

# Belize: Selected Issues



# BELIZE

## SELECTED ISSUES

May 2023

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# BELIZE

April 18, 2023

## SELECTED ISSUES

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Department

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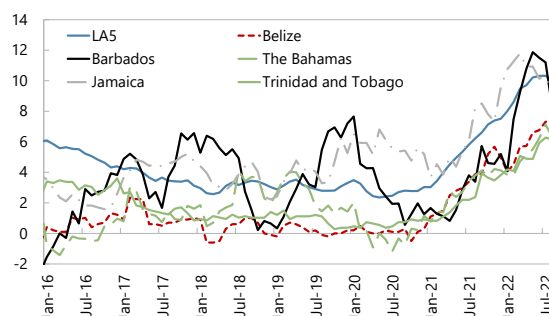
# ANALYZING INFLATION DYNAMICS IN BELIZE

*This chapter studies inflation dynamics in Belize with the goal of quantifying the role of external and domestic factors in the recent inflationary episode and projecting inflation going forward. The chapter first applies a Principal Component Analysis (PCA) to inflation data of several countries and finds that global factors have contributed substantially to both the historical variation and the recent surge in Belize's inflation. An estimated Phillips curve also finds that external factors, proxied by food and fuel prices and US inflation, have been a key driver in the surge in Belize's inflation during the last two years. Going forward, the Phillips curve projects that Belize's inflation will gradually fall to 1.2 percent over the medium term as commodity prices and global inflation decline.*

## A. Introduction

**1. Belize's inflation has risen significantly since mid-2021, in line with regional peers.** The increase in inflation has likely been due to both external and domestic factors. External factors include disruptions in global value chains, higher shipping costs, and increased global food and fuel prices, particularly in 2022 following Russia's invasion of Ukraine. Domestic factors include closing output gaps as economic activity recovered from the pandemic, currency depreciations, and higher inflation expectations in some countries.

**Headline Inflation in Latin America and the Caribbean**  
(In percent, year on year)



Sources: Haver Analytics and IMF staff calculations.  
Note: LA5 = simple average of Brazil, Chile, Colombia, Mexico, and Peru.

**2. This chapter seeks to quantify the role of external and domestic factors on the recent increase in Belize's inflation and project inflation going forward.** It first applies a PCA to the inflation rates of 68 countries during 2000-22 to identify global factors driving inflation dynamics across countries and estimate their importance for Belize. To complement this analysis, the chapter also estimates an augmented Phillips curve using local projection methods, which is used to analyze the drivers of the recent surge in inflation and project inflation going forward.

**3. Global factors explain most of the recent surge in inflation in Belize and are projected to reduce inflation going forward.** The PCA shows that global factors explain over 70 percent of the historical variation in Belize's inflation since 2000 and nearly all the increase in inflation between June 2021 and June 2022. The Phillips curve also shows that external factors, proxied by global food and fuel prices and US inflation, explain most of increase in inflation since mid-2021, and projects that these factors will lower inflation in Belize in the coming years as US inflation and global food and fuel prices decline.

## B. Principal Component Analysis (PCA)

**4. The contribution of global factors to inflation variation in Belize is estimated using PCA.** PCA models transform many covarying time series into a smaller number of orthogonal series (sequences of common or global factors), in a way that each successive common factor explains as much as possible of the remaining variation in the original time series. The PCA model is applied to the monthly year-on-year headline inflation rates of 68 countries between January 2000 and August 2022, standardized with mean zero and a standard deviation of one. Regional aggregates are calculated using 2019 population weights.

**5. The inflation rate is decomposed between a global component and an idiosyncratic component.** For each country  $i \in \{1, 2, \dots, 68\}$ , inflation is decomposed into a global component, which takes into consideration country-specific loading coefficients over a fixed number of global factors  $f \in \{1, 2, \dots, F\}$ , and an idiosyncratic component:

$$\pi_{it} = (\lambda_{i1} \dots \lambda_{iF}) \cdot (g_{1t} \dots g_{Ft})' + \varepsilon_{it}$$

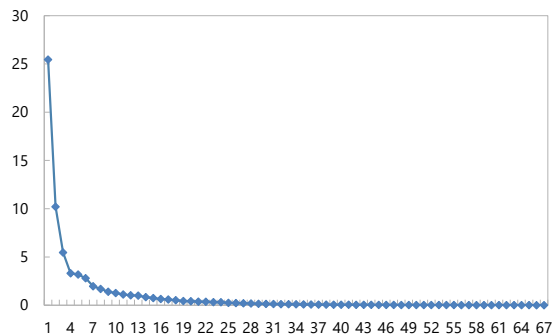
where  $\lambda_{if}$  is country  $i$ 's loading coefficient for global factor  $g_{ft}$  and  $\varepsilon_{it}$  the idiosyncratic component, which is assumed to be uncorrelated with the global factors. The global component of inflation in each country (or group of countries) is defined as:  $G_{it} \equiv (\lambda_{i1} \dots \lambda_{iF}) \cdot (g_{1t} \dots g_{Ft})'$ .

