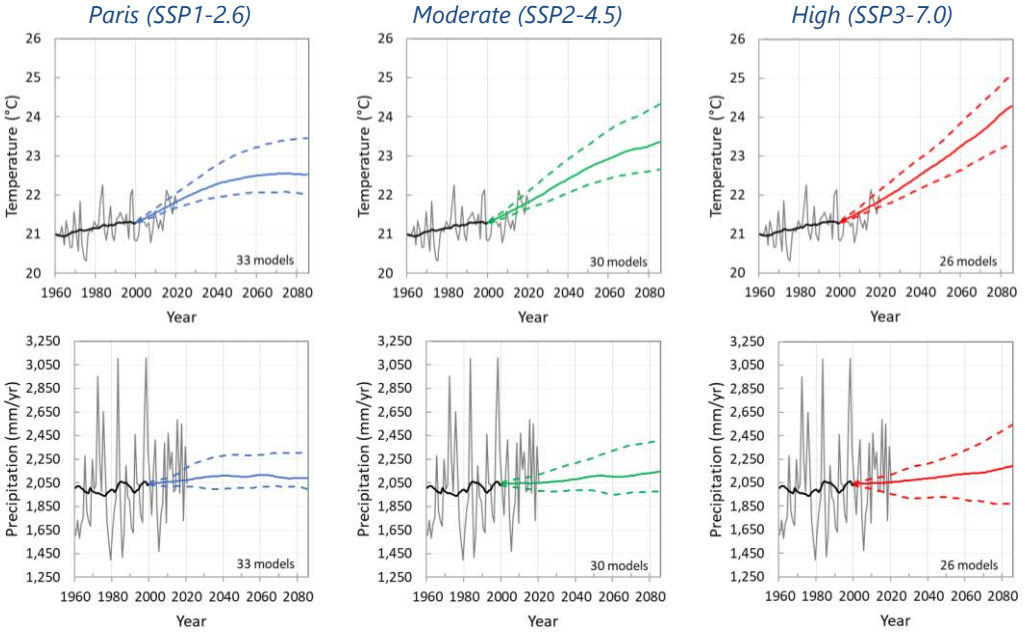
6. This section outlines trends that are expected to have a negative impact on Ecuador's economy. Average annual temperature will continue to increase for at least several decades. This warming trend will push maximum daily temperatures above 35°C, a dangerous and new phenomenon rarely observed today, for several weeks during the year. Rainfall intensity is expected to increase, particularly in coastal and highland areas, potentially raising flood risks. Sea level will continue to rise throughout the century. There are no clear trends in indicators of droughts and projections do not indicate significant changes, but droughts will continue to periodically hit Ecuador's economy with potentially large adverse effects as revealed by empirical evidence (see ¶8) and by the ongoing severe drought, which has caused widespread and prolonged power outages (see Selected Issues Paper "Securing Electricity Sufficiency and Reliability"). While additional analysis is needed, for example to uncover infra-annual changes in climate, trends identified by this preliminary analysis suggest that Ecuador's economy will be exposed to climate change risks and underscore the need for robust climate adaptation strategies. The following section uses state-of-the-art methods to quantify the economic impact of slow-onset warming, weather shocks and in

[4] IPCC regional synthesis for the Northwestern South American Region, consulted on November 13, 2024.

[5] This analysis uses the CIAM model developed by Diaz (2016). The model relies on SLR projections from Kopp et al. (2014), developed using the previous vintage of climate scenarios (RCPs). More recent projections of SLR using the most recent vintage of scenarios (SSPs) (Fox-Kemper et al., 2021) are very similar to those in in Kopp et al. (2014) for Ecuador, except for a new low-confidence extreme emissions and extremely fast Antarctica Ice Sheet melting projection (data at latitude -3° and longitude -81°, from Garner et al., 2021). The SSP1-2.6 scenario is very similar to the RCP2.6 scenario and the SSP2-4.5 scenario is very similar to the RCP4.5 scenario. Projections based on the RCP8.5 emissions scenario are used to provide a pessimistic but unlikely outcome. The analysis of SLR costs relies on the moderate scenario. Among Ecuador regional peers, SLR is projected to be slower in Chile, faster in Colombia, and of approximately the same size in Peru.

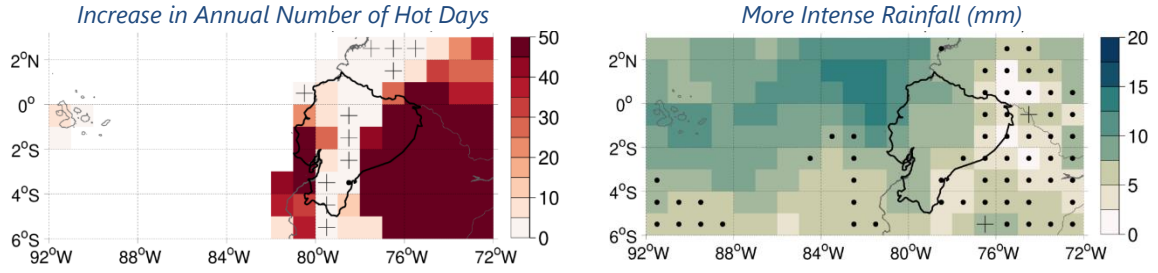
particular extreme temperatures, and sea-level rise (SLR). The concluding section provides a blueprint to design an effective and efficient adaptation strategy.

Time Series of Average Annual Temperature (°C), and Total Annual Precipitation (mm/year)



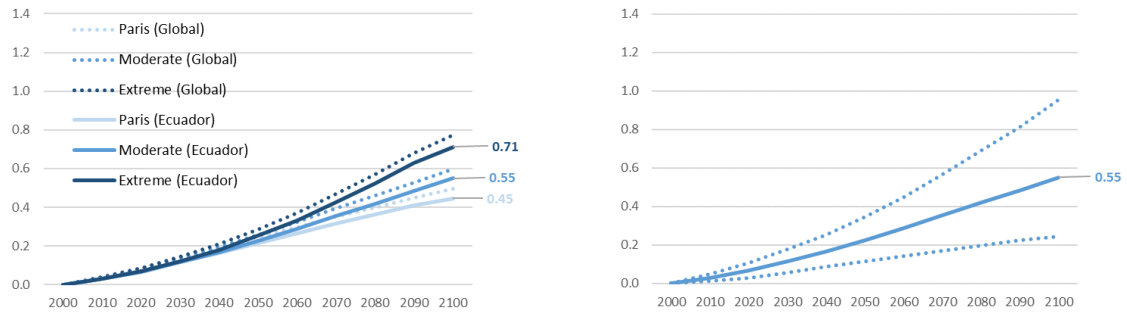
Sources: FADCP Climate Dataset (Massetti and Tagklis, 2023), using CRU data (Harris et al., 2020), and CMIP6 data (Copernicus Climate Change Service, Climate Data Store, (2021): CMIP6 climate projections).
Notes: The gray line describes historical mean annual temperature/precipitation based on observations (CRU). The black line describes the 30-year moving average of historical data centered around each 30-year period. Colored lines represent the median and the 80 percent range of temperature and precipitation anomalies (10^{th} and 90^{th} percentiles) added to the CRU value (thick black line in the year 2000). SSP1-2.6 is in line with the Paris goal to keep global mean temperature increase below 2°C with respect to pre-industrial times. SSP2-4.5 represents continuation of present trends. SSP3-7.0 is a high emission scenario. By 2050, median projections indicate warming of 1.1°C under the SSP1-2.6 scenario, 1.5°C under SSP2-4.5, and 1.6°C in the high SSP3-7.0 scenario. By 2086, warming is projected to reach 1.2°C in SSP1-2.6, 2.1°C in SSP2-4.5, and 3.2°C with SSP3-7.0, using median projections.

Projected Changes of Number of Hot Days and Extreme Precipitation by 2050 under SSP2-4.5



Source: FADCP Climate Dataset (Massetti and Tagklis, 2023), using data from The Copernicus Interactive Climate Atlas (C3S Atlas- https://atlas.climate.copernicus.eu/atlas).
Notes: Projected changes relative to the 1991-2020 baseline under the SSP2-4.5 scenario for the Medium Term (2041-2060). Number of days in a year with maximum temperature above 35°C (left) and maximum of 1-day accumulated precipitation (right). An advanced method for representing ensemble robustness is based on the approach proposed in the Sixth Assessment Report (AR6) of the IPCC, categorized into three levels. Crosses indicate significant changes for individual models, but less than 80 percent of the models agree on the sign of change (Conflicting Signals). Dots indicate areas significant changes for less than 66 percent of the models (No Change or No Robust Signal). In areas without any symbol more than 66 percent of the models project significant changes and at least 80 percent of the models agree on the sign of change.

Sea-level Rise Projections Along the Coastline of Ecuador, Relative to 2000 Level (meters)



Notes: (left) Local (solid) and Global (dotted) Sea-Level Rise (SLR) probabilistic projections until 2100 under three emission scenarios (Paris - RCP 2.6; Moderate - RCP 4.5; Extreme - RCP 8.5). Median SLR for each emission scenario. (right) local SLR probabilistic projections using the Moderate (RCP 4.5) emission scenario. Solid lines depict median SLR, dotted lines depict the 5th and 95th percentiles of the distribution to account for uncertainty in the speed of SLR and tipping points in Greenland and Antarctica Ice Sheets melting.

B. Macro-Economic Risks

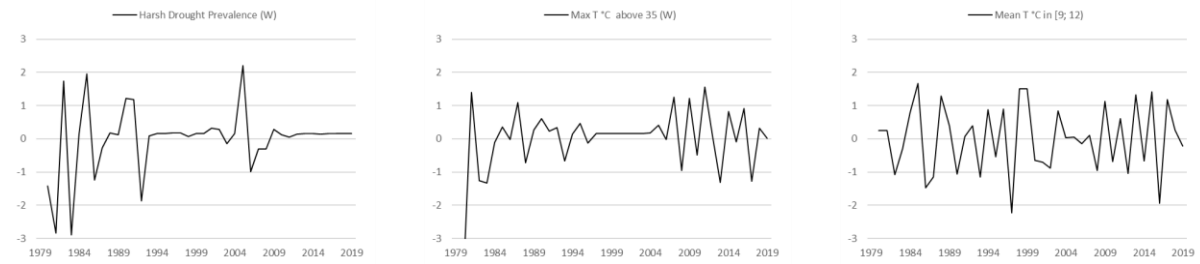
7. Weather shocks, slow-moving warming, and SLR can lead to large costs even if adaptation measures are taken, but the exact magnitude of losses is highly uncertain. The analysis of climate-related macroeconomic risks in Ecuador uses three complementary methodologies. First, it starts from estimating how present-day *weather shocks* affect year-to-year per capita GDP growth using big data and machine learning methods developed at the IMF (Akyapi, Bellon, and Massetti, 2024). This is a useful starting point to identify vulnerabilities that can be exacerbated by climate change. However, it is a new area of research, and a full set of projections of these impacts using different emissions scenarios is left for future analysis. Hence, the analysis is complemented by projecting the impact of *slow-onset warming* on GDP per capita using well-established methods in the literature that exploit random temperature variations from the observed warming trend (Kahn et al., 2021). Finally, the cost of SLR in Ecuador under alternative adaptation scenarios is estimated using the state-of-the-art model CIAM (Diaz, 2016), which builds on three decades of academic research. This assessment of climate change economic impacts in Ecuador is necessarily limited in scope and does not include the case of very large negative impacts from abrupt climatic, environmental, and climate change-induced societal changes. While these risks should not be ignored by policymakers, they cannot be precisely quantified due to a lack of empirical evidence.

The Impact of Weather Shocks on GDP Growth

8. With hot days becoming more frequent, productivity losses caused by extreme heat are projected to reduce growth by 0.2 percentage point below normal levels by mid-century. This analysis relies on estimates of the impact of deviations of weather from normal conditions on GDP per capita growth starting from hundreds of billions of weather observations developed by Akyapi, Bellon, and Massetti (2024). Weather shocks are defined as year-to-year differences in the

weather variables. The model selects three important climate variables: severe droughts (PDSI index less than -4), hot days (with maximum temperature above 35ºC – TX35), and days with temperature between 9 and 12ºC. More severe droughts and more hot days have a negative impact while more days with temperature between 9 and 12ºC increase growth. By combining estimates of the impact of weather shocks using data from Latin American countries and observed weather shocks in Ecuador shown in text top figure, it is possible to quantify the effect of weather shocks on past growth in Ecuador as shown in text middle figure. Overall, weather shocks do not appear to have a large impact on growth.[6] Severe droughts have historically caused the largest impacts (top text figure). Droughts can for example affect growth through its impact on hydroelectric power generation (see Selected Issue Paper "Securing Electricity Sufficiency and Reliability"). The recent episodes of severe drought are not yet captured by historical data, but rare, severe, events can cause GDP per capita losses of up to 0.4 percent, according to this analysis. Hot days (TX35) have not been an important drag on growth in the past, but this may change in the future because extreme heat is on the rise (section A, middle text figure). An additional week in which the entire population is exposed to maximum daily temperature above 35ºC can reduce growth by 0.1 percentage point below its normal level. The projections shown in section A middle text figure (country average) suggests that in 2050 the population will experience each year approximately two additional weeks with maximum daily temperature above 35ºC, which implies a reduction of growth equal to 0.2 percentage point. Without adaptation, this translates into a 6 percent loss in the level of GDP per capita over three decades.[7]

First Differences of Selected Climate Variables in Ecuador (Standardized Variables)

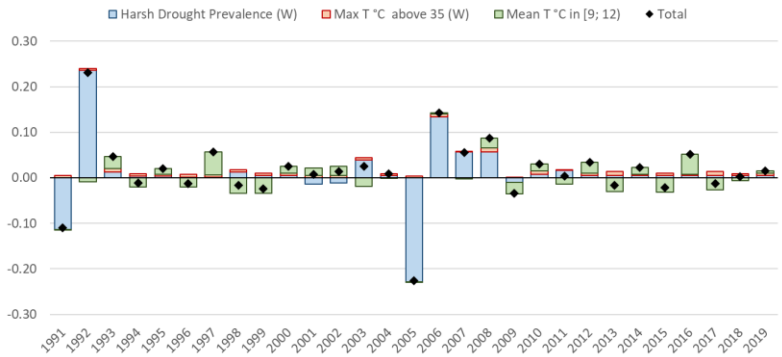


Source: Akyapi, Bellon, and Massetti (2024).
Notes: The figures illustrate first differences in Ecuador of variables selected in by Akyapi, Bellon, and Massetti (2024).

[6] IMF staff repeated the analysis in using the same climate variables selected by Akyapi, Bellon, and Massetti (2024) and economic data only for Ecuador, but none of the variables has statistically significant impacts due to the small size of the estimation sample. A dedicated application of machine learning methods to data from Ecuador does not reveal any important variable to explain variations of GDP per capita growth. Indicators of droughts and floods developed using EMDAT disaster data do not significantly affect growth under alternative model specifications.

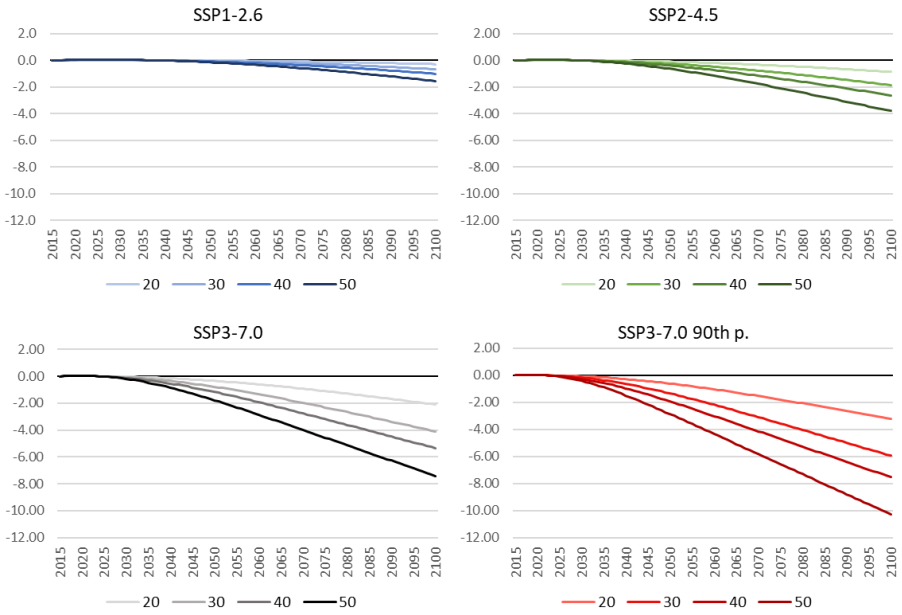
[7] Weather shocks are defined as year-to-year differences. In a year with fewer (more) extreme heat days than the previous year growth will be higher (lower) than the previous year – keeping anything else constant. Without trends, the average of weather shocks is equal to zero and average growth is not affected by weather. But with a positive trend – e.g., in extreme heat – negative economic shocks tend to be larger than positive ones and this causes a persistent reduction of growth below normal. Long-term impacts calculated assuming a 3 percent growth rate of GDP per capita.

Impact of Selected Climate Variables on Growth in Ecuador (Percentage Points)



Source: Akyapi, Bellon, and Massetti (2024).
Notes: Impacts estimated using estimates for countries in Latin America. Black diamonds indicate the net impact of all variables.

Reduction of GDP per Capita With Respect to Continuation of Present Temperature Trends (Percentage)



Source: IMF staff using Kahn et al. (2021), and CMIP6 data (Copernicus Climate Change Service, Climate Data Store, 2021) processed by Massetti and Tagklis (2024).

Notes: The impact of the warming trend for each scenario is estimated using Kahn et al. (2021) under the assumption that adaptation can offset the warming trend after 20, 30, 40, or 50 years. Impacts are measured as percentage deviations of real GDP per capita relative to a reference scenario in which the warming trend follows the historical pattern. Country specific warming trends are calculated for each scenario using the bias-adjusted ensemble median projections of temperature anomalies with respect to 1985-2014 over 30-year time periods centered around each year using CMIP6 data. The SSP1-2.6 scenario is in line with the Paris goal to keep global mean temperature increase below 2ºC with respect to pre-industrial times. SSP2-4.5 represents continuation of present trends. SSP3-7.0 is a high emission scenario. SSP3-7.0 90th p. uses the 90th percentile of the SSP3-7.0 ensemble instead of the median to provide a high-emission, fast-warming, pessimistic case. The warming rate in the SSP3-7.0 90th percentile scenario is very similar to the median warming rate projected using the SSP5-8.5, which is used by the authorities for planning adaptation.

Slow-Moving Warming

9. An acceleration of the warming trend can reduce GDP per capita by up to 10 percent in 2100 relative to normal levels. The analysis relies on estimates of the impact of warming on

GDP per capita growth from Kahn et al. (2021) to estimate the long-term effect of warming projected under alternative emissions scenarios in Ecuador. The theoretical model postulates that per-capita real output growth is already affected by observed temperature trends. The historical warming trend is already a drag on growth and a continuation of the present warming trend has no impact on growth. An acceleration of the warming trend, relative to historical values, has a negative impact on GDP growth while a deceleration of the trend has a positive impact, as shown in bottom text figure. Abiding by the Paris Agreement goals (SSP1-2.6), thereby slowing the warming trend with respect to historical values, raises projected GDP per capita above reference. The SSP2-4.5 scenario is close to continuation of present trends and has small impacts. The SSP3-7.0 scenario represents an acceleration of the present trend and generates negative impacts. The 90th percentile of the SSP3-7.0 scenario provides a worst-case outcome and generates the largest negative impacts.[8] In this high-emission and fast-warming scenario temperature increases by 4.0°C compared to the period 1985-2014, faster than in the past four decades.

10. Adaptation can help to reduce negative impacts from higher temperatures. Adaptation is implicitly included in the model because after *m* years countries are assumed to have fully adapted to the new temperature level. This analysis considers *m* = 20, 30, 40, and 50. m = 50 implies that it takes 50 years to adapt to the future level of temperature, while m = 20 implies that the economy fully adapts in 20 years. Assuming slow adaptation, GDP per capita is projected to decline by approximately 10 percent annually by 2100 with respect to what it would be if the present warming trend continues.[9] In a scenario without any adaptation damages are twice as large (Mohaddes and Raissi, 2024). Fast adaptation can instead reduce losses to approximately 3 percent of GDP per capita, for the same temperature change. These costs are relative to a world in which temperature increases along the observed trends and economic growth is already below its full potential. These estimates do not cover all potential impacts. For example, they do not include the effect of extreme weather and SLR, which needs specialized models presented in the following sections. They also do not include the cost of adaptation, which underestimates costs in the fast adaptation scenarios. Tail risks like climate-change induced social conflict (e.g., Ge et al. 2022; Ide et al. 2020) cannot be excluded but are not included in this analysis due to large uncertainties.

Sea-Level Rise (SLR)

11. Using the state-of-the-art model of SLR costs and adaptation CIAM (Diaz, 2016),[10] IMF staff estimates that the annual average cost of SLR without adaptation is approximately equal

[8] The warming rate in the SSP3-7.0-90th percentile scenario is very similar to the median warming rate projected using the SSP5-8.5, which is used by the authorities for planning adaptation.

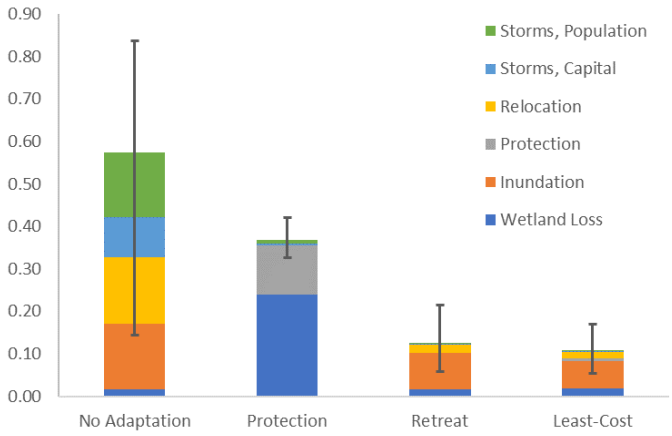
[9] These figures are close to the reginal averages estimated for Latin America and Caribbean as well as South America. See IMF, WHD Regional Economic Outlook, October 2024. Online Annex 6. On Economic Losses from Slow-Onset Climate Events in Latin America and the Caribbean.

[10] CIAM is a global model used to estimate the economic cost and benefits of adaptation to SLR (Diaz, 2016). The global coastline is divided into more than 12,000 segments of different length grouped by country. Each segment is further divided into areas of different elevation. For each segment, the model has data on capital, population, and

(continued)

to 0.6 percent of GDP from 2020 to 2099, using a moderate emission scenario (text figure)**.** Fast SLR for the same moderate emissions scenario would push costs to 0.8 percent of GDP. Due to the slow response of SLR to changes in temperature, using an extreme-emissions scenario changes costs only marginally. Costs are due to permanent inundation of coastal areas (0.15 percent), disutility cost of forced relocation (0.16 percent), and floods during storm surges (0.25 percent). These costs measure welfare losses and are the appropriate metric to estimate the full economic impact of SLR. However, they cannot be translated into GDP losses or other fiscal impacts without other models or additional assumptions.[11]

Annual Average Cost of Sea-Level Rise, 2020-2099 (in percentage of GDP)



Source: IMF staff using the CIAM model (Diaz, 2016).

Notes: Average annual cost. Whiskers on top of each bar indicate the range of total cost using the 5th and 95th percentile of the probabilistic distribution of SLR. Due to the highly non-linear nature of coastal impacts, adaptation costs, and effectiveness of adaptation measures, ranges are not always symmetric around total costs.

12. Coastal protection can be very cost effective, but its negative environmental impacts can be large (text above figure). CIAM calculates the cost of SLR and the cost of protection considering many factors, including coastal topography, distribution of population and capital, and protection costs. An investment of approximately 0.12 percent of GDP annually throughout the century allows to neutralize land loss and storm-surge impacts in all coastal areas, but interference with wetland areas—for example, in the vicinity of the city of Guayaquil—can cause environmental

wetland coverage at different elevations. By using projections of local SLR from Kopp et al. (2014), it is possible to estimate the areas that will be inundated and the amount of capital and population at risk. Storms cause periodic inundations on top of SLR. The model does not consider risks from river floods.

[11] The literature uses general equilibrium models to translate loss of capital and land into long-term macroeconomic impacts, including global trade effects (e.g., Bosello et al., 2012). Alternatively, it is possible to derive first-order approximations of the fiscal costs of SLR by assuming how much of the social cost of SLR is either directly borne by the public sector or compensated with public finances. Direct losses may derive from reconstruction costs of public assets and purchase of new land for public use. Losses of private capital and private land may have an impact on public finances if they affect tax revenues, or if the government compensates private losses. Increased spending on social programs aimed at easing disutility costs of relocation from inundated area can lead to higher expenses. If the government assumes full responsibility for all losses, including the adverse effects of relocation, costs can be interpreted as an upper bound to government financing needs.

losses equal to 0.24 percent of GDP annually. While environmental losses do not directly affect public finances, they should be counted, to provide a complete estimate of protection costs for society. Overall, coastal protection costs 0.4 percent of annual GDP, on average, between 2020 and 2099. Nature-based solutions can help minimize environmental losses, and large uncertainty on both physical impacts and economic value of biodiversity suggest caution in interpreting this result, but the possibility of large negative environmental externalities cannot be neglected.

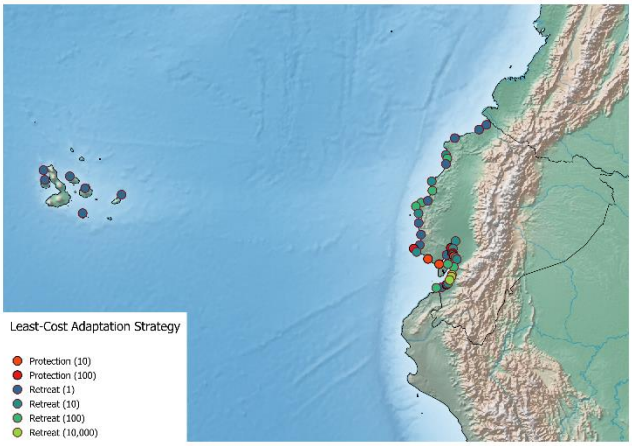
13. Planned retreat from the coastline can lower the cost of SLR by avoiding negative environmental impacts, but it needs careful planning, and its distributional consequences must be estimated and assessed. Planned retreat relies on a proactive move of the population and on a long-term strategy that let assets exposed to permanent inundation depreciate over time. In this gradual process, capital losses are minimal, and only bare land is lost to the sea, which is allowed to expand its range, reshaping the coastline and wetland areas. The opportunity cost of this land is equal to the value of agricultural or marginal land in the country, as established by Yohe (1990). The population affected does not need to move long distance to avoid SLR predicted for this century. Relocation to different neighborhoods within the same coastal city is usually sufficient. However, the affected populations would prefer to be protected. Gains for society should be assessed against losses for parts of the population. Compensations can help alleviate these conflicts.

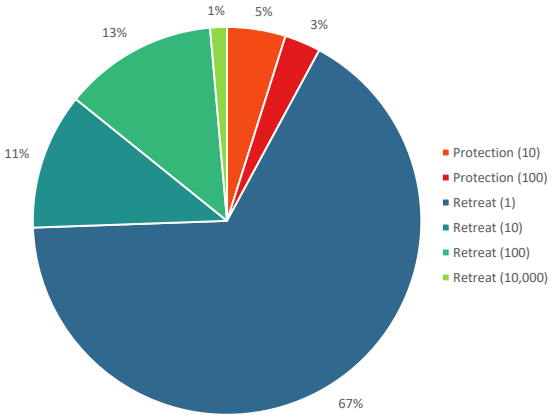
14. A mix of protection and planned retreat is the least costly strategy for the country. Planned retreat over 92 percent of the coastline and protection in the remaining 8 percent reduce the cost of SLR from 0.6 percent of GDP to 0.11 percent of GDP per year on average, from 2020 to 2099. The coastline of the country is divided in 46 separate segments in CIAM that vary in length from 0.8 Km to 422.5 Km and costs are calculated separately for each coastal segment (text figure). This allows determining the cost-efficient strategy by coastal segment, and the corresponding national costs. Protection is the efficient solution in proximity of the coastal cities of Guayaquil, Salinas, Posorja, and Machala. Three percent of the coastline is protected to withstand 1/100 years coastal storm surge floods, while the remaining protections are calibrated to avoid 1/10 years floods. For 67 percent of the coastline, retreat is the efficient option. In most areas, the retreat perimeter is chosen to deal only with SLR, while in 25 percent of the coastline the perimeter is adjusted to avoid flooding of different intensity.

15. More granular data is necessary to exactly determine costs in a highly dynamic coastal environment as in Ecuador, but this preliminary analysis establishes a useful roadmap. CIAM has a high level of resolution, but it does not capture coastal characteristics at the much higher resolution needed to fully reveal impacts and protection costs. While the model captures baseline erosion and vertical land movement, it does not capture the interaction of SLR with the ongoing coastal erosion processes. The model also does not capture the cost of infiltration of saline water into coastal aquifers. However, the model includes non-market costs such as loss of life due to storm floods, wetland loss, and disutility from relocation. While a more detailed analysis is warranted, CIAM's results are in line with Hinkel et al. (2018), a major study in the literature. Considering multiple SLR, economic development, and using different discounting rates Hinkel et al.

(2018) find that the cost of SLR with cost-effective protection levels can range between 0.01 percent and 0.08 percent of GDP, annually, in Ecuador, a result similar to CIAM's estimate.

Optimal Adaptation Strategy by Coastal Segment (left) and as a Share of Total Coastline Length (right)





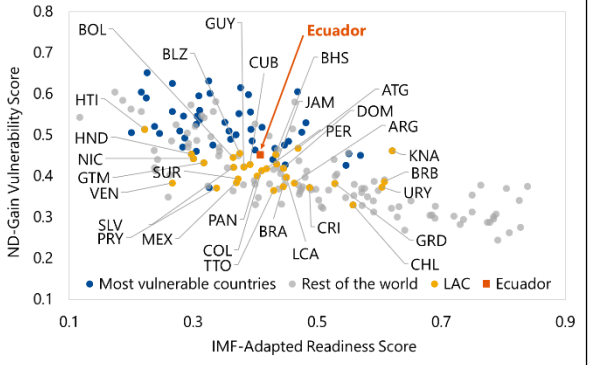
Sources: IMF staff based on coastal segment characteristics from the CIAM model (Diaz, 2016), country boundaries from EuroGeographics and UN-FAO, and free Natural Hearth vector and raster map data @ naturalearthdata.com.

Notes: Country's coastline is divided in 46 segments. Each dot in the map indicates the center of a coastal segment. Coastal segments vary in length from 0.8 Km to 422.5 Km, with a median length equal to 28.1 Km. Number in parenthesis indicate the level of protection against storm-surge floods, from 1/10 to 1/10,000 events (non-relevant categories omitted). Retreat (1) indicates a retreat perimeter that deals only with SLR and does not consider storm surge risks.

C. Adaptation Capacities, Policies and Financing Needs

16. Ecuador has made strides in developing policies and measures aimed at increasing its adaptive capacity, still the country's readiness can be further enhanced. According to IMF adjusted ND-Gain index, the countries scores around the median compared to Latin American peers. However, in terms of the countries' readiness to cope with changes and uncertainties in climate, there is room for improvement in the areas of governance readiness, ecosystem services, health, and human habitat. Ecuador has made substantial progress in building a policy foundation for the country's adaptation priorities. Most recently in 2023, the government adopted its National Adaptation Plan (NAP) (2023– 2027) that prioritizes six sectors (Human Settlements; Water Heritage; Natural Heritage; Health; Productive and Strategic Sectors; and Food Sovereignty, Agriculture, Livestock, Aquaculture and Fisheries). The NAP constitutes important step in

Climate Risks and Readiness (NDGAIN, 2021)



Sources: Notre Dame Global Adaptation Initiative and IMF.

mainstreaming adaptation in key sectors—its effective implementation will depend on resource availability, clarity of responsibilities, and technical and human resources.[12]

17. Building a roadmap for including adaptation into macrofiscal planning, based on important general principles, can be helpful, even if it is difficult to provide precise estimates. IMF staff has developed guidance to help countries adapt by integrating climate change in macrofiscal planning (Gonguet et al. 2021; Bellon and Massetti, 2022a,b; Aligishiev, Bellon, and Massetti, 2022; Sakrak et al. 2022). These principles frame adaptation in terms familiar to economists and in the broader context of sustainable development, with the intent of guiding public investment and enabling efficient private adaptation.

- **Adaptation would be most effective if it is an integral part of development planning.** In the Paris Agreement (Article 7), adaptation is established as "the global goal of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development." Investments in climate change adaptation are similar to other investments in development because their common goal is to maximize future welfare given the available resources (Bellon and Massetti, 2022a).

- **The authorities must carefully allocate fiscal resources across all competing needs, including adaptation to climate change, while incentivizing private adaptation and considering distributional effects.** The authorities can prioritize adaptation policies with positive externalities, by removing market imperfections and policies that hinder efficient private adaptation. Individuals and firms have strong incentives to adapt because many adaptation benefits tend to be local and private. However, there is a clear role for government intervention when adaptation has large externalities, as in the case of coastal protection or strengthening of public infrastructure. As market inefficiencies and policy failures may limit private adaptation or create distortions, another key role for the authorities is to continue promoting reforms that ease the efficient use of all resources and ensure competitive access to markets (Bellon and Massetti, 2022a). For example, access to credit markets allows farmers to invest in adaptation and efficient water pricing creates incentives to conserve water. Finally, policies are needed to alleviate the impact of climate change for the most vulnerable part of the population, ensuring a just transition.

- **Cost-benefit analyses (CBA) can play an important role in helping decision makers to consistently collect, aggregate, and compare information on public adaptation projects.** As exemplified by the analysis of SLR, adaptation investment and policy will typically have trade-offs that would be better assessed by comparing social costs and benefits using a systematic approach. What to do, when, how, and at what cost ultimately rely on choices that should reflect the preferences of each society. However, application of CBA to adaptation as well as to all other development programs, complemented by analysis and correction of distributional impacts, can

[12] CCDR 2024.

help decision makers maximize overall social welfare by avoiding wasting scarce resources (Bellon and Massetti, 2022a).

- **A unified approach for mitigation and adaptation is needed to maximize synergies and minimize trade-offs (Selected Issue Paper on Mitigation).** Robust mitigation policies would incentivize nature-based adaptations—e.g., coastal mangrove ecosystems for coastal protection—and penalize negative climate externalities of adaptation—e.g., increased use of chemical fertilizers in agriculture.

D. Concluding Remarks

18. The analysis highlights significant climate trends that pose risks to Ecuador's economy. Rising average temperatures, increased rainfall intensity, and sea-level rise, are expected to negatively impact economic growth. With slow adaptation, high emissions (SSP3-7.0), and fast-warming, econometric methods project that GDP per capita may decline by approximately 10 percent annually by 2100 with respect to what it would be if the present warming trend continues. Increasing exposure to extreme heat may further slow economic growth. The annual average cost of sea-level rise could reach 0.6 percent of GDP from 2020 to 2099. A combination of coastal protection and planned retreat can reduce costs by 80 percent but needs careful planning, and its distributional consequences must be estimated and assessed. This points to a crucial role for adaptation.

19. Adaptation would considerably strengthen macroeconomic resilience. Ecuador has recently adopted a National Adaptation Plan (2023-2027), which is working to further enhance adaptive capacity. Going forward, potential areas of focus for adaptation policies include (i) removing market imperfections (e.g., inefficient credit allocation) to promote private adaptation; (ii) building resilient infrastructure; (iii) implementing regulations that internalize climate considerations (e.g., zoning that prohibits construction in flood zones); (iv) refining disaster risk management responsibilities and integrating disaster risk in public finance; and (v) increasing cooperation at the national and international level.

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CLIMATE MITIGATION POLICIES TO ACHIEVE NATIONAL DETERMINED CONTRIBUTION TARGETS[1]

The authorities are committed to climate action through their Nationally Determined Contributions (NDCs). Beyond reducing emissions, mitigation efforts can enhance economic efficiency, unlock natural resource potential, and reduce risks from climate policies in trading partners. The energy sector offers opportunities to cut emissions through improved efficiency and the re-utilization of flared gas, while Ecuador's forests provide significant carbon sequestration potential, strengthening both environmental and economic resilience. Well-designed mitigation policies can drive growth, enhance resilience, and create opportunities while ensuring equity and sustainability.

1. Though Ecuador has relatively low emissions of greenhouse gases (GHGs) globally and regionally, emissions have grown over the past three decades (Figure 1)**.** Ecuador's contribution to global GHG emissions is low and ranks among the low emitters of in the region. For Ecuador, three sectors accounted for almost 90 percent of GHG emissions in 2022: energy (50 percent), land use/land use change/forestry (LULUCF) (25 percent), and agriculture (14 percent). While CO_2 accounted for almost 72 percent of the GHG emissions, mainly from the LULUCF and transportation sectors, methane (CH_4) made up 25 percent primarily from agriculture, waste, and fugitive emissions. According to the IMF's Climate Change Indicators Dashboard, emissions have been growing over the past two decades, largely driven by the transportation sector, whose emissions have more than doubled and are projected to continue to rise.

2. In 2019, Ecuador set its first NDCs. These outlined an unconditional target of 9 percent reduction in GHG emissions by 2030, compared with a business-as-usual (BAU) scenario, and a conditional target of 21 percent from BAU by 2030 (Figure 1). Meeting these objectives requires climate mitigation policies. Over the past year, Ecuador has made substantial progress in strengthening its mitigation policy framework, including through the adoption of a National Mitigation Plan and the preparation of a long-term National Plan for the Transition to Decarbonization, enhancing sector-specific policies and plans for renewable energy and committing to methane emission reductions by signing the Global Methane Pledge. The authorities' recent actions to remove fuel subsidies for large shrimp farms and align gasoline prices with international prices will also help reducing air pollution and GHG emissions.

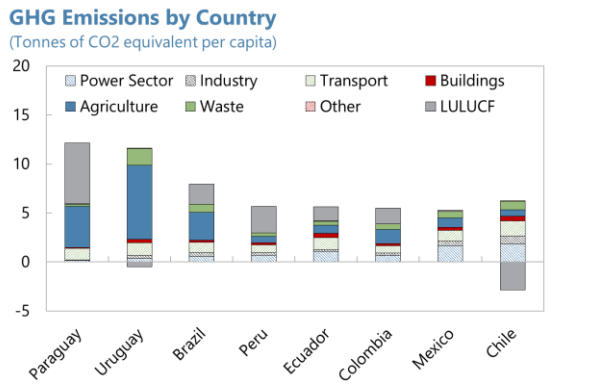
3. The authorities' National Climate Change Strategy 2012-2025 prioritizes reducing emissions in key sectors, including energy, LULUCF, and agriculture. As the largest emitter, the energy sector offers opportunities to reduce emissions through improving energy efficiency and reutilizing flared gas (World Bank 2024). Ecuador's vast forests, which comprise a significant portion of the Amazon Basin, offer substantial potential for carbon sequestration through reforestation and conservation efforts. Finally, sustainable agricultural practices would help reduce emissions while

[1] Prepared by Sylke von Thadden-Kostopoulos, Anthony Liu, Danielle Minnett (all FAD), Vu Chau, and Ilya Stepanov (both WHD).

maintaining Ecuador's competitive edge as trading partners introduce stricter deforestation-free regulations.[2]

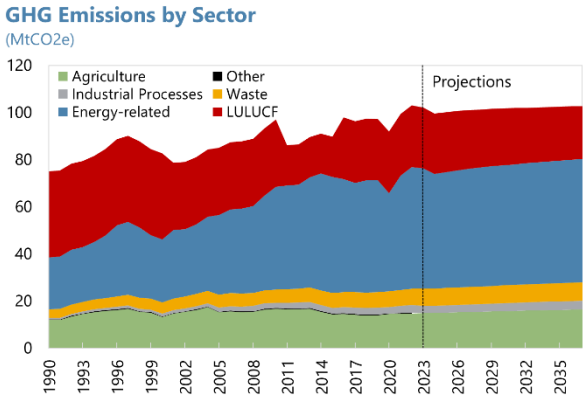
Figure 1. Ecuador: GHG Emissions and NDC Targets

Although Ecuador accounts for only 0.2 percent of global GHG emissions and ranks low in the region…



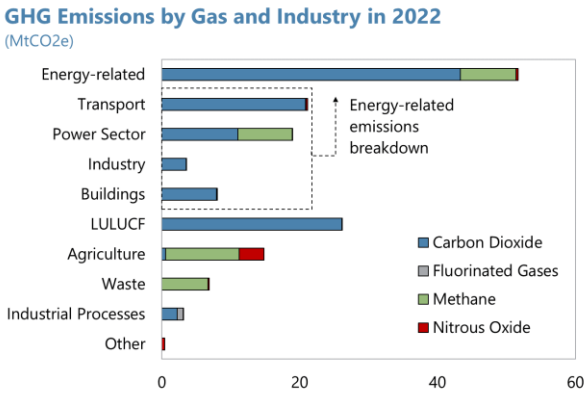
Sources: IMF Climate Change Indicators Dashboard and World Economic Outlook. IMF staff calculations.

…emissions have increased over time.



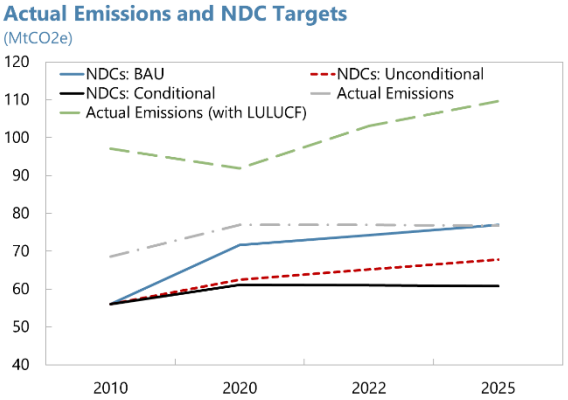
Sources: IMF Climate Change Indicators Dashboard and CPAT.

Most emissions come from energy (in particular, transport and power), followed by LULUCF and agriculture.



Sources: IMF Climate Change Indicators Dashboard, CPAT.

Ecuador is committed to mitigation actions, setting emission targets in the NDCs.

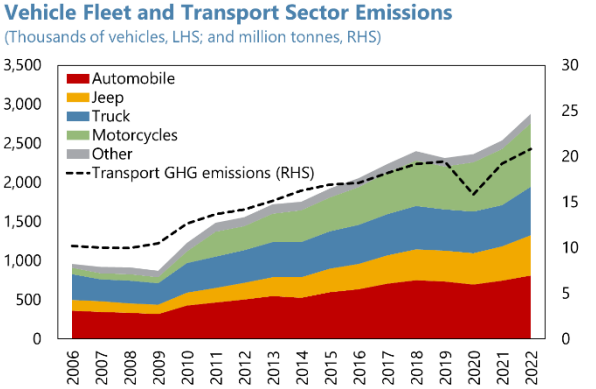


Sources: IMF Climate Change Indicators Dashboard and NDCs (2019).

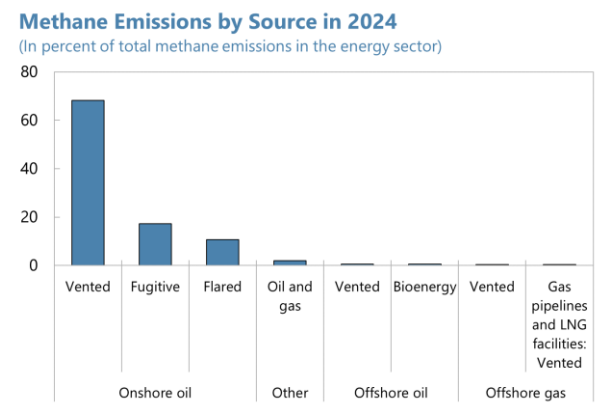
4. Energy-related emissions, largely driven by the power and transport sectors, have shown divergent trends over the past decade. Emissions from power generation have plateaued and then declined slightly by 3 percent since 2012, due to a reduction in fossil fuel-based generation and a green energy matrix. In contrast, emissions from transport have continued to rise, increasing

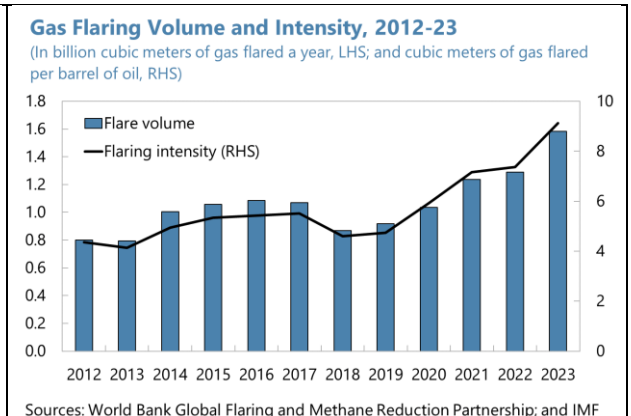
[2] European Union. Regulation on Deforestation-free Products.

by 47 percent over the last ten years, primarily driven by the expansion of the vehicle fleet (text figure).



5. Decarbonizing the energy sector will help reduce emissions. This could include diversifying the energy mix towards other renewable sources besides hydro (which currently account for only a small share of electricity generation) along with overall improvements in energy efficiency via national policies.[3] Transport sector policies could benefit from encouraging the use of public transit, advancing on regulations and controls on emissions standards, while, in the longer term, promoting transport electrification once electricity supply challenges are adequately addressed. Lowering emissions in the transport sector could also yield important co-benefits, such as improved air quality and reduced healthcare costs.[4]





6. Containing fugitive, vented, and flared emissions from oil and gas production will also help reduce GHG emissions. The energy sector is one of the largest emitters of methane. The bulk of methane emissions in this sector come from onshore oil, largely from gas venting followed by fugitive and flared gas. According to the Global Flaring and Methane Reduction Partnership, flaring volume and intensity have increased over the past decade (text figures). The 2019 NDCs Implementation Plan envisioned reducing flaring and using petroleum-associated gas for power

[3] The Government has implemented several initiatives to promote energy efficiency, including the enactment of the Organic Law of Energy Efficiency in 2019, the establishment of the National Energy Efficiency Committee, and the development of the National Energy Efficiency Plan 2016–2035 (PLANEE). Additionally, in 2024, the government passed the Ley Orgánica de Competitividad Energética (LOCE), which provides the legal framework for implementing various measures outlined in the PLANEE.

[4] According to the Climate Policy Assessment Tool (CPAT), total air pollution mortality in Ecuador in 2023 was 5,048 people annually. By 2030, in the baseline (assuming no actions) it is projected to increase by 8.5 percent.

generation and liquefied petroleum gas (LPG) production (mostly under conditional NDCs). This will require regulations ensuring that producers undertake appropriate abatement actions (World Bank 2022). Eradicating routine gas flaring and venting is a cost-effective way to reduce GHG emissions. IEA (2023) indicates that between 40-60 percent of these emissions could be avoided at no net cost through investments in technology such as leak detection and repair and vapor recovery. Through upfront investment in these technologies, methane could be recovered and sold, reducing GHG emissions while contributing to Ecuador's gas supply.

7. As forestry and agriculture sectors compete for land-use resources, a unified approach for mitigation and adaptation is necessary. Agricultural expansion has led to rapid deforestation, reducing the forest area by 10 percent between 1998 and 2022. This lowered the forest cover rate by 5 percentage points, and thereby also the carbon stock in forest. Ecuador has been successful in implementing several forest conservation policies, including National System of Protected Areas (SNAP) as well as SocioBosque, a voluntary forest conservation scheme that provides payments for forest conservation. Both have shown positive results in reducing deforestation and could potentially be scaled up. Nevertheless, their further expansion will require targeting high deforestation risk areas and ensuring long-term financial sustainability (World Bank 2024). Going forward, sustainably limiting deforestation will largely depend on the evolution of climate smart agricultural practices, as improved livestock production systems (e.g., via improved pastures, agroforestry solutions) could help relieve pressure on forest lands. Adaptation policies that aim to enhance the adoption of sustainable agriculture would help with mitigation goals.

8. Combining mitigation policy tools and green growth strategies could help reduce emissions while fostering equitable growth. A combination of policy tools—such as targeting subsidies, feebates for clean vehicles, and methane fees for extractive industries—could be more effective than relying on a single instrument. Green public investments, infrastructure improvements, and incentives for other renewable energy sources (besides hydro) and sustainable land use practices would also help accelerate decarbonization. While these measures may require increased public financing, they can also drive growth through investment, green foreign direct investment (Jaumotte et al. 2024), higher productivity, and job opportunities (World Bank 2024).

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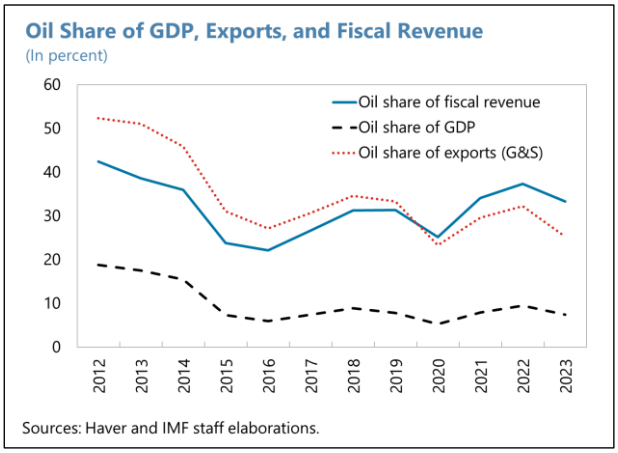
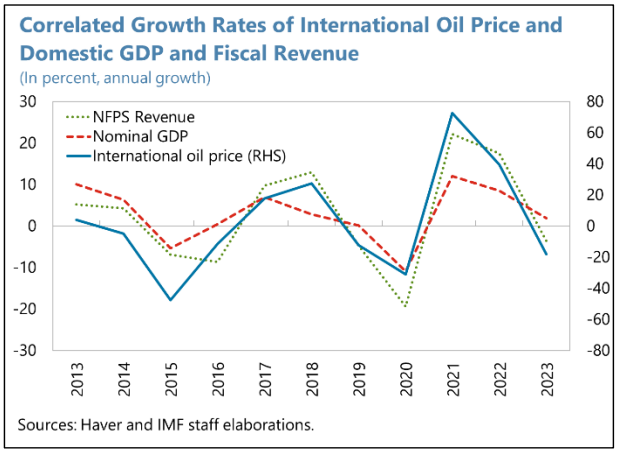
REDUCING VULNERABILITIES TO THE GLOBAL ENERGY TRANSITION TOWARDS A LOW-CARBON ECONOMY[1]

High dependence on oil makes the Ecuadorian economy vulnerable to international oil developments. The global transition towards a low-carbon economy poses risks to the Ecuadorian economy through declining global oil demand and uncertainties about oil prices. Diversifying and upgrading the quality of exports, through policies to improve country fundamentals and facilitate trade integration, could help mitigate this risk.

A. Vulnerabilities to the Global Energy Transition

1. Ecuador's high dependence on oil makes the country vulnerable to international oil developments. Although the role of oil in Ecuador's economy has diminished since the commodity price collapse of 2014-2016, it remains a crucial component of economic activity. In 2023, oil accounted for approximately 7.5 percent of GDP, one-quarter of exports, and one-third of Non-Financial Public Sector (NFPS) fiscal revenue. Consequently, Ecuador's economic growth, fiscal revenue, and export levels are closely tied to fluctuations in international oil prices, exhibiting highly correlated growth rates (text figures).

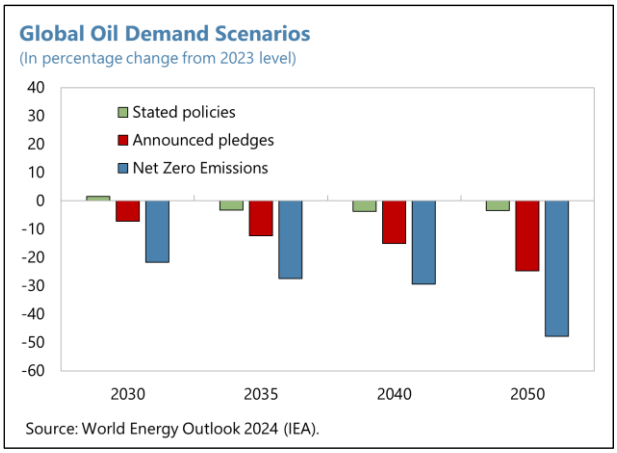


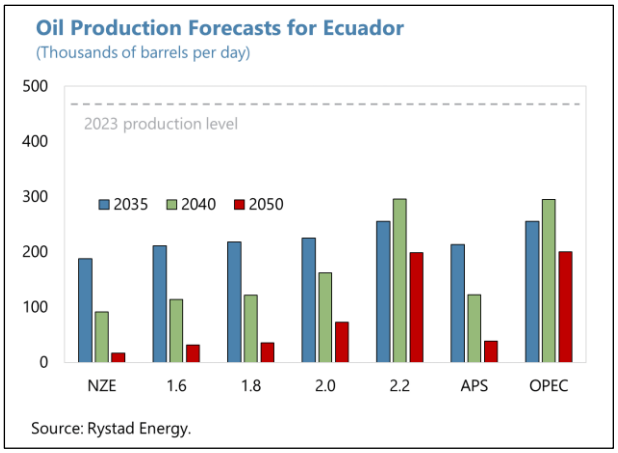


2. The global transition towards a low-carbon economy (henceforth, the "global energy transition") presents material risks for Ecuador due to the uncertainties regarding global oil demand and prices. The future trajectory of global oil demand hinges on various factors, including mitigation policies; technological advancements and the pace of adoption of electric vehicles; and the growth of renewable energy sources. According to projections from the International Energy Agency, global oil demand could decline by 4 percent to 29 percent from the 2023 level by 2040, depending on different mitigation scenarios. This decline is likely to adversely affect oil production

[1] Prepared by Vu Chau (WHD).

in Ecuador, with forecasts suggesting a potential 38-81 percent reduction by 2040.[2] A back-of-envelope calculation indicates that, *ceteris paribus*, this could imply a 3-6 percent decline in the level of nominal GDP, 10-20 percent decline in exports, and 13-26 percent decline in fiscal revenue. Furthermore, the uncertainty surrounding future oil prices is exacerbated by whether the energy transition is primarily driven by demand-side policies (which curb demand and depress oil prices) or supply-side policies (which dampen supply and increase oil prices) (Boer et al., 2023).





3. Transition risks arising from the global energy transition extend beyond oil. The mining sector, for example, could have potential upside risk through a higher global demand for copper, as it is an important metal for renewable energy infrastructures (e.g., solar panel, wind turbines, energy storage systems) and electric vehicles. At the same time, policies aiming to target exports with high embedded emissions (e.g., border carbon adjustments (BCA) or bans against deforestation-linked products) could negatively affect the agriculture sector.

4. Export diversification will help Ecuador reduce vulnerabilities to the global energy transition. Having an over-concentrated export basket that relies heavily on a single product or group of products could increase the risk of having large unpredictable macroeconomic outcomes, should such product become "unfavorable" during the global energy transition. This chapter reviews Ecuador's export diversification progress throughout recent decades and draws lessons for the export diversification strategy going forward.

B. Export Diversification and Quality Upgrading Since 1960s

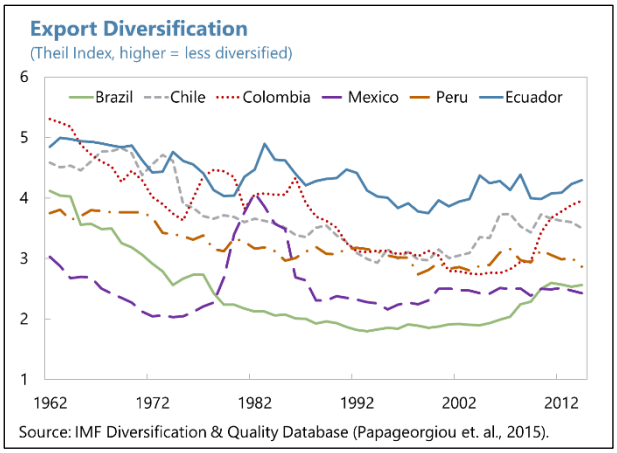
5. Ecuador's exports are less diversified compared to regional peers. A measure of export diversification is the Theil index, which calculates the "entropic distance" between the actual export

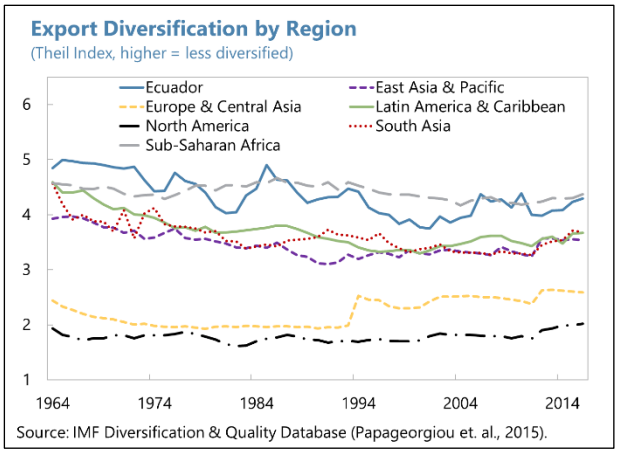
[2] Transition scenarios: NZE (Net Zero Emission by 2050) scenario from the IEA sets a narrow pathway for the global energy sector to achieve net zero CO2 emission by 2050. The APS (Announced Pledge Scenario) assumes all aspirational mitigation targets announced by governments are met in full. The OPEC scenario sees a bullish liquids demand with gradual increase until 2045. The 1.8, 2.0, and 2.2 scenarios (constructed by Rystad) correspond to projected oil demand paths consistent with a global average temperature rise of 1.8, 2.0, and 2.2 degree Celsius relative to pre-industrial levels, taking into account the different speeds of electric vehicle adoption.

basket and a hypothetical perfectly balanced basket (where all products are exported by the same amount). The Theil index is given by:

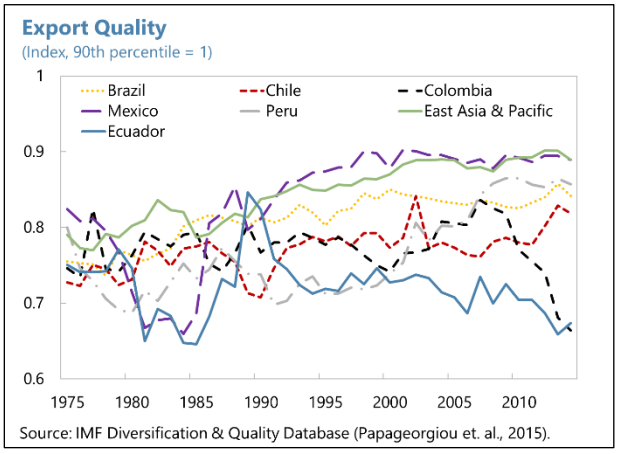
$$T = \frac{1}{N}\sum_{k=1}^{N}\frac{x_k}{\bar{x}}\ln\left(\frac{x_k}{\bar{x}}\right),$$

where N is the number of active export product lines, x_k is the actual value of a particular export, and $\bar{x}$ is the average exports. When all products are exported by the same amount, $x_k = \bar{x}$ for all products, and the Theil index has a value of zero. A higher Theil index implies a less diversified export basket. Ecuador's exports have traditionally been less diversified compared to regional peers, except for Colombia in the early 1960s (left text figure). However, most LA5 countries have made substantial progress to diversify their exports portfolio, with notable cases of Brazil, Chile, and Colombia (even though exports in these countries appear to have become less diversified again after the oil boom in the late 2000s). The remarkable diversification progress made in the region is comparable to that of East and South Asia (right text figure). Meanwhile, Ecuador's exports basket remains concentrated.[3]





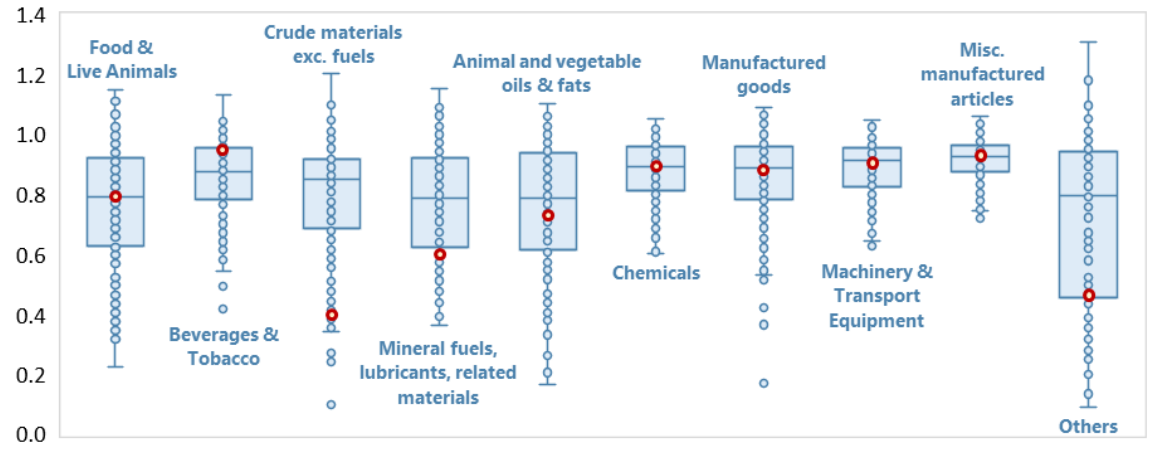
6. Ecuador also has lower export quality than regional peers. Papageorgiou et. al. (2015) proposes a measure of quality using the unit value of export (trade price) after netting out other non-quality factors that could affect trade prices, such as domestic labor costs or proximity to high-income markets. The estimation of quality is done at the product level and quality is normalized so that the 90th percentile quality takes the value of 1. By this measure, Ecuador has consistently had



[3] The IMF Diversification & Quality Database only has data up to 2014. A similar index "Economic Complexity Index," which assesses the number and complexity of a country's export products and has data availability until 2021, shows similar trends (i.e., Ecuador historically and currently has lower export complexity than regional peers).

lower export quality compared to LA5 countries since the 1960s. Quality also has deteriorated over time in Ecuador, while it has improved in some other countries in the region (Brazil, Mexico).

7. There is scope for upgrading quality in most export industries. The text figure plots the "quality ladder," i.e. the distribution of quality across all countries, grouped by high-level product categories. Each circle represents a country, and Ecuador's position within each quality ladder is indicated in red. Each distribution is visualized by a box-and-whisker plot, which features the minimum-maximum ("whiskers") as well as the interquartile range and the median ("box"). Except for *Beverages and Tobacco*, a category with relatively high quality, export quality in Ecuador in all remaining product categories is either at the median (e.g., for *Food & Live Animals, Chemicals, Manufactured Goods, Machinery and Transport Equipment*) or close to/inside the bottom quartile (e.g., in *Crude Materials* or *Mineral Fuels*). Bringing export quality closer to the frontier could help Ecuador earn higher value added per unit and increase the value of non-oil exports.

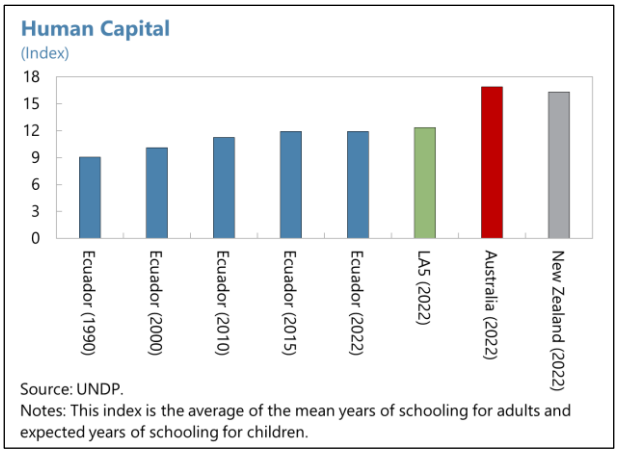


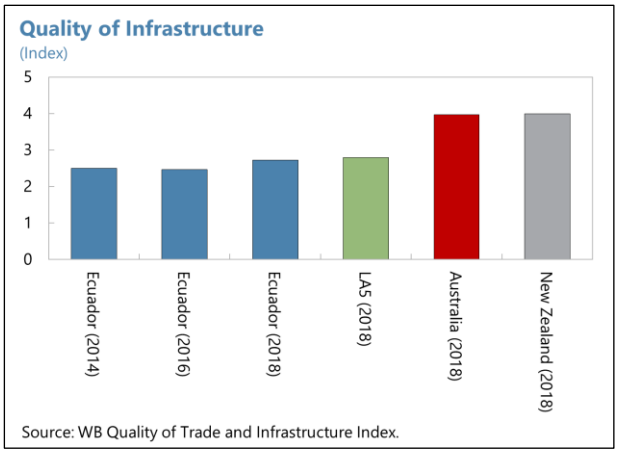
Sources: IMF Diversification & Quality Database (Papageorgiou et. al., 2015); IMF staff elaborations.

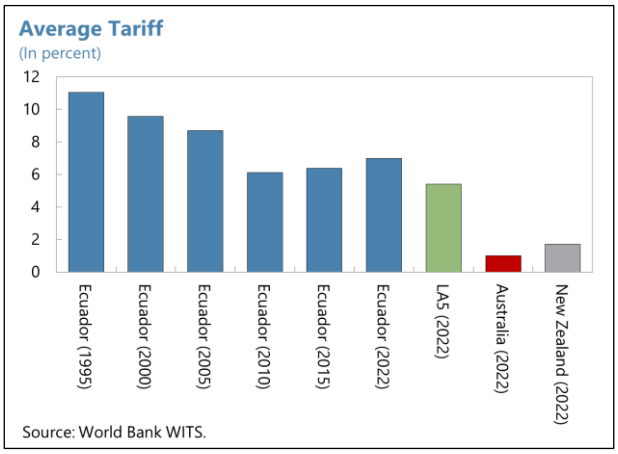
8. Developing and increasing non-oil exports is key to the diversification strategy, which can be achieved from horizontal policies to improve country fundamentals. While diversification in theory can be achieved by lowering oil production and exports, such policy would hamper growth, fiscal, and external sustainability, and lead to stranded assets. Instead, an orderly diversification strategy that ensures macroeconomic stability should rely on the development of non-oil industries. Salinas (2021) estimates a gravity model for non-hydrocarbon and mining (NHM) exports and finds that two factors explain well a country's NHM exports value: "*proximity to markets,*" measured by the average inverse distance to destinations weighted by their economic sizes, and *fundamentals*—particularly education, quality of infrastructure, government effectiveness, and average tariffs. The role of fundamentals is highlighted for the case of Australia and New Zealand, two other commodity producers who are relatively far from destination markets yet have high NHM exports thanks to strong fundamentals. Ecuador's NHM exports, on the other hand, are

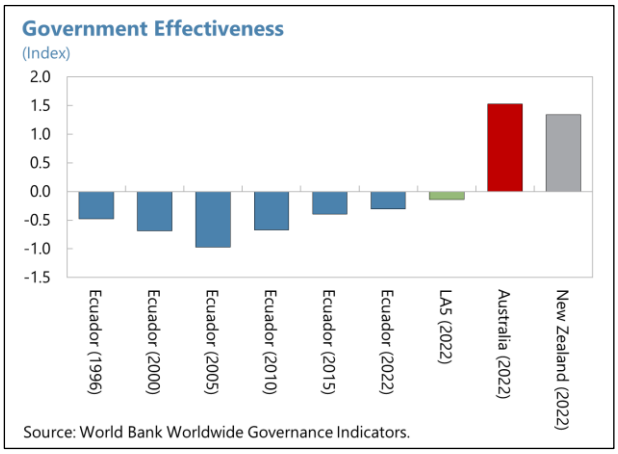
primarily explained by proximity to markets, and fundamentals do not help increase NHM exports further.

9. Continued efforts to improve human capital, infrastructure, government effectiveness, and trade integration would support Ecuador's growth and development. The text chart below shows Ecuador's progress in improving the four indicators of fundamentals considered by Salinas (2021): human capital, infrastructure, average tariffs, and government effectiveness. Human capital is measured by the UNDP Education Index, which is the average of the mean years of schooling for adults and expected years of schooling for children. Infrastructure, average tariffs, and government effectiveness are indicators provided by the World Bank. The chart shows Ecuador's significant progress in increasing human capital and infrastructure quality, which are now in line with regional peers. Similarly, the average tariff has been significantly reduced (from 11 to 7 percent) but remains above the LA5 average. The government effectiveness index, which is normalized to have mean zero and ranges from -2.5 to 2.5, has also shown an improvement but remains lower than LA5 peers. The LA5 indicators are significantly below the levels of New Zealand and Australia, the high NHM exporters discussed previously.









C. Implications

10. Reducing dependence on oil is critical to reduce vulnerabilities to the global energy transition and improve macroeconomic stability. This can be achieved by diversifying the export basket and upgrading quality, as both measures have significantly lagged regional peers. Ecuador has ample room to upgrade quality in most export industries, which would help earn higher value added for the domestic economy. A strategy to boost non-oil exports could focus on continuing to improve fundamentals, especially education, infrastructure, and government effectiveness. Continuing to foster regional and international trade integration, as exemplified by the recent Free Trade Agreements with China and Costa Rica; reduce tariff and non-tariff trade barriers; and increase participation in global value chains would also create opportunities for trade expansion and diversification. Removing market imperfections (e.g., inefficient credit allocation) and barriers that prevent firms from entering the market, innovation, and growth would further increase business dynamism and boost exports.

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ADDRESSING ECUADOR'S CLIMATE FINANCING NEEDS[1]

Ecuador faces significant climate financing needs for adaptation and mitigation, which the World Bank estimates at US$3.7 billion annually through to 2050. In 2023, the country secured funding to support the conservation of the Galápagos Islands through a debt-for-nature swap. Going forward, Ecuador can explore additional climate financing avenues, including sustainable bonds, which offer several advantages compared to conventional bonds, paving the way for innovative financial solutions to address climate change.

A. Introduction

1. Ecuador has sizeable adaptation and mitigation investment needs. The World Bank's Country Climate Development Report (CCDR) for Ecuador estimates that annual climate investment needs will average US$3.7 billion per year between 2025 and 2050. While this figure carries a degree of uncertainty, it serves as a useful indicator of the scale of the financing needed.

2. In 2023, Ecuador completed the world's largest debt-for-nature swap to date to support the environment. As part of this, Ecuador partnered with the Inter-American Development Bank (IDB) and the U.S. International Development Finance Corporation (DFC) to complete the world's largest debt-for-nature swap to date. Through a special purpose vehicle, the government bought back US$1.6 billion of commercially held debt at 40 cents on the dollar, unlocking an estimated US$450 million to support conservation efforts in the Galápagos Islands. In December 2024, Ecuador undertook another transaction to support conservation of the Amazon.[2]

3. There are several options available to countries looking to secure climate financing. Appropriate instruments vary according to countries' economic and fiscal conditions, as well as climate and environmental contexts. Sustainable bonds are a popular option as they are widely traded and offer advantages over conventional bonds. Debt-for-nature swaps are also a viable avenue to attract private sector climate finance, particularly due to their potential debt reduction benefits, but do not facilitate the scaling of financing or provide broader market liquidity. In addition to these options, other climate financing instruments include carbon offsets, blended finance partnerships, and other variations on the suite of instruments available for conventional financing.

4. This paper focusses on sustainable bonds and debt-for-nature swaps as two key debt solutions for climate financing. The focus on sustainable bonds provides useful context, as the requirements for these instruments are relevant for many other types of climate financing instruments. Debt-for-nature swaps are of interest, given Ecuador's experience with these

[1] Prepared by Dominique Lam (MCM).

[2] Ecuador undertook a debt-for-nature swap to support conservation of the Amazon at the time of publication of this Selected Issue Paper. Given the timing, this transaction is outside of the scope of this paper.

transactions. The next section discusses global climate finance trends, with a particular emphasis on Latin America and outlines standards that facilitate sustainable bond issuances. Section C describes Ecuador's experience with climate financing, including its efforts to build a sustainable finance ecosystem and highlights notable transactions. Section D concludes.

B. Climate Finance Trends Globally and in Latin America

Types of Sustainable Bonds

5. Sustainable bond issuances have become more popular in recent years as a key source of climate financing. Sustainable bonds broadly fall into two categories: use of proceeds and sustainability-linked bonds. Use-of-proceeds bonds finance projects with specific environmental or social benefits. There are three main types of use-of-proceeds bonds: green bonds that finance climate or environmental activities; social bonds that finance activities with social benefits; and sustainability bonds that finance both green and social initiatives. Sustainability-linked bonds are structurally tied to the issuer's performance. For instance, the issuer could choose to tie the bond's coupon to a GHG emissions target, with a step-down or step-up on the coupon due, if the issuer is successful or not successful in reducing GHGs to a pre-agreed target level. Sustainability-linked bond issuance receipts can be used for general budgetary purposes; they are not linked to specific expenditures. These four sustainable bond types have product standards that are set out by the International Capital Markets Association (ICMA), also known as "the Principles."

6. As sustainable financing evolves, issuers will continue to innovate and create new instruments, whilst investor preferences may also change. There are other bond types which could be considered variations on the four sustainable bond types outlined above. Some issuers may consider these to fall under the category of sustainable bonds, though ultimately investors will decide on whether a particular issuance can be labeled 'sustainable' based on their mandate and regulations they adhere to. The three most common alternative formats are: blue bonds, super-green bonds, and transition bonds. Blue bonds and super-green bonds are usually considered to be direct variations of sustainable bonds and their associated product standards, whilst the guidelines for transition bonds are still evolving. Blue bonds, when issued as a standalone conventional bond and not part of a debt-for-nature swap, are considered a subset of green bonds under the Principles. In this case, the proceeds from a blue bond would be used entirely to support coastal, marine, or river-based activities, which promote sustainability or decarbonization, while still following the product standards for green bonds. Super-green bonds combine the characteristics of use-of-proceeds and sustainability-linked bonds. Issuers commit to spending the financing on green expenditures as well as meeting climate or environmental targets. In this way, issuers of super-green bonds might comply with both the Principles for green and sustainability-linked bonds. Transition bonds are considered to support the issuer towards their low-carbon objectives, but do not fully meet the criteria of green bonds. There is yet to be broad-based agreement amongst issuers and investors on the appropriate standard for transition bonds.

7. Sustainable financing can also be raised without the use of a "sustainable bond" label. Issuers with strong climate or environmental credentials can raise financing through conventional

means without the use of the sustainable bond label. Investors may sometimes consider this financing to be sustainable if the issuer has robust climate and environmental credentials that are aligned with their overall strategy. For example, investment in a solar panel manufacturer could be considered as sustainable without the use of a specific climate financing instrument. However, issuers will need to demonstrate compliance with the Principles if they intend to apply a sustainable bond label.

Requirements for Sustainable Bond Issuances and Benefits for Issuers

8. Issuers of sustainable bonds need to fulfill specific requirements to demonstrate transparency and credibility to investors. Issuers of sustainable bonds typically adhere to guidelines outlined by the Principles. In 2023, 97 percent of issuers of sustainable bonds referenced the Principles, demonstrating their use as a de facto global standard. Key requirements for sustainable bonds issuances are described in Box 1. These specific requirements allow investors to understand the issuer's climate and environmental plans, and to verify their integrity. Investors typically assess that the issuer's overall plans are in line with the climate and environmental strategy described as part of the particular sustainable bond issuance on offer. As the market for sustainable bonds further develops, the requirements may continue to evolve.

Box 1. Sustainable Bonds and Requirements that Issuers are Expected to Fulfill

Issuers of sustainable bonds need to satisfy several requirements, given the differentiation with conventional financing. The ICMA provides the secretariat for the principles and guidelines that are recommended for sustainable bond issuances ("the Principles"). This box summarizes key features that issuers may need to consider for the issuance of green, sustainability, and sustainability-linked bonds. Social bonds may follow similar principles with a focus on social, rather than climate or environmental, outcomes.

Using sustainable bonds as a means of financing creates a platform for the issuer to highlight its climate and environment strategy to potential investors through an investor roadshow and sustainable bond framework. Given the differentiation with the conventional financing program, the issuer needs to acquaint investors with the new financing approach, through a tailored roadshow and detailed framework for its intended sustainable bond issuance. The framework summarizes the issuer's climate and environment strategy, how the financing will support implementation, and the principles for managing the financing. ICMA recommends that issuers of appoint an external reviewer(s), also known as a Second Party Opinion (SPO) provider, to assess alignment of the framework with the Principles. Investors will typically assess the overall Environmental, Social, and Governance (ESG) credentials of an issuer in addition to the specific sustainable bond instrument.

Issuers face more governance requirements and scrutiny from investors for sustainable bonds than for conventional financing instruments. Issuers are expected to report annually to investors on progress made based on the principles outlined in the framework. For use-of-proceeds bonds, annual reporting would state how the financing has been allocated to relevant expenditures. For sustainability-linked bonds, reporting would need to demonstrate progress towards the targets under measurement. As part of this, issuers are expected to maintain a coherent climate and environmental strategy, offering a clear progress update on how the sustainable bond financing supports its implementation.

In the case of sustainability-linked bonds, legally binding documentation is required to outline how the bond's structure or financial characteristics may vary in the event of a sustainability performance target (SPT) being met or not met. The documentation describes the timelines for achieving the SPT,

Box 1. Sustainable Bonds and Requirements that Issuers are Expected to Fulfill (concluded)

trigger event(s), payment amount, and mechanism. In addition, the Principles recommend external annual verification for each indicator and for any date or period relevant for assessing the SPT.

Use-of-proceeds bonds, such as green bonds, have significant governance and reporting requirements. The Principles recommend that issuers produce an externally audited allocation report, detailing activities financed by the issuance, and an impact report, describing how those activities have supported the issuer's achievement of their climate and environmental goals. Given the reporting requirements, green bonds issuances are often accompanied by changes to governance arrangements.

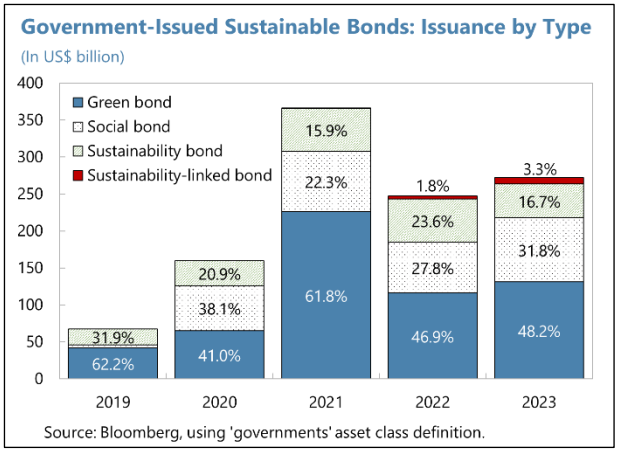
The additional governance requirements of use-of-proceeds bonds are usually addressed through changes in inter-ministerial processes, and methods to select green bond expenditures and monitor and report on those activities. Issuers may decide to create a green taxonomy, determining which expenditures are eligible for use within the green bond. In the absence of a taxonomy, issuers can submit their proposed expenditures for verification to their SPO provider.

Sources: ICMA website "The Principles and Related Guidance," and Lindner and Chung (2023).

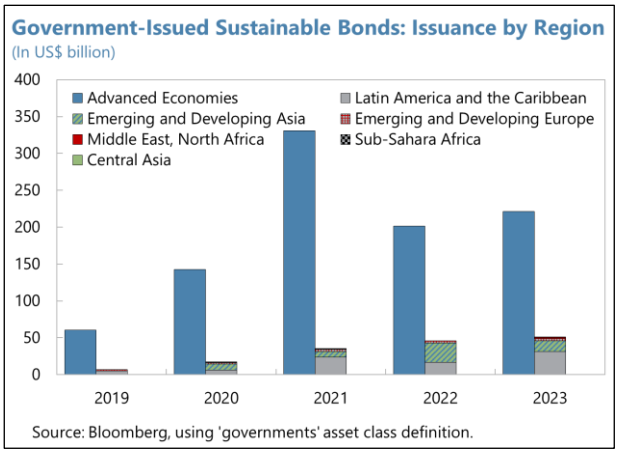
9. Sustainable bond issuances can entail financing benefits for the issuer, including improved liquidity, cost-effectiveness, and reduced debt-interest service. Sustainable bonds are widely recognized and publicly tradeable, providing issuers with market liquidity comparable or higher than conventional financing. This is largely due to the additional governance measures that appeal to sustainable investors. Sustainable bonds can also be cost effective. In the past, green bonds have been issued at a discount for issuers, also known as a "greenium," leading to reduced financing costs for the issuers (Carmichael and Rapp, 2022). Cost-effectiveness can also be achieved if the issuer uses the same framework to issue multiple times, addressing their financing needs at scale and spreading the one-off upfront costs required to structure the framework across multiple issuances. Debt-interest service benefits can occur under a sustainability-linked issuance. In this case, the benefit would occur if the bond is structured with a step-down in coupon following a trigger event and conditions for that event are met.

Sustainable Bond Issuances Trends Globally and in Latin America

10. Sustainable bond issuances have become more popular in recent years as a key source of climate financing. In 2019, governments across the world, including sub-sovereign entities, raised over US$65 billion from sustainable bond issuances (based on Bloomberg's "asset class" definition of "governments"). This figure grew to over US$270 billion in 2023. Whilst sustainable bond issuance was only 2.2 percent of total government debt issuance in 2023, these instruments have become an important tool for governments to fund their climate and environmental strategies.



11. Issuers in Latin America and the Caribbean (LAC) have been successful in raising financing through sustainable bonds. Government issuers in LAC, including sub-sovereign agencies, local and regional governments, issued US$30 billion in sustainable bonds in 2023, making LAC region the largest issuer of sustainable bonds amongst Emerging Market and Developing Economies (EMDEs).



12. Issuers in LAC have also been pioneers of novel sustainable finance instruments. For example, Chile has issued all four sustainable bond types. In 2022, Chile issued the world's first sovereign sustainability-linked bond, raising US$2 billion repayable over 20 years, with Sustainability Performance Targets (SPT) related to GHG emissions and renewable energy power generation. As part of the sustainability-linked structure, Chile committed to a step-up in coupon of 12.5 basis points for each target missed. Similarly, Uruguay also issued a sustainability-linked bond in 2022. Uruguay's issuance was a world-first for a sovereign to feature both a step-up and step-down structure. The bond is linked to two SPTs, GHG emissions and area of natural forest cover, with a step-up or step-down of 15 basis points for underperformance or overperformance of each target. Uruguay benefitted from greater diversification, with over 20 percent of investors in the sustainability-linked issuance being new holders of Uruguayan debt. Ecuador has also been a pioneer, issuing the world's first sovereign social bond in 2020. This issuance raised US$400 million to provide mortgage loans at a preferential interest rate to low and middle-income families and facilitate access to housing for more than 24,000 families.

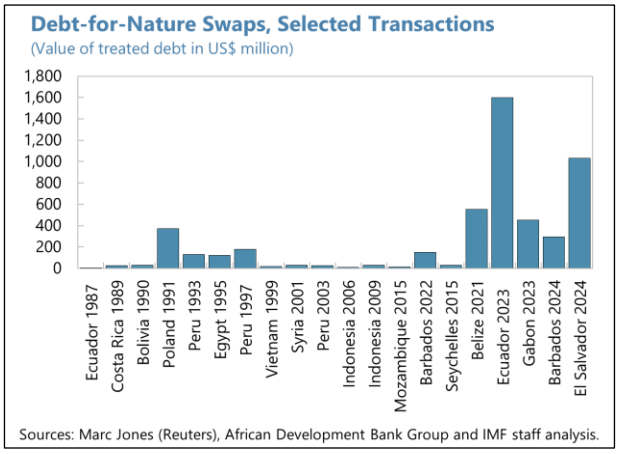
Debt-for-Nature Swaps

13. Debt-for-nature swaps are one-off transactions between governments and one or more of its creditors to replace sovereign debt with one or more liabilities that entail a spending commitment towards nature or conservation goals. Spending is usually committed and managed through a new entity tasked with managing nature conservation projects.

14. There are two categories of swaps, depending on the type of creditor of the debt being swapped. First, bilateral swaps are transactions where official bilateral debt is reduced in exchange for a commitment toward expenditures on specific nature or other development objectives. Second, in a trilateral swap commercial debt is repurchased for new debt. In the latter, countries use newly issued credit-enhanced debt to buy back bonds, committing part of the debt service savings—the difference in debt service between the old and new debt—toward conservation. This type of swap thus involves the exchange of one unsecured debt liability for two or more new liabilities (i.e. new guaranteed debt and expenditure commitments). Ecuador's 2023 transaction was a commercial debt swap.

15. In a typical commercial debt swap, the country contracts credit-enhanced debt and uses the proceeds to buy back bonds in capital markets. The credit-enhancement can be provided by a development partner, leading to interest rate payments that are lower than what the country would have had to pay based on its standalone credit. The country commits part of the resulting savings towards environmental goals. The funds servicing the debt may flow through a Special Purpose Vehicle (SPV) which is set up to handle the funds.

16. Debt-for-nature swaps can provide savings for the issuer whilst also supporting environmental objectives. The fiscal space that is created by a successful transaction is partially used to support nature or climate objectives. For commercial debt swaps, the transaction may crowd-in private investors interested in the new bond on offer as well as supporting the country's climate and environmental goals. Debt-for-nature swaps are one-off transactions by design and not intended to facilitate the scaling of climate financing. They are effective when the issuer is looking to reduce its debt burden and has environmental objectives it can finance through the savings of the swap.



17. Ecuador was one of the first countries to complete a debt-for-nature swap in 1987 and completed the world's largest swap in 2023. Debt-for-nature swaps have been used by EMDEs with more frequency in recent years. In 2023, Ecuador completed the world's largest debt-for-nature swap to support conservation efforts in the Galápagos Islands (see below and Box 2).

C. Ecuador's Experience with Climate Financing

18. The Ecuadorian government has had experience with both sustainable bond issuances and debt-for-nature swaps. Ecuador issued the world's first sovereign social bond in 2020, raising US$400 million to provide affordable housing. In 2023, the government completed a debt-for-nature swap, with savings partially being used to fund conservation in the Galápagos Islands (see Box 2). The government undertook another debt-for-nature swap to support conservation of the Amazon in December 2024.

19. In the private sector, a number of domestic financial institutions have issued sustainable bonds since 2019. Some financial institutions noted that their balance sheet had a pipeline of green bond-eligible assets, indicating that climate financing investment opportunities exist in Ecuador. However, these financial institutions generally sought funding from unlabeled, conventional sources, rather than sustainable bond issuances. Where financial institutions have issued sustainable bonds, they were usually supported by multilateral organizations. Although foreign investors, particularly those bound by EU regulations, might be attracted to invest in green bond-eligible assets in Ecuador and therefore create demand for sustainable bond issuances, local

financial institutions noted that the interest rate restrictions and the capital outflow tax are a deterrent to overall investment, particularly from abroad. This may be reflected in foreign direct investment flows, which averaged 1.1 percent of GDP between 2000 and 2022, lower than the average of 3.4 percent in Latin America and the Caribbean. The additional requirements associated with sustainable bond issuances also hinder the development of the green finance market, in the absence of any specific incentives to support it.

20. The financial sector has made strides to build an ecosystem for sustainable finance. Efforts to support the domestic sustainable finance ecosystem started as early as 2016, when the Association of Private Banks of Ecuador (ASOBANCA) issued the Sustainable Finance Protocol. The Protocol was updated in 2023 and aims to support the implementation of international best practices in sustainable finance within the local financial services sector. Further to this, the Quito Stock Exchange issued a guide for green and social bonds in 2020, and ASOBANCA initiated the development of a green taxonomy for their members in 2023, which is being implemented from September 2024.

21. The authorities have been working to create the green finance ecosystem, particularly for green bonds. In 2023, the Ministry of Economy and Finance published a sovereign green bond framework, outlining the country's climate and environmental strategy through to 2025, and how green expenditures would be selected for eligibility under the green bond issuances. In September 2024, the government announced the creation of the Sustainable Finance Council, which includes the Ministry of Economy and Finance (MEF), the Ministry of Environment, Water and Ecological Transition (MAATE), and the National Planning Secretariat (NPS), to support the development of green finance in Ecuador. The first working group of the Sustainable Finance Council will develop a national taxonomy, bringing together a wide range of stakeholders including from the financial sector, non-financial public sector entities, academia, and international development agencies. This stakeholder engagement will draw on experiences with sector-level taxonomies, such as ASOBANCA's work in the private banking sector, while ensuring alignment with national sustainable development needs and international best practices. .

22. The authorities have undertaken initiatives to create a climate finance risk management approach. In 2021, MAATE published a National Climate Finance Strategy. This strategy called on the financial supervisors (also known as the "superintendencies") to increase the management of climate and environmental risk in the financial sector. In 2022, both the Superintendencia de Economía Popular y Solidaria (SEPS) in the credit cooperative sector, and the Superintendicia de Bancos (SB) issued resolutions requiring the development of environmental and social risk frameworks (SARAS). This enacted change in the credit cooperative sector. Many banks had SARAS in place, and do not face additional requirements from its implementation. Overall, the implementation of environmental and social risk management frameworks should support the identification of sustainable bond-eligible assets.

Box 2. Ecuador's 2023 Debt-for-Nature Swap

In May 2023, Ecuador completed the world's largest debt-for-nature swap. As part of the swap, the Ecuadorian government set up a special purpose vehicle (SPV) that purchased US$1.6 billion in bonds at 40 cents per dollar. The SPV issued a "blue bond" for US$656 million The DFC and IDB provided guarantees of US$656 million and US$85 million on the "blue bond," respectively. These guarantees reduced the interest costs of the "blue bond". The swap reduced Ecuador's debt service by an estimated US$1.1 billion through to 2041, an amount equivalent to 0.8 percent of 2023 GDP. Meanwhile, the Ecuadorian government set up a "blue loan" with the SPV, the repayment of which covers both the repayment of the "blue bond" and spending to support marine conservation.

To support marine conservation as part of the debt-for-nature swap, the Galápagos Life Fund (GLF) was set up. The purpose of the GLF is to promote and maintain the natural capital of the Galápagos Islands and their marine ecosystems.

A part of Ecuador's interest payments on the "blue loan" are used towards the GLF. This will provide annual funding of approximately US$12 million for 18.5 years between 2023 and 2041. The swap also provides upfront funding for an endowment fund that is projected to reach US$227 million by 2041. The GLF will administer the endowment fund and marine conservation activities in the Galápagos Islands. The swap is expected to provide a total of US$450 million for conservation activities in the Galápagos Islands.

Sources: IMF Regional Economic Outlook, Western Hemisphere, October 2023, DFC and IDB press releases, and media reports.

D. Concluding Remarks

23. Climate financing succeeds in an ecosystem that is supportive of conventional private investment and may need additional incentives in order to thrive. The overall investment environment affects the availability of climate financing. In addition, climate financing has its own additional requirements, that can be a disincentive to seek sustainable financing. However, opportunities for international investors in climate financing do exist in Ecuador and can provide another source of funding for the financial sector. Therefore, catalyzing climate financing in the private sector either needs to involve changes to the overall investment environment, or specific incentives for green investments. For instance, the process of issuing sustainable bonds could be streamlined and made easily available to potential issuers, to make issuances simple and straightforward. This change could provide a non-monetary incentive to the issuance of sustainable bonds and could make it an attractive funding route relative to conventional financing.

24. To facilitate sustainable bond issuances in Ecuador, the authorities could implement comprehensive governance arrangements on the implementation of their climate and environmental strategies. Regardless of the specific instruments used to meet climate finance needs, investors will assess the transparency and accountability in the monitoring, measurement, and reporting of the country's NDCs. This is true for public or private sector climate and environmental projects. In addition, Ecuador's national implementation plans and strategies on climate and environment will be part of investor due diligence. Therefore, enhancing the governance arrangements on the NDCs and climate and environmental strategies would support investor confidence, demonstrating the existence of a favorable environment for sustainable bond issuance.

25. To attract climate financing, the authorities could explore a range of options, particularly those that can provide financing at scale and liquidity benefits, such as sustainable bonds. The authorities may consider developing and implementing a medium-term financing strategy that includes sustainable bond issuances. This can be developed as a multi-year program, as the instruments can provide financing at scale, are tradeable, and therefore have the potential to deliver liquidity benefits. Any climate financing decisions should be considered within the country's overall financing plans and strategies.

26. To design a climate financing strategy, it is important to evaluate which instruments best suits the country's needs. If sustainable bonds are considered, it will be valuable to consider the distinct governance requirements for use-of-proceeds and sustainability-linked bonds. Use-of-proceeds bonds impose stringent public financial management and reporting requirements and limit how the government can utilize the financing. It is also important to consider all the regulatory and governance requirements upfront, as these obligations will continue for years following the issuance of the bond until it matures. In addition, for sustainable bonds, it is advisable to limit the choice of instrument to one type, if possible. This approach would enable the authorities to establish a program of issuances under one framework, minimizing the potential for market fragmentation, enhancing liquidity, and optimizing the efficiency of sustainable bond issuances.

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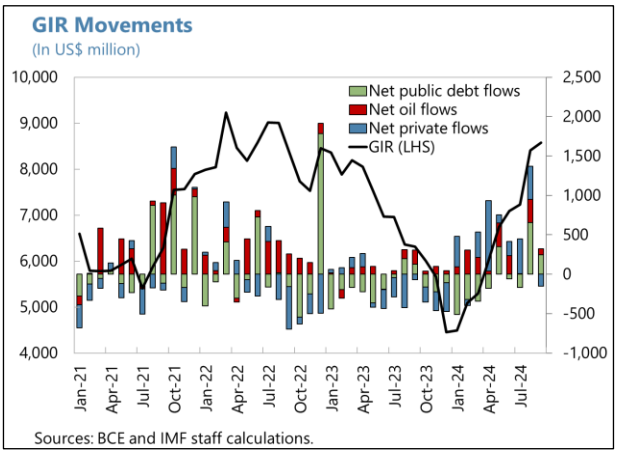
RESERVE ADEQUACY IN ECUADOR'S DOLLARIZED ECONOMY[1]

Ecuador's liquid reserves have improved significantly with the ongoing successful implementation of the authorities' economic program, supported by the EFF. However, they remain low by standard adequacy metrics, reducing the country's ability to withstand large shocks. Continued efforts to build adequate reserve buffers remain essential to increase resilience and protect macroeconomic stability.

1. In light of dollarization, assessing Ecuador's reserve adequacy necessitates careful consideration of several specific factors. As a fully dollarized economy, Ecuador is insulated from risks associated with currency fluctuations or mismatches. All liquid assets in the economy can, in principle, be used to finance international trade or cross-border transactions (Mansilla 2019, Chow et al. 2023). In addition, since foreign liquidity buffers are not solely concentrated at the central bank, the analysis of reserve adequacy may differ from assessments in economies that issue their own currencies.

2. A prudent reserve level needs to encompass adequate buffers to address potential pressures arising from the balance of payments, financial sector dynamics, and fiscal sector needs. Adequate liquidity buffers are needed to support financial institutions in the event of liquidity pressures, as well as a buffer for government financing (IMF 2015). The reserves of the Central Bank of Ecuador (BCE) depend on the deposits of public institutions as well those of private banks and nonbank institutions. Gross international reserves (GIR) are highly sensitive to variations in oil revenues, government external financing, and financial system flows (text figure). Private banks' deposits, in turn, reflect credit allocation by the financial sector, demand for cash in the economy, reserve requirements, and capital flow management measures (CFMs) (IMF 2019). Liquidity pressures in the financial sector, including those originating from deteriorating fiscal performance or a fall of trade inflows for private companies, can translate into pressures on reserves. An analysis of the capacity of the financial and public sector buffers to address these different liquidity needs is important to evaluate Ecuador's reserve position.



3. The Fund's reserve adequacy metric (ARA) provides a useful framework for evaluating the reserve position, but specific circumstances of dollarized economies should also be considered. This metric (IMF 2011, 2013) comprises four components to capture potential liquidity

[1] Prepared by Giulio Lisi (SPR).

drains stemming from balance of payments dynamics.[2] The metric is composed as the weighted sum of (i) export income, which reflect the loss in reserves from lower external demand or terms of trade shock; (ii) short-term debt, which accounts for potential drains associated with rollover of existing obligations and related financing needs; (iii) medium- and long-term debt and equity liabilities, which capture risks related to additional portfolio flows; and (iv) broad money, which considers potential vulnerabilities arising from drains on the domestic financial sector during a crisis (e.g., due to withdrawals of liquid deposits from the domestic banking sector). The weights for each variable are calibrated based on observed losses in periods of financial stress in non-dollarized emerging markets (IMF 2011). In addition, the metric considers the potential role of fixed versus floating exchange rate regimes in absorbing external shocks. Additional important considerations include the role of CFMs in lowering the risk of capital flight as well as the availability of private and public liquid buffers in dollarized economies (IMF 2016b). Reserves in the range of 100 to 150 percent of the metric are considered broadly adequate for precautionary reasons (IMF 2016a).

IMF Reserve Adequacy Metric, Weights

(In percent)

		Fixed Exchange Rates	Floating Exchange Rates
Short-Term Debt		30	30
Other liabilities		20	15
Broad Money	With CFM	5	2.5
	Without CFM	10	5
Exports		10	5

Source: IMF 2015.

4. Analysis of the ARA and other reserve adequacy metrics suggest that Ecuador's reserve position is relatively low, although it has improved rapidly in 2024. As of end-2023, reserve buffers at the BCE accounted for only 18 percent of the ARA metric considering weights for fixed exchange rate regimes (21 percent after adjusting for CFMs), below adequacy levels. Besides ARA, the analysis considers additional metrics considered in the literature (IMF 2011), including reserve coverage for months of prospective imports, broad money, and short-term debt, as well as the coverage of central government's deposits at the BCE relative to spending needs (with one month of spending proposed as a benchmark, cf. IMF 2016). Except for short-term debt coverage, Ecuador's reserve position at the end of 2023 was below adequacy levels. Nonetheless, international reserves rebounded rapidly in the first three quarters of 2024 due to higher net exports, import compression, and strong remittances inflows, as well as disbursements from international financial institutions. These trends supported an increase in international reserves to US$8.6 billion as of end-September 2024 (from US$4.5 billion at end-2023), as reflected in a projected improvement in reserve adequacy

[2] The potential liquidity drains contemplated by the ARA metric are relevant for all types of economies, including dollarized economies. Therefore, the ARA metric provides a useful framework for evaluating the adequacy of reserve buffers in dollarized economies, with due consideration of the specificities and institutional arrangements of such economies.

metrics for 2024 (see below), with reserve buffers almost doubled to 33 percent of the ARA metric as of end-September 2024.

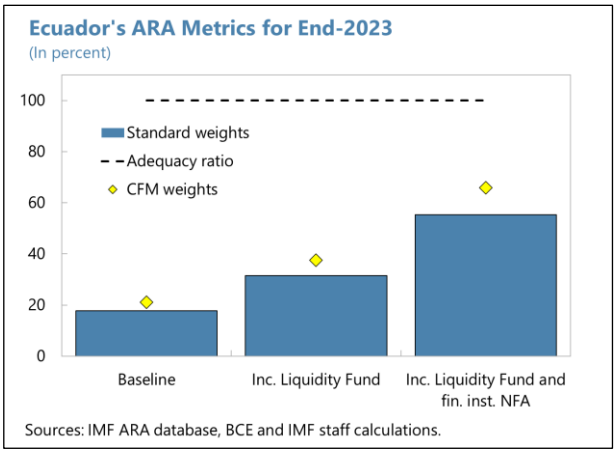
Ecuador's Reserve Coverage Ratios

	Reserves/ARA	Reserves/Imports (months)	Reserves/Broad money (percent)	Gov. deposits/ Expenditures (months)	Reserves/ ST debt
Metrics, Dec-2023	17.8	1.6	5.5	0.1	110.3
Metrics, Sep-2024 1/	32.6	3.0	10.2	0.5	173.8
Benchmark	100.0	3.0	20.0	1.0	100.0

Sources: BCE, and IMF staff calculations.
1/ Based on IMF staff projections for 2024.

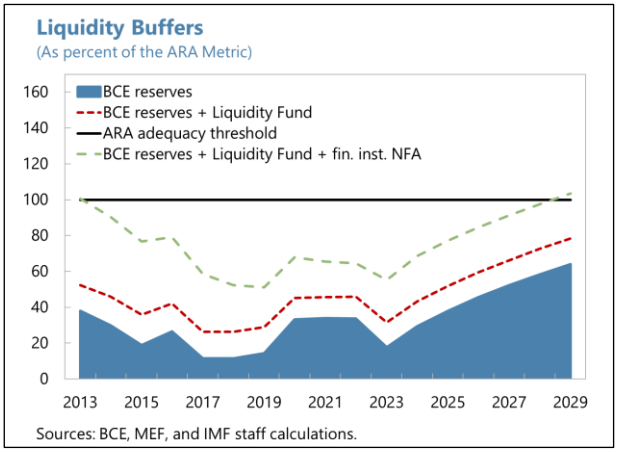
5. Besides the BCE's GIR, the financial sector's Liquidity Fund and financial institutions' net foreign assets (NFA) constitute additional sources of liquidity to address potential financial sector liquidity strains. When discussing reserve adequacy in a dollarized economy, consideration should be given to all available liquid resources to meet financial and government financing needs (IMF 2015). The financial sector's Liquidity Fund (US$3.8 billion at end-September 2024) serves lender-of last resort functions and is fully invested in liquid external assets. As such, it constitutes an important buffer to address potential liquidity strains in the financial sector, a risk captured by the broad money component of the ARA metric. In addition, domestic financial institutions hold buffers in the form of net liquid foreign assets (i.e., bonds and shares, and cash, NFA), equivalent to about US$7.2 billion as of end-September 2024. These resources can also be potentially used to address short-term liquidity drains in individual financial institutions, but they do not constitute centralized buffers; as such, they cannot be directly used to address other balance of payments shocks (e.g., those arising from a shortfall in external financing for the sovereign). Adding the Liquidity Fund and financial institutions' NFA to the GIR held by the central bank provides a helpful indicator to measure the full level of liquidity in Ecuador's economy, complementing the assessment based on central bank's reserves. However, as in the case of the Liquidity Fund, the financial institutions' NFA are not directly comparable to the international reserves held by the central bank, as they cannot be used to address shocks other than those faced by the corresponding financial institutions.

6. Consideration of additional liquidity buffers still leaves a gap to achieve full reserve adequacy, despite recent improvements. Including the Liquidity Fund, the end-2023 liquidity buffer increases to 32 percent of the projected ARA for 2024 metric (38 percent if adjusted for CFMs), still below adequate levels. After including financial institutions' NFA, the size of total available liquid resources at end-2023 rises to 55 percent (66 percent after accounting for CFMs), still below ARA adequacy levels (text figure). With the robust increase in GIR in



2024, central banks' reserves and the Liquidity Fund together are expected to increase to 43 percent of the projected ARA metric for the year (51 percent if adjusted for CFMs), rising to 68 percent of ARA metric when domestic financial institutions' NFA are also included in the analysis (81 percent accounting for CFMs). Although recently improving, available liquid resources in Ecuador's economy remain below adequate levels suggested by the ARA metric, suggesting the need for further accumulation of reserve buffers in line with the EFF program's baseline scenario.

7. Building adequate reserve buffers would increase resilience to shocks and protect macroeconomic stability. Under staff's baseline scenario, Ecuador's GIR position is projected to gradually increase to cover 57 percent of the ARA metric by 2028. Considering additional buffers from the Liquidity Fund, liquidity buffers in 2028 would represent 71 percent of the ARA metric. Projected buffers would rise to 96 percent if financial institutions' NFA are also considered (text figure). This projection hinges on the steadfast implementation of the fiscal consolidation and structural reforms envisaged under the EFF-supported program.



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