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ECUADOR

SELECTED ISSUES

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ECUADOR

SELECTED ISSUES

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Approved By
Western Hemisphere Department

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CONTENTS

RAISING ECUADOR'S GROWTH POTENTIAL IN A POST-PANDEMIC WORLD[1]

Ecuador's pre-COVID potential growth slowed substantially, from about 4 percent during 2001-2014, to just over 1 percent by 2015-2019, constrained by structural bottlenecks. The pandemic rendered a heavy hit to the economy in 2020, which, in the absence of structural reforms, could cause permanent scarring and sluggish potential growth of around 1.5 percent. Structural reforms in labor market, financial sector, external finance, and trade can boost growth up to 4 percent.

A. Introduction

1. Ecuador's potential growth has been low in recent years, and the pandemic dealt a severe blow to the economy. Before the Covid-19 pandemic hit the economy last year, Ecuador had recorded one of the lowest potential growth rates over the period of 2015-2019, at a meagre 1 percent. A combination of factors related to the structural barriers and overvalued exchange rate have contributed to growth underperformance. The pandemic hit when the country was worst prepared to handle a crisis of such magnitude, given low reserve buffers and absence of borrowing space. As a result, the actual GDP collapsed by record 7.8 percent in 2020, pushing unemployment and poverty rates higher up. Many high-contact sectors are yet to recover to pre-pandemic levels, likely indicating fall in their potential output.

2. In the absence of significant structural reforms, there is a risk of significant scarring of potential output, with repercussions on employment and private investment. Episodes of past pandemics suggest potential long-term per capita output loss could be as high as 10 percent in the severest cases, while the average loss was around 7 percent (IMF, 2021). This analysis shows that Ecuador could permanently lose about 6 ½ percent of output relative to pre-pandemic trends, resulting in lower potential growth over the longer term. On the other hand, structural reforms can boost potential growth up to 4 percent. The rest of the note is organized as follows: Section B analyzes Ecuador's pre-pandemic growth performance and summarizes key barriers to higher growth; Section C focuses on the impact of COVID-19; and Section D estimates growth dividends from reforms.

B. Pre-pandemic Growth Performance

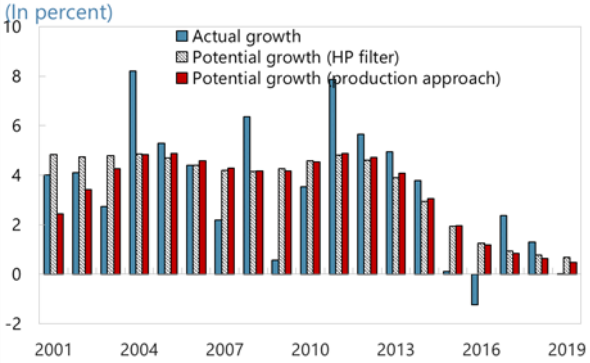
3. Hodrick–Prescott (HP) filter and the production function (PF) approaches were used to estimate potential GDP growth. For the first method, the HP filter was applied to the annual real GDP series. On the other hand, the PF approach utilizes a Cobb- Douglas production function, $Y = A * K^{\propto}(L * H)^{1-\propto}$ where Y is output, K – capital, L – labor, and H—human capital inputs, and A is total factor productivity (TFP), which is calculated as residual. The parameters of the production function and methods to estimate TFP are based on Acevedo (2019). After deriving the components

[1] Prepared by Botir Baltabaev (WHD).

of the GDP, an HP filter was used to smooth the (univariate) time series for labor input (unemployment and participation rate), capital services and TFP. The smoothed estimates of factors inputs and productivity were then used to calculate potential GDP and its growth rate.

4. Potential growth slowed substantially after the 2014 oil price shock. Both estimates of potential growth indicate average potential growth of over 4 percent during 2001-2014. This has collapsed to a meagre 1 percent over 2015-2019. These results are broadly in line with what other studies have found for Ecuador (e.g., Alvarado, 2020).

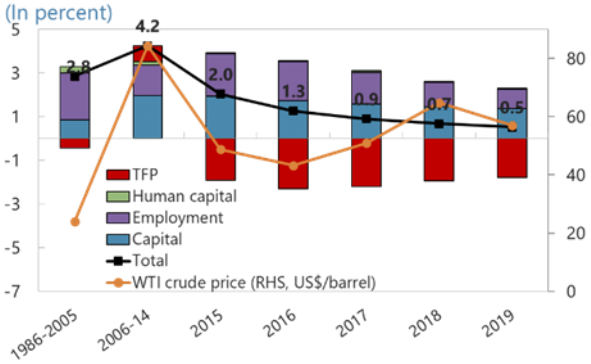
Ecuador: Potential Real GDP Growth Estimates
(In percent)



Source: BCE, Haver Analytics, and IMF staff calculations.

5. The slowdown in potential growth was driven by TFP decline on the supply side. Weak aggregate demand and rigid labor markets implied any hit to factors of production would first take place through TFP decline, with slower subsequent capital accumulation. This indeed occurred in Ecuador, with TFP taking the brunt of the fall over 2015-2019. While the contribution of capital declined modestly, the gradual fall in labor contribution was more tangible. Similar pattern of growth decomposition holds once accounted for the size of the informal economy. There also exists positive correlation between growth/TFP and oil prices, similar to other oil exporting countries (IMF, 2016), as high oil prices helped finance greater public and infrastructure investment with positive spillovers to TFP.

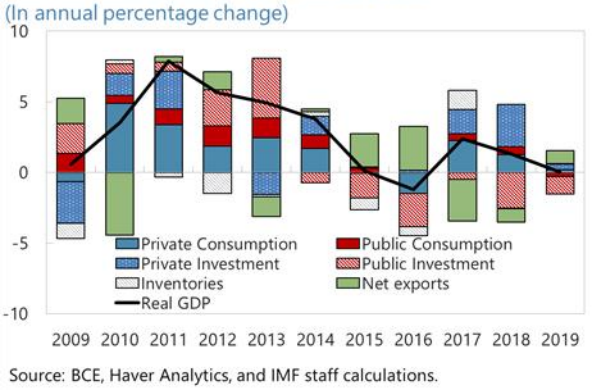
Ecuador: Contributions to Growth and Oil Prices
(In percent)



Source: Haver, BCE, PWT v9.0, and IMF staff calculations.

6. Permanently lower fiscal spending from the demand side also played a role in the slowdown. Faced with the reality of lower oil prices and related lower revenues, government spending, particularly of public investment, adjusted to the new realities. Moreover, structural barriers and low competitiveness stemming from the rigidities in the labor market, difficult business climate and overvalued real exchange rate (Panel Figure 1, top four panel charts), implied that the private demand and net exports could not fill the void left by lower-for-longer public spending. Hence, lackluster demand due to weak public demand was the main factor of pre-pandemic actual growth slowdown, with repercussions on potential growth slowdown.

Ecuador: Contribution to Real GDP Growth
(In annual percentage change)



Source: BCE, Haver Analytics, and IMF staff calculations.

Figure 1. Ecuador: Pre-Pandemic Bottlenecks and Vulnerabilities

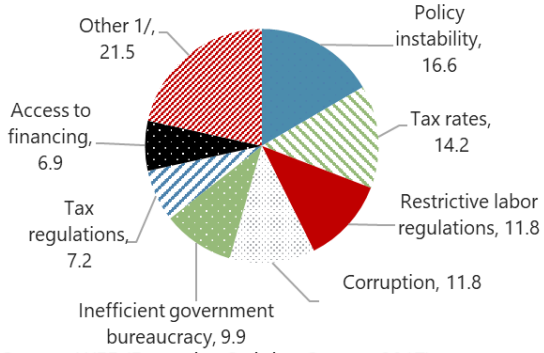
Wages and productivity were misaligned…

Labor Productivity and Wages
(2007=100)

Source: Haver, BCE, and IMF staff calculations.

Rigid labor markets and onerous regulations stifled private sector development…

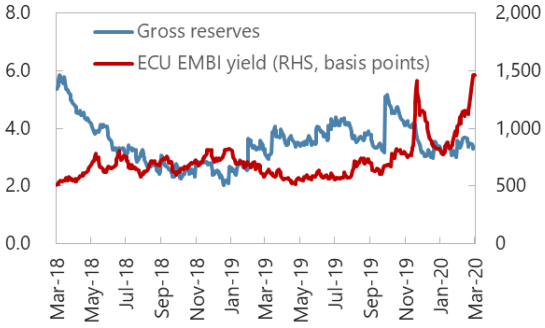
Problems for Doing Business, 2017



Source: WEF (Executive Opinion Survey, 2017).

Pre-pandemic reserve buffers were extremely low, and the market access was lost.

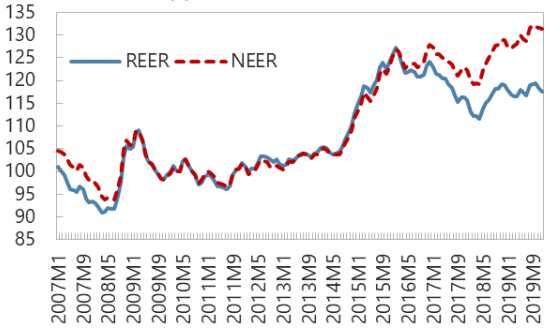
GIR Buffers and Sovereign Yield
(In US$ billions)



Source: BCE and Bloomberg.

…which, coupled with the dollarized regime, eroded external competitiveness.

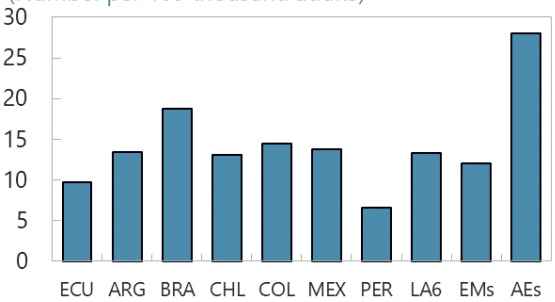
NEER and REER
(2010=100, +=appreciation)



Source: INS Database and IMF staff calculations.

…which was exacerbated by lower access to finance.

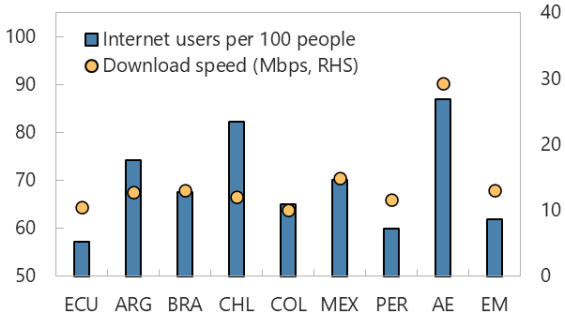
Commercial Bank Branches, 2019
(Number per 100 thousand adults)



Source: IMF Financial Access Survey.
Note: AE=Advanced Economies; EM=Emerging Markets.

While digitalization levels were subpar.

Internet Speed and Usage, 2019

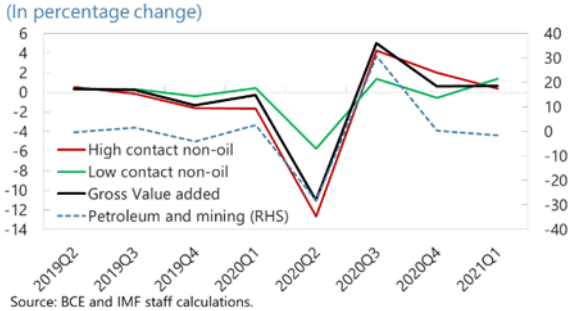


Source: World Bank and IMF staff calculations.
Note: AE = Advanced Economies, EM = Emerging Markets.

C. The Impact of COVID-19 Pandemic

7. The pandemic led to a record contraction of 7.8 percent in actual GDP. Ecuador was ill-prepared for COVID-19 crisis due to the lack of fiscal buffers and absence of adequate digital infrastructure to support the economy during the lockdown (Panel Figure 1, bottom two panel charts). As a result of mobility restrictions to contain the spread of the virus, economic activity fell by 12.8 percent (y-o-y) in 2020:Q2. The drop was led by a sharp decline in high-contact sectors' output, as well as in petroleum output due to an idiosyncratic pipeline damage. Subsequent recovery was muted, especially in 2020:Q4, leading to an overall contraction in 2020 of 7.8 percent.

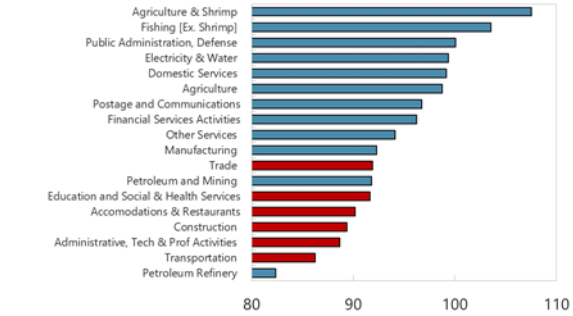
Ecuador: Quarterly Growth 1/
(In percentage change)



Source: BCE and IMF staff calculations.
1/ High contact sectors: construction, trade, hotel, restaurants, transportation, professional services, education and health services. Low contact sectors: agriculture, shrimp, fishing, manufacturing, utilities, communications, finance, public administration, domestic and other services.

8. High-contact service sectors were severely affected. High contact sectors, which accounted for about 43 percent of gross value added pre-pandemic, fell by about 12 ½ percent in 2020:Q2 (q-o-q), driven by sharp drops in transportation, accommodation and restaurant services. As of end-2020, most high-contact sectors failed to recover about 10 percent of their 2019 output. The crisis also led to elevated unemployment in the economy, driven by job losses in high-contact sectors. Even after the recovery in subsequent, unemployment remains elevated, while the quality of jobs is below the adequate levels (see accompanying SIP).

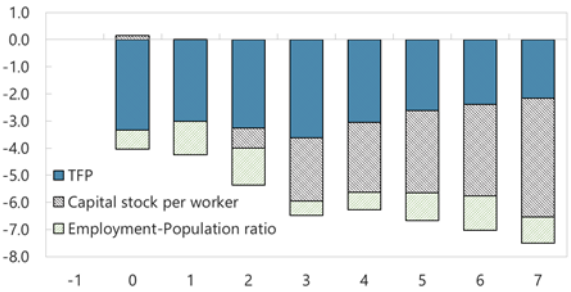
Ecuador: Sectoral Value Added, 2020 1/
(As a share of 2019 level)



Source: BCE, Haver Analytics, and IMF staff calculations.
1/ Red bars indicate high-contact sectors.

9. In the absence of reforms, the COVID-19 crisis could lead to permanent scarring and further reduce potential growth. A prolonged period of unemployment in sectors severely affected by the pandemic can reduce related human capital, while some jobs, firms, and activities could be permanently lost, resulting in permanent unemployment and stranded capital. Moreover, an increased shift towards working from home in services industry could result in stranded physical capital, with repercussions on investment activity. In fact, past pandemics suggest average output loss of over 7 percent compared to pre-pandemic trends (IMF, 2021), driven by capital and TFP losses, at around 4 ½ and 2 percentage points, respectively.

Contribution to Per Capita GDP Loss from Pandemics 1/
(In percentage points)



Source: PWT 10.0, WEO, and IMF staff calculations.
1/ Past pandemics refer to modern era pandemics and epidemics that include: Hong Kung flu, SARS, H1N1, MERS, Ebola, and Zika.

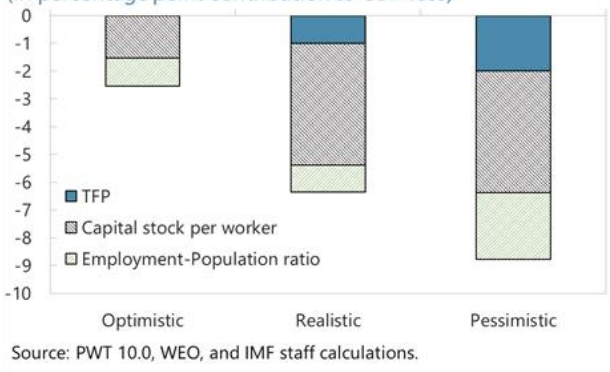
Table 1. Ecuador: Growth Dividend from Structural Reforms
(In percentage points change in Real GDP growth after 5 years)

Studies	IMF, 2015	Biljanovska & Sandri, 2018	IMF, 2019	David et al., 2020
Country samples	EMs	Brazil	EMs and LICs	LA and Caribbean
Labor market	Less than 1	1	0.8	-
Product market	Less than 1	0.6	1	1
Financial sector	1 to 2	1.2	2	2
External Finance	1 to 2	-	1.3	-
Trade Liberalization	Less than 1	0.5	1	3
Governance	Less than 1	0.8	2	-

Table 2. Ecuador: Potential Growth Decomposition Pre-and Post-Covid
(In percentage points change in Real GDP)

	Low-oil 1986 -2005	High oil 2006-14	2015-19	Pre-Covid 2026-2030	Post-Covid 2026-2030	
					No-reform	Reform
Capital	0.8	2	1.6	1.5	1	1.7
Employment	2.2	1.4	1.4	0.9	0.9	1.3
Human capital	0.3	0.2	0.1	0.1	0.1	0.2
TFP	-0.4	0.7	-2	0	-0.5	0.8
Total	**2.8**	**4.2**	**1.1**	**2.5**	**1.5**	**4**

10. Ecuador could lose about 6½ in output relative to pre-pandemic trend. In an optimistic scenario—based on assumptions of no change in TFP, average fall in labor and lowest fall in capital from the past pandemics—permanent loss could only be 2½ percent by 2030. However, given the severity of the pandemic and magnitude of the recession, output loss could realistically reach 6½ percent of pre-pandemic levels. This estimate assumes TFP will be permanently lower by 1 percentage points, while capital and labor loss will be at the average of the past pandemics. In a more pessimistic scenario, the pandemic can cause a permanent loss of about 9 percent over the long-term, as the contributions from TFP and labor will be even lower. Therefore, structural reforms are key to boost potential growth, and ease the impact of the pandemic on output.



Source: PWT 10.0, WEO, and IMF staff calculations.

D. Reform Options to Boost Long-term Growth

11. Previous studies have discovered significant growth dividend from structural reforms. The overall growth dividend from comprehensive structural reforms in Emerging Market economies (EMs) ranges from 1 to 2 percent (Table 1; IMF, 2015; IMF, 2019, Biljanovska & Sandri, 2018; David et al., 2020). The substantial boost comes from reforms in the financial sector— reforms that enhance financial inclusion and reduce cost of intermediation—and external finance—opening up to foreign direct and portfolio investments. The reforms in the labor market—such as, increasing labor market flexibility—and trade liberalization (e.g., reducing of trade barriers, deeper trade integration) bring the next big return. Several papers also cite hefty growth dividends from governance reforms that improve intuitions and policy frameworks.

12. Ecuador undertook significant reforms to restore macroeconomic stability and improve governance. The key achievements include fuel subsidy reform; amendments to the fiscal responsibility law to anchor medium-term fiscal sustainability; amendments to the anti-corruption framework to criminalize corruption; and amendments to the central bank law (COMYF) to restore the central bank autonomy and strengthen dollarization.

13. Analysis of structural barriers to growth indicate significant room for reforms. Constraints due to dollarized regime puts even more emphasis on the importance of structural reforms to increase labor productivity and private investment. As was shown in Panel Figure 1, there exist substantial room to enhance labor market flexibility (see accompanying SIP); increase access to finance, among others, by reducing domestic real interest rates (see accompanying SIP); and further streamline regulations and licenses. There could be additional benefits from integrating into US-linked global value chains and saving fiscal resources to finance infrastructure for digital economy, given the future of work will increasingly be online.

14. The suggested reforms could substantially increase growth relative to the baseline. If most of these reforms are successfully implemented, the long-term potential growth can reach 4 percent. This is 1.5 percentage points higher relative pre-Covid potential growth estimate and is about the average from past reform episodes in other countries. The higher potential growth will be fueled by significantly higher TFP and labor accumulation compared to pre-Covid potential growth, while the contribution of physical and human capital will be comparable to what was observed during 2015-2019. The presumption of higher labor and TFP growth is due to labor market reforms, which make labor more productive and allow firms hire more people. Physical capital, while comparable to 2015-2019, will still be much higher than the previous episodes of lower oil prices, as structural reforms will enable greater private investment and fill the void left by public investment during lower oil price periods. However, if none of these reforms are undertaken, there is risk of falling into mediocre growth rates, in an environment of projected lower oil prices and pandemic scarring.

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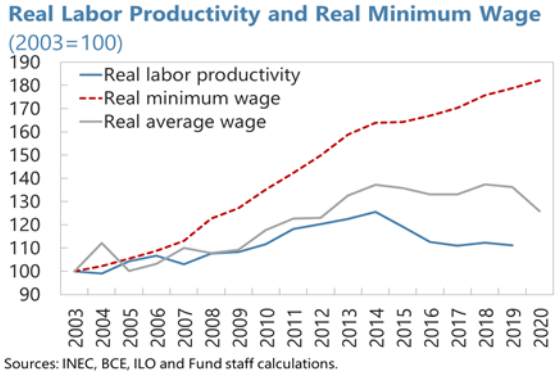
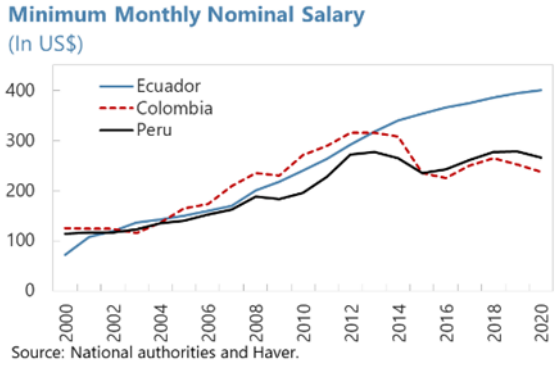
LABOR MARKET DISPARITIES IN TIMES OF COVID-19: EMERGING SCARS AND POLICY OPTIONS[1]

This note documents disparities in labor market outcomes in Ecuador during COVID-19 using quarterly micro labor force survey data from December 2019 to June 2021. We find evidence that the unskilled and minority groups were hit hardest by the pandemic, with unskilled women with young children subject to a double whammy amid school closure. While headline employment numbers have improved one year into the pandemic, the quality of jobs remains weak and the recovery in formal employment timid. The SIP discusses policy options to promote formal employment, level the playing field among labor market participants, and limit pandemic scarring on Ecuador's social and human capital.

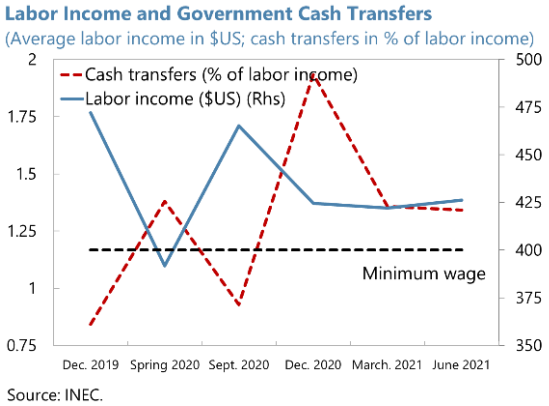
A. Backdrop

1. The Ecuadorian labor market was characterized by high rigidity going into the COVID-19 pandemic. Macroeconomic distortions included a mostly discretionary setting of the minimum wage and the rigid labor arrangements. For instance, the minimum wage has outpaced productivity growth in recent years and is now double the level in Colombia and 75 percent higher than in Peru (text charts).





2. The pandemic widened disparities among labor market participants and compounded pre-existing labor market weaknesses, putting a premium on la *Ley de Oportunidades Laborales* being prepared by the authorities. As of December 2020, the pandemic had pushed an additional 1.5 million Ecuadorians into poverty (compared to December 2019), with about [one] million persons falling into extreme poverty. While the shoring up of cash transfers supplemented household income (text chart), microdata suggests that the pandemic has wiped out many years of progress in reducing labor



[1] Prepared by Constant Lonkeng (WHD)

income inequality in Ecuador. There has also been a wide regional disparity in employment outcomes, with the poverty rate in rural areas double that of urban areas, compounding pre-existing spatial employment vulnerabilities (***SIP on spatial distribution of employment, social protection, and climate vulnerabilities***).

3. This SIP documents systematic disparities in labor market outcomes among Ecuadorians during COVID-19 and explores policy options to limit pandemic scars on the country's social and human capital. Using quarterly vintages of micro labor survey data from December 2019 to June 2021, we make a deep dive into the various facets of the impact of COVID-19 on the labor market in Ecuador. The SIP documents labor market disparities not only at the pandemic trough in the Spring of 2020—as most existing studies have done—but also during the subsequent recovery more than a year into the pandemic. Among other peculiar features of the analysis, the paper examines the extent to which school closure has disproportionately affected labor markets outcomes for persons with young children. Furthermore, a regression analysis is used to assess how systematic the observed patterns are. The note also analyzes the adjustment mechanisms that households have developed to cope with the pandemic. It argues that while those mechanisms have helped contained the impact of the COVID-19 shock on livelihood at a critical juncture, they are resulting in pandemic scars, including persistent informality and low-quality jobs, fueled by pre-existing labor market rigidities. Finally, and more importantly, the SIP explores policy options to reform the labor market and limit COVID-19 scars on the social and human capital of Ecuador, and therefore safeguard the country's growth potential (***see potential growth SIP***).

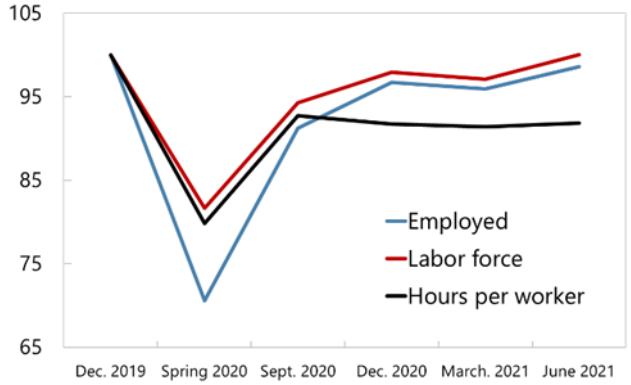
4. More broadly, the note is a contribution to the growing literature on the socio-economic impact of COVID-19 and attendant policies. Existing papers on the micro impact of COVID-19 on the labor market have mostly covered advanced economies (see, e.g., Adams-Prassl et al., 2020, Fabriozio et al., 2020, among others), reflecting micro data constraints in developing countries. Notable exceptions are Al Masri et al. (2020) and Alvarez and Pizzinelli (2021) who use micro data for Brazil and Colombia respectively. Moreover, many of the existing studies have focused on the crisis trough. Our analysis complements existing studies by providing evidence for another developing country and by extending the analysis to the recovery phase, which should ultimately inform policies towards economic *reactivation* in Ecuador, beyond immediate crisis management. This is also one of the few papers that analyze how the presence of young children in households affect the labor market outcomes of parents amid school closure. Moreover, we estimate the determinants of labor income and how they've evolved through the pandemic, controlling for endogenous selection into employment (***see Lonkeng (2021), forthcoming IMF Working Paper, for details***). We are not aware of another study that has implemented this approach in times of COVID-19 and in the context of a developing country.

B. Impact of COVID-19 and Households Adjustment Mechanisms

5. The pandemic has had a devastating impact on the Ecuadorian labor market. Like in many other countries, COVID-19-related supply disruptions led to a massive drop in employment and exits from the labor force in the Spring of 2020 (by about 30 and 20 percent respectively). Since then, aggregate employment numbers and labor force participation have gradually recovered to pre-

pandemic levels (text chart). However, the number of hours worked per employee has plateaued, after the rapid yet partial recovery in 2023:Q3, in line with GDP dynamics. This was due to increased reliance on part-time work as adjustment mechanism to COVID-19, including possibly as economic agents leveraged the flexibility in work arrangements provided by la *Ley Humanitaria* adopted in the wake of the pandemic.

Aggregate Employment, Labor Force and Hours Worked
(Index, Dec. 2019 = 100)



Sources: INEC and author's calculations.

6. A deep dive into micro data suggest that the unskilled and minority groups were hit hardest, with the negative impact persisting through the economic recovery. While employment and labor force participation have gradually recovered to pre-pandemic levels among persons with college education ("high-skilled") after the initial collapse, the recovery has been very partially among the less educated (persons with basic education or less) and minority groups (Figure 1). The persistent employment impact among the unskilled might be partly explained by the fact that they exited the labor force in larger numbers from the crisis onset, further eroding their already limited human capital. Also, sectoral data suggest that wholesale & retail trade and accommodation & food services (all high contact activities) accounted for about 30 percent of women employment prior to the pandemic, suggesting that they were more at risk of losing their jobs during COVID, all else equal, given the aversion to contact. There was a wide regional disparity in activities going into the pandemic, with touristic areas like Galapagos more exposed.

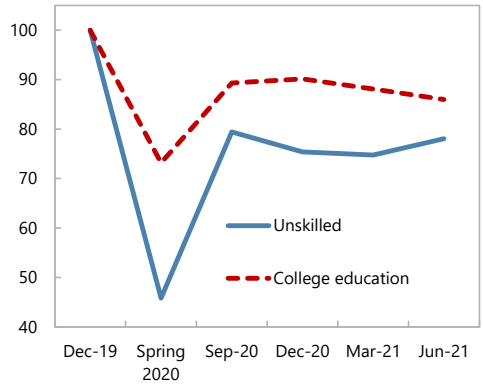
7. Workers with young children reduced market work amid school closure, with unskilled mothers continuing to carry a heavier burden of home-based childcare. We use the information on the structure of households in the labor survey micro datasets to identify children below the age of 12 and trace the impact of their presence on the employment outcomes of their parents, given extended school closure (schools have remained closed in Ecuador through Summer 2021).[2] The presence of children in households during school closure particularly affected the unskilled, with unskilled women bearing the heavier burden of home-based care (Figure 2). There are two points worth noting. First, the stronger adjustment among the unskilled may partly reflect their lower opportunity cost of employment as they earn less from labor (see *Mincer* wage functions in Section V). Second, the left panel chart in Figure 2 together with the middle and right panel charts suggest that women were only disproportionally affected by the presence of children to the extent that they were unskilled, a nuance to the unconditional findings on gender in Fabrizio (2021) based on the U.S. labor market. These peculiar findings for Ecuador have important policy implications (see Section IV).

[2] We constructed a dummy variable ("*children*") that takes the value 1 if there is at least one young child in the household and the value 0 otherwise. This variable is included as control in the regression analysis in Section V.

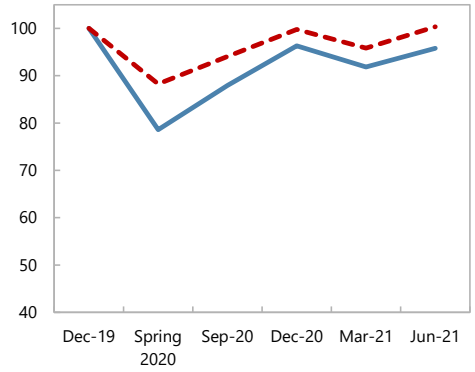
Figure 1. Ecuador: Disparity in Adequate Employment and Labor Force in Times of COVID-19

(Education and ethnicity dimensions, index, Dec. 2019=100)

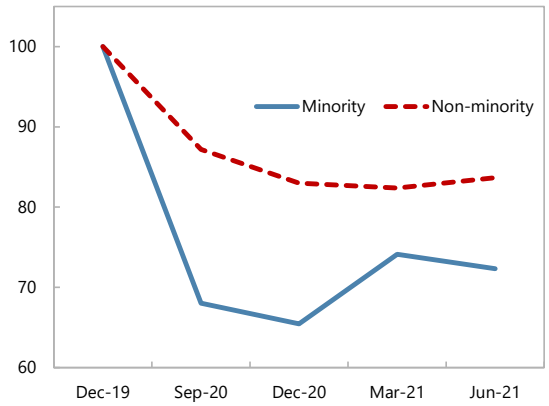
Adequate Employment (Share in the group)



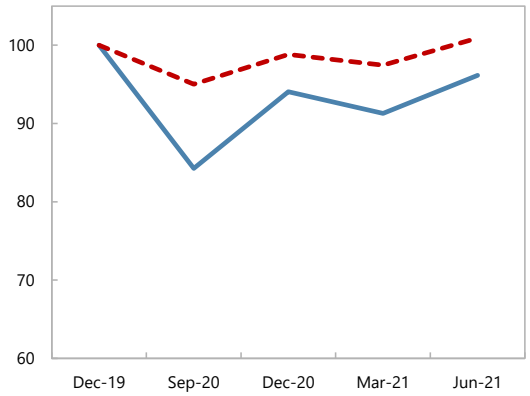
Labor Force Participation (Share in the group)



Adequate Employment [1/], (Share in the group)



Adequate Employment [1/], (Share in the group).



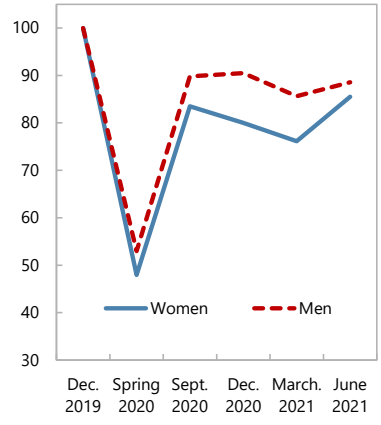
Sources: INEC survey data and author's calculations.

1/The Spring 2020 labor survey did not collect information on ethnicity.

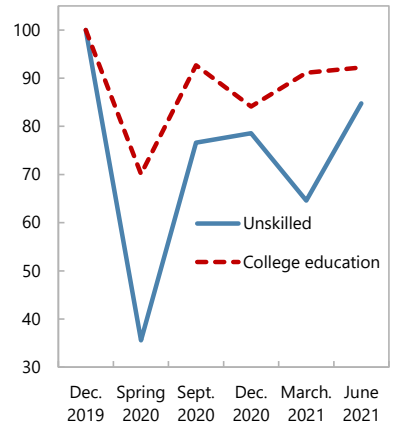
Figure 2. Ecuador: Adjusting to School Closure: Gender and Skill Dimensions

(Index, Dec. 2019=100; Share of full-time workers in each sub-group)

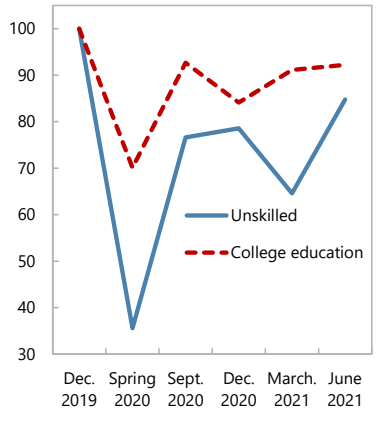
Employment Among All Married with Children: Gender



Employment Among Married Men with Children: Education



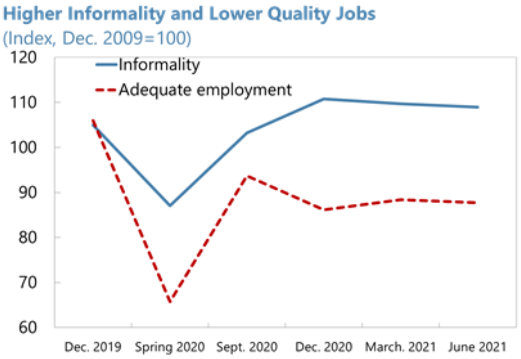
Employment Among Married Women with Children: Education



Sources: INEC labor survey data and author's calculations.

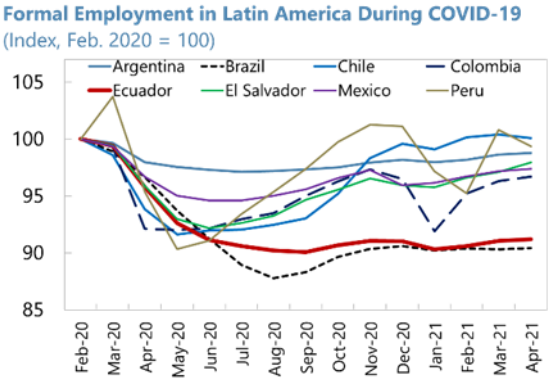
C. A Primer on Pandemic Scars one Year into COVID-19

8. While the endogenous mechanisms developed by households helped cushion the impact of the COVID shock at a critical juncture, they are resulting in persistent informality and weak job quality. While the shoring up of government cash transfers provided much-needed relief to households (text chart), they were not enough to entirely cushion the impact of the pandemic on Ecuadorians.[3] Faced with the dire reality of COVID-19, households—some of which are "hand-to-mouth"—had to develop new ways to generate subsistence income to cope with the new reality and save their families' livelihoods. While these rescue mechanisms helped navigate the crisis in its early stage, informality is persistent and the quality of jobs is weak. The share of adequate employment (full-time job earning at least the minimum wage) indeed remains well-below pre-pandemic levels and the recovery in formal employment has been very timid (text chart).



Sources: INEC and author's calculations.

9. The slow recovery in formal employment after bottoming out in Spring 2020 is a shared feature of the economic recovery across Latin America but is more acute in Ecuador (text chart). Moreover, there might have been a vicious circle whereby rising informality as a mechanism for households to save their families' livelihoods has undermined lives through faster virus spread due to work-related mobility, especially among vulnerable groups.

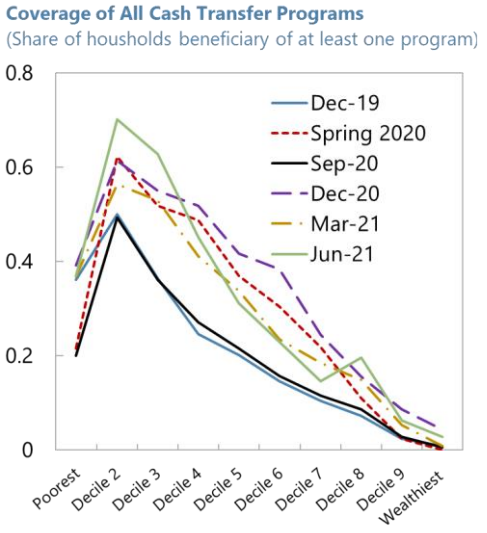


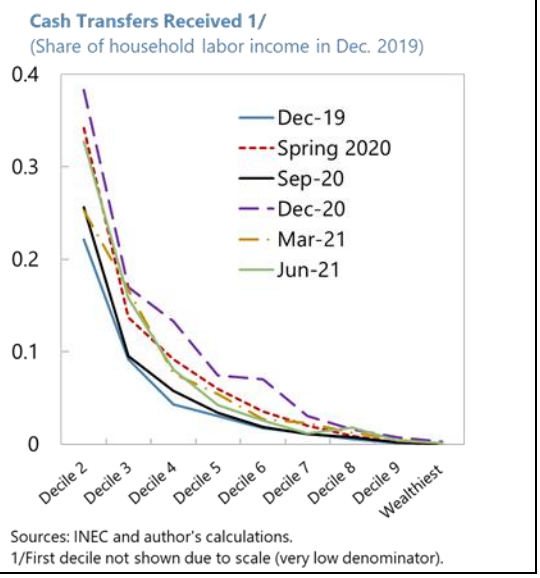
Sources: IESS for Ecuador and COVID-19 Observatorio Laboral (laDB) for others.

10. The expansion of coverage of low-income families under social assistance program and shoring up of payouts mitigated the impact of the COVID-19 shock. The increase in both the extensive margin (coverage) and intensive margin (payouts) of social assistance programs, especially in the Spring of 2020 and December 2020, supplemented household income (Figure 3). There is, however, scope to improve the regional coverage of social assistance programs going forward (*SIP on spatial distribution of employment, social protection, and climate vulnerabilities*). Moroever, going forward, social protection should be complemted with structural labor policies to level the playing field among labor market participants and generate high-quality jobs that benfit all Ecuadorians (see Section VI).

[3] The relaxation of eligibility criteria for unemployment benefits in the wake of the crisis complemented government's cash transfers, but information on those benefits is not available from the labor force surveys used in this note.

Figure 3. Ecuador: Cash Transfers—Coverage and Payouts





D. Policy Implications and Possible Extension

11. The COVID-19 pandemic has made the need to make the labor market more flexible, and ultimately foster the creation of formal jobs, more pressing for Ecuador. Persistent informality in the recovery phase of the pandemic is a source of concern both because of the associated low productivity and the vulnerability of informal sector workers who typically lack access to social security. At the same time, by providing subsistence income to households, the informal sector serves as a cushion against shocks, as evidenced during COVID-19. A viable approach to reducing informality should therefore recognize that informality is an endogenous response to prevailing economic conditions and policy distortions. In this regard, options to limit informality include lowering barriers to formalization, an income tax policy that does not unduly discourage the creation of formal jobs, and the establishing schemes to improve employees-employers matching, including through specialized training. Additionally, the government should adhere to the recently adopted mechanism for setting the minimum wage that ties changes to the minimum wage to macroeconomic parameters such as inflation and productivity to support competitiveness and policy predictability.

12. Tackling the rooted causes of labor market disparities would support the authorities' quest for job-rich growth that benefits all Ecuadorians. The finding that the recovery in employment is translating into weak job quality, especially among minority groups and the unskilled, suggests a rising class of "working poor", calling for continued expansion of coverage of social assistance programs to reach low-income families. From a medium-term perspective, and considering that the unskilled and minority groups have been hit hardest by the pandemic, it would be important to expand education and training to level the playing field among labor market participants and limit pandemic scars on the country's human and social capital.

13. Flexible work arrangements and better childcare options can improve the employment outcomes of parents, especially mothers. The increased reliance on part-time jobs by persons with

young children as adjustment mechanism, if causality is established (¶14), would suggest that there is merit to have flexible work arrangements as adopted in la *Ley Humanitaria* in the wake of the pandemic. Promoting father leave policies could also level the playing field between married mothers and fathers on the labor market. Improving access to market-based childcare when the pandemic wanes could incentivize market work. These measures should be complemented with deliberate effort to promote flexible work arrangements on the employer side and continued income support by the government to vulnerable households while the pandemic lasts.

14. It will be equally critical to continue tracking labor market developments to inform policy in an ongoing basis. This would allow policymakers to assess the changing structure of the economy, identify emerging labor market scars and adjust social protection and labor policies commensurately. Also, an impact evaluation of the labor market measures adopted under la *Ley Humanitaria* would inform labor market reform going forward.

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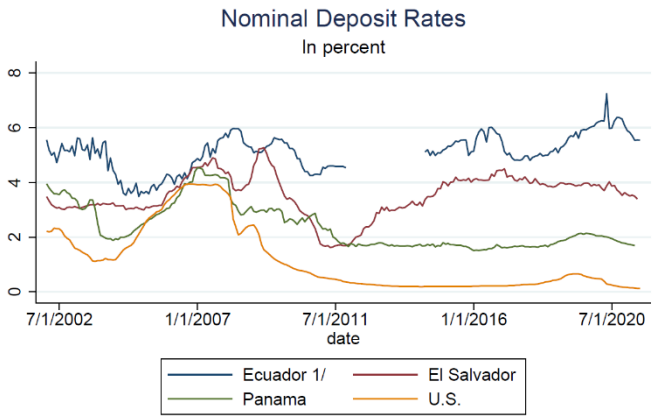
DETERMINANTS OF DEPOSIT RATES IN FULLY DOLLARIZED ECONOMIES: THE CASE OF ECUADOR[1]

A. Introduction

1. This paper aims to shed light on the determinants of interest rates in the dollarized economies of Ecuador, El Salvador, and Panama, with particular focus on the former. Despite the adoption of the US dollar as legal tender, and hence, lack of independent monetary policy, there exists significant dispersion in observed interest rates among these economies. In terms of deposit rates, these three dollarized economies display evident variability, with Ecuador having the highest rate, particularly in recent years. For example, in 2020, the average deposit rate in Ecuador was 6.3 percent, while for El Salvador and Panama they were 3.8 and 1.9 percent, respectively. In addition, given the strong interest Ecuadorian authorities have shown in this subject, particularly on the reasons behind why businesses and consumers face high borrowing rates, this paper will attempt to investigate the determinants of the dispersion in deposit rates. These results should guide the design of policies that could help reduce market-determined interest rates.

2. Regression-based results show that the EMBI yield and capital outflow tax explain the high deposit rates in Ecuador. Moreover, the key factors identified in economic theory and in previous empirical literature -namely the federal funds rate, bank reserves, and inflation- also affect deposit rates. Finally, in the case of Ecuador, there seem to exist additional country-specific structural factors that could have also contributed to high deposit rates.



Source:Haver
1/ From November 2011-April 2014 the Board of Directors of the Central Bank of Ecuador decided not to publish the reference rate.

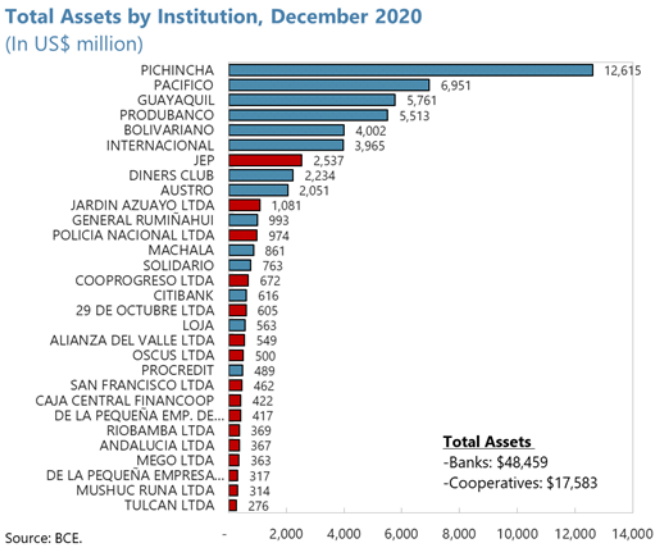
3. Market competition for funds between lower segments of banks and upper segments of cooperatives seems to drive high deposit rates in Ecuador. Cooperatives, some of which are bigger than medium-sized banks, have been paying an average deposit rate of about 2.6 percentage points higher than private banks since 2016[2], while also gaining market share in terms of deposits, from about 24 percent of the market in January 2016 to about 34 percent of market in February 2021[3]. There is no straightforward answer as to why cooperatives have been able to pay higher interest rates: this could be related to different business models, cooperatives' status as not-for profit

[1] Prepared by Pablo Druck (MCM), Botir Baltabaev, Juan Pablo Erraez, and Ivan Burgara (all WHD).

[2] For this paper Banco Pacifico in included as a private bank.

[3] Using data for new deposits of private banks, as defined by the Superintendency of Banks, and Cooperatives-which primarily includes Segments 1 and 2.

institutions, or the fact that cooperatives and banks face different regulatory frameworks. According to market participants, the main competition across the financial sector for depositors is between small- and medium-sized banks and larger cooperatives. In this competitive market, cooperatives' ability to consistently pay higher interest rates could put pressure on banks to increase deposit rates to protect their source of funding.



4. The rest of the paper is organized as follows: Section B discusses the empirical strategy, data, and regression results; Section C focuses on the analysis of the competition for funds between cooperatives and banks in Ecuador; and Section D concludes.

B. Fundamentals of Deposit Rates

Empirical Strategy and Data

5. We use the extended Monti-Klein model of a monopolistic banking system to derive the empirical model (Dermine, 1986). The details of the theoretical and empirical model are discussed in Druck *et al.* (forthcoming), Since the analysis will include cross country panel data, the model for estimation is given by (1):

$$r_{it}^{D} = \beta_0 + \beta_1 r_{it} + \beta_2 r_{it}^{F} + \beta_3 \theta_{it} + X_{it} + \mu_i + \sigma_{it} \qquad (1)$$

where X is a vector of control variables, μ_i are country fixed effects (given by country dummies), and σ_{it} is the idiosyncratic error. Equation (1) will be estimated using pooled OLS regressions. The analysis employs a two-tier approach; the first will focus on a cross-country panel regression comparing Ecuador, El Salvador, and Panama to the United States, while the second focuses on Ecuador specific time-series data.

6. The panel regression analysis uses term-deposit rate data published by the Central Bank of Ecuador (BCE). This rate is the weighted average term-deposit rate of three financial entities: private banks, cooperatives, and mutuals. The other three countries in our sample do not report a similar weighted average term-deposit rate and, due to lack of data, it was not possible to construct one. Therefore, a simple average across term-deposits is used for El Salvador, Panama, and the United States. All the data is in monthly frequency and ranges from 2001-2020, except for the Ecuador term-deposit rates from November 2011-April 2014, when deposit rates remained fixed,[4] data during this period was dropped. The BCE-reported rate included two additional financial entities

[4] During this period the Board of Directors of the Central Bank of Ecuador decided not to publish the reference rate.

-cooperatives and mutuals- that were not included in the other three countries. To make a deeper analysis of deposit rates paid by banks versus those paid by cooperatives we built another database based on monthly data, starting in 2016, of the deposit rates for new deposits, on a month-by-month basis, for institutions in the private bank, cooperative, and mutual sectors. Using this data, a weighted average deposit rate was calculated for private banks, cooperatives, mutuals, and the total financial system (TFS). The description and source of independent variables is discussed in detail in Druck *et al.* (forthcoming).

Results of Regression

7. The EMBI yield is a significant determinant of deposit rates (Table 1). When fixed country effects are considered in a pooled regression, on average a percentage point rise in EMBI yield can lead to about 0.2-0.3 percentage points increase in domestic deposit rates, while the Ecuador-specific result is about 0.1 percentage points. In time-series regression for Ecuador, the impact of EMBI yield is even higher, at around 0.4 percent. The regression results also demonstrate that a one percentage point increase in the capital outflow tax, only relevant for Ecuador, has a similar magnitude of impact to deposits as EMBI yield from the pooled regression. Moreover, the relatively large coefficient in the dummy for Ecuador indicates substantial domestic idiosyncratic factors that explain high deposit rates. In line with the theoretical model and other relevant empirical literature, we find statistically significant impacts from the federal funds rate, inflation, and bank reserves to deposits.

8. Tightening the EMBI spread through fiscal consolidation and gradual removal of the capital outflow tax would help reduce bank funding costs in Ecuador. While fiscal consolidation will benefit the country by ensuring fiscal sustainability and regaining access to private credit markets, it also brings the additional benefit of reducing funding costs for financial intermediaries, as it will compress the EMBI spread and reduce the country risk premium. Ecuador should also consider removing the capital outflow tax, to make the country attractive to capital inflows. However, this should be done in a gradual way, by monitoring the impact of relaxation on capital inflows and outflows, as well as the negative impact on fiscal revenues.

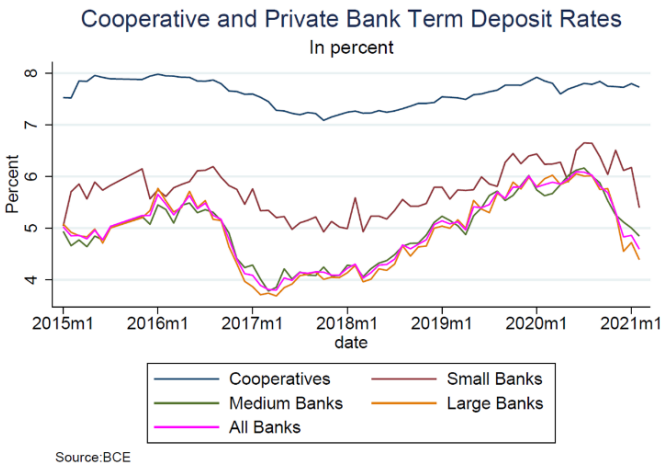
Table 1. Ecuador: OLS Regressions of Deposit Rates

	Dollarized panel (ECU, ELS, PAN, US, 2001-2020)			Ecuador time series (2016-2019)		
	Public data	Public data	Public data	Total calc.	Bank calc.	Coop. calc.
	-1.000	-2.000	-3.000	-4.000	-5.000	-6.000
Economic activity growth	0.114	0.128	0.370	0.428	0.732	0.339
	-0.917	-0.890	-0.688	-0.688	-0.596	-0.432
Fed funds rate	0.494***	0.366***	0.381***	0.315**	0.381**	0.107*
	0.000	0.000	0.000	-0.013	-0.021	-0.086
Inflation	0.036***	0.010	0.017	0.350***	0.490***	0.233***
	-0.002	-0.399	-0.121	-0.001	0.000	0.000
Bank reserves to deposits	0.011***	-0.088***	-0.083***	-0.138***	-0.209***	-0.034
	0.000	0.000	0.000	-0.001	0.000	-0.124
Gross international reserves to imports	0.001***	0.001***	0.001***	0.002*	0.003*	0.001**
	0.000	0.000	0.000	-0.050	-0.053	-0.035
Capital outflow tax[1]	0.281***	0.251***	0.242***			
	0.000	0.000	0.000			
EMBI yield	0.335***	0.195***	0.272***	0.458***	0.617***	0.238***
	0.000	0.000	0.000	-0.002	-0.002	0.000
PAN dummy		-0.121	-0.253***			
		-0.146	-0.005			
ELS dummy		2.697***	2.314***			
		0.000	0.000			
ECU dummy		1.382***	2.191***			
		0.000	0.000			
ECU dummy * EMBI			-0.172***			
			0.000			
EMBI square				-0.021***	-0.028***	-0.011***
				-0.003	-0.003	0.000
Observations	726.000	726.000	726.000	48.000	48.000	48.000
Adjusted R^2	0.830	0.884	0.889	0.647	0.680	0.710

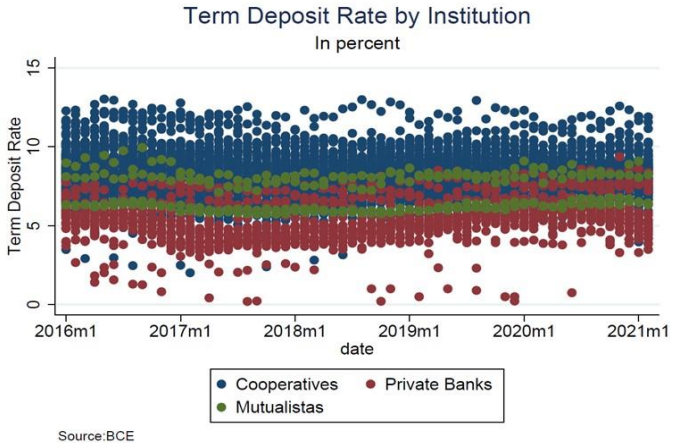
[1] Capital outflow tax only exists in Ecuador since January 2008. For other years and countries, the value is zero. p-values in parentheses * p < 0.10, ** p < 0.05, *** p < 0.01.

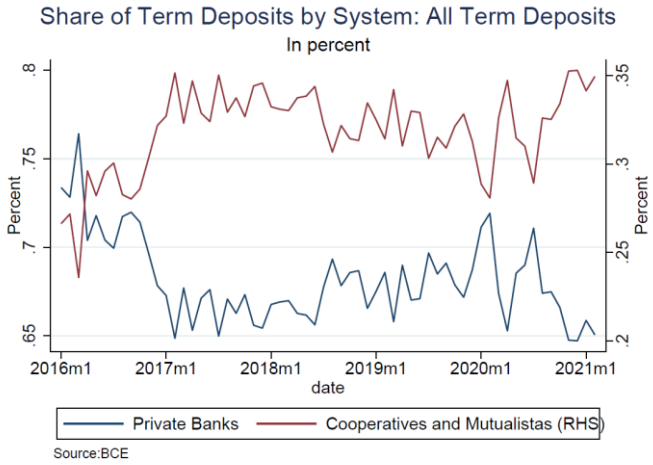
C. Deposit Interest Rates and Market Share

9. The Ecuador financial sector is comprised mainly of private banks and cooperatives. As of July 2021, measured by deposits, banks represented about 72 percent of the financial system, while the cooperative and mutuals sectors represented about 28 percent. Ecuador has two regulatory institutions for the financial system, the Superintendency of Banks (SB) that oversees private and public banks and the Superintendency of Popular and Solidarity Economy (SEPS) that oversees cooperatives and mutuals. In this section we will refer to these two sectors as SB and SEPS.[5]



10. Deposit rates in cooperatives have been higher than deposit rates for banks. Based on data availability (Jan 2016-Feb 2021), cooperatives have been paying higher deposit rates than banks, an average of about 2.6 percent higher during the period. Also, the difference in deposit rates between these two groups of financial institutions widened during 2017-18 and has been widening again since late 2020. These two episodes coincide with increases in market liquidity; during 2017-18 the central bank injected liquidity into the economy while in the latest episode the accumulated liquidity is a side effect of the pandemic. The different behavior between these institutions suggest that banks and cooperatives react differently to liquidity shocks (text chart). Also, data on monthly average deposit rates paid by each financial institution shows that most institutions overseen by SEPS have been paying consistently higher interest rates than banks (text chart).





11. Market share. Measured from the deposit side, and using data only on new deposits done in the respective month, the market share of cooperative has increased to about 34 percent in

[5] This section uses only data classified by SB as private banks and Cooperatives of segments 1 and 2, and for market share measures only consider the information incorporated in the sample as described in the section of data.

February 2021, up from about 24 percent in January 2016 This is an average increase of about 1.6 percent of the market share per year.

12. Loans. While banks serve all types of customers, cooperatives and mutuals serve mostly to microcredit and consumer loans (panel chart).

13. Regulatory framework. The regulatory frameworks are different between the SB and the SEPS. As the following table shows, the regulatory framework for the SPES is more lenient that the regulatory framework for the SB.

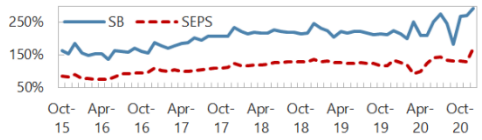
Figure 1. Ecuador: Credit by Economic Segment [1/ 2/]

1/ BP: Private Banks; CO: Cooperatives; MU: Mutuals; TFS: Total Financial System.
2/ Data for November-December 2017 is not available.

14. While more research is needed to understand the reasons behind these developments, closing regulatory gaps for all deposit takers would ensure resilience and a level playing field. The regression-based model suggests that an additional factor explaining high deposit rates could be some structural idiosyncratic features. Several hypotheses could be in play, such as (i) different regulatory frameworks set up by the SB and the SEPS; or (ii) since cooperatives are not-for-profit maximizers, maybe they can afford to pay higher deposit rates. Nevertheless, the cooperative sector has gained substantial market share in recent years and has been growing rapidly, which some market participants attribute to them offering higher deposit rates compared to commercial banks.

The higher interest rates offered by this sector and its rapid growth require the authorities to closely monitor these developments to ensure that these institutions have adequate risk management practices. As cooperatives gain systemic importance in the Ecuadorian financial sector, closing regulatory gaps for all deposit takers is necessary.

Table 2. Ecuador: Comparison of Regulations

		SB	SEPS
Liquidity requirements	Computation for liquidity requirement 1/	Sight deposit at 25 percent, term deposits at 9.5 percent	Sight deposit at 3.75 percent, term deposits at 6.6 percent
	Invest at least 60 percent domestically	Imposes obligations to buy domestic financial assets.	No obligation to invest in domestically financial assets. With deposit in central bank fulfill this obligation.
Reserve Requirements		5% for banks with more than US$1 billion in assets; and 2% for banks with less than US$1 billion in assets.	No regulations for SEPS on reserve requirements.
Liquidity Fund		5% of deposits (before pandemic 8%). As of June 2021 liquidity fund assets are US$2379 million.	2% of deposits (2.5% before pandemic). As of May 2021 liquidity fund assets are US$354 million.
Deposit insurance		0.6%, plus a risk premium between 0.01-0.05%.	0.65% for cooperatives segments 1 and 2; 0.25% segment 3; 0.12% segment 4; and 0.05% for segment 5.
Non-Performing Loans (NPL) 2/		16 days after missed payments	35 days after missed payments
Provisions	Lower provisioning for SEPS		
Capital to risk-weighted assets ratio		9%, for a number of assets weights for the calculation of this ratio are higher for SB than for SEPS.	9% for segments 1 and 2, and lower for the rest.

Sources: SB and SEPS.

1/ Using simple average of accounts included in the regulations.

2/ During the period of the study. Currently, a measure to deal with Pandemic was for the SB and SEPS to extend to 60 days the reclassification to NPL.

D. Conclusion

15. The assessment conducted to shed light on the determinants of interest rates suggest some policy measures that could help to reduce interest rates: As mentioned earlier, the interest rate for Ecuador government bonds and the tax on transfer abroad were found to be determinant factors for deposit interest rates. Hence, a stronger fiscal position that reduces the cost of funding for the government could help reduce deposit rates, as well a reduction in the tax on transfers abroad. Regarding the structural issues, it seems that the competition for funds between cooperatives and banks could be pushing up deposit rates. A comprehensive assessment of this market is needed to understand the reason behind this. Nevertheless, as cooperatives gain systemic importance in the Ecuadorian financial sector, closing regulatory gaps for all deposit takers would ensure resilience and a level playing field.

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ORIGIN, FUNCTIONING AND CONSEQUENCES OF CENTRAL BANK BALANCE SHEET EXPANSION IN ECUADOR[1]

In an economy that is using the US dollar as legal tender such as Ecuador, money creation is in principle impossible. But a series of legislation approved in 2009-2014, allowed an expansion of the Central Bank of Ecuador's (BCE) balance sheet in the 2010s to finance the fiscal deficit, leaving the public sector with large liabilities towards the BCE and low reserve coverage that put the financial system at risk. This note reviews the legal and policy changes that affected the functioning of the BCE and how this institution took part of the financing of the public sector in the 2010s. A stress test analysis is performed to evaluate the liquidity impact of such policies.

A. Mechanism and Illustration of Central Balance Sheet Expansion in Ecuador

1. The Central Bank of Ecuador (BCE) was conceived as a reserve bank when the dollarization system was initially put in place. It is an open debate whether in a fully and officially dollarized system, a central bank is necessary, and whether an entity that enables the clearing of domestic payments and allows transactions with the rest of the world would be sufficient, e.g. this is the case in Panama. The BCE had a ban on granting credit to the public or private sector since March 2000, following the move to official dollarization. A so-called "system of four balances" was established to support the new monetary regime to ensure full coverage of the BCE obligations, since the BCE's role of lender of last resort/money creation disappeared with dollarization. It was based on the principles of risk management to grant confidence in the financial system and the BCE operations, ensuring that BCE's reserves were exceeding bank reserves and public sector deposits (see Box 1).

2. Between 2009 and 2014, a series of legislation were adopted that, in practice, allowed the BCE to finance the fiscal deficit. In December 2009, the BCE Board adopted a resolution that allowed the institution to acquire government bonds from public banks, and therefore increased its holding of public debt. The main objective of this process, called "Domestic Investment", was that those resources be channeled to private companies through productive loans from public banks.[2] This mechanism was reconfigured in 2012, and the transactions assigned to public banks were triangulated directly to the Ministry of Economy and Finance (MEF) to support the budget (see García, 2016). As of September 2014, the government promulgated a new Monetary and Financial

[1] Prepared by Juan Pablo Erraez and Julien Reynaud (WHD).

[2] The Board of Directors of the Central Bank of Ecuador issued Regulation No. 200-2009 on September 24, 2009, creating the Domestic Investment Program with the objective of "... channeling surplus liquidity from the different sources of public savings to the national economy, through public financial institutions and reimbursable financial instruments...".

Code (COMYF)[3] in which this mechanism was legalized and credit operations between the BCE and the MEF were undertaken directly.

Box 1. Ecuador's Original Four Balance Rule

On March 13, 2000, the Law for the Economic Transformation of Ecuador (Ley para la Transformación Económica del Ecuador) was published in the Official Gazette. Article 33 defined the four-balance system backing rule as follows:

The **first balance** consisted of a fraction of the monetary base (M1), which are low denomination coins (1-5-10-25-50 cents). To balance these liabilities, an identical amount of international reserve was to be recorded on the asset side of the balance sheet of the BCE.

The **second balance** consisted of deposits of public and private financial institutions. To balance these liabilities, an identical amount of international reserve was to be recorded on the asset side of the balance sheet of the BCE. The law required that the first two systems always be covered by international reserves for at least 100 percent.

The **third balance** comprised the deposits of the non-financial public sector (NFPS). The system did not require a complete coverage with international reserves.

The **fourth balance** covered the remaining asset and liability accounts of the BCE, including the equity and income accounts. Once the third balance was covered, its remnant was to be added to the assets covering the fourth balance.

3. The following illustrations expose how the BCE balance sheet was expanded:

- Figure 1 represents the initial state in which the central bank is a reserve bank, with a high ratio of liquidity to liabilities, just as the BCE in the early 2000s. Assets include international reserves and non-financial domestic assets. The liabilities side is composed of resources of private and public financial institutions, as well as the deposits of all the entities of the non-financial public sector (NFPS). To complete the balance sheet, there are other liabilities and equity. In this example, the reserve coverage ratio is 75/ (20+10+40) = 107 percent.

- The so-called "Domestic Investment" mechanism was an accounting process where the BCE acquired unmarketable and unfunded securities from the public banks. Therefore, in practice the BCE invested in public banks without its own resources, i.e. with an electronic accounting record. The BCE balance sheet was expanded with the purchase of public bank securities that translated in an increase in central bank liabilities. This process is illustrated in Figure 2. Suppose that the BCE invests 20 in public banks. On the asset side, illiquid domestic financial assets (which are IOU issued by public banks) increase, while on the liability side, public bank resources at the BCE increase by the same amount. The BCE's balance sheet is artificially expanded because if those obligations were to be called, the BCE would have to use cash, i.e. international reserves. The international reserves are still 75, but liabilities are now 90 (20+30+40), therefore the reserve coverage goes down to 83 percent.

[3] https://www.bce.fin.ec/index.php/boletines-de-prensa-archivo/item/696-c%C3%B3digo-%C3%B3rganico-monetario-y-financiero-es-publicado-hoy-en-el-registro-oficial

Figure 1. Ecuador: BCE as a Reserve Bank

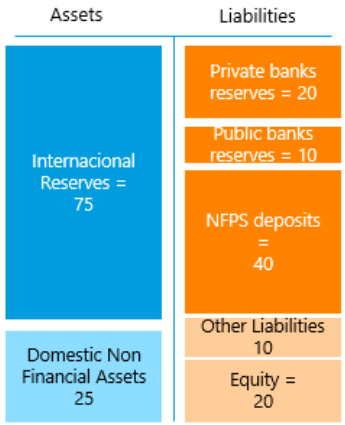
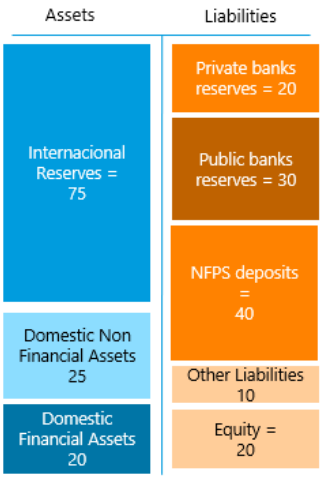
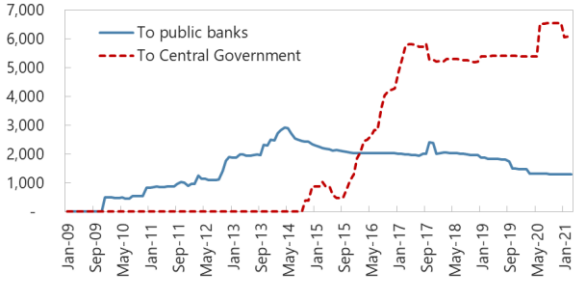


Figure 2. Ecuador: BCE's Balance Sheet Artificially Expanded



4. As illustrated, the mechanism of central bank balance sheet expansion in a dollarized system raises the probability of foreign default as it decreases the reserve coverage ratio. In Ecuador, by 2014, BCE credits to public banks peaked at about 3 percent of GDP (text chart). As of March 2021, the outstanding public banks' debt to the BCE is US$1.3 billion. Given fiscal difficulties following the fall in commodities prices in late 2014, this mechanism grew significantly from October 2015 to May 2017 to reach close to US$7 billion, over 7 percent of GDP. Currently, the Ministry of Economy and Finance owes the BCE approximately US$6 billion.[4]

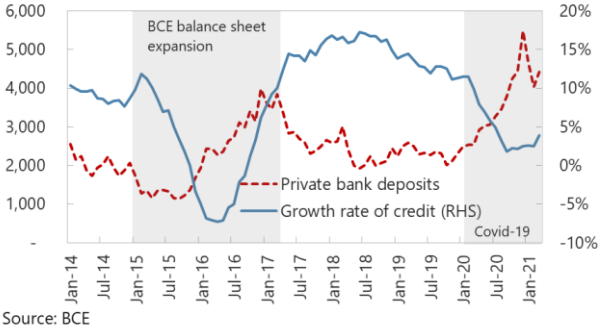
Stock of Credit Granted to Public Banks and Central Government, Jan-2009 to Mar-2021 1/ (In US$ millions)



Source: BCE.
1/ Includes public bank share in "dacion en pago."

5. Since the expansion of central bank balance sheet works as a multiplicator, it raised deposits and ultimately affected the balance of payments, through capital outflows. From the perspective of the balance sheet of the public institutions that were credited by the BCE, there is also an expansion of their balance sheets. Assets increase, since they have more resources at the central bank and translate in public spending that utimately transit to private financial institutions, increasing thereafter there liquid resources at the BCE. These reserves at the BCE have no

Private Banks Deposits at BCE and Growth Rate of Credit to the Private Sector, Jan-2014 to Mar-2021 (In US$ millions)



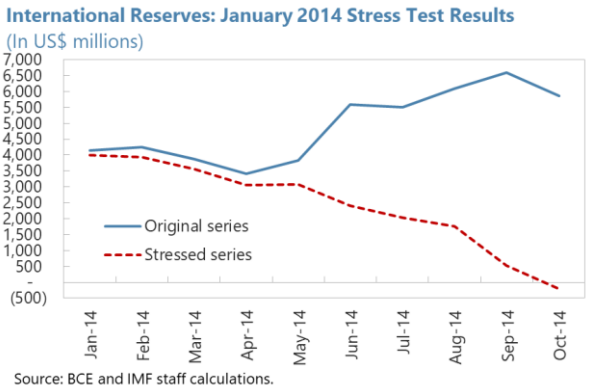
Source: BCE

[4] On June 30, 2021, the MEF and the BCE signed an agreement whereby the MEF bought-back the outstanding debt of public banks at the BCE, clearing legacy assets from the balance sheet of the BCE and increasing its liquidity (https://www.bce.fin.ec/index.php/boletines-de-prensa-archivo/item/1436-el-gobierno-fortalece-la-liquidez-del-banco-central-y-protege-la-dolarizacion).

remuneration and are an opportunity cost for financial institutions. The natural response of banks and cooperatives was to increase the offer of credits (text chart). Following the stiff contraction in 2015 due to the fall in oil prices and the resulting economic contraction, the growth rate of credit to the private sector rebounded from mid-2016 to reach a growth rate of 12%-18% between mid-2017 and mid-2019. Problems can emerge when BCE clients, now with more resources, decide to make payments abroad or demand cash. Since there is no more full coverage of liabilities by international reserves, it creates a liquidity imbalance for the central bank and ultimately put the financial system at risk.

B. Stress Test Analysis

6. A stress test method consists of gauging each month what the reserve coverage would have been without future external public debt disbursements. It is assumed that no new public financing is obtained, but external payments, both public and private, will continue. The objective is to determine the number of months that international reserve can cover without the inflow of new resources from public external debt. It is both a liquidity and a financing stress test since the more the international reserve can cover liabilities without the need for external debt, the more liquid is the central bank to cover its obligations and the less dependent the government becomes on this external source of financing. This can be viewed as a benchmark, such as for example international reserves to months of imports commonly used. This methodology can be illustrated as follows (text chart): In January 2014, it is assumed that no new public external disbursements are received onward. In this circumstance, it would have taken seven months for the international reserves to reach US$2 billion, eight months to reach US$500 million, and reserves would have been exhausted after nine months. This exercise is replicated for each of the 84 months between January 2014 and December 2020.

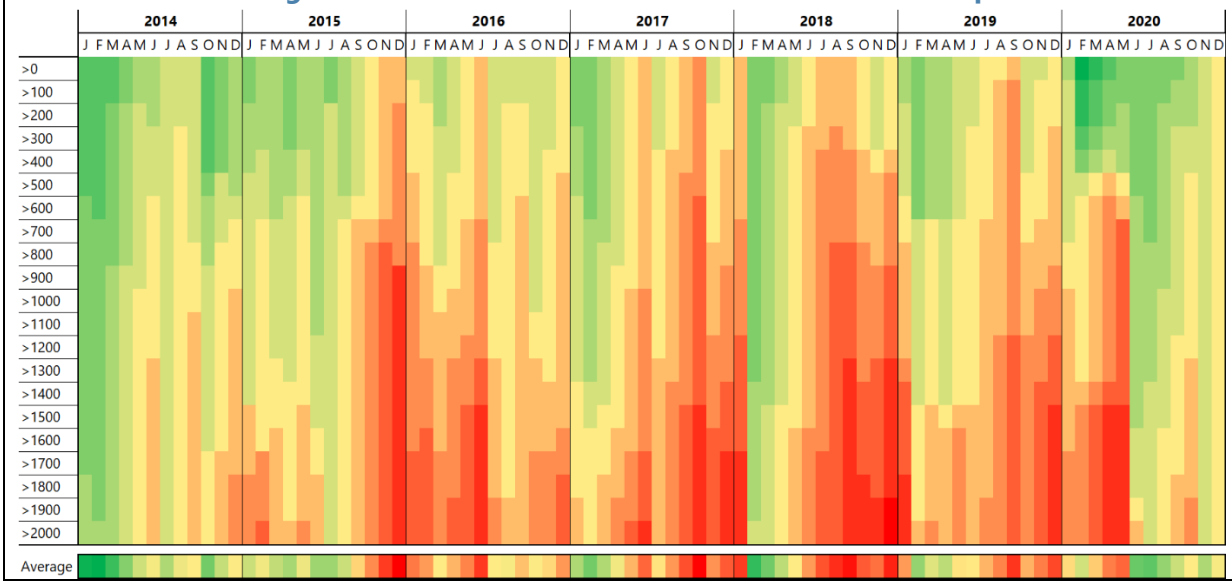


Source: BCE and IMF staff calculations.

7. Our results indicate important liquidity shortages starting end-2015 and exacerbating in 2018, when the Ecuadorian authorities started negotiation on a program with the IMF. Using a heat map, we present results for each of the months from January 2014 through December 2020, arranged in columns. In rows, we present a continuous threshold where we applied the methodology to determine the liquidity pressures at each point in time ranging from zero to US$2 billion. The result is expressed in the number of months that international reserve will take to reach the defined threshold. The values found vary between 2 and 8 months. In other words, there are specific months in which international reserve would have last two months or less without the need of new external debt inflow. The range of colors reflects these results; the greenest color corresponds to values above 8 months, and the reddest values below 2 months. Focusing on the average line at the bottom, very high-risk levels, i.e. below 2 months on coverage, are recorded in 4 of the 84 months of

analysis. In 14 months, international reserves can only withstand three months without new financing. In other words, in 21 percent ((14+4)/84) of instances between 2014 and 2020, the BCE was in a situation where its liquidity horizon was less than three months. Overall, there were very few months in which the BCE had sufficient amount of international reserves, but liquidity pressures were exacerbated in the year 2018, that recorded 7 of the 18 high-liquidity stress episodes.

Figure 3. Ecuador: Results of the Stress Test—Heat Map



C. Conclusion

8. We illustrated how an expansion of the Central Bank of Ecuador's balance sheet put the financial sector, and ultimately the dollarization system, at risk but also put significant stress on the cash position of the public sector. Using a stress test-like methodology, we documented how an expansion of the balance sheet of a central bank in a dollarized economy generated a need for external resources, given the increase in liabilities that could be demanded for foreign payments or cash needs. To solve the liquidity shortages, the Ecuadorian government relied on obtaining external debt through the issuance of sovereign bonds and bilateral loans, and with multilateral organizations more recently. Ultimately, this left the Ministry of Economy and Finance (MEF) with large outstanding obligation towards the BCE that remain a significant legacy, in particular during difficult times.

9. To fortify the institutional foundations of the dollarization system, Ecuador reversed the 2014 amendments to the COMYF in 2021. Amendments to the COMYF were approved by the National Assembly and published in the Official Gazette on May 3, 2021. One of the main objectives of those amendments was to prohibit all future quasi-fiscal activities of the BCE as well as direct and indirect lending to the government or public sector (including loans, advances, guarantees or transactions that indirectly support lending operations of the public sector). Additionally, the law seeks to strengthen the central bank's autonomy and governance arrangements and to strengthen

the central bank's financial stability oversight function. Ultimately, the law seeks to achieve full coverage of liabilities with international reserves by 2035, a return to the so-called "four balances".

10. IMF technical staff team is working together with the authorities of the BCE to ensure the financial balances are in line with international financial standards (IFRS). The unmarketable and unfunded securities (IOU's) received from the public banks and Central Government would likely have been significantly lower in value upon origination in fair-value terms. This reduction in value on origination would have either: (i) reduced the BCE's ability to invest as much in the public banks or Central Government; or (ii) the BCE would have had to record a loss on origination, which would have eroded the BCE's equity. The application of international recognized accounting standards would have made the risks more apparent, potentially reducing the motivation to have undertaken them in the first place.

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NATURAL DISASTERS, CLIMATE-RELATED PHYSICAL AND TRANSITION RISKS IN ECUADOR[1]

Ecuador faces significant climate-related physical and transition risks, as well as natural disaster risks, which may result in considerable economic and social losses. Despite having low per capita greenhouse gas emissions, Ecuador has acted to reduce emissions and to announce policies to reduce emissions further. The country also faces a risk in the global transition to a low-carbon economy and moving away from oil, which will lower oil revenues in the medium- and long-term. This paper overviews the current landscape, the recent developments, the institutional setup, and examines the challenges ahead. It also provides policy recommendations for enhancing the policy framework.

A. The Current Landscape

1. Ecuador is subject to natural disasters and climate-related risks. Natural disasters may be climate (e.g. flooding) and/or non-climate related (e.g. earthquakes or volcanic activity). Both may result in significant economic and social losses, as well as in increasing fiscal pressures. Data from the EM-DAT database, compiled and maintained by the Centre for Research on the Epidemiology of Disasters, shows that Ecuador experienced 42 natural disaster episodes between 2000 and 2020 (Table 1). Most of them are related to flooding (19 events) and volcanic activity (10 events). Landslides (6 events) and earthquakes (5 events)[2] are also common in the country. The frequency of these events is high, as there have been on average 2 events recorded per year. A similar pattern is present throughout the recent history of Ecuador (Figure 1). The 2021 INFORM Global Risk Index rates the disaster risk of Ecuador as "medium" and ranks the country 76 out of 191 in terms of riskiness. However, the index shows very high risk of an earthquake (9.8 out of 10 in terms of riskiness), a tsunami (9.2 out of 10) and high risk of a flood (6.7 out of 10).

Table 1. Ecuador: Natural Disasters Since 2000 and their Frequency

	Number of Episodes Since 2000
Earthquake	5
Flood	19
Landslide	6
Volcanic Activity	10
Drought	2
Total	**42**

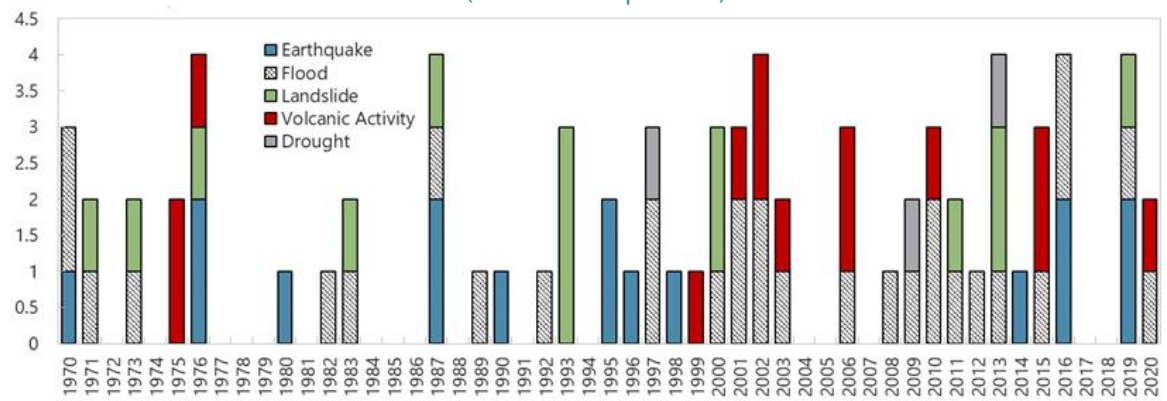
Source: EM-DAT Database.

2. The economic, social, and environmental costs associated with climate-related events are significant (Box 1). Extreme weather-related events affect key economic sectors such as fisheries, which produces shrimps - one of the key exports, and agriculture. Moreover, part of the exposure to climate change reflects the geography of the country, which has extensive and populated coastal lines that host the main trading hub, the port of Guayaquil.

[1] Prepared by Matteo F. Ghilardi (WHD)

[2] The database reports the most significant earthquakes. The number of events would be significantly higher if minor events were included.

Figure 1. Ecuador: Natural Disasters in Ecuador
(number of episodes)



Source EM-DAT database.

3. Ecuador's emissions per capita of greenhouse gases are lower than most Latin American countries. In per capita terms, according to the World Resources Institute, Ecuador produced 5.4 metric tons equivalent of gases in 2017, placing the country as the 95th emitter among the 193 countries in the database. Emission levels are particularly high in the Energy sectors and in the land use change and forestry. Other sectors, such as agriculture, waste and industry do not produce significantly high levels of greenhouse gas emissions. The level of emissions increased only marginally since 2000. Among countries in the region, Ecuador produces a relative low amount of emissions (Table 2).

Table 2. Ecuador: Greenhouse Gas Emissions-Per Capita

	Emissions (in tCO2e per capita)	World Ranking	Average Emissions of Top 5 Countries (in tCO2e per capita)	Average Emissions of Top 10 Countries (in tCO2e per capita)	Average Emissions of Selected LatAm Countries (in tCO2e) 1/
Total	**5.4**	**95**	**41.7**	**33.5**	**7.4**
Agriculture	0.8	77	7.6	5.8	2.3
Energy	2.2	109	28.1	22.6	3.2
Industrial Processes	0.2	112	3.3	2.5	0.3
Land-Use Change and Forestry	1.6	29	27.8	17.3	1.3
Waste	0.2	115	7.6	4.5	0.4

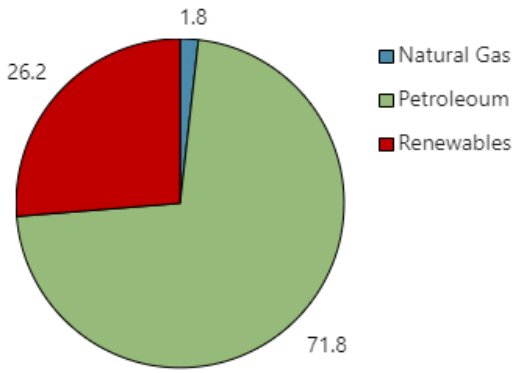
Source: World Resource Institute.
1/ The sample includes Brazil, Mexico, Argentina, Venezuela, Colombia, Peru, Bolivia, Chile, and Uruguay.

4. Ecuador is an oil producer, heavily dependent on oil revenues and faces transition risks from moving away from fossil fuels. At the end of 2019, the oil sector accounted for about 6 percent of total GDP and about 26 percent of total exports. At about US$7.8 billion in net terms, oil revenues represented about 21.7 percent of total revenues. Current oil reserves amount to 8.3 billion barrels. Assuming constant production at 2020 levels, oil production is assured for at most the next 45 years, implying a transition risk in the next few decades. In addition, the oil sector suffers from a

low domestic refining capacity, which limits oil revenues, and an old pipeline infrastructure, which limits export's capacity.

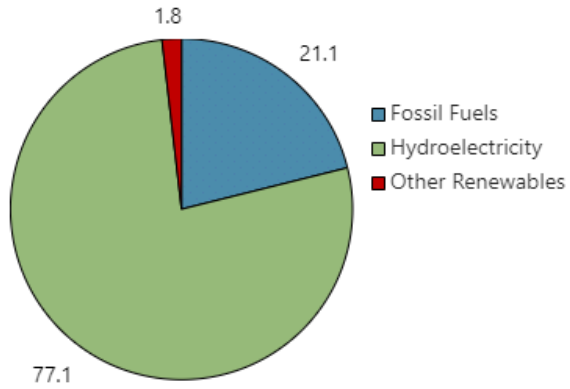
5. While most of the production of electricity comes from renewable sources, the consumption of energy from renewables is lagging. Renewable energy consumption accounts for about 26 percent of the total. The country does not consume energy from coal or nuclear energy. Most electricity production comes from renewables, especially from hydroelectricity. However, hydroelectricity production is subject to rainfall and climate events (e.g. el Niño). Other renewable production sources (e.g. wind, solar) are not well developed and there are no long-term plans to invest in the sector.

Figure 2. Ecuador: Primary Energy Consumption by Fuel
(in percent)



Source: U.S. Energy Information Administration

Figure 3. Ecuador: Electricity Generation
(in percent)



Source: U.S. Energy Information Administration

B. Institutional Setup and Current Policies

6. Ecuador was the first country in the world to include ecosystem rights in the constitution. The "rights of nature" are recognized in Article 10 and Article 71-74, which: (i) protect the ecosystem rights to exist and flourish; (ii) give people the authority to petition on the behalf of nature; and (iii) require the government to remedy violations of these rights. They also prohibit the extraction of non-renewable resources in protected areas and state that the production of monocultures should be avoided. In addition, Article 389 establishes that the State will protect people, communities, and nature in the face of the negative effects of disasters through risk prevention and disaster mitigation. According to Article 414, the State must adopt adequate and transversal measures for the mitigation of climate change, by limiting the emissions of greenhouse gases, deforestation, and air pollution.

7. In addition, Ecuador has taken further legislative actions to facilitate climate change adaptation and mitigation. With decree n. 1815 (2009), climate change adaptation and mitigation were recognized as state policies. In addition, the decree sets the definitions and the guidelines of climate change adaptation and mitigation, and mandates the implementations of three further plans:

(i) the National Plan for the Creation and Strengthening of Institutional Conditions; (ii) the climate Change Mitigation Plan; (iii) The Climate Change Adaptation Plan. The Decree also resulted in the adoption of the National Strategy on Climate Change strategy in 2012, which establishes the strategic and institutional pillars for future climate change plans.

8. Ecuador signed the Paris agreement in 2016, ratified it in 2017, and set the Nationally Determined Contributions (NDC) targets in 2019. The NDC was the result of a multi-stakeholders, participatory process. It focuses on five sectors for mitigation (energy, waste, industrial processes, agriculture, and land use) and six for adaptation (agriculture, health, human settlements, food safety, water, and natural heritage), with each led by the responsible line ministry. Ecuador set an unconditional GHG reduction target of 9 percent from business-as-usual (BAU) by 2025 and a conditional reduction target of 20.9 percent from BAU by 2025 in the energy sector. The conditional target is subject to availability of resources and support by the international community.

9. The recently enacted subsidies reform represents a crucial step towards reducing greenhouse gases. In May 2020, the authorities introduced a significant reform aimed at reducing gasoline and diesel subsidies. The reform introduced a formula-based pricing mechanism for diesel and gasoline that links domestic retail prices to supply costs, where monthly changes are capped to prevent large swings in retail prices. Besides generating long lasting fiscal savings, this mechanism will encourage a more efficient energy use, reduce the depletion of natural resources, and help preserve the environment.

C. The Road Ahead and Recommended Policy Actions

10. Climate-related disasters are expected to intensify in the coming years with the raising of temperatures and generate significant cross-sectional losses. In a no-change in policies scenario at global level, the World Bank (2009) estimates that temperatures in Ecuador will increase by about 2ºC by the end of the century, implying a higher frequency and severity of climate-related disaster events. Key sectors such as agriculture, fishery, forestry, and livestock are expected to be the ones more exposed to these changes. In addition, agriculture would suffer from the high rates of deforestation, while the energy sector is also expected to have threats from changes in precipitation patterns.

11. Despite the recent efforts, Ecuador is not well placed to respond timely to natural disasters and to the effects of climate change. The strategy "financing of climate", published in 2021, outlines the steps for green financing and represents a significant step towards defining a comprehensive financing strategy. However, relatively low reserves, together with high borrowing costs for external loans, hinder the timely response to natural events. In addition, climate change calls for significant investments, which are needed in the medium- and long-term to build efficient infrastructure and to protect key sectors from the adverse impact of climate shocks.

12. The oil sector may not generate the same level of revenues in the medium- and long-term. Oil reserves have a finite lifespan, currently estimated in about 45 years. In addition, changes in global demand stemming from increasing production of electric vehicles can lower demand of oil

products. This would eventually shorten the lifecycle of oil fields. Furthermore, oil prices could settle at unsustainable levels. According to the International Energy Agency, oil prices could drop to around USD 35/barrel by 2030 and then drift down slowly towards USD 25/barrel by 2050 in a zero net emissions scenario. The combined effect would be a negative oil balance, implying that the oil sector could become a liability.

13. Given the increase in risks posed by natural disasters, climate change, and the perspective changes in the oil sector, Ecuador should scale-up its policy efforts. The following policy steps should be considered:

- *Implement the policies in the national climate change strategy*. The strategy considers mitigation and adaptation policies and clearly sets objectives and guidelines to meet them. The objectives are outlined at the sectoral level with a precise timeline (end-2025). However, implementation is lagging and there is no further report on the progress towards meeting those objectives. A roadmap for meeting those objectives should be published as early as possible, together with a strategy for the longer-term.

- *Maintain the commitments in the Nationally Determined Contributions (NDC) targets and implement policies to promote them*. The NDC strategy is an important step towards a greener economy. Given the current levels of emission, Ecuador is on track to meet its 2025 target. The strategy to reduce GHG emissions envisions policies at the sectoral level, which should be implemented as early as possible to allow for a gradual transition.

- *Maintain the decree on fuel subsidies*. The recently introduced mechanism encourages a more efficient energy use. As it expected to lower greenhouse gases emission, it is akin to a carbon tax, and it is an important structural reform for greener economic developments in Ecuador. In addition, it increases revenues for the budget, which could be used for additional green investments.

- *Identify "crown jewels" and promote investment to preserve them*. These are key sectors for growth and exports (e.g. production of shrimps and agricultural products), which should be particularly ringfenced from natural disasters and climate change. The investment should preserve these sectors from potential losses and maintain employment.

- *Save additional oil revenues with a clear governance structure on investment and use, together with implementing policies, to increase non-oil revenues*. The increase in non-oil revenues would allow for a higher non-oil primary balance and a significant increase in deposits and reserves. These savings could then be used in the medium- and long- term to finance the investment needs, have buffers to protect the country from adverse natural disaster and lower the reliance on expensive financing.

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SAVINGS AND INVESMENT DYNAMICS AND CLIMATE CHANGE[1]

Climate change could potentially impact Ecuador's savings and investment balance through physical risks to capital, a potential transition away from fossil fuels, or the need to invest for climate change adaptation and mitigation. Although data limitations and uncertainties prevent a full quantitative assessment of this impact, illustrative applications of standard external sector assessment models can provide a useful framework for considering the potential implications of climate change. Additional data, such as costing of climate change adaptation and mitigation plans will be key to determining how climate change will impact the optimal savings and investment mix. Further, since climate change is a global phenomenon, such an assessment would need to be done for all countries to ensure multilateral consistency.

A. Introduction

1. Climate change may impact Ecuador's sustainable savings and investment balance. Physical risks from climate change (e.g. more frequent natural disasters), transitional risks from a shift away from fossil fuels, or large investment needs to adapt and mitigate climate change may all impact the savings and investment balance to varying degrees. While research on the external sector and climate change has been mostly limited to the direct impact on trade, consideration of the impact on the savings and investment balance can shed light on implications for climate change on macroeconomic sustainability. It also highlights the importance of climate change as a macro-critical issue.

2. Although data limitations and several uncertainties prevent a full, multilaterally consistent, quantitative assessment, illustrative applications of standard models provide a framework for considering how climate change might impact the savings and investment balance. Additional data, such as costing of climate change adaptation and mitigation plans, for both Ecuador and globally, would be critical for determining the optimal savings and investment mix in a multilaterally consistent way. However, this SIP uses illustrative applications of standard External Balance Assessment (EBA) models as a framework for considering how climate change might affect Ecuador's current account norm

Physical Risks

3. Climate change presents the physical risk of damage to capital both from increased exposure to natural disasters or more gradual impacts of global warming.[2] Theoretically, the

[1] Prepared by Deirdre Daly (SPR).

[2] Physical risks may not be limited to those directly impacting the country. For example, in a study on cross-border spillovers of physical climate risks through international trade and supply chain linkages finds that foreign climatic disasters in major trading partner countries lower the home-country stock market valuation for the aggregate market and for the tradable sectors. Exposures to foreign long-term climate change risks also reduce the asset price valuations of the tradable sectors at home (Feng and Li, 2021).

overall impact of natural disasters on the current account (CA) is somewhat ambiguous.[3] On the one hand, the associated destruction of wealth can negatively affect consumption, while a lower present value of income may deter investment. On the other hand, the damage in physical capital may lead to an increase in investment in the aftermath of natural disasters. These dynamics may also be affected by the degree of financial openness with a higher degree of openness allowing countries to smooth shocks to maintain consumption. Empirically, Rasmusen (2004) and Laframboise and Loko (2012) find that CAs worsened in the wake of natural disasters, while Prati et al. (2011) found that natural disasters raise the CA in countries with low financial openness, and reduce it in countries with high financial openness as such openness can enable countries to smooth consumption in response to the shock and rebuild productive capacity. Although so far there is limited empirical analysis on the impact of gradual global warming on savings and investment balance, related uncertainties and the potential for losses in productivity could also deter investment.

4. Natural disasters may call for precautionary savings. The CA in the EBA-Lite framework includes a dummy variable based on historical economic damages for natural disasters (relative to other countries to ensure multilateral consistency), and the sign of the effect on the CA depends on the degree of financial account openness the degree of financial account openness. However, climate change may necessitate additional precautionary savings than implied by this adjustor based on historical data if natural disasters become more recurrent or more severe.

5. While physical risks related to climate change have been identified for Ecuador, estimating additional required precautionary savings is subject to uncertainty and would also need to factor in multilateral considerations. According to the 2019 Norte Dame Global Adaptation Initiative (ND-GAIN) Index, which measures a country's exposure, sensitivity, and capacity to adapt to the impacts of climate change, Ecuador registered a higher vulnerability score at 0.44 compared with the average for LA6 countries of 0.41.[4] A geospatial analysis on climate change risks based on countries' latitudes found that Ecuador is susceptible to large potential increases in heat and humidity related to climate change (McKinsey, 2020). The study identified high risks for Ecuador in terms of the share of the capital stock vulnerable to flooding and the share of outdoor working hours affected by extreme heat. That said, projecting the full physical impact of climate change in Ecuador is particularly challenging, given its varying topography and climate conditions (Chimborazo and Vuille, 2021). For example, some suggest the possibility for more droughts or more flooding in Ecuador depending on the region and time of year (Campozano et al., 2020). In addition, investments in disaster resilient capital could mitigate the need for some precautionary savings as discussed below.

Transitional Risks

6. Climate change may also present a transitional risk if there is an earlier than anticipated global shift away from fossil fuels. Oil exports made up 34 percent of Ecuador's

[3] See also the discussion on natural disaster shocks in The Revised EBA Lite Methodology (IMF, 2019b).

[4] Ecuador most vulnerable indicators included the projected impact of climate change on cereal yields (rice, wheat, and maize) and dam storage capacity.

export base on average over 2016-20. The consumption-based module in the EBA-Lite framework used to derive a medium-term current account norm assumes that Ecuador can use its entire proven reserve base (around 8.3 billion barrels or 45 years of production). A decline in global fossil fuel demand during this period (for example as countries aim to meet commitment emissions reductions) could result in stranded oil assets that can no longer be extracted on a commercial basis. However, the supply and price response of a global transition away from fossil fuels. complicates estimating the impact of potential transition. For example, oil producers may have incentives to accelerate production where feasible ahead of a transition and declining investment in oil fields could contribute to price increases (IMF, 2019b). Applying a simple sensitivity analysis to the consumption-based model for Ecuador, holding prices and production constant, suggests that for a 10 percent reduction in the reserve base (around 4 years of production) would increase the current account norm by 0.1 percentage points of GDP.

7. Financial and real diversification would serve as important mitigating factors for transition risks. Financial diversification could involve investing any oil export surpluses in low-carbon assets (e.g. through a well-governed sovereign wealth fund). Real diversification would involve developing non-oil sectors of the economy, including through broader efforts to boost competitiveness.

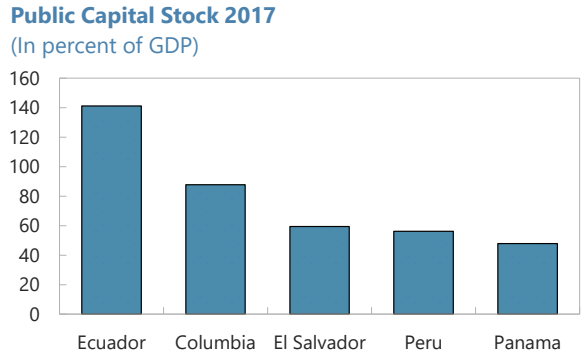
Investment Needs

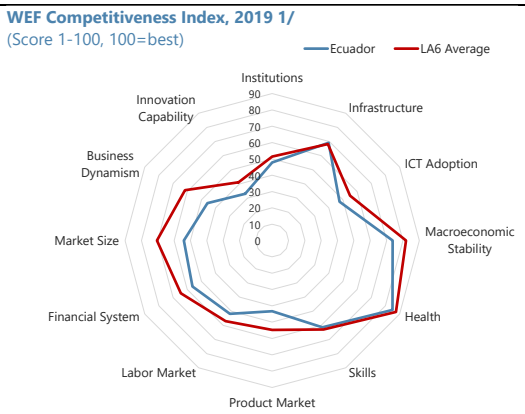
8. Climate change could present additional investment needs to support climate change adaptation and mitigation. If such investments enhance productivity or ensure economic sustainability, a lower current account norm might be warranted. While the EBA-Lite consumption-based module does not consider the possibility of allocating resource wealth to finance productive investment, the EBA-Lite Investment Needs model aims to account for this. It draws on the idea that capital scarcity would lead to a higher marginal product of capital. If the marginal product of capital is higher than the cost of borrowing, it would be optimal to use resource windfalls to finance investment.

9. Investment needs have not typically been a determining factor in Ecuador's external sector assessment given its relatively high capital stock. IMF estimates of the stock of public capital show that Ecuador ranks relatively high compared with its peers. Survey-based competitiveness indicators like the WEF Global Competitiveness indicator also suggest that infrastructure is one of the few areas where Ecuador does not lag peers. However, climate change could present additional investment needs for adaptation or mitigation. Ecuador's relative susceptibility to climate related disruptions suggests adaptation needs, and Ecuador has made specific mitigation commitments under the Paris Agreement to reduce emissions by 9 percent (or 21 percent conditional on support of the international community) (See Section V).

10. An application of the investment needs model to Ecuador, suggests a significantly lower current account norm. A critical assumption of the model is the efficiency of public investment, with higher levels of public investment efficiency translating into more productive capital and thus lower current account norms. Applying the baseline oil reserve and production

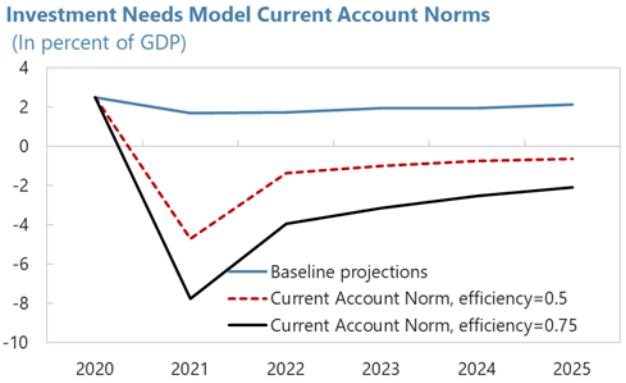
assumptions[5] and a 50 or 75 percent public investment efficiency assumption,[6] would generate medium term current account norms of -0.6 percent of GDP and -2.1 percent of GDP respectively.





Sources: IMF Public Capital Stock Database. World Economic Forum Global Competitiveness Index
1/ The World Economic Forum's Global Competitiveness Index combines official data and survey responses from business executives on several dimensions of competitiveness

11. However, a key limitation to applying the investment needs model to assess the impact of climate change is that the productive returns from adaptive or mitigation capital may differ from traditional capital. Investment in climate adaptation may not necessarily be productive since it may only involve protecting or repairing existing capital from climate-related losses rather than contributing to higher output. In fact, some have argued that investment in adaptive capital could lead to lower output growth since fewer resources would be available for productive capital, continuous adjustments in the capital stock to adapt may lead to lower capital efficiency, and shifting more investment to repairing or replacing capital may involve less innovation and technology transfer (Batten, 2018; Fankhauser et al., 1999; Pindyck, 2013). Other models like the IMF's Debt-Investment-Growth Natural Disasters (DIG-ND) model have attempted to model climate adaptive investments more directly, by incorporating investment in 'resilient' capital that would reduce the rate of capital depreciation and simulating natural disaster shocks. However, these applications of this model have typically involved small economies where the size of the natural shock is considerable.[7] Meanwhile, investment in climate



Source: IMF staff calculations.

[5] Both the standard consumption-based allocation model and the application of the investment needs model use conservative assumptions about oil price and production movements including reserves limited to the proven reserve base,

[6] In other words, 50 or 75 percent of public investment spending translates into productive capital.

[7] Marto et al. (2017) for example apply the model to Vanuatu using a 2015 cyclone as the basis for a shock where post-disaster needs exceed 60 percent of GDP.

change mitigation may yield cost-saving productive returns as evidenced by some microeconomic studies,[8] but low-carbon investments could also be less productive than traditional carbon-intensive investments.

B. Conclusions and Policy Implications

12. Illustrative applications of standard EBA-Lite models have shown that climate change may impact the savings and investment balance in Ecuador, but the overall direction of the impact is uncertain. More frequent natural disasters or a transition away from fossil fuels may warrant higher precautionary savings. Climate mitigation and adaption needs on the other hand may suggest that a shift toward higher investment may be warranted, depending on the productivity of investments.

13. Nevertheless, several questions remain when determining how climate change considerations would affect the optimal savings and investment mix and multilateral considerations informed by a global analysis of all countries would need to be taken into account for a decisive assessment.[9] First, a fuller understanding of Ecuador's specific investment needs for climate change and the potential returns on such investment is warranted, particularly given its relatively high levels of capital stock. A second question is how climate change will impact different exporting sectors of the economy. This could include how commodity prices would respond to climate-related supply shocks. Third, is how the response to climate change will be financed. Models like the investment needs model assume debt financing, but drawing precautionary savings built up or financial innovations (e.g. debt for climate swaps), might unlock lower cost financing. Finally, the impact of climate change on Ecuador's savings and investment balance would need to be evaluated in a multilateral context. The current account and real effective exchange rate are measured relative to other countries, and as such are determined by both a country's own characteristics and foreign country characteristics. Such analysis is complicated by the fact that the varying impact of climate risks across countries could lead to some redistribution of incomes, and changes in relative prices and trade flows.

14. Costing of climate adaption and mitigation measures for both Ecuador, and more broadly, will be key to assessing the implications for the savings and investment and the optimal mix. Currently, such information is limited. For example, the Institute for Global Environmental Strategies Nationally Determined Contributions Database does not have financial needs estimates for around 60 percent of the 197 countries (including Ecuador).[10] The varying results of the investment needs model according to different public investment efficiency assumptions also highlights the importance of public investment management in any strategic climate-related investment

[8] For example, Rexhauser and Ramer (2014) find that investments in resource efficiency positively effects firm profitability.

[9] These questions consider limitations to using standard EBA-Lite models to understand the impact of climate change on the savings and investment balance However, there may be further limitations such as the potential for dynamic effects.

[10] Institute for Global Environmental Strategies Nationally Determined Contributions Database.

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THE DISTRIBUTIONAL IMPACT OF CLIMATE, EMPLOYMENT, AND SOCIAL VULNERABILITIES[1]

The analysis of the distributional impact of fiscal and social reforms is often disassociated from climate adaptation reforms. At the same time, the distributional impact of climate adaptation reforms is seldomly performed at the subnational level, especially in developing countries. This analysis aims at marrying these two dimensions for Ecuador by constructing the spatial distribution of climate, economic, and social vulnerabilities.

1. The COVID-19 pandemic and subsequent economic crisis have disproportionally affected low-income families, increased poverty headcount, and exacerbated income inequality in Ecuador. The ongoing expansion of social assistance programs—to reach 80 percent of families in the three lowest income deciles by end-2021—is partly offsetting the economic downturn for vulnerable families and containing income inequality. The fiscal savings from the phase out of regressive fuel subsidies are being channeled towards targeted cash transfers and other critical public spending.[2]

2. While positive at the aggregate level, policies to foster a transition to a greener economy are likely to have heterogeneous local economic effects. The international community has advocated that countries have the opportunity to foster a green and equitable recovery (see, e.g., Allan and others 2020, Coalition of Finance Ministers for Climate Action 2020).[3] Environmental-friendly policies include increasing the share of renewable sources in the energy mix, retrofitting buildings, increasing forestation and carbon sequestration, and moving away from carbon-intensive industrial processes. These policies, however, would disproportionally affect some localities, given the geographical concentration of activities with high green-house gases footprint (see forthcoming IMF's Regional Economic Outlook for the Western Hemisphere). While greening the economy indeed seems to be globally welfare-enhancing, it is arguably Pareto inefficient between countries (i.e., it is Hicks-Kaldor efficient with transfers). Climate policies likely have similar distributional implications between constituencies and income groups within countries.

3. Policies on greening the recovery therefore ought to be carefully designed to avoid backlash. While clean-energy infrastructure is labor intensive in the short term (Garrett-Peltier 2017), not all green investments create jobs quickly (Popp and others 2020). Also, some forms of green investment are not job-rich in the long term and require specific skills: for example, windmills are capital intensive and produced in only a few countries.

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[1] Prepared by Mariano Moszoro (FAD), Juan Pablo Erraez (WHD), and Constant Lonkeng (WHD).

[2] Cf. Ecuador - 2020 - Staff Report bundle for the First Review Under the EFF, Annex I.

[3] Countries' joint commitment on climate change is enshrined in the Paris Agreement, which entails a zero-net emission of carbon dioxide (CO2) by 2050. Ecuador signed the Paris Agreement in 2016.

4. This study assesses the configuration of climate change, employment, and social protection in Ecuador across geographical districts. It constructs composite indices of climate, employment, and social vulnerabilities at the province-level and normalized as *z*-scores—i.e., the observed value minus the mean, divided by the standard deviation. The normalized variables have a mean of zero and a standard deviation of one, making the different indices comparable.[4] The indices are as follow:

- **Climate vulnerability.** The climate vulnerability index is the average of the z-score of vulnerability to extreme temperatures, droughts, and fires and the z-score of vulnerability to extreme rains, floods, and mass movement from the World Bank's (2021) report. Map 1 plots the climate vulnerability by province. Carchi, Loja, Napo, Pastaza, and Zamora Chinchipe are the most vulnerable to climate, followed by El Oro, Imbabura, Orellana, and Sucumbios. I.e., generally, the Amazonia region provinces and the border provinces in the Sierra region are historically more vulnerable to extreme climate events.

- **Employment vulnerability.** Employment opportunities in Ecuador are unequally distributed across provinces. The employment vulnerability index for each province is computed as the z-score of the sum of the unemployment and inadequate employment rates: [(1 – employed/labor_force) + employed x (1 – adequate_employment)]. The employment data comes from the labor survey at the household level conducted quarterly by the Instituto Nacional de Estadística y Censos (INEC). We use December 2019 as representing the pre-pandemic period. Map 2 plots the employment vulnerability index by province. Cotopaxi, Chimborazo, Napo, and Zamora Chinchipe have the highest employment vulnerability, followed by Bolivar, Carchi, Morona Santiago, Pastaza, and Tungurahua.

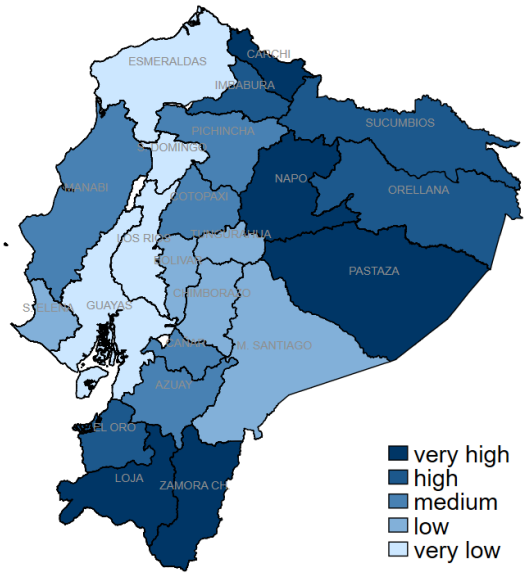
- **Social vulnerability.** While Ecuador has incremented the social protection programs to the lowest three income deciles, the evolution of coverage of cash transfers has been uneven across provinces. The social vulnerability index is computed as the z-score of the share of the poor population not covered by social protection. Due to the lack of geographical data on the distribution of social protection for the bottom three deciles, the social vulnerability index was proxied as the share of the poor population not receiving the two major cash transfers—i.e., "Bono de Desarrollo Humano" (BDH) and "Bono de Desarrollo Humano con Componente Variable" (BVA)—weighted by the share of these transfers to the bottom three income deciles: [1 – (0.78 x BDH + 0.95 x BVA)/(population x poverty_rate)]. The data on BDH, BVA, and their weights comes from the Ministry of Economic and Social Inclusion (MIES). Map 3 plots the social vulnerability index by province. Chimborazo, Pichincha, Pastaza, and Sucumbios stand out as socially vulnerability, followed by Carchi, Esmeraldas, Morona Santiago, Santa Elena, and Zamora Chinchipe. The uneven distribution of social protection is due to the limited updating of the social registry for regions that are hard to access (e.g., Pastaza and Sucumbios) and some regions

[4] The Galapagos province was omitted from the analysis, as it is not densely populated and faces its idiosyncratic climate and employment (mainly in tourism) challenges.

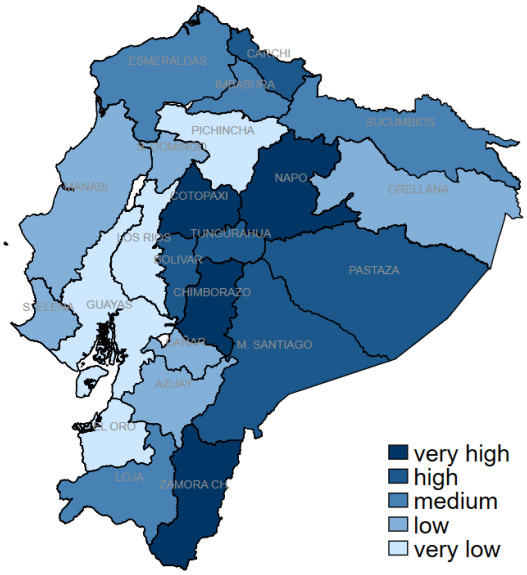
enlarging "urban pockets of poverty" (e.g., around Quito in Pichincha and around Riobamba in Chimborazo).

Figure 1. Ecuador: Climate, Employment, and Social Vulnerabilities by Province

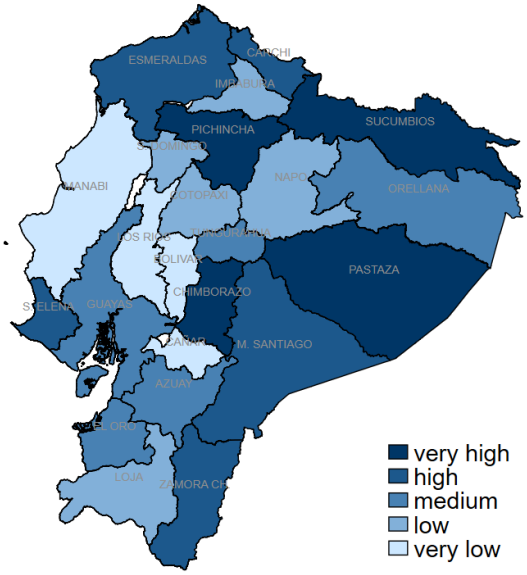
Map 1. Climate vulnerability in Ecuador by province…



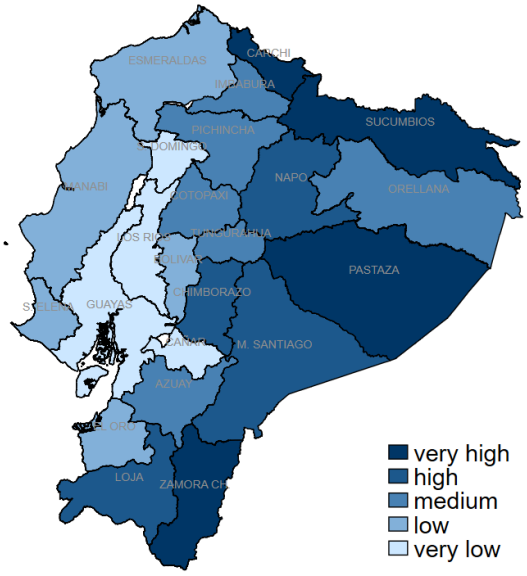
Map 2. Employment vulnerability in Ecuador by province…



Map 3. Social Vulnerability in Ecuador by province…



Map 4. Compound climate, employment and social vulnerabilities in Ecuador by province…



Source: World Bank, INEC, MIES and authors' calculation.

- Policy options. The analysis highlights that the vulnerability to climate events, labor markets fragility, and weak social protection are significant and partly overlap across locations (see Table 1 with cross-correlations). Map 4 presents a compound "heat map" constructed as the unweighted sum of the ranks of climate, employment, and social vulnerability indices and Figure 1 plots the analyzed vulnerability dimensions. Carchi, Pastaza, and Zamora Chinchipe

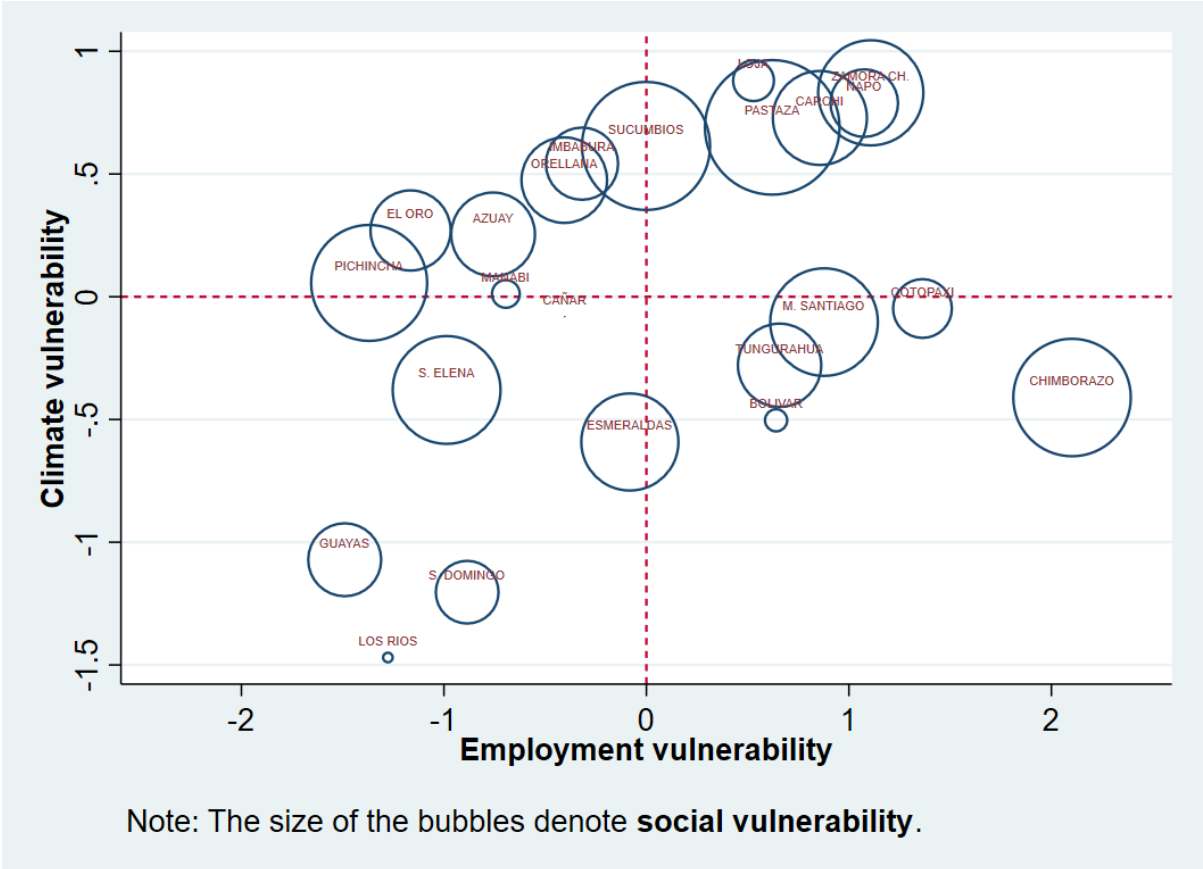
stand out as triple down: susceptible to extreme climate events, fragile employment, and weak social protection coverage. To ameliorate the climate and employment vulnerabilities, indicative targets of social protection coverage could include a location-specific floor: for example, no less than 80 percent coverage by province.

Table 1. Ecuador: Cross-Correlations of Climate, Employment, and Social Vulnerability Indices by Province

	Climate vulnerability	Employment vulnerability	Social vulnerability
Climate vulnerability	1.00		
Employment vulnerability	0.39**	1.00	
Social vulnerability	0.34*	0.22	1.00

Source: Author's calculations.

Figure 2. Ecuador: Scatter Plot of Climate, Employment, and Social Vulnerability Indices by Province



Note: The size of the bubbles denote **social vulnerability**.

Source: Authors' calculations.

5. Future analysis could harness more elaborated approaches and data for a detailed spatial and income analysis. For example:

- Employment transition matrixes of greening the economy by provinces and cantons (i.e., simulated employment shifts by industrial codes and geographical location) accompanied by fiscal schemes for compensating the losing constituencies (e.g., social assistance, training, carbon taxes, abatement technologies, and clean energy subsidies; see: Schaffitzel, Jakob, Soria, Vogt-Schilb, and Ward 2020).

- A dynamic economic assessment model of the world economy with a high spatial 1×1-degree resolution to determine the impact of temperature changes in productivity and amenities depending on local temperatures (cf. Alvarez and Rossi-Hansberg 2021) in Ecuador, and Colombia and Peru for comparison and range validation.

- The IMF's Carbon Pricing Assessment Tool (CPAT) allows for the estimation of various impacts of policies to accelerate green transitions, notably carbon pricing, on various metrics, including distributional impacts (see upcoming WHD REO for application to selected Latin American countries).

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