**6. The analysis selects three global factors.**

This is because: (i) the three components explain over 60 percent of the inflation variation across countries; (ii) the Cattell (1966) test, which looks at the differences in eigenvalues of consecutive global factors, suggests that the appropriate number of factors is three (the differences in eigenvalues is small after that); and (iii) recent statistical tests from Onatski (2010), Ahn and Horenstein (2013) and Gagliardini et al. (2019) indicate that the appropriate number of components is around two.

**Eigenvalues of the Principal Component Analysis**

(Scree plot of eigenvalues of each component)



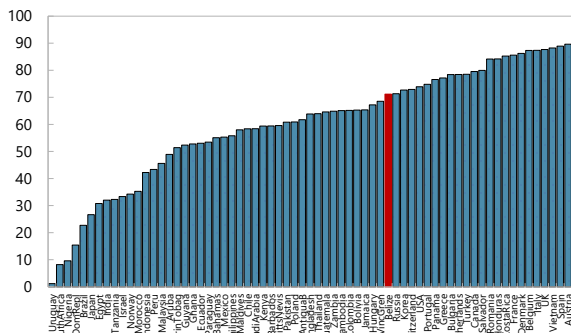
Sources: IMF staff calculations.

**7. Global factors explain a large share of the variation in Belize's inflation since 2000.**

Global factors explain 71.2 percent of variation of inflation in Belize over the last 22 years, with the first factor alone explaining 69.2 percent. When compared to other countries, Belize ranks in the top 40 percent of the distribution of countries in the sample and has one of the largest shares of inflation variation explained by global factors in Latin America and the Caribbean.

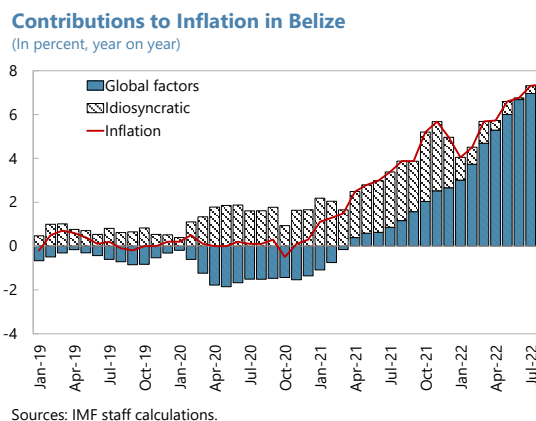
**Inflation Variation Explained by Global Factors**

(In percent)

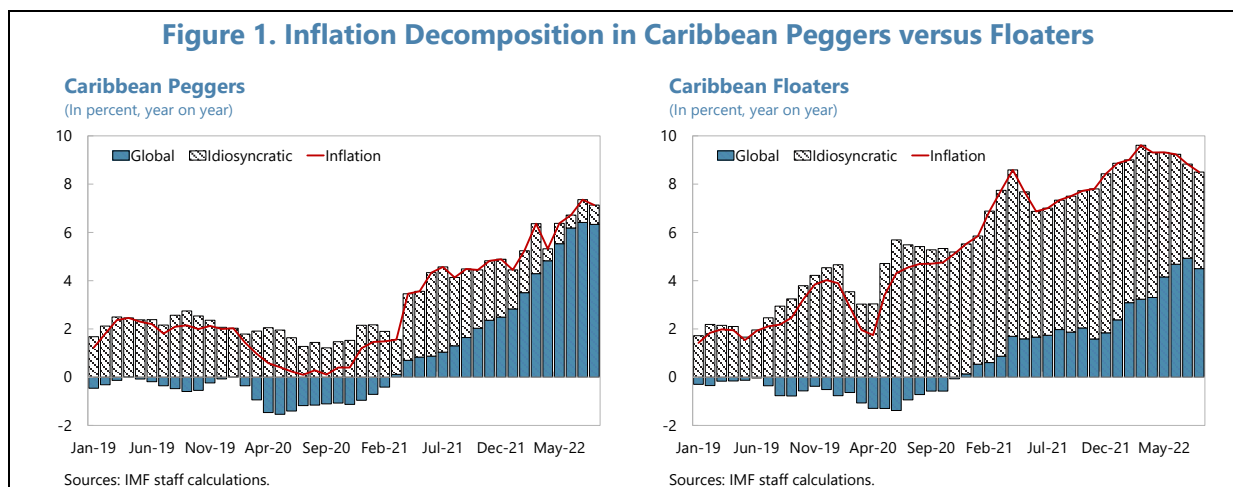


Sources: IMF staff calculations.

**8. Global factors explain an even larger share of the increase in Belize’s inflation since mid-2021.** Inflation in Belize remained near zero in 2019-20 as a small negative global component was offset by a small positive idiosyncratic component. This changed since early 2021, when inflation started increasing in line with the rise in both the idiosyncratic and the global components. The global component became more prominent in 2022, when inflation peaked at 7.4 percent year-on-year in August 2022, of which 6.9 percent was due to global factors.

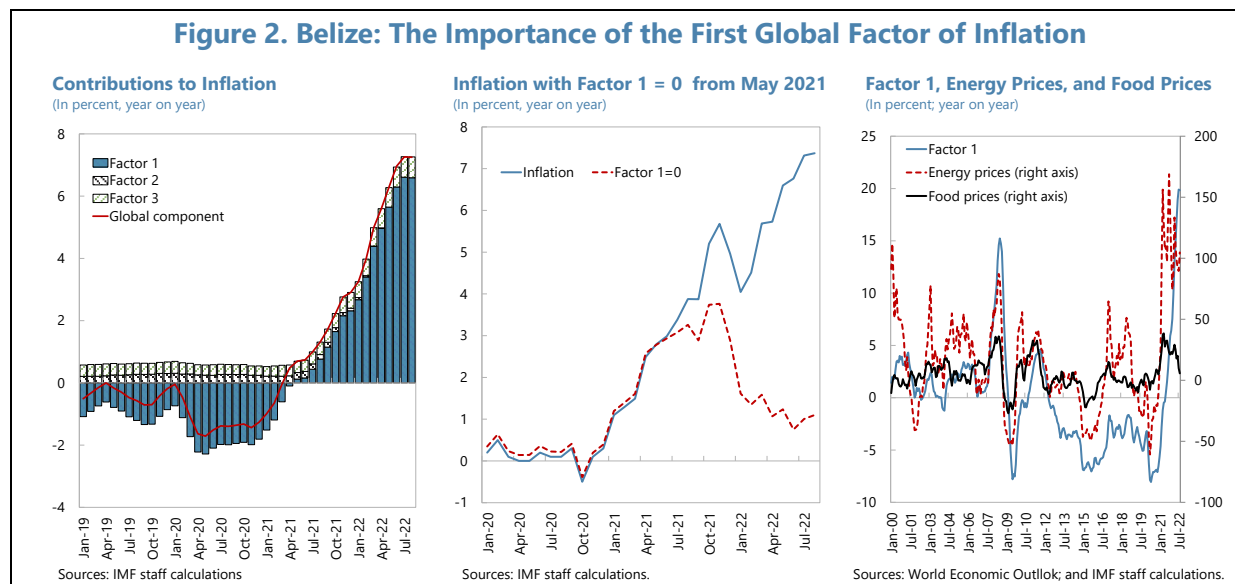


**9. The importance of global factors in the recent surge in inflation is common across the Caribbean.** Figure 1 decomposes inflation between global and idiosyncratic factors for the average Caribbean economy with pegged and floating exchange rate regimes. Two features stand out. First, countries with a pegged exchange rate experienced lower inflation. Second, although global factors contributed to the increase in inflation in both groups since mid-2021, they contributed more for the peggers than for the floaters. This likely reflects different weights of food and fuel in the CPI baskets as well as the impact of currency depreciation in the floaters.



**10. Factor 1 explains most of the recent rise in Belize’s inflation and is strongly correlated with global energy and food prices.** Figure 2, left panel, shows that factor 1 contributed most of the overall global component, especially in 2022. As the middle panel shows, inflation in Belize would have been much lower in 2022 if Factor 1 had been kept at zero from May 2021, peaking at 3.8 percent in November 2021 and falling after to near 1 percent in August 2022. This likely reflects the large impact of global commodity prices on Belize’s inflation. As the right panel shows, Factor 1 comoves closely with global energy and food prices, with a correlation of 0.64 with global energy prices and 0.51 with global food prices between 2000 and 2022.

**Figure 2. Belize: The Importance of the First Global Factor of Inflation**



### C. Estimating an Augmented Philips Curve

**11. An augmented Phillips curve is estimated to complement the PCA and identify the key drivers of inflation in Belize.** In addition to global commodity prices, theory indicates that inflation depends on the output gap, changes in the nominal exchange rate, and inflation expectations. Moreover, as the Belizean dollar is pegged to the US dollar, US inflation may have a direct impact on Belize’s inflation. Thus, quarter-on-quarter seasonally adjusted inflation in Belize ( $\pi_t$ ) is regressed on inflation expectations, proxied by lagged inflation ( $\pi_{t-l}$ ), the lagged output gap ( $gap_{t-l}$ ), quarter-on-quarter log changes in the nominal effective exchange rate ( $dln(NEER)_{t-l}$ ), quarter-on-quarter seasonally adjusted CPI inflation in the US ( $\pi_{t-l}^{USA}$ ), and quarter-on-quarter percent changes in oil ( $\pi_{t-l}^{OIL}$ ) and food ( $\pi_{t-l}^{FOOD}$ ) prices as follows:

$$\pi_t = \alpha + \sum_{l=1}^{L_\pi} \beta_l \pi_{t-l} + \sum_{l=1}^{L_{gap}} \delta_l gap_{t-l} + \sum_{l=0}^{L_{NEER}} \kappa_l dln(NEER)_{t-l} + \sum_{l=0}^{L_{\pi^{USA}}} \phi_l \pi_{t-l}^{USA} + \sum_{l=0}^{L_{\pi^{OIL}}} \gamma_l \pi_{t-l}^{OIL} + \sum_{l=0}^{L_{\pi^{FOOD}}} \nu_l \pi_{t-l}^{FOOD} + \varepsilon_t$$

**12. The estimation results show that external factors have significant effects on Belize’s inflation.** The results are presented in Table 1, where the Akaike’s Information Criteria (AIC) was used to choose the optimal number of lags for each variable. Column (1) shows that global factors such as food and oil prices have a positive and significant effect on Belize’s inflation. Column (2), which adds contemporaneous US inflation to the specification in (1), shows that the coefficient on food prices is still significant, although smaller, but the one on oil prices is not. The output gap and lagged inflation also have positive and significant effects on Belize’s inflation.



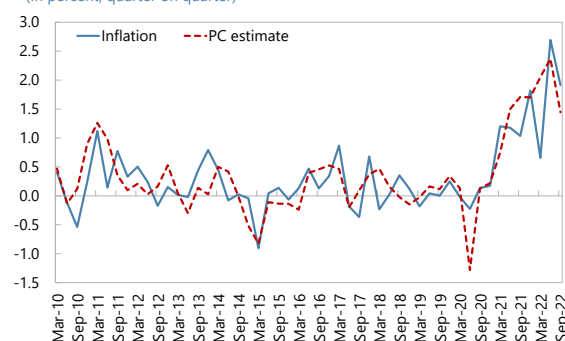
**Table 1. Belize: Phillips Curve Estimates**

	(1)	(2)
$\pi_{t-1}$	0.145* (0.0843)	0.0608 (0.0756)
$\pi_{t-2}$	0.209** (0.0818)	0.147** (0.0728)
$gap_{t-1}$	0.0165* (0.00848)	0.0197*** (0.00748)
$dln(NEER)_t$	0.0211 (0.0501)	0.0196 (0.0441)
$\pi_t^{FOOD}$	0.0368** (0.0154)	0.0182 (0.0139)
$\pi_{t-1}^{FOOD}$	0.0488*** (0.0143)	0.0358*** (0.0128)
$\pi_t^{OIL}$	0.0191*** (0.00551)	-0.00132 (0.00599)
$\pi_t^{US}$		0.847*** (0.146)
Constant	0.176** (0.0777)	-0.211** (0.0954)
Observations	121	121
R-squared	0.427	0.560
AIC	247.6	217.7

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

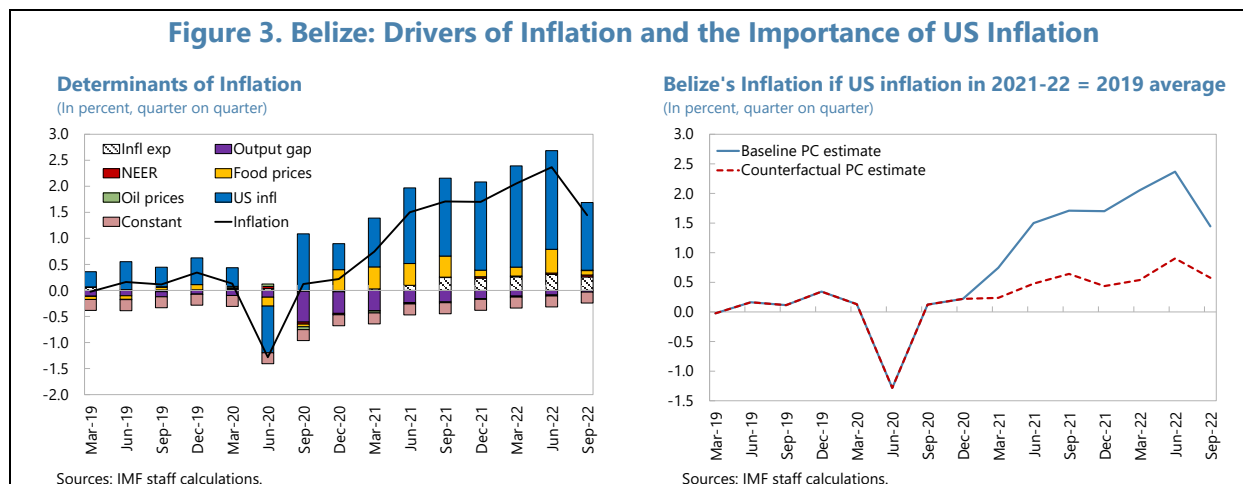
**13. The Phillips curve fits the data well.** With an R-squared of 56 percent, it explains a large share of Belize's inflation variation. It also tracks well the peaks and troughs of inflation, as well as the surge since mid-2021. US inflation and food prices are the main drivers of inflation, especially in the most recent period (Figure 3, left panel). The closing of the output gap and lagged inflation also contributed to the rise in inflation, but less so. The importance of external factors is also evident in Figure 3, right panel, which shows that Belize's inflation in 2021-22 would have been much lower if US inflation had stayed at its 2019 average. Over the long run, the closure of the output gap, the stabilization of commodity prices, the change in the NEER and US inflation would lower Belize's inflation to 0.28 percent per quarter on average.

**Inflation in Belize - Model versus Data**  
(In percent, quarter on quarter)

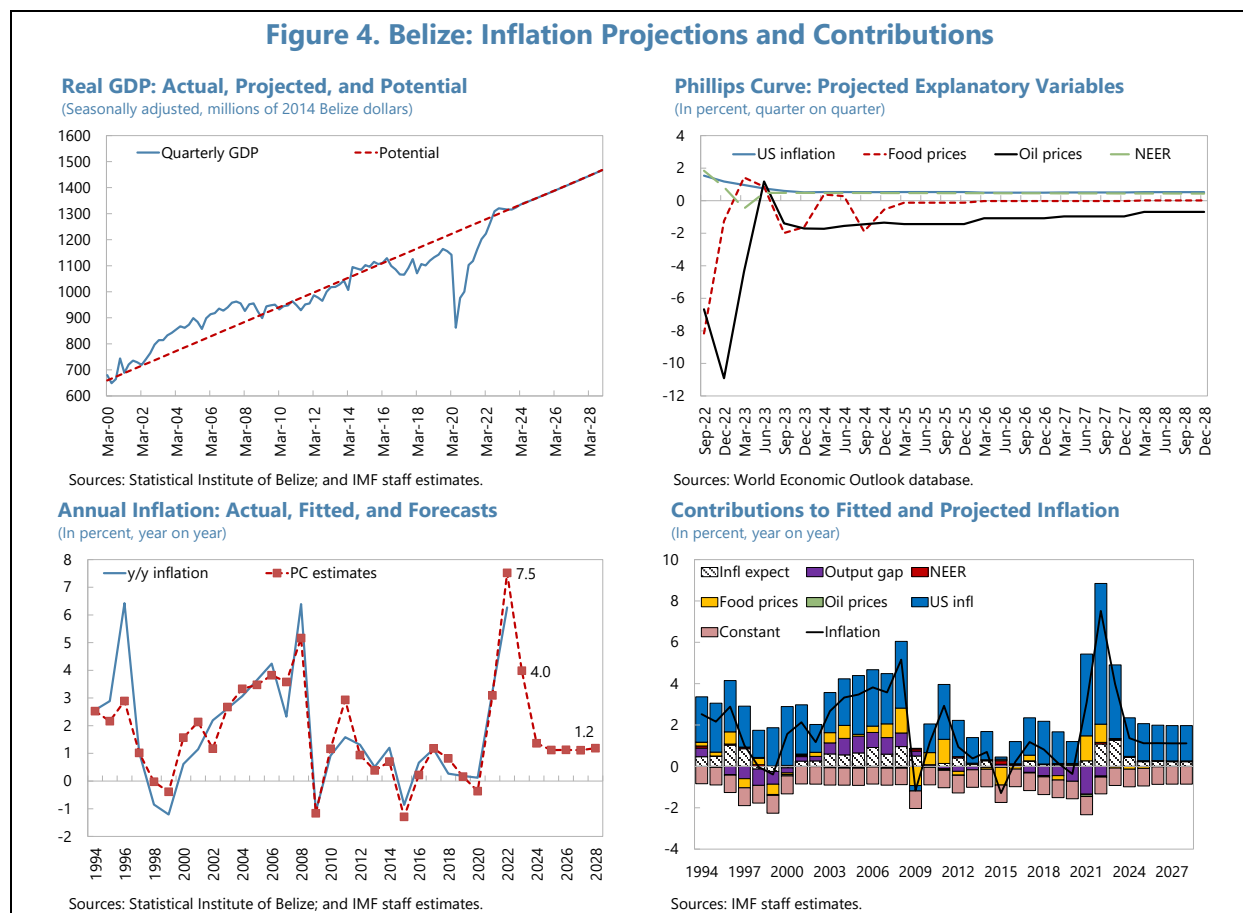


Sources: Statistical Institute of Belize; and IMF staff calculations.

**Figure 3. Belize: Drivers of Inflation and the Importance of US Inflation**



**Figure 4. Belize: Inflation Projections and Contributions**



**14. The model projects that Belize’s inflation will peak at 7.5 percent in 2022, declining gradually afterwards to 1.2 percent over the medium term.** The chapter uses the January 2023 World Economic Outlook database to project the explanatory variables in the Phillip’s curve, which in turn are used to project inflation in Belize. In particular, the output gap is projected to close at end-2023, global fuel prices are projected to fall, and US inflation, food prices, and the NEER are

projected to moderate (Figure 4, top panels).<sup>1</sup> These projections are interacted with the estimated coefficients to project quarterly inflation, which are then compounded to estimate annual inflation. As noted above, the model tracks well actual inflation between 1994 and 2021, and projects that inflation will peak at 7.5 percent in 2022 and decline to 4.0 percent inflation in 2023 and 1.2 percent over the medium term. The peak in inflation in 2022 as well as the subsequent decline is driven by the dynamics of US inflation and food prices, with lag inflation reinforcing these trends.

## D. Conclusions

**15. This chapter shows that external factors have contributed significantly to the surge in Belize's inflation since mid-2021.** A Principal Component Analysis applied to data on inflation for 68 countries during 2000-22 finds that global factors, which comove closely with energy and food prices, explain over 70 percent of the historical variation of inflation in Belize. They also explain most of the increase in Belize's inflation since mid-2021. An estimated Phillips curve also finds that external factors, proxied by US inflation and food prices, have been the main drivers of inflation in Belize since the 1990s, and especially since mid-2021.

**16. Global factors are projected to reduce Belize's inflation significantly going forward.** The explanatory variables of the estimated Phillips curve are projected using the January 2023 World Economic Outlook database, which in turn are used to project Belize's inflation for the next six years. The results indicate that Belize's inflation is projected to decline from a peak of 7.5 percent in 2022 to 4.0 percent inflation in 2023 and 1.2 percent over the medium term. The decline is driven mostly by the projected fall in US inflation and food prices.

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<sup>1</sup> The January 2022 World Economic Outlook has quarterly projections until 2024Q4 and annual projections until 2028. The quarterly projections between 2025Q1 and 2028Q4 are estimated assuming constant quarter on quarter growth rates within each year, calibrated to match the projected annual growth rates.

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# REFORMING BELIZE'S PENSION PLAN FOR PUBLIC OFFICIALS

*This chapter uses a demographic model to analyze reforms to Belize's Pension Plan for Public Officials (PPPO), a non-contributory defined-benefits retirement plan with low retirement age and high pension benefits. Without reforms, the PPPO deficit is projected to increase from 1.1 percent of GDP in 2022 to 4.1 percent in 2072, totaling 77.3 percent of GDP in present value over the next 50 years. Introducing a 10 percent contribution rate, reducing the replacement rate from 67.5 percent to 50 percent, and raising the retirement age from 55 to 65 would lower the long-run deficit to 1.6 percent of GDP and cut its 50-year present value to 26.1 percent of GDP. More generally, the PPPO's retirement age should be indexed to life expectancy to mitigate the fiscal costs of population aging over time.*

## A. Introduction

**1. Belize's public officials participate in two pension systems.** They participate in the long-term branch of the General Social Security Scheme (GSSS), a defined benefit pension system with contributions by both employers and employees and a retirement age of 65 (or between 60 and 64 if not employed). This scheme provides a basic level of social protection, with a maximum pension of 60 percent of pensionable salary after a full career.<sup>1</sup> Public officials also participate in the PPPO, a non-contributory defined-benefits pension scheme with a retirement age of 55. Pensions benefits under the PPPO accumulate with the number of years in public service and peak at two-thirds of the highest salary received during this period.

**2. Adding both pension benefits, the average replacement rate for public officials is close to 100 percent, much higher than in peer countries.** The PPPO's average replacement rate was 67.5 percent in 2021, while the GSSS' average replacement rate was 27.9 percent of the average income in the public sector.<sup>2</sup> Adding both pension benefits, Belize's replacement rate for public officials is 95.4 percent, much higher than in other countries. For example, OECD (2021) estimates the gross replacement rate for males in the OECD at 51.8 percent, while OECD (2014) estimates it at 61.9 percent for males in Latin America and the Caribbean.<sup>3</sup>

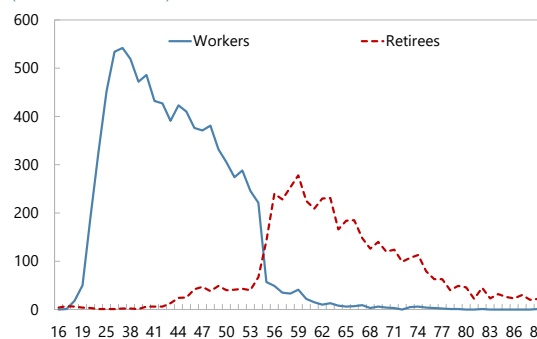
<sup>1</sup> The GSSS contribution rate was raised from 8 percent during 2003-19 to 10 percent since April 2022 to ensure its sustainability. The pensionable salary, over which contributions are paid and pension benefits are calculated, was capped at BZ\$320 per week during 2003-19. This cap was raised to BZ\$520 per week since April 2022 to improve the pension benefits of the high earners.

<sup>2</sup> The average replacement rate is defined as the average pension of current retirees over the average wage of current workers participating in the pension system. Public officials are assumed to receive the average GSSS pension benefit, which is a lower bound estimate as most public officials earn more than the GSSS's pensionable salary.

<sup>3</sup> The OECD's gross replacement rates correspond to the individual gross pension entitlement after a full career over gross pre-retirement earnings. Therefore, these numbers are not directly comparable to those reported for Belize.

**3. Belize’s demographic ratio is low, but it is projected to grow over time.** Belize’s public sector had 15,117 workers and 4,767 retirees under the PPPO in FY2021, implying a demographic ratio (ratio of retirees to workers) of 31.5 percent. This ratio is expected to remain moderate in the near term as public workers are young, with an average age of 36.8 years and 47.3 percent of them being between 27 and 39 years old. But the ratio is projected to increase over the medium term when this group retires. The current cohort of retirees is also young (12 percent are younger than 55 and 50.1 percent are between 55 and 65) and will continue to receive pension benefits for several years.

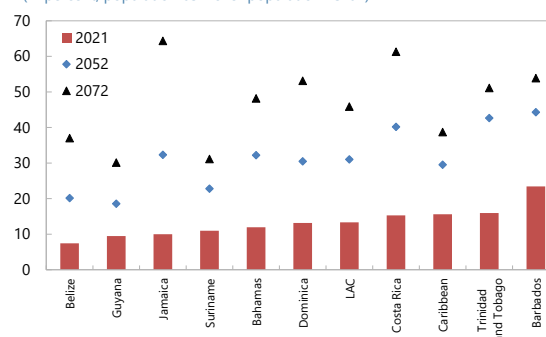
**Age Profile of Public Sector Workers and Retirees**  
(Number of individuals)



Sources: Administrative data from the Belizean authorities; and IMF staff calculations.

**4. Population aging will further raise the demographic ratio.** Belize’s population is young, with an old-age dependency ratio (population 65+ over population between 15 and 64) of 7.4 percent in 2021, one of the lowest in the Caribbean. However, population aging is projected to increase it to 20 percent in 2052 and 37 percent in 2072, while life expectancy at 55 years of age expected to steadily increase from 22 in 2022 to 29.8 in 2072. As a result of this and the current age profile of public workers, the PPPO’s demographic ratio is projected to increase from 31.5 percent in 2022 to 58.4 percent in 2052 and 83.8 percent in 2072.

**Old-Age Dependency Ratios Across Countries**  
(In percent, population 65+ over population 15-64)



Sources: UN Population Prospects.

**5. Without reforms, the PPPO deficit is projected to grow significantly over time due to the generosity of the system and population aging.** The PPPO deficit is projected to increase from 1.1 percent of GDP in 2022 to 4.1 percent of GDP in 2072, with a present value of the deficits accumulated during 2022-72 of 77.3 percent of GDP. Making the system sustainable will require implementing parametric reforms. The sooner these reforms are implemented, the less disruptive they can be. Delaying their implementation will imply that larger parametric reforms will be needed later to make PPPO sustainable. This chapter analyzes the impact of changing the contribution rate, the replacement rate, and the retirement age, but not the nature of the system (e.g., from a defined benefit to a defined contribution or from a pay as you go to individual accounts).

**6. Prompt implementation of the recommended reforms would reduce the PPPO deficit by two thirds.** Staff recommended benchmark reforms include: (i) reducing the replacement rate for new retirees by 1 percentage point per year starting in 2023 until it reaches 50 percent in 2039; (ii) increasing the contribution rate for workers and the government by 0.5 percentage points per year each, starting in 2023 until they reach 5 percent in 2032 each or 10 percent in total; and (iii) raising the retirement age by 1 year per year starting in 2027 until it reaches 65 in 2036. These reforms would reduce the PPPO deficit to 1.6 percent of GDP by 2072, and the present value of the

accumulated deficits during 2022-72 to 26.2 percent of GDP. The savings for the government would be smaller than the reduction in the PPPO deficit as it also must pay its share of the contributions. Containing the wage bill would also help moderate the increase in the PPPO deficits.

## B. The Demographic Model

### 7. The first step in the analysis is to project employment and GDP over the medium-term.

For this, the analysis uses available population projections and a production function. Working age population (individuals older than 14) is taken from the UN World Population Prospects database. To estimate the labor force, it is assumed that the labor force participation rate remains constant at the pre-pandemic average of 64.8 percent over the medium term. The unemployment rate is assumed to gradually decrease from 6.1 percent in 2022 to its long run equilibrium of 5.0 percent. Real GDP growth is projected at 2 percent over the next decade, before slowing in line with employment growth under the assumption that the capital-to-labor ratio remains constant. Total factor productivity is projected to grow by 1 percent per year. The change in the GDP deflator is projected to decline from 4.1 percent in 2023 to 1.2 percent over the medium term.

**8. The analysis focuses on public workers younger than 55 and retired public officials older than 54.** These assumptions facilitate the development of a simple framework to study the impact of different parametric reforms to the PPPO without introducing complex exceptions to the model.<sup>4</sup> The number of public workers of age  $a < 55$  in 2022 is denoted by  $\delta_a^{22}$ , while the total number of public workers of all ages in 2022 is denoted by  $\Delta^{22} = \sum_{a=14}^{54} \delta_a^{22}$ .

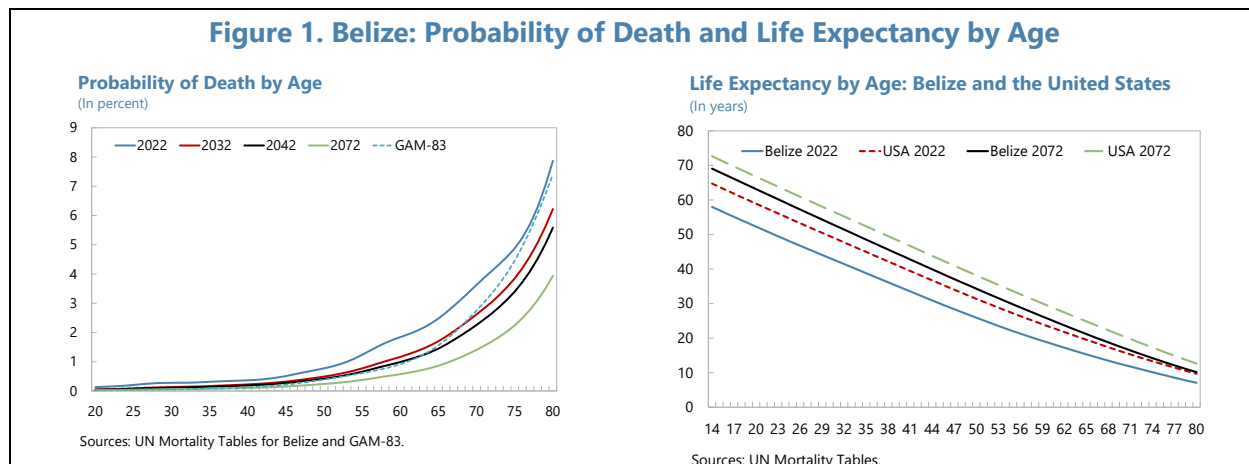
**9. The medium-term projections assume that the size of the public sector declines as the economy develops.**<sup>5</sup> Public sector employment in Belize accounted for 8.1 percent of employment in 2022. This share is assumed to fall by 0.04 percentage points per year, reaching 6.1 percent in 2072. The total number of public workers at each point in time ( $\Delta^t$  for all  $t > 2022$ ) is estimated by multiplying total employment by the share of public sector employment in total employment.

**10. The demographic profile of public workers over time is estimated by interacting their age distribution in 2022 with time-varying survival probabilities.** The next step in the analysis is to calculate the number of public workers of age  $a$  at year  $t$ ,  $\delta_a^t$ , for  $t \geq 2023$ . This group has two components. First, the workers that survived from the previous period  $s_a^t = (1 - \psi_{a-1}^{t-1}) \delta_{a-1}^{t-1}$ , where  $1 - \psi_{a-1}^{t-1}$  is the survival probability of a person  $a - 1$  years old in year  $t - 1$ . This subgroup becomes more predominant over time as the probability of death falls and life expectancy rises for all ages over the next 50 years (Figure 1). The second component is the new hires, which are estimated as the total number of public workers from the aggregate data minus the number of pre-existing workers  $N^t = \Delta^t - \sum_{a=14}^{54} s_a^t$ . Following the current age profile, the analysