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September 15, 2025

Approved By
Western Hemisphere Department

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CONTENTS

THE INFLATIONARY RISKS OF EXPANSIONARY FISCAL POLICY[1]

Drawing on an extensive literature, this paper examines the extent to which expansionary fiscal policy poses a challenge to containing inflation.[2] *It does so by assessing how inflation responds to shocks to the fiscal deficit and public debt, and by identifying the channels through which these effects operate in Latin American countries. The analysis finds that unanticipated fiscal deficits are associated with higher current and future inflation. Consistent with predictions from an open economy Phillips curve framework, output gaps widen, inflation expectations rise, and the real exchange rate depreciates—due to an increase in the risk premium—following a shock. Unanticipated public debt is also linked to higher inflation mainly through the output gap and exchange rate channels.*

1. This paper examines the extent to which expansionary fiscal shocks challenge the fight against inflation. This question is particularly relevant for Colombia, where fiscal policy has become expansionary during 2024-25 at a time when inflation has remained above the central bank's target range. This issue is also relevant in peer Latin American and emerging market economies, as countries balance the need to bring down inflation against the need to support the post-pandemic recovery and address new social and infrastructure demands.

2. How inflation responds to expansionary fiscal shocks is crucial for determining the appropriate policy response. Monetary policy calibration should consider the drivers and risks of inflation, including those stemming from fiscal policy. Following a period of elevated inflation and a restrictive monetary stance, an expansionary fiscal stance would boost domestic demand, limiting the scope for monetary policy normalization. Meanwhile, maintaining high interest rates could constrain fiscal space due to the increased public debt burden and could add to appreciation pressures, creating an adverse feedback loop for fiscal and external imbalances with negative confidence effects. Conversely, a tighter fiscal policy would enable a quicker reduction in policy rates, while supporting a reduction in fiscal and external imbalances.

3. There are several channels through which expansionary fiscal policy impacts the price formation process. First, it boosts domestic aggregate demand, creating upward pressure on prices—particularly for non-tradables—especially when supply is relatively inelastic in the short run. Second, inflation expectations could become de-anchored if the central bank is perceived as reluctant to maintain a sufficiently tight monetary policy stance, given concerns that higher interest rates would raise the cost of servicing public debt and threaten debt sustainability. Another key channel operates through the exchange rate. While a fiscal expansion typically leads to currency appreciation due to stronger domestic demand as well as increased capital inflows resulting from higher domestic interest rates (Monacelli and Perotti, 2010), negative effects on confidence could

[1] Prepared by Sophia Chen (WHD).

[2] See Leeper and Leith (2016) for a survey of the literature.

dominate.[3] As such, the impact will much depend on economic fundamentals, including the strength and quality of institutions. For example, in countries with high public debt and weak policy credibility. a fiscal expansion could erode investor confidence, significantly raise the risk premium, and trigger currency depreciation (Ghosh et al., 2013).

4. While these transmission channels are relevant in both advanced and emerging market economies, the risks are more pronounced in the latter. Emerging markets often face greater exposure to external shocks and generally have weaker fiscal and central bank credibility, even if these have been strengthened in many countries. Moreover, while an increasing share of public debt has been issued in domestic currency, currency mismatches persist in some cases, which can amplify the inflationary consequences of fiscal expansion (Celasun et al., 2004; BIS, 2019).

5. The empirical literature provides some evidence supporting the theoretical channels through which fiscal deficits can influence inflation and inflation expectations. Catão and Terrones (2005) find a strong link between deficits and inflation in high-inflation and developing countries, but not in low-inflation advanced economies. More recent studies show that the effect depends on fiscal space and the economic cycle (Cevik and Miryugin, 2023), as well as the fiscal-monetary policy regime (Banerjee et al., 2022). Research on inflation expectations finds they fall after fiscal consolidation (David et al., 2025) and rise following public debt surprises (Brandão-Marques et al., 2024) or news about future debt (Coibion et al., 2021). However, evidence on other transmission channels is less clear. This study contributes a unified empirical framework linking fiscal shocks to inflation and its drivers, using an open-economy Phillips curve. It thus offers a comprehensive view of key channels to inform policy in the current context of fiscal strain and inflation above target.

6. This paper estimates the impact of fiscal policy on inflation and channels through which it operates in financially integrated Latin American economies (LA5) using an open economy New Keynesian Phillips curve framework. The sample includes Brazil, Chile, Colombia, Mexico, and Peru, all of which have inflation targeting and flexible exchange rate regimes during the assessed period of 2010-24. The dynamic responses of inflation are assessed using a local projections method. The baseline fiscal policy measures are the end-of-year structural deficit and public debt, both expressed as a percentage of the previous year's GDP. Additionally, alternative measures—such as the structural primary deficit, cyclically adjusted deficit, and cyclically adjusted primary deficit—are also examined. Under the assumed framework, inflation is influenced by factors including the output gap, expected inflation, and the exchange rate (Galí, 2015), as well as the risk premium which interacts with these factors.

7. For identification purposes, the analysis focuses on inflation responses to shocks to the fiscal deficit and public debt. A fiscal deficit shock is defined as the difference between the actual year-end fiscal deficit and its forecasted value from the IMF's World Economic Outlook

[3] In countries with fixed exchange rate regimes, fiscal expansions lead to a drain in reserves.

published in October of that year. Public debt shocks are defined similarly.[4] The dependent variable measures shocks to end-of-year headline inflation, also defined as the difference between actual and forecasted values. In other words, the estimation captures the relationship between unanticipated changes in fiscal policy and inflation outcomes. Using shocks instead of the levels of the inflation and fiscal variables offers a key advantage: it helps mitigate concerns about reverse causality and spurious correlations that may result from omitted variables.

8. The regression specification also accounts for the dynamic nature of inflation responses and potential confounding factors. It includes two lags of the dependent variable, as well as contemporaneous and one lag of real GDP growth and public debt. These controls help capture business cycle dynamics and the influence of the existing debt stock that may correlate with the shocks. To address potential effects from monetary policy decisions, the model also incorporates monetary policy shocks calculated as analysts' forecast errors of policy rates. Further details on the empirical specification and data are provided in the Annex.

9. The results show that shocks to the structural deficit are significantly associated with higher inflation, with inflation drivers consistent with the New Keynesian Phillips curve framework. Specifically, headline inflation rises by 0.35 percentage points following a fiscal deficit shock equivalent to 1 percentage point of GDP (Figure 1, Table 1). This effect is persistent, with headline inflation still elevated by 0.3 percentage points one year after the shock. Following the shock, one-year-ahead inflation expectations rise by 1 percentage point both in the current and the following year. In contrast, longer-term inflation expectations (five-year-ahead) remain unchanged, likely reflecting the effectiveness of the existing monetary policy framework in anchoring longer-term inflation expectations.[5] The output gap increases by 0.38 percentage points in the current year, consistent with higher aggregate demand. The real exchange rate depreciates by 1 percent, possibly reflecting depreciation pressure from eroding investor confidence that outweighs the appreciation effect of higher demand and increased domestic interest rates. Additionally, there is evidence of a higher risk premium, albeit to a modest degree, with one-year and five-year credit default swap (CDS) spreads increasing by 6 and 11 basis points, respectively. This increase is consistent with investors' perception of higher sovereign risk, with the modest size possibly reflecting confidence in the strength of the policy framework to ensure debt sustainability. As a preview of the results discussed below, there is evidence that the increase in CDS spreads depends on the level of debt and is larger when debt levels are higher.

10. Inflation responses to alternative measures of fiscal deficit shocks are similar. For example, inflation rises by 0.32 and 0.30 percentage points following a shock to the cyclically

[4] The availability of market analysts' forecasts for fiscal deficits and public debt is very limited for our purposes.

[5] The estimated effects on inflation and inflation expectations are broadly in line with recent literature that use similar frameworks or structural VARs. For instance, Cevik and Miryugin (2023) find that headline inflation rises by 0.73 percentage points, on average, in the year of a fiscal deterioration of at least 1.5 percent of GDP in overall or primary balances. Similarly, Brandão-Marques et al. (2024) show that public debt surprises lead to a small but statistically significant increase in five-year-ahead inflation expectations in emerging markets—rising by 2 basis points for each 1 percentage point increase in the debt-to-GDP ratio.

adjusted deficit in the current and following year, respectively (Figure 2, Table 2). In response to a cyclically adjusted primary deficit shock, the increases are 0.34 percentage points in both years. The results also indicate the same set of inflation drivers with comparable response magnitudes, except that the response of the risk premium is more muted following a primary structural deficit shock or a cyclically adjusted primary deficit shock, and the exchange rate response is more muted following a cyclically adjusted deficit shock.

11. Shocks to public debt are also significantly associated with higher inflation. A one-percentage-point-of-GDP shock to public debt is linked to a 0.25 percentage-point increase in inflation in the current year and a 0.22 percentage-point increase in the following year (Figure 3, Table 1). Similar channels involving aggregate demand and the exchange rate are evident, with the output gap increasing by 0.25 percentage points and the real exchange rate depreciating by 1 percent. Furthermore, there is evidence that the response of inflation expectations and the risk premium depends on the level of debt, with both increasing more when debt is higher, while the real exchange rate also depreciates more under high debt levels (Table 3). For example, the real exchange rate depreciates by 12 percentage points. One-year-ahead and five-year-ahead inflation expectations rise by 1.0 and 0.2 percentage points, respectively, while the five-year CDS spread increases by 54 basis points one year after the debt shock when the debt level is at or above 55 percent of GDP.[6] In contrast, when debt levels are low, the responses are muted.

12. The results remain robust across different cyclical positions of the economy and hold true for both fiscal expansions and contractions. Additional analyses, not shown here, confirm that the findings hold when controlling for the economy's cyclical position—proxied by the output gap—as well as for external trade positions—proxied by the terms of trade. Similar patterns emerge for both positive and negative shocks to the fiscal deficit or public debt. In other words, unanticipated fiscal contractions are associated with lower inflation, as are unexpected reductions in public debt.

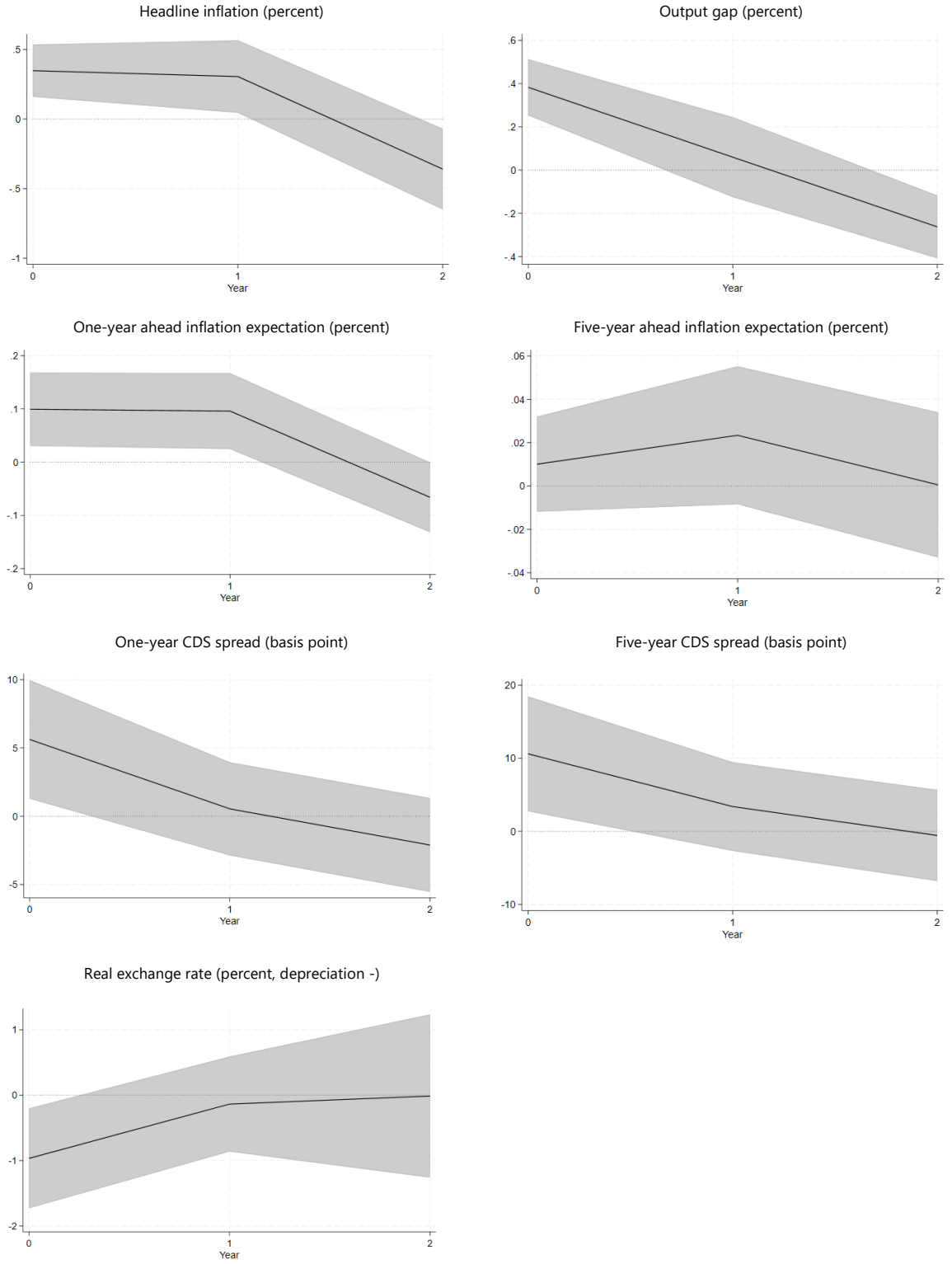
13. Overall, the findings suggest that the fiscal policy stance has significant implications for inflation in our sample of Latin American countries. Shocks to the fiscal deficit and public debt are inflationary, with effects persisting for up to one year. The evidence highlights potential transmission channels, including increased aggregate demand, elevated inflation expectations, exchange rate depreciation, and higher risk premiums on account of concerns over deteriorating public finances. In terms of magnitude, while the aggregate demand channel is the most influential, estimates also indicate that both exchange rate depreciation and rising risk premiums can be substantial in the event of large fiscal shocks. As such, loose fiscal policy and increasing fiscal risks can heighten inflationary pressures, complicating monetary policy—especially in an environment of elevated inflation and external vulnerabilities.

14. A strong and credible policy framework is essential to effectively address the inflationary challenges posed by expansionary fiscal policy and rising public debt. On the fiscal

[6] Results are qualitatively similar with alternative thresholds for high debt, such as 50 or 60 percent of GDP.

side, a robust framework reassures markets of long-term fiscal discipline and helps ensure that temporary fiscal expansions do not become unsustainable. On the monetary side, central bank credibility plays a critical role in anchoring inflation expectations, supporting a cautious and data driven monetary policy stance and reinforcing its commitment to price stability. The importance of credible policy frameworks is underscored by empirical results: while actual inflation responds significantly to fiscal deficit and public debt shocks, one-year-ahead inflation expectations react only moderately, and five-year-ahead inflation expectations remain stable in countries with strong frameworks. This suggests that strong credibility and institutions can help prevent an inflationary spiral by anchoring long-term inflation expectations, even in the face of near-term fiscal pressures.

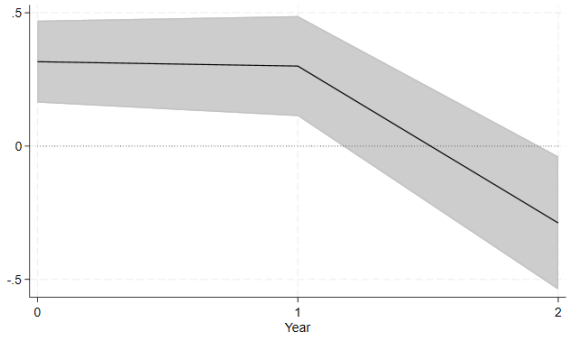
Figure 1. Colombia: Responses to Structural Deficit Shocks



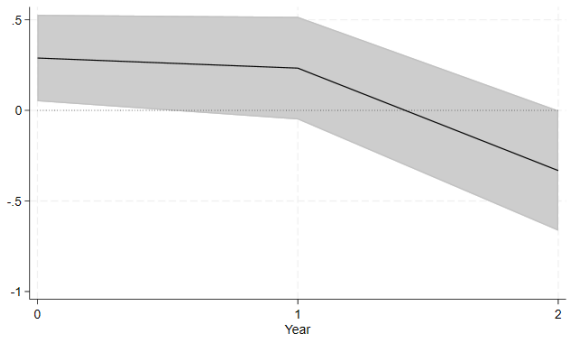
Sources: Consensus Economics, IMF International Financial Statistics, IMF World Economic Outlook, and author's calculations.

Figure 2. Colombia: Inflation Responses to Alternative Measures of Fiscal Shocks

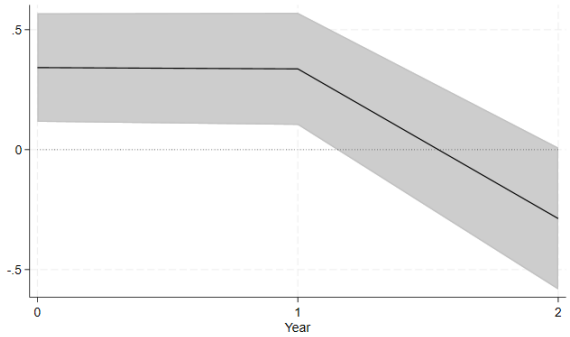
Response to cyclically adjusted deficit shocks (percent)



Response to primary structural deficit shocks (percent)

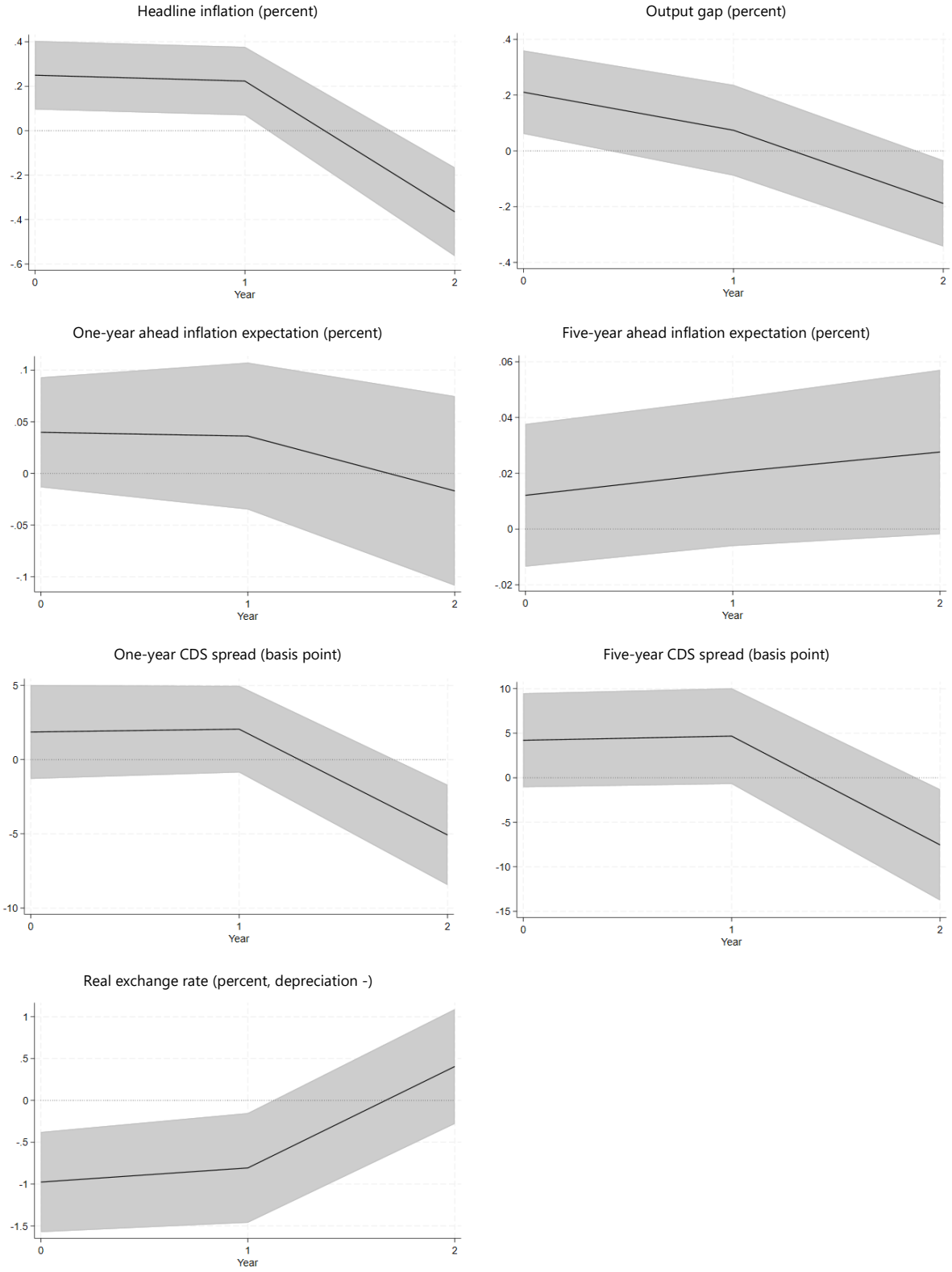


Response to cyclically adjusted primary deficit shocks (percent)



Sources: Consensus Economics, IMF International Financial Statistics, IMF World Economic Outlook, and author's calculations.

Figure 3. Colombia: Responses to Public Debt Shocks



Sources: Consensus Economics, IMF International Financial Statistics, IMF World Economic Outlook, and author's calculations.

Table 1. Colombia: Responses to Fiscal and Public Debt Shocks
(Baseline)

	Headline inflation	Output gap	Inflation expectation (1-yr ahead)	Inflation expectation (5-yr ahead)	CDS spread (1 yr)	CDS spread (5 yr)	Real exchange rate
Structual deficit shock							
Year 0	0.348***	0.108	0.099**	0.010	5.625**	10.607**	-0.966**
	(0.114)	(0.122)	(0.042)	(0.013)	(2.642)	(4.779)	(0.464)
Observations	45	44	45	45	45	45	45
R-squared	0.856	0.856	0.948	0.973	0.859	0.901	0.937
Year 1	0.305*	0.304***	0.096**	0.023	0.541	3.390	-0.136
	(0.158)	(0.064)	(0.043)	(0.019)	(2.075)	(3.687)	(0.441)
Observations	45	40	45	45	45	45	45
R-squared	0.839	0.889	0.920	0.960	0.860	0.909	0.936
Year 2	-0.359*	0.304***	-0.066	0.001	-2.106	-0.560	-0.013
	(0.176)	(0.064)	(0.040)	(0.020)	(2.091)	(3.794)	(0.758)
Observations	45	40	45	45	45	45	45
R-squared	0.777	0.889	0.912	0.951	0.882	0.910	0.937
Public debt shock							
Year 0	0.250**	0.210**	0.040	0.012	1.861	4.208	-0.976**
	(0.094)	(0.091)	(0.032)	(0.016)	(1.922)	(3.207)	(0.364)
Observations	55	40	60	60	60	60	60
R-squared	0.806	0.740	0.921	0.959	0.804	0.861	0.940
Year 1	0.223**	0.074	0.036	0.020	2.052	4.674	-0.807*
	(0.094)	(0.099)	(0.043)	(0.016)	(1.774)	(3.267)	(0.398)
Observations	55	40	60	60	60	60	60
R-squared	0.787	0.708	0.856	0.939	0.831	0.867	0.933
Year 2	-0.365***	-0.188*	-0.017	0.028	-5.073**	-7.540*	0.406
	(0.121)	(0.094)	(0.056)	(0.018)	(2.054)	(3.797)	(0.417)
Observations	55	40	60	60	60	60	60
R-squared	0.721	0.643	0.818	0.939	0.857	0.884	0.935

Note: This table reports estimates from the local projection model in equation (1). Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Sources: Consensus Economics, IMF International Financial Statistics, IMF World Economic Outlook, and author's calculations.

Table 2. Colombia: Responses to Alternative Measures of Fiscal Deficit Shocks

	Headline inflation	Output gap	Inflation expectation (1-yr ahead)	Inflation expectation (5-yr ahead)	CDS spread (1 yr)	CDS spread (5 yr)	Real exchange rate
Cyclically adjusted deficit shock							
Year 0	0.317***	0.319***	0.098***	0.010	5.913**	10.193**	-0.771
	(0.093)	(0.076)	(0.035)	(0.013)	(2.225)	(3.856)	(0.481)
Observations	45	44	45	45	45	45	45
R-squared	0.868	0.825	0.952	0.974	0.878	0.912	0.937
Year 1	0.300**	0.051	0.093**	0.020	1.657	5.264	-0.023
	(0.114)	(0.101)	(0.037)	(0.018)	(1.923)	(3.278)	(0.423)
Observations	45	40	45	45	45	45	45
R-squared	0.849	0.703	0.923	0.059	0.863	0.916	0.936
Year 2	-0.288*	-0.195**	-0.048	0.000	-1.137	1.648	0.287
	(0.152)	(0.081)	(0.035)	(0.019)	(1.926)	(3.673)	(0.647)
Observations	45	40	45	45	45	45	45
R-squared	0.765	0.686	0.908	0.954	0.876	0.910	0.937
Primary structural deficit shock							
Year 0	0.289*	0.423***	0.086**	0.034	0.821	3.738	-1.107*
	(0.145)	(0.088)	(0.039)	(0.022)	(2.133)	(4.323)	(0.638)
Observations	46	35	49	49	49	49	49
R-squared	0.880	0.898	0.957	0.962	0.834	0.876	0.949
Year 1	0.233	-0.016	0.066	0.045	-1.092	-0.071	0.062
	(0.172)	(0.161)	(0.064)	(0.027)	(1.984)	(4.146)	(0.566)
Observations	46	35	49	49	49	49	49
R-squared	0.855	0.716	0.892	0.949	0.865	0.900	0.950
Year 2	-0.332	-0.384***	-0.027	0.024	-1.073	-0.891	0.215
	(0.202)	(0.120)	(0.065)	(0.027)	(2.364)	(3.896)	(0.661)
Observations	46	35	49	49	49	49	49
R-squared	0.784	0.796	0.860	0.951	0.847	0.888	0.949
Cyclically adjusted primary deficit shock							
Year 0	0.342**	0.379***	0.100**	0.038	4.523	8.549	-1.269**
	(0.137)	(0.098)	(0.045)	(0.026)	(3.028)	(5.073)	(0.571)
Observations	45	35	47	47	47	47	47
R-squared	0.905	0.903	0.960	0.967	0.861	0.876	0.958
Year 1	0.337**	-0.005	0.075	0.042	1.849	6.199	-0.141
	(0.142)	(0.141)	(0.066)	(0.026)	(2.426)	(4.166)	(0.440)
Observations	45	35	47	47	47	47	47
R-squared	0.880	0.716	0.896	0.952	0.873	0.912	0.960
Year 2	-0.287	-0.283**	-0.040	0.029	-0.119	3.695	0.504
	(0.180)	(0.119)	(0.063)	(0.029)	(2.593)	(4.474)	(0.662)
Observations	45	35	47	47	47	47	47
R-squared	0.790	0.762	0.863	0.956	0.847	0.896	0.961

Note: This table reports estimates from the local projection model in equation (1). Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Sources: Consensus Economics, IMF International Financial Statistics, IMF World Economic Outlook, and author's calculations.

Table 3. Colombia: Responses to Public Debt Shocks by Levels of Debt

	Headline inflation	Output gap	Inflation expectation (1-yr ahead)	Inflation expectation (5-yr ahead)	CDS spread (1 yr)	CDS spread (5 yr)	Real exchange rate
Public debt shock and interaction with high debt dummy							
Year 0							
Public debt shock	0.200	0.209	-0.016	-0.027	-0.430	-1.520	-0.476
	(0.185)	(0.186)	(0.047)	(0.022)	(2.484)	(3.420)	(0.549)
*Public debt shock * high debt*	-0.443	-0.539	0.081	0.231	13.349	47.759*	-11.266***
	(1.165)	(1.133)	(0.053)	(0.176)	(19.044)	(24.316)	(2.944)
Observations	55	40	60	60	60	60	60
R-squared	0.826	0.746	0.939	0.967	0.846	0.913	0.956
Year 1							
Public debt shock	0.023	0.007	-0.099	-0.023	-1.011	-3.489	-1.148
	(0.193)	(0.158)	(0.062)	(0.025)	(2.261)	(3.635)	(0.705)
*Public debt shock * high debt*	1.299	-1.025	0.907***	0.233*	13.663	54.348**	-2.791
	(1.073)	(0.940)	(0.284)	(0.131)	(16.198)	(23.850)	(3.884)
Observations	55	40	60	60	60	60	60
R-squared	0.814	0.771	0.908	0.956	0.866	0.904	0.938
Year 2							
Public debt shock	-0.541**	-0.332	-0.097	-0.026	-5.038*	-9.186**	0.529
	(0.247)	(0.196)	(0.067)	(0.024)	(2.625)	(4.347)	(0.912)
*Public debt shock * high debt*	1.519	1.323	0.832**	0.352**	27.557**	57.204***	-2.756
	(1.321)	(0.866)	(0.405)	(0.135)	(10.950)	(19.079)	(3.240)
Observations	55	40	60	60	60	60	60
R-squared	0.738	0.681	0.86	0.959	0.900	0.926	0.94

Note: This table reports estimates from the local projection model in equation (2). Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Sources: Consensus Economics, IMF International Financial Statistics, IMF World Economic Outlook, and author's calculations.

Annex I. Empirical Methodology and Data

1. The following impulse response system of equations are estimated:

$$y_{i,t+h} = \alpha^h + \theta^h S_{i,t} + \sum_{k=0}^{K} \Gamma_k^h X_{i,t-k} + \sigma_i^h + \upsilon_t^h + u_{i,t}^h, \quad (1)$$

where the subscripts i and t index country and time respectively, and the superscript $h = 0,1,2$ denotes the horizon being considered (i.e., the number of years after t). The dependent variable is a measure of inflation or its drivers to be discussed below. The independent variable of interest, $S_{i,t}$, is a shock to fiscal deficit or public debt, defined as the difference between the actual year-end value and its forecasted value from the IMF's World Economic Outlook published in October of that year. In the baseline, fiscal deficit is measured as the structural deficit expressed as a percentage of the previous year's GDP. Alternative measures of fiscal deficit—including structure primary deficit, cyclically adjusted deficit, and cyclically adjusted primary deficit—are also considered. Public debt is measured as gross public debt as a percentage of the previous year's GDP. In the regression on inflation, the dependent variable $y_{i,t+h}$ is a shock to end-of-year headline inflation, defined as the difference between actual and forecasted values. In the regression on the output gap, the dependent variable is the difference between the actual and forecasted values of the output gap, where the output gap is measured as a percentage of potential GDP. In the regressions on other inflation drivers, the dependent variables are, respectively, the real effective exchange rate, one-year-ahead and five-year-ahead inflation expectations, and one-year and five-year CDS spreads. These are measured as actual values rather than forecast errors due to the lack of forecasted data. α^h is a constant. $X_{i,t-k}$ are control variables, including one lag of the shock ($S_{i,t-1}$), one and two lags of the dependent variable ($y_{i,t-1}, y_{i,t-2}$), contemporaneous and one lag of real GDP growth and the government debt-to-GDP ratio, and monetary policy shocks. We include country fixed effects to absorb unobserved time-invariant heterogeneity across countries, and year fixed effects to absorb unobserved common shocks. To limit the influence of outliers, the variables are winsorized at the 2nd and 98th percentiles.

To examine whether the responses depend on the debt levels, the following equations are estimated:

$$y_{i,t+h} = \alpha^h + \theta^h S_{i,t} HighDebt_{i,t} + \kappa^h HighDebt_{i,t} + \sum_{k=0}^{K} \Gamma_k^h X_{i,t-k} + \sigma_i^h + \upsilon_t^h + u_{i,t}^h, \quad (2)$$

where $HighDebt_{i,t}$ is a dummy variable equal to 1 when the public-debt-to-GDP ratio is at or above 55 percent in the baseline estimation, and 50 or 60 percent in the robustness tests.

2. Data on fiscal deficit, public debt, output gap, and real GDP growth are from the IMF's World Economic Outlook database. Data on real effective exchange rates are from the IMF's International Financial Statistics. Data on inflation expectations are from Consensus Economics. Data on monetary policy shock are estimated by Checo et al. (2024). These shocks are constructed using analysts' forecast errors of policy rate decisions—an approach building on the literature identifying monetary policy shocks using high-frequency data. The identification assumption is that analysts construct their forecasts by incorporating the endogenous response of monetary policy to economic conditions. Under this assumption, analysts' forecast errors reflect exogenous variation in monetary policy decisions.

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MACRO-FISCAL IMPACTS OF COLOMBIA'S ENERGY TRANSITION PLAN[1]

This paper assesses the risks and opportunities of Colombia's energy transition plan. Recognizing that a sharp fall in oil and coal production would weigh heavily on fiscal sustainability and regional economies, it emphasizes that a well-managed expansion of renewable energy would be essential to mitigate these effects through policies to reskill workers, protect vulnerable communities, and foster broad social support. Moreover, complementary domestic, financial, and export-oriented reforms would further mitigate the economic costs, underscoring the importance of diversification, productivity gains, and stronger competitiveness to ensure the transition is sustainable and growth-enhancing.

Background

1. The Petro administration has been aiming to reduce Colombia's reliance on oil and coal by diversifying towards non-traditional, higher value-added exports while expanding its renewable energy sector. The government's "green transition" strategy also strives to ensure that vulnerable populations are protected and impacted communities are appropriately supported.

2. Staff have long advocated for well-designed and executed policies to facilitate a gradual and growth-friendly transition. In the 2023 AIV Consultation, staff used a general equilibrium model to show that a sudden stop in oil production without developing a new export sector would be disruptive and seriously worsen fiscal and external sustainability. In the 2024 Article IV Consultation, staff showed that frictions that prevent the entry of new productive firms and distort the allocation of labor and capital were responsible for Colombia's low TFP growth and reversals in export diversification after the late 2000s, highlighting the need to develop industries with comparative advantage and greater exports valued added. This paper extends the work by providing further insights on the potential macro-fiscal impact of the energy transition.

3. While the oil and coal sectors are paramount to the Colombia's economy, Colombia's petroleum reserves and production levels are set to continue to decline. Fossil fuels represent 10 percent of Colombia's fiscal revenues, 35 percent of exports, and around 4 percent of GDP of the economy's value added. The importance is set to decline, however. For the oil sector, the reserves-to-production ratio, which assesses the remaining productive life of current proven reserves, stands at around 7 years, implying that without new discoveries, production is expected to cease in about 30 years. Similarly, gas production, which amounted to about 3 trillion cubic feet (Tcf) in 2020, is projected to last 6.5 years. Recent offshore discoveries could help boost production, but these are only expected to commence production after 2030.

4. Currently, oil production is concentrated in a small number of larger onshore fields, mostly owned by the national oil company. Among the more than 400 producing oil fields, only

[1] Prepared by Marco Arena, Daria Kolpakova and Roberto Perrelli (WHD), Bihong Huang (MCM), Alberto Garcia-Huitron and Alpa Shah (FAD), and Philippe Wingender (RES).

17 fields have production exceeding 10,000 barrels per day (bpd) in 2023, and only 8 fields with production greater than 20,000 bpd. Technical costs vary widely across fields, with granular estimates suggesting that 80 percent of production has a unit cost below US$40 per barrel, although only 60 percent of production would be commercially viable at a price below US$40 per barrel. Ecopetrol, the national oil company, remains the largest producer, accounting for 60 percent of production.

5. Meanwhile, coal production is highly concentrated among a few large mines, and on a recent steep decline. Colombia is the leading coal producer in Latin American, and the fifth largest exporter of thermal coal in the world. Production grew rapidly in the 2000s, more than doubling over the course of a decade until its peak of 91.5 million tons in 2017. Since then, production has been in marked decline (reaching 54.5 million tons in 2023), impacted by several mine closures. Thermal coal is largely exported, making up about 15 percent of total exports.

6. Government revenues from oil and coal extraction are collected through a royalty-tax fiscal regime. Oil projects operate under a range of fiscal regimes depending on the contract date, typically with either a flat 20 percent royalty or a progressive royalty from 8 to 25 percent depending on field production.[2] In addition, a corporate income tax applies to profits, with rates currently at 35 percent. Coal mines producing more than 3 million metrics tons of coal per year are subject to a 10 percent royalty. A windfall tax was introduced in 2023 at a rate of 10 percent and increased to 15 percent in 2024.

7. Future oil production will also be impacted by the administration's decision to restrict new exploration. The government has halted any new licensing rounds for oil exploration. Recent fiscal policy initiatives include a price-based windfall tax of 10-15 percent on petroleum profits and disallowing the deduction of royalties from corporate income tax (later overturned by the high court). While these changes may increase government revenue in the short run, they are likely to further reduce oil production over the medium to long term.

Economic Impacts of the Energy Transition

8. The proposed transition is taking place in the context of considerable global uncertainty regarding future fossil fuel usage. Staff analysis uses the International Energy Agency (IEA) forecasts of global oil, gas, and coal production and prices under three climate change mitigation scenarios (Figure 1).[3] The Stated Policies Scenario (STEPS) provides an outlook based on the latest policy settings, including energy, climate, and related industrial policies. The Announced Pledges Scenario (APS) assumes all national energy and climate targets made by governments are met in full and on time. The Net Zero Emissions by 2050 (NZE) scenario assumes mitigation efforts

[2] Contracts also contain either constant shares of production that vary by contract or a 'high price participation' that applies a sliding scale rate of participation according to the oil price.

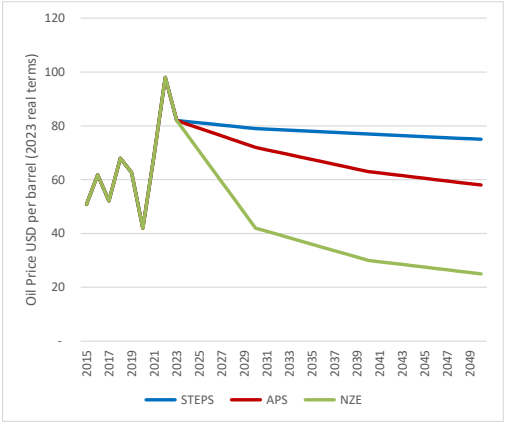
[3] Colombia's baseline projections used for the purposes of macroframework tables are difficult to compare with those resulting from the application of the IEA scenarios because the former assumes no new contracts on fossil fuel exploration whereas the latter are driven by changes in global demand and global prices.

which limit global warming to 1.5 °C. These projections, however, are subject to considerable uncertainty as energy policies in key economies continue to evolve. Using a project-level (bottom-up) modeling methodology (FARI Methodology[4]), staff analysis shows the impact of the projected decline in oil price on Colombia's oil production under alternative scenarios:

- Under the **STEPS scenario**, oil production would decline from current levels (estimated at 736 thousand barrels per day (bpd), towards 510 thousand bpd by 2030, 184 thousand bpd by 2040, and 44 thousand bpd by 2050 (Figure 2, Panel A).

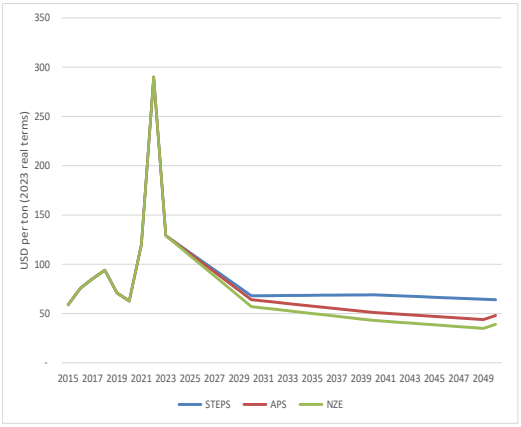
Figure 1. World: Projected Fossil Fuel Production and Prices—Global Scenarios

A. Transition Scenarios: Oil Prices



Source: International Energy Agency (IEA).

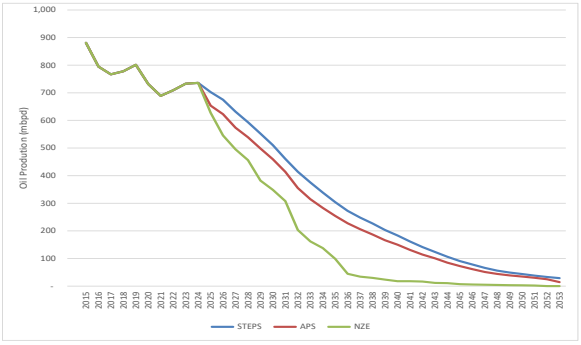
B. Transition Scenarios: Coal Prices



Source: International Energy Agency (IEA).

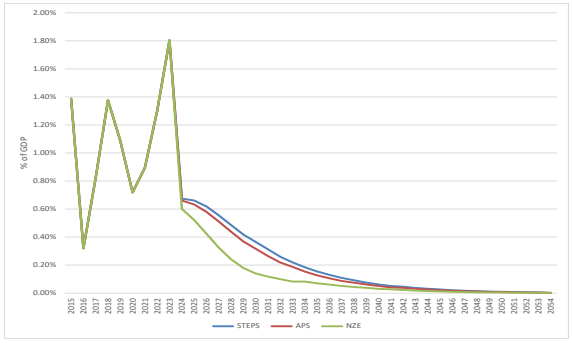
Figure 2. Colombia: Oil Production and Government Revenues, 2015-2050

A. Transition Scenarios: Oil Production



Source: IMF staff estimates

B. Transition Scenarios: Government Revenues



Source: Hacienda and IMF staff estimates

[4] The analysis uses the IMF's FARI project-level cash flow model to estimate government revenues from fossil fuel projects under different energy transition scenarios. It models each major coal mine and oil field individually, incorporating production, cost, and fiscal regime data to assess profitability and determine when projects may shut down as prices decline. The approach relies on detailed asset-level data (notably from Rystad Energy for oil). Historical revenues reflect authorities' reported royalty and income tax collections for the years 2015–2023.

- In the **APS scenario**, Colombia would be producing 460 thousand bpd by 2030, 150 thousand bpd by 2040, and 35 thousand bpd by 250, with several smaller fields ceasing production. The APS scenario converges to a production level 20 percent lower than the STEPS scenario in 2050.

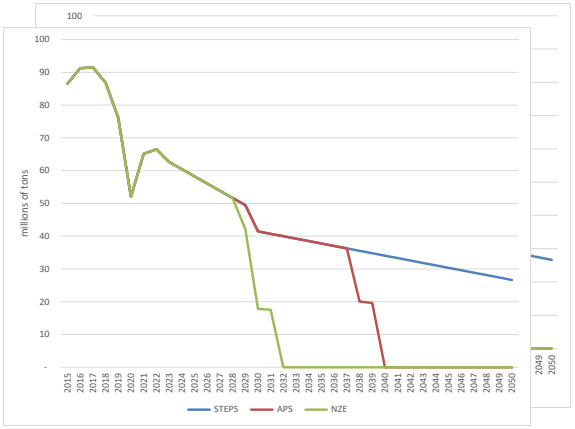
- Under the **net zero (NZE) scenario**, the decline is sharper, with production dropping to 350 by 2030, 18 thousand bpd by 2040, and to only 3 thousand bpd by 2050.

9. Meanwhile, the projected reduction in oil production would carry serious fiscal implications. Under the net zero scenario, royalty and income tax revenues from oil production would fall to 0.14 percent of GDP by 2030, and to near zero by 2050 (Figure 2, Panel B). The impact is slightly lower in the other two scenarios. Altogether, the analysis shows that a steep decline in oil production would reduce Colombia's royalties and income tax revenues by 0.9-1.2 ppts of GDP per year by 2030. The losses would be higher once lower dividends from Ecopetrol are factored in.

10. Much like oil, the coal industry would see a steep decline in production across Colombia's regions.[5] Mining production costs in Colombia range from US$40 to US$70 per ton. Staff analysis assumes an operating cost in the range of US$30-45 per ton, with an additional US$20 per ton in transportation costs. The APS scenario accelerates the decline in production in the 2025-2030 period with early closure of the Cerrejon mine (4 years earlier than in the STEPS scenario) and all other mines by 2040 (Figure 3, Panel A). Government revenues follow this steep decline, amounting to 0.07 percent of GDP by 2030 and 0.01 percent of GDP in 2039 before mining activity ceases (Figure 3, Panel B). Under the NZE scenario, all Colombian coal production is assumed to cease by 2032, when the European coal price is projected fall to US$54/ton.

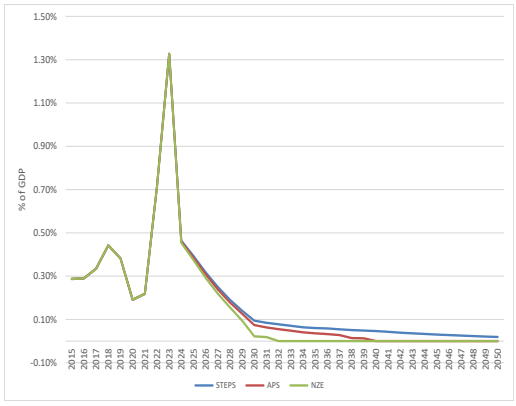
Figure 3. Colombia: Coal Production and Government Revenues, 2015-2050

A. Transition Scenarios: Coal Production



Source: IMF staff estimates

B. Transition Scenarios: Government Revenues

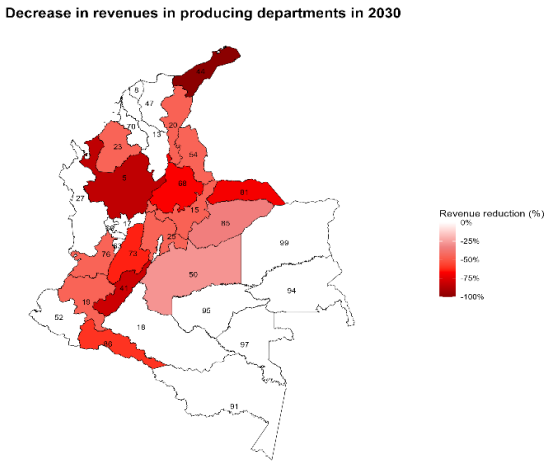


Source: Hacienda and IMF staff estimates

[5] The forecasted decline in production is calibrated to align with the IEA forecasted production from Central and South America in 2030 and 2050 assuming Colombia continues to account for approximately 88 percent of regional production, the average over last 10 years.

11. In addition, declining fossil fuel production would also have a significant impact on subnational governments. Royalties from coal and oil are distributed to subnational departments and municipalities according to a revenue sharing formula which factors population, poverty, and unemployment levels in each area. Figure 4 shows the decrease in revenue by 2030 across producing regions because of declining commodity prices and production under the APS scenario. Analysis suggests that regions such as Antioquia, La Guajira and Huila will see more marked decline in revenues due to mine closures and depletion of oil fields. Major oil and coal regions such as Meta, Casanare and Cesar are more insulated due to their wider production bases, but nonetheless would see a decrease in their direct allocation of royalties in the range of 38 to 46 percent.

Figure 4. Colombia: Decrease in Direct Allocation of Royalty Revenues to Producing Regions



Code	Label	Code	Label
5	Antioquia	52	Nariño
8	Atlántico	54	Norte de Santander
11	Bogotá, D.C.	63	Quindio
13	Bolivar	66	Risaralda
15	Boyacá	68	Santander
17	Caldas	70	Sucre
18	Caquetá	73	Tolima
19	Cauca	76	Valle del Cauca
20	Cesar	81	Arauca
23	Cordoba	85	Casanare
25	Cundinamarca	86	Putumayo
27	Choco	91	Amazonas
41	Huila	94	Guainia
44	La Guajira	95	Guaviare
47	Magdalena	97	Vaupes
50	Meta	99	Vichada

Source: IMF staff estimates.

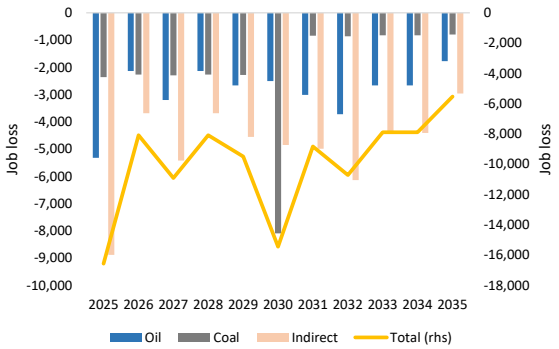
12. The direct employment impact in oil and coal production is limited. Estimates for 2023 suggest that there were only around 105,000 jobs in both sectors, accounting for about 1 percent of Colombia's total labor force, well below the contribution to the labor market of other sectors like trade (18 percent) and agriculture (14 percent). That said, this excludes employment in related upstream and downstream industries.

13. The employment impact, however, could be larger after considering interlinkages between the oil and coal sectors and other industries. Many industries benefit from oil operations through input provision, including support services for extractive industries, land transportation, and oil refining and fuel blending (75 percent of the total value of inputs). Downstream, oil refining and fuel blending and gas distribution account for 91 percent of the total value of outputs. For coal, storage and complementary transport services, support services for extractive industries, oil refining and fuel blending, land transport and vehicle repair and maintenance account for 70 percent of inputs, while oil refining and electricity generation account for more than 80 percent of total outputs.

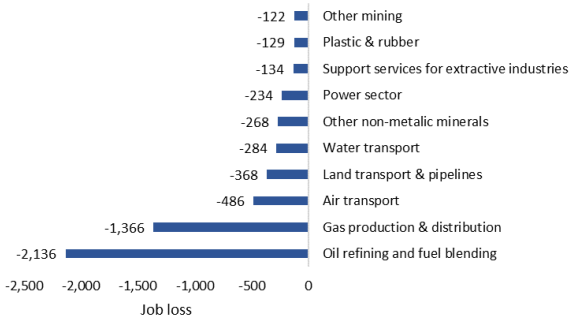
14. As such, total job losses from declining oil and coal production could rise sharply.[6] Preliminary estimates based on the production paths of the APS described earlier (Figure 5) suggest that annual job losses could average over 10,000 over the next decade, with the oil sector being the most impacted.[7] Importantly, indirect job losses are equally relevant as they account for roughly half of the total job losses in any given year. Most indirect job losses happen in the sectors with largest upstream links, such as land transport and pipelines, support services for extractive industries, and storage and complementary transport, and downstream, such as oil refining, fuel blending, and gas distribution.

Figure 5. Colombia: Labor Market Impact of Declining Production of Coal and Oil Under APS Scenario

A. Job loss from Declining Oil and Coal Production and Upstream and Downstream Interlinkages



B. Indirect Job Losses in 2025, Top 10 Sectors



Source: IMF Staff using GEIH 2023 and DANE's IO.

Implications for the Electricity Sector and Renewable Energies

15. Colombia has a diversified electricity generation matrix and its capacity could increase by more than half in the next 15 years. Colombia's generation matrix is dominated by hydroelectric production, which accounts for about two thirds of total installed capacity. Hydro is complemented by thermal energy (30 percent of total installed capacity), mainly from natural gas and coal and liquids to a lesser extent. Solar and wind account for the remaining 4 percent. The Mining and Energy Planning Unit estimates that by 2037, the generation capacity could increase by almost 65 percent with respect to 2023 if renewable energy projects included in its indicative expansion plan (2023-2037) are completed timely to meet the increasing energy needs. In those

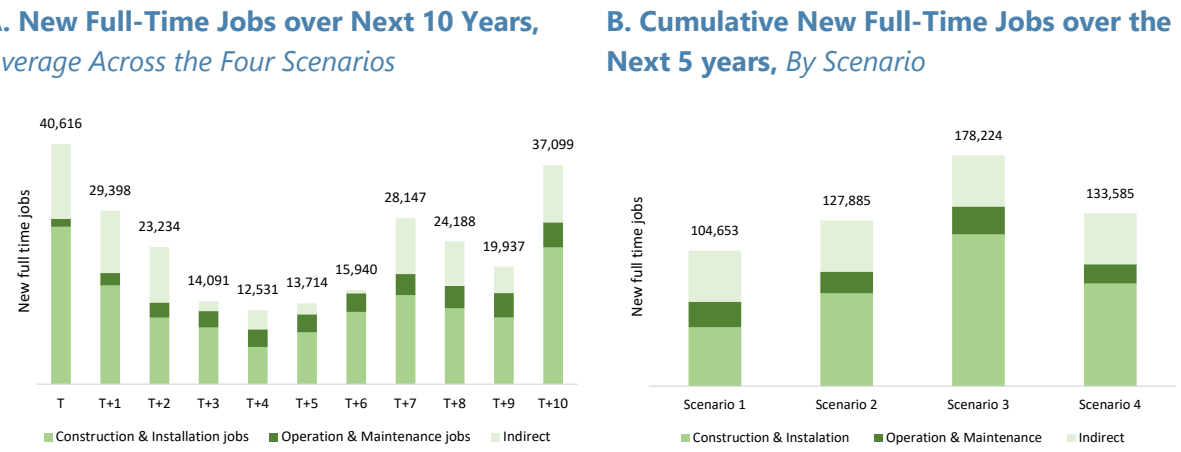
[6] The paper uses the latest complete labor survey (2023) at the time of the analysis as a reference point.

[7] By 2030, key coal mines are assumed to be shut down.

plans, solar and wind would be the main source of expansion. Based on this indicative expansion plan, staff uses an average of four hypothetical scenarios of electricity generation capacity over the next 10 years, from year T to T+10.

16. The expansion of the power sector and the energy transition could be associated with about 135 thousand additional jobs over the next 5 years, albeit with high degrees of uncertainty. Currently, nearly 70 thousand workers are employed in the power sector. Estimates suggest that an additional 40 thousand full-time jobs could be created if planned renewable projects are completed, which is subject to considerable degrees of uncertainty. In addition, only 3.3 percent would be permanent employments (in operation and maintenance, O&M). About 65 percent of the new job positions would come from construction and installation of plants that would start operating in subsequent years. Moreover, about one third of total new employment would come from indirect employment. In the subsequent decade, the average new job creation could reach 22 thousand per year. However, most of those jobs would be linked to construction and installation (Figure 6).

Figure 6. Colombia: Energy Transition Impact on Power Sector and Upstream/Downstream Industries

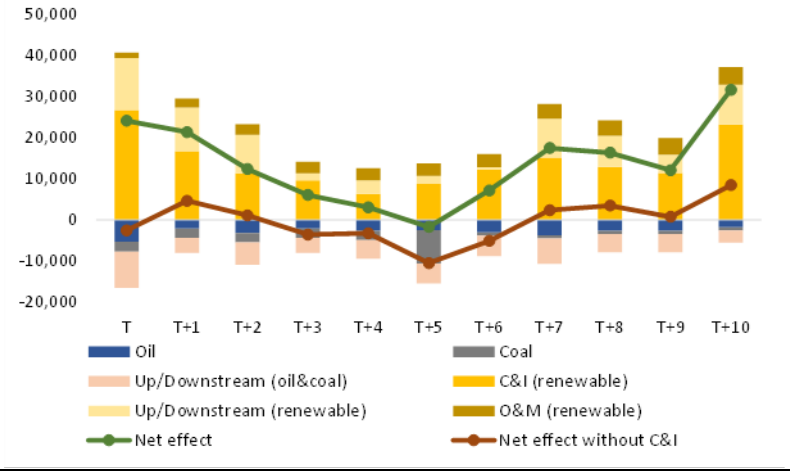


Source: IMF Staff using GEIH 2023, DANE's IO and Hanna et al. (2024).

17. The positive employment impact of the electricity sector expansion could outweigh job losses in the oil and coal industries, especially when jobs in construction and installation are factored in. Staff analysis suggests that, in year T, the net impact could be around 24 thousand new full-time jobs (Figure 7). The picture changes significantly if construction and installation (C&I) jobs are not considered (net loss of 2.5 thousand jobs). The results are mainly driven by the ambitious expansion of solar and wind, as they are more labor intensive than fossil-fuel based electricity generation. Thus, in the absence of such growth and green transition in the electricity sector, as reflected in the Ministry of Energy's Indicative Expansion Plan, the positive impact of the electricity sector would be lower. Targeted policies need to be addressed at workers from the oil and coal industries and related sectors. Reskilling programs and unemployment insurance should be strongly considered as part of a comprehensive active labor market policy in Colombia.

18. Regions in Colombia are set to experience heterogenous labor market impacts. The impacts would depend on each region's reliance on traditional fossil fuel-based jobs and the availability of renewable sources of energy such as wind and solar. The bulk of coal workers are concentrated in La Guajira, Cesar, Boyacá, and Cundinamarca. For oil, workers concentrate on Santander, Meta, Casanare, Putumayo, Antioquia, and Bogota. Regarding solar and wind energy potential, Angel-Sanint et al. (2023) conducted a multi-criteria analysis to analyze the financial, political, and social feasibility of renewable energy development. The results of their analysis show that wind energy potential is concentrated in La Guajira, while solar potential is more distributed across departments, including Santander, Tolima, Atlántico, Magdalena, Cesar, and La Guajira.

Figure 7. Colombia: Labor Market Impact of Coal, Oil, and Power Sectors
(Full-time job equivalent positions)



Source: IMF Staff calculations using GEIH 2023, DANE's IO and Ministry of Energy's Indicative Expansion Plan of Electricity Generation (2023). C&I: Construction and Installation.

19. Most regions facing job losses from the energy transition in the expanding electricity sector may see a net increase in jobs. The subnational analysis relies on national input-output tables and assumptions about electricity generation expansion, and it is subject to uncertainties. Staff evaluates solar and wind potential using data from Angel-Sanint et al. (2023) alongside the ERA5 Copernicus dataset, while biomass, biogas, and hydro resources are mapped according to UPME's energy atlas. A limitation is the assumption that renewable projects will proceed as planned by UPME, despite significant local opposition to projects like wind energy in La Guajira, potentially leading to unbalanced job impacts between sectors. The analysis is limited to three years due to uncertainties in renewable energy development. Job losses in La Guajira and Cesar could be offset by new electricity sector jobs if projects proceed as planned, with Antioquia and Tolima also likely benefiting from their hydroelectric and solar potential. The authorities should assess skill gaps to ensure the workforce can take advantage of these opportunities. Conversely, departments like Boyacá, Huila, Norte de Santander, and Bogotá are expected to face net job losses without compensation from the electricity sector. In these regions, governments should focus on diversification, developing new advantages, and strengthening social safety nets for affected households.

20. For the energy transition to positively impact the labor market, two key issues must be addressed: developing future skills and securing local community support. While the expansion of the electricity sector may surpass job losses in oil and coal, the government must actively cultivate a skilled workforce to meet industry demands. This transition also presents a chance to tackle gender inequalities in energy markets. Ensuring local indigenous communities support the construction of generation plants and transmission lines is crucial. Monetary compensation, like the 'Electricity Transfer,' would be insufficient; targeted skill programs and tailored support addressing community concerns, alongside effective communication, are necessary to maximize local benefits.

21. Without appropriate support, energy transition policies could face a risk of reversal. In the short run, Colombia can leverage on its social safety net to limit the impact on vulnerable households, while setting up reskilling programs to ensure that those households rejoin the labor force in the medium term. Government's support would be most effective if its conditional to the participation in reskilling programs. This is a necessary condition so that no one is left behind as Colombia makes progress in its energy transition and to build support for other reforms.

The Role of Reforms in Mitigating Energy Transition Costs

22. The Global Integrated Monetary and Fiscal Model (GIMF-GVC) is used to model the macroeconomic impacts of oil depletion over the next 30 years and how policies can help reduce these losses. In the baseline scenario, oil production declines by 95 percent over 30 years. The depletion is fully anticipated by forward-looking agents. Investment and consumption decisions therefore already factor in these long-run changes. The exchange rate incorporates news about future oil depletion so that equilibrium conditions on traded goods markets determine its path absent other changes. Impulse responses are calculated as deviations from a counterfactual scenario where oil production remains constant at current levels. This allows us to illustrate both the macroeconomic impacts of oil depletion, in addition to policies that could be implemented to compensate for these losses.

23. Results suggest that real GDP would be 12 percent lower compared to a counterfactual scenario in which oil production remains constant at current production levels. Potential growth would decline by 0.4 percentage point annually over 30 years. The decline in exports, consumption, and investment lower GDP by 6 percent, 5 and 2 percent, respectively. The total impact on GDP reflects the direct and indirect losses of capital in the aggregate production function. Capital in the oil, coal, and energy sector would decline by 20 percent of GDP. With a capital income share of 23 percent, this explains around half of the long-term losses in GDP.[8] Employment in Colombia's oil, coal, and energy sectors is projected to fall sharply, reducing total labor supply by 0.8 percent as workers shift to tradables and nontradables. GDP losses of 9 percent are attributable to lower labor productivity overall while 3 percent are attributable to labor reallocation away from oil, coal, and energy (Figure 8, Panels A-D).

[8] The oil, coal, and energy sector in the model also includes immediate downstream sectors that will be directly impacted by the loss of production such as petroleum refining, coking and distribution of gas. In total, the sectors accounted for 6.3 percent of GDP in 2023 (4 percent for oil and coal and 2.3 percent for downstream sectors).

Figure 8. Colombia: Macroeconomic Impact of Oil Depletion: Counterfactual Analysis

Source: IMF staff estimates.

24. In addition, the real exchange rate would weaken by about 12 percent over the same period. Importantly this depreciation is relative to a point in time when markets have already priced in the oil depletion. When including the "news" effects of future depletion, the total depreciation is

21 percent. This helps boost exports of tradables, but the effect is small compared to export losses from oil, coal, and energy (Figure 8, Panel E). Despite revenue losses of about 3 percent of GDP, government debt would remain broadly stable under the fiscal rule, but reduced transfers would lower consumption among liquidity-constrained households (Figure 8, Panel F).

25. That said, policy reforms could mitigate GDP losses associated with the energy transition.[9] Three types of reforms are considered: (i) a domestic reform package implemented over a 30-year period that assumes higher TFP (5 percent) and labor productivity and lower markups in the tradables and non-tradables sectors; (ii) a financial reform package implemented over a 15-year period aimed at lowering verification costs and borrower riskiness (by 100 bps) in the tradables and non-tradables sectors; and (iii) an export reform package implemented over a 30-year period that increases Colombia's trade weights in partners' import demand for tradables by 50 percent, supporting more robust exports and a stronger exchange rate.

(i) Domestic reforms that increase productivity and market competition could alleviate much of the output losses from fossil fuel depletion. Instead of losses of 12 percent, GDP would decline by only 4 percent over the next 30 years. This would entail higher consumption and investment, the result of positive income effects and higher returns to capital in the tradables and non-tradables sectors (Figure 9, Panel A). Higher productivity and lower markups in non-tradables push domestic inflation down, which further depreciates the real exchange rate. This also supports the current account balance over much for the reform period. Government debt declines from around 53 percent of GDP to around 49 percent of GDP.

(ii) Financial reforms improve GDP outcomes, although to a lesser extent than reforms that increase productivity and market competition. Compared to the oil depletion with no policy scenario, GDP would be around 1.5 percent higher after 30 years, at around 10.5 percent below baseline GDP (Figure 9, Panel B). The improvement arises from higher consumption and investment in broadly equal proportion. Thus, compared to the domestic reform scenario, financial reforms allow for relatively stronger investment to support GDP. The impact on the real exchange rate is muted compared to the previous reform scenario.

(iii) Reforms that increase Colombia's export shares have a similar impact on GDP as the financial reform package. GDP is 9.5 percent smaller than baseline after 30 years, with relatively larger contributions from consumption and exports (Figure 9, Panel C). The reforms also increase imports, a result of stronger demand for intermediate goods in the tradable sector. This reform supports the exchange rate which, instead of falling by 12 percent, declines by 4.5 percent after 30 years.

26. Importantly, a comprehensive reform package that combines various features of the proposed reforms would deliver output gains over the medium term. Specifically, when all three

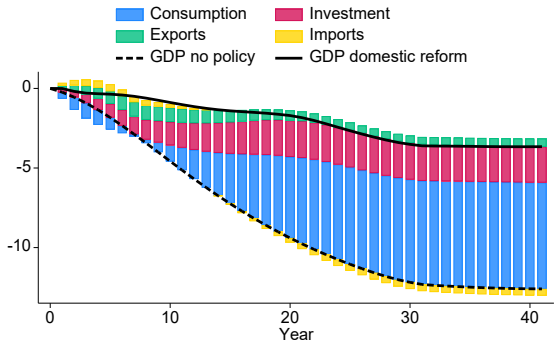
[9] For details on specific reforms, see staff previous work (IMF Selected Issues Papers) in the 2023 and 2024 Article IV Consultations.

reform packages are implemented together, real GDP recovers beyond the losses from oil depletion—instead of 12 percent losses, real GDP would be 0.8 percent larger than the baseline (Figure 9, Panel D). On the expenditure side, this is reflected in strong responses of consumption and investment, both of which exceed their baseline levels. About 40 percent of export losses from oil depletion are compensated by higher tradables exports. The peso depreciates by around 13 percent, broadly similar to the depreciation in the no-reform scenario.

Figure 9. Colombia: Macroeconomic Impact of Reforms

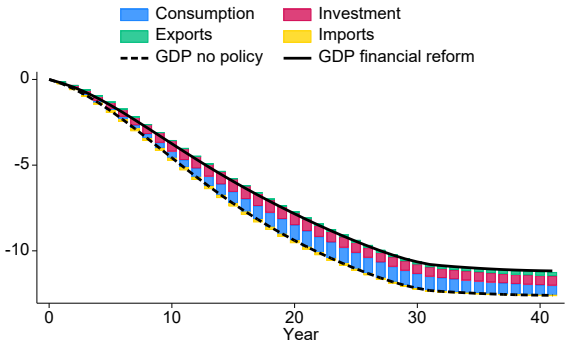
A. Changes in GDP and Contributions by Components under Domestic Reforms

(Percent of Counterfactual GDP)



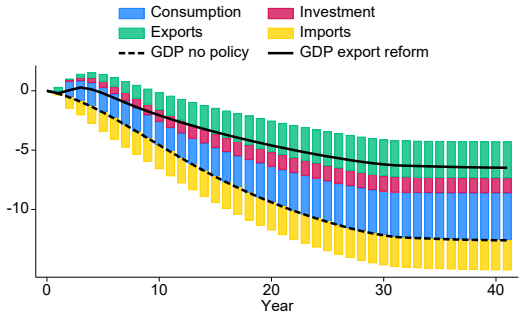
B. Changes in GDP and Contributions by Components under Financial Reforms

(Percent of Counterfactual GDP)



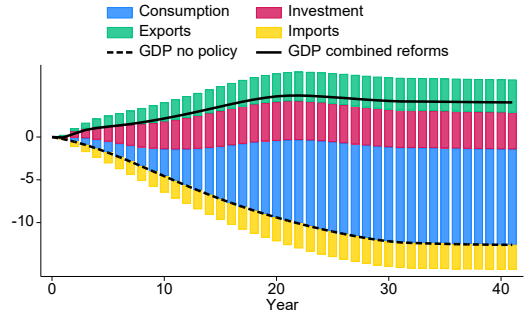
C. Changes in GDP and Contributions by Components under Export Reforms

(Percent of Counterfactual GDP)



D. Changes in GDP and Contributions by Components under Combined Reforms

(Percent of Counterfactual GDP)



Source: IMF staff estimates.

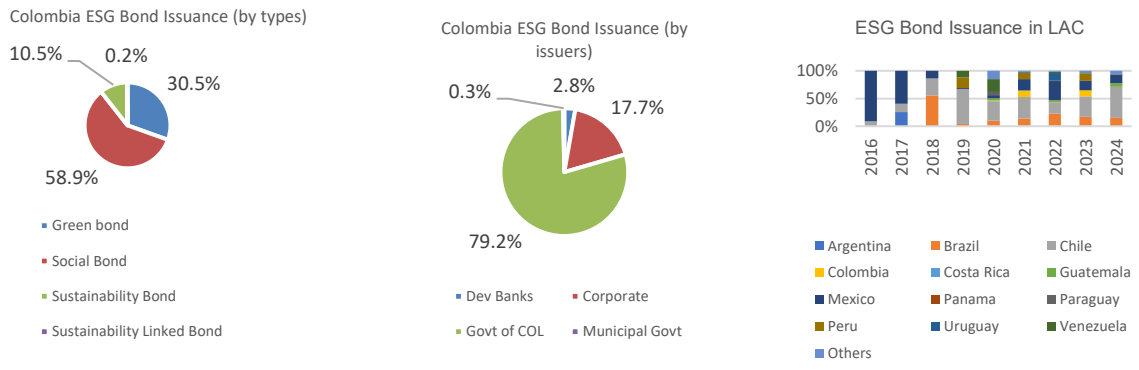
Annex I. Financing the Energy Transition

1. The development of new financial instruments is essential to mobilize resources for the energy transition. To finance the energy transition, Colombia would need about US$92 billion in additional investment by 2050. This amount represents 1.2 percent of the country's discounted cumulative GDP over 2030-2050 (World Bank, 2023). However, the public sector would have limited resources to increase annual investment, sourced mainly through carbon pricing, higher taxes, and spending efficiency. Against this background, staff estimates that the private sector would need to contribute with at least 80 percent of Colombia's additional investment needs.

2. Colombia has strengthened its institutional framework and capacity building on ESG finance through several initiatives. The National Climate Change System coordinates climate finance management across national, regional, and local levels while Regional Climate Change Nodes link local governments, businesses, and financial institutions to mobilize regional finance. Since 2019, the SFC's biennial ESG and climate risks and opportunity survey has assessed financial institutions' progress in managing environmental risks, identified challenges and needs of supervised entities regarding environmental and social issues, prioritized the tools like the Green Taxonomy, and created supervisory expectations for incorporating ESG issues in various industries.

3. Despite the authorities' efforts, Colombia's climate finance remains below potential. As of 2023, the green portfolio accounted for 2.4 percent of total loans. Between 2020 and 2024, Colombia issued US$15.3 billion in ESG bonds—nearly 60 percent in social bonds. Around 80 percent of ESG bonds were issued by the government, while the private sector accounted for 18 percent of total issuances. Despite rapid progress, Colombia ESG bonds market is underdeveloped compared to its regional peers, accounting for only 6 percent of total ESG issuance in LAC.

Figure 1. ESG Bond Issuance in Colombia and LACs



Source: IMF staff calculation using Refinitiv Data.

4. ESG labeling can lower costs for corporates in advancing sustainable finance. Although ESG bonds in LAC are relatively small and had a late start, they enjoy a pricing advantage relative to

conventional bonds. We collect 2105 bonds issued by 17 Latin American countries during 2016-2024[1] from Refinitiv Eikon. We first use a logit function to estimate a propensity score to predict the probability of being labeled ESG bonds and then match the ESG bond (treatment units) and non-ESG bonds (control units) using the estimated propensity score. The average treatment effect on the treated (ATT) indicates that ESG bonds have yields to maturity (YTM) that are, on average, 100 basis points lower than those of matched non-ESG bonds, after controlling for key bond characteristics (Annex I Table 1). This yield differential suggests that investors are willing to accept lower returns in exchange for exposure to sustainable assets. Moreover, while ESG and non-ESG bonds showed no significant yield differences before COVID-19, a notable premium emerged afterward, with ESG bonds yielding 190 basis points less. This shift likely reflects growing investor awareness of sustainability and resilience. The effect is strongest among corporate issuers, with no significant difference observed for government or supranational bonds.

Annex I. Table 1. Colombia: Effects of ESG Labeling on Bond Yields to Maturity

	ESG bond	Non-ESG bond	ATT	T-Statistics	P-Value
Full Sample	6.38	7.38	-1.0	-2.51	0.01
By Time					
Before Covid	7.9	7.67	0.24	0.18	0.86
After Covid	6.05	7.96	-1.9	-3.65	0.0
By Issuer					
Agency	5.08	1.64	3.44	1.31	0.2
Corporate	6.77	7.73	-0.97	-2.02	0.04
Government	5.5	5.94	-0.44	-0.62	0.54
Other Gov/Supra	7.08	5.81	1.27	0.6	0.55

Source: IMF staff estimation using Refinitiv Data.

5. Further analysis indicates that a more robust ESG disclosure framework is associated with lower spreads when issuing ESG bonds. To quantify ESG disclosure regulation across Latin American countries, we reviewed official documents and regional surveys of securities regulators for 8 LAC countries,[2] focusing on four core dimensions: disclosure approach, applicability, assurance requirements, and materiality perspective. Each core dimension was scored to reflect regulatory stringency, with higher values indicating greater rigor. We then applied Principal Component Analysis to aggregate these four dimensions into a single composite disclosure framework score for each country. We regress ESG bond spread—i.e., the yields to maturity (YTM) minus the yields of a similar-maturity US Treasury Bond—on ESG disclosure score while controlling for country effects, time effects and bond-level characteristics such as Fitch credit rating, maturity, amount of issuance, currency, coupon type, existence of external review, type of Issuers, and TRBC sector. The result shows that stronger ESG disclosure frameworks are significantly associated with an average

[1] Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, French Guiana, Guatemala, Honduras, Mexico, Panama, Paraguay, Peru, Suriname, Uruguay, and Venezuela.

[2] The selection of these 8 countries -- Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Panama, and Peru-- is primarily based on the availability of official documents on ESG disclosure and the surveys implemented by IDB and ECLAC (Economic Commission for Latin America and the Caribbean).

reduction of 33 basis points in ESG bond spreads, highlighting the role of regulatory transparency in lowering financing costs for sustainable issuers (Annex I Table 2, Panel A). Subsample analyses reveal that this effect is more pronounced post-COVID, particularly for agency issuers, domestic currency bonds, and high-yield instruments, suggesting that enhanced disclosure reduces investor uncertainty and risk premium, especially in riskier segments (Annex I Table 2, Panels A and B).

6. To strengthen Colombia's ESG financial market, key priorities include ensuring macro-financial stability, improving regulatory framework, and expanding issuer participation. Standardized reporting and third-party verification will enhance transparency. Support for municipalities and SMEs through credit enhancement and technical assistance can lower borrowing costs. Regional and international cooperation, including integration with Latin American sustainable finance platforms and partnerships with multilateral institutions, can provide vital technical and financial support.

Annex I. Table 2. Colombia: Impact of Disclosure Framework on ESG Bond Spread

	Panel A					
	By Time			By Issuer		
	Full Sample	Before COVID	After Covid	Agency	Corporate	Govt/Treasury/Central Bank
Disclosure	- 0.33***	-0.15	-0.6***	-0.72***	-0.31***	-0.31***
	(-6.19)	(-0.64)	(-8.35)	(-3.42)	(-4.67)	(-4.45)
Observations	1794	777	1017	69	1221	444
R-Squared	0.41	0.44	0.47	0.89	0.5	0.57
Control	Yes	Yes	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes
	Panel B					
	By Currency				By Credit Risk	
	Domestic Currency	Euro	US$	Other Currencies	High Yield	Investment Grade
Disclosure	-0.65***	-0.48***	-0.33***	-0.11	-0.56***	-0.24***
	(-7.16)	(-4.43)	(-5.58)	(-0.76)	(-3.92)	(-5.58)
Observations	494	58	1109	133	375	641
R-Squared	0.52	0.97	0.50	0.41	0.33	0.4
Control	Yes	Yes	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table reports the estimation of the impact of ESG disclosure regulatory index on bond spreads. The dependent variable is the spread of ESG bonds. t-statistics are computed using robust standard errors (reported in parentheses). ***, ** and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Source: IMF staff estimation using Refinitiv Data.

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LABOR FORCE PARTICIPATION IN COLOMBIA[1]

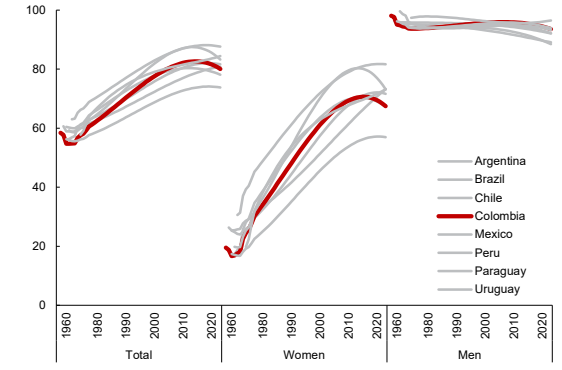
Colombia's labor force participation (LFP) showed a steady and gradual decline for both men and women between 2012 and 2019, which contrasts with rising LFP in regional peers. This paper assesses the factors behind LFP dynamics in Colombia to inform policy options for boosting participation and supporting Colombia's long-term growth, against the headwinds from slowing birthrates and population aging.

Background

1. Colombia has experienced a gradual decline in labor force participation (LFP) over the last decade, especially among women. Colombia's LFP rose from less than 50 percent of the working-age population in the 1950s to 68 percent in 2010-12. Since then, it has declined to around 63 percent. While Colombia's male LFP has oscillated around 80 percent, its female LFP rose from 12 percent in the 1960s to 55 percent in the middle of last decade, falling to 52 percent since then. These patterns are even more noticeable when assessed in terms of prime working age population (Figure 1, Panel A). Moreover, female LFP starts to drop sharply at 45-49 years old—or 10 years earlier than male LFP (Figure 1, Panel B).

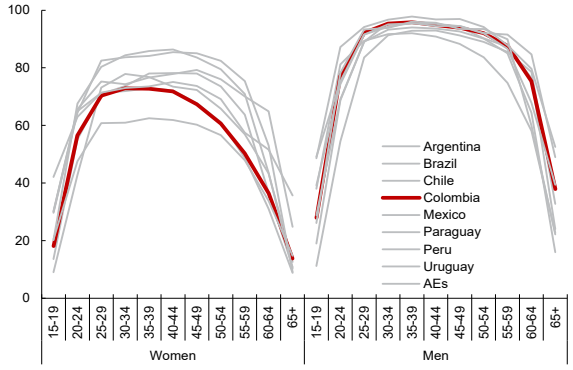
Figure 1. Colombia: Labor Force Participation by Gender and Age, 1960-2023

A. Labor Force Participation by Gender, 1960-2023
(Percent of prime working-age population, 25-54 yrs.)



Sources: ILOSTAT and IMF staff calculations.

B. Labor Force Participation by Gender and Age, 2023
(Percent of working-age population)



Sources: ILOSTAT and IMF staff calculations.

2. While declines in LFP coincided with the escalation of Venezuelan migration to Colombia, the latter does not seem to fully explain it. While the large influx of people may be correlated with labor market outcomes, it is unlikely that migration can fully explain the observed drop in Colombia's LFP. Exploiting cross-regional information, Alvarez and others (2022) find that regions with greater migration inflows did not experience larger declines in (male or female) labor force participation rates. Moreover, Bahar and others (2021) do not find a significant effect of an

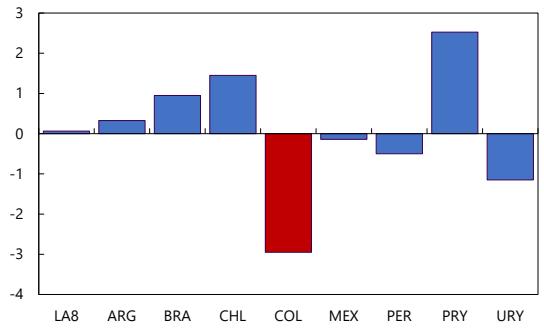
[1] Prepared by Marco Arena, Camila Casas, and Roberto Perrelli (WHD).

increase in the number of residency permit (*Permiso Especial de Permanencia*, PEP) holders on the labor force. Bonilla and others (2024) find a causal and negative effect of migration on the probability of participation in the labor force, but the reduction is small (0.3 percentage points). Given these findings in the literature, we explore other potential reasons that can explain declines in LFP.

3. Understanding Colombia's persistent gender gaps in LFP is a critical aspect of this puzzle. At almost 25 percent, Colombia's current gender gap in LFP was second only to Mexico, which has also seen a faster and more dramatic reduction in the LFP gap since 2000.[2] Latin American peers, like Peru and Uruguay, presented gender gaps around 14-15 ppts, not far from the average gender gap found among advanced economies (11 ppts as of 2023). A closer look at the data suggests that, unlike most regional peers, the decline in Colombia's LFP took place prior to the pandemic (Figure 2, Panel A), especially for women. During 2013-19, Colombia's female participation in the labor force dropped almost 3 ppts whereas the average for the largest economies in the region was broadly unchanged or increased (Figure 2, Panel B). Since Colombia's LFP decline precedes the pandemic crisis, exploring the cross-country variation of the evolution of gender gaps will be essential to better understand these trends.

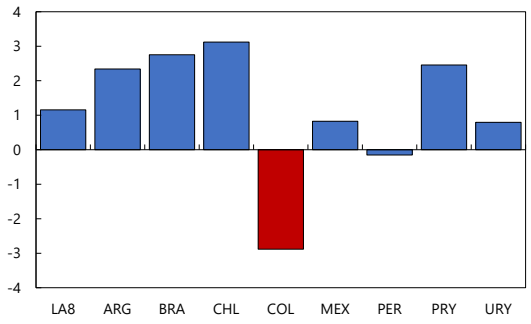
Figure 2. Colombia: Cross-Country Comparison Labor Force Participation

A. Total Labor Force Participation: Change Between 2013 and 2019
(Percent of working-age population, 15+ yrs.)



Sources: ILOSTAT and IMF staff calculations.

B. Female Labor Force Participation: Change Between 2013 and 2019
(Percent of working-age population, 15+ yrs.)



Sources: ILOSTAT and IMF staff calculations.

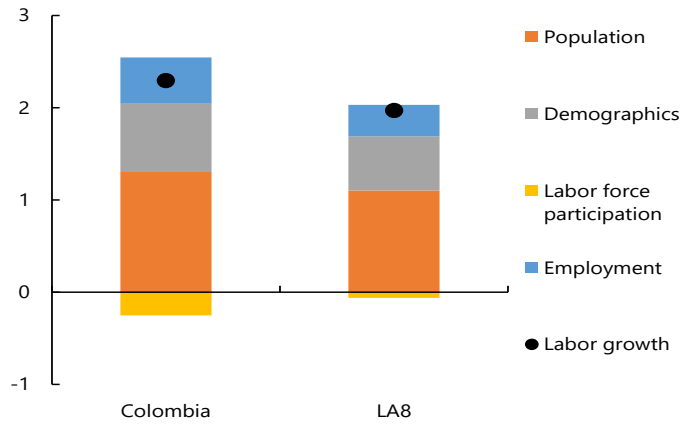
4. The decline in LFP has hampered Colombia's labor and real GDP growth over the past decade. During 2000-19, Colombia's labor has grown on average 2.3 percent per year—0.3 ppts faster than in its Latin American peers (LA8 countries).[3] The lion's share of Colombia's labor growth comes from the growth in total population (1.3 percent in Colombia, 1.1 on average in LA8 countries) and in working age population ("demographics"; 0.7 percent in Colombia, 0.6 in LA8), with

[2] For details, see Closing the Gap: Labor Market Participation in Latin America, IMF Regional Economic Outlook—Western Hemisphere).

[3] Argentina, Brazil, Chile, Colombia, Mexico, Paraguay, Peru, and Uruguay.

both statistics including all residents (i.e., nationals and migrants). Employment growth was also higher in Colombia (0.5 percent) than in LA8 (0.3 percent) during 2000-19. However, Colombia's labor force participation growth (-0.3 percent) was the lowest among LA8 countries (Figure 3).

Figure 3. Colombia: Labor Growth, 2000-19
(percentage points)



Sources: Penn World Table 10.0 database; 2024 UN Population Prospects; ILOSTAT; and IMF staff calculations.
Notes: In the present study, "LA8" refers to a purchasing-power-parity GDP- weighted average across Argentina, Brazil, Chile, Colombia, Mexico, Paraguay, Peru, and Uruguay.

Data, Methodology, and Results

5. Econometric analysis is conducted using microdata from the Colombian household survey (*Gran Encuesta Integrada de Hogares*) together with the *migration modules* for all individuals 15-64 years old—a total of over 576 thousand observations (for 2023), of which 54 percent of the surveyed individuals were women. Probit regressions are done to assess the drivers explaining LFP (for both women and men) including household characteristics (head, married), young children, elders, education, whether the individual is a Venezuelan migrant, age, geographical domain (rural/urban). Also, the analysis includes a measure of security/crime (per capita rate of homicides). A robustness analysis is performed by estimating the probit regressions for the years 2019 and 2024. Additional regressions are also estimated for the individual years between 2013 and 2019 (pre-pandemic period) but excluding some variables due to data limitations (e.g., Venezuelan migrant).

6. For the pre-pandemic period (2013-2019), almost all the explanatory variables have similar marginal effects. Table 1 shows individual regressions for the years between 2013 and 2019 for women, men, and the total sample. The results suggest that only the variable "children" shows a declining marginal effect during the pre-pandemic period (from 0.0440 in 2013 to 0.0287 in 2019), which could be one factor behind the gradual decline in LFP during that period.

Table 1. Colombia: Drivers of Probability of Participating in the Labor Force, 2013-19
(Marginal effects)

Women	2013	2014	2015	2016	2017	2018	2019
head	0.149	0.148	0.149	0.150	0.149	0.151	0.157
married	-0.016	-0.012	-0.010	-0.010	-0.012	-0.012	-0.013
young_children	-0.052	-0.054	-0.054	-0.056	-0.049	-0.050	-0.055
children	0.044	0.042	0.039	0.037	0.033	0.027	0.029
education	0.093	0.092	0.091	0.093	0.093	0.095	0.097
age	0.002	0.002	0.002	0.002	0.002	0.002	0.001
rural	-0.065	-0.070	-0.055	-0.039	-0.042	-0.041	-0.055
Observations	260,118	270,358	271,547	269,567	265,528	265,121	263,841

Men	2013	2014	2015	2016	2017	2018	2019
head	0.065	0.068	0.069	0.064	0.059	0.059	0.058
married	0.125	0.121	0.121	0.127	0.128	0.128	0.129
young_children	0.052	0.048	0.050	0.052	0.059	0.062	0.059
children	-0.009	-0.010	-0.013	-0.015	-0.018	-0.016	-0.016
education	0.038	0.040	0.039	0.043	0.042	0.045	0.047
age	0.002	0.002	0.002	0.002	0.003	0.003	0.003
rural	0.080	0.067	0.077	0.075	0.088	0.091	0.081
Observations	220,901	231,190	234,259	233,224	229,690	230,247	228,222

Total	2013	2014	2015	2016	2017	2018	2019
gender	-0.194	-0.192	-0.189	-0.190	-0.190	-0.196	-0.198
head	0.159	0.156	0.156	0.155	0.153	0.153	0.156
married	0.047	0.049	0.051	0.053	0.052	0.052	0.051
young_children	-0.008	-0.010	-0.009	-0.009	-0.002	-0.003	-0.006
children	0.021	0.020	0.017	0.014	0.011	0.010	0.011
education	0.070	0.071	0.069	0.072	0.072	0.074	0.076
age	0.002	0.002	0.002	0.002	0.002	0.002	0.002
rural	0.006	-0.001	0.010	0.017	0.021	0.022	0.010
Observations	481,019	501,548	505,806	502,791	495,218	495,368	492,063

Marginal effects statistically significant at 1 percent (except the marginal effects in underlined cells, which are not statistically significant).

Source: IMF staff calculations.

7. Results suggest that childcare and eldercare appear to be among the main factors hindering female labor force participation in Colombia. The econometric analysis suggests that having young children (less than 5 years old) reduce women's probability of staying in the Colombian labor force by around 6 percentage points, whereas having elders living at home (for

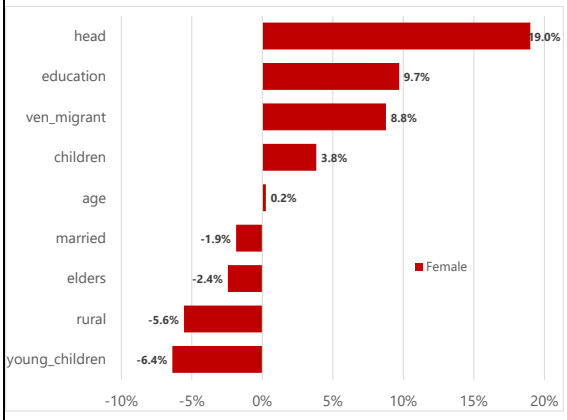
example, parents and older family members) shaves this probability by additional 2 ppts (Figure 4, Panel A).

8. The rise of Venezuelan migrants, who have higher propensities to participate in the Colombian labor force, may have played a role. Among key patterns that have been identified in the literature (e.g., Alvarez et al, 2022), Venezuelan migrants appear to be more educated than the average Colombian. Also, migrants tend to be younger (28 years old on average) than Colombians (32 years old). These differences partially explain the migrant's higher labor force participation rate than that of the locals.[4] After controlling for other characteristics, staff's econometric analysis shows that being a Venezuelan migrant boosts the probability of participating in the Colombian labor force by about 10 percentage points on average—9 ppts for women and 12 ppts for men (Figure 4, Panels A and B). It is possible, however, that higher inflows of Venezuelans in the country could have negatively impact female LFP through a reduction in LFP among less-skilled Colombians facing competition for jobs with them, while the opposite effect could be found among high-skilled women (Pedrazzi and Peñaloza-Pacheco, 2022).[5]

9. Other factors played a secondary role. While the measure of crime (homicide rates, in levels) is statistically significant, the size of the coefficient is small (Figure 5). However, care is needed with the interpretation that crime would not be an explanatory factor of LFP, as there could be other forms of crime and insecurity not captured by the chosen measure. No major differences were observed for the results using 2024 data.

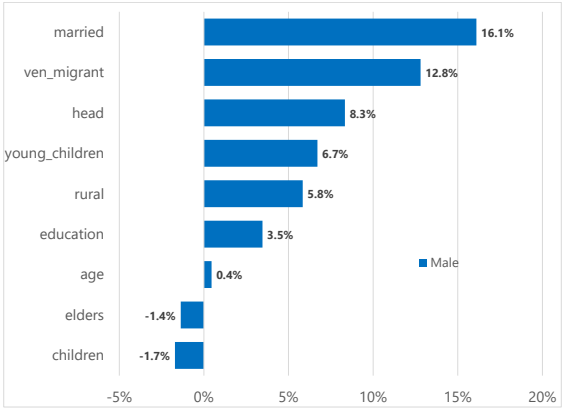
Figure 4. Colombia: Drivers of Probability of Participating in the Labor Force, 2023
(Marginal contribution to an individual's probability of staying in the labor force; from probit regression)

A. Female



Source: IMF staff calculations.

B. Male



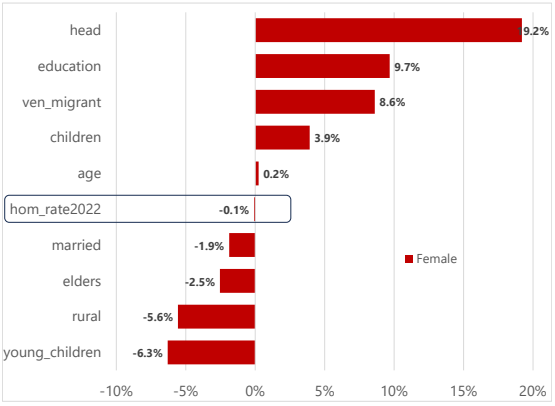
Source: IMF staff calculations.

[4] About 74 percent of the Venezuelan migrants actively sought a job, compared with 63 percent of the locals.

[5] Importantly, the authors find no evidence of such effect among high-skilled Colombian females. Moreover, a positive effect of the Venezuelan migration on Colombia's female LFP is found among high-skilled Colombian women living with at least one young child (up to 5 years old) as a dependent.

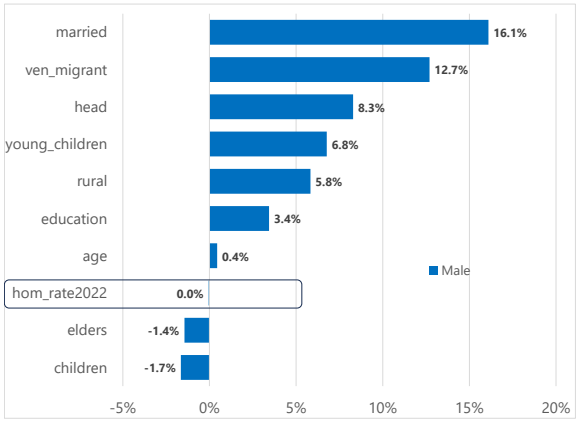
Figure 5. Colombia: Drivers of Probability of Participating in the Labor Force, 2023
(Marginal contribution to an individual's probability of staying in the labor force; from probit regression)

A. Female



Source: IMF staff calculations.

B. Male



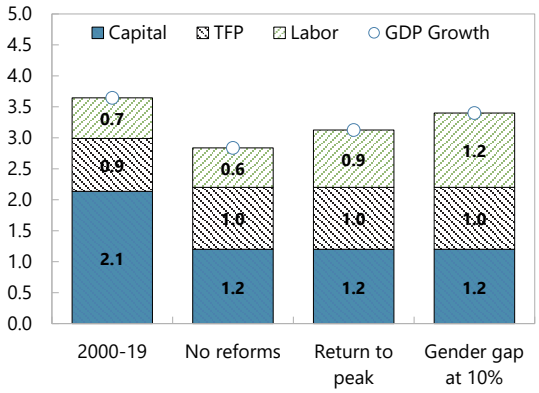
Source: IMF staff calculations.

Recommendations

10. Policies to enhance work flexibility, expand childcare and eldercare services, and better integrate migrants in the labor force could raise Colombia's long-term growth potential.

- **Demographic Drags**. In the two decades up to the pandemic, labor dynamics contributed on average with 0.7 percentage points to Colombia's annual real growth rate. Going forward, however, negative population changes are expected to weigh on growth and, all else equal, to reduce the labor contribution to long-term growth by 0.1-0.2 ppts. The falling contribution from labor could be larger as birth rates in Colombia have plummeted since the pandemic.[6]

Figure 6. Colombia: Labor Contribution to Long-Term Growth: A Counterfactual Analysis (percentage points)



Source: IMF staff calculations.

- **Impact of Boosting LFP**. A counterfactual analysis where the LFP rate would return to the peak could increase Colombia's long-term growth rate by 0.3 ppts. Moreover, if the gender gap in labor participation could be narrowed to 10 percent—the average gap observed in advanced economies—the contribution from labor could boost long-term growth by 0.6 ppts

[6] According to Colombia's National Statistics Office (DANE), the number of births per year has declined from more than 200 thousand in 2019 to less than 90 thousand last year.

(Figure 6). Further integrating migrants in the labor force would add to these figures. Finally, increasing labor force participation would reduce funding pressures on Colombia's pension system.

- **Policies**. Enhancing work flexibility, expanding childcare and eldercare services, and better integrating migrants in the labor force could boost Colombia's LFP.[7] Reaping the economic gains from migration requires further accelerating and strengthening labor market integration. Key dimensions include expanding access to formal labor markets through more integrated approaches and deepening active labor market policies including job search and labor protections. Formalizing migrant workers and easing access to the formal labor market would reduce misallocation and mismatching.

[7] See, for instance, Berniell et al. (2023).

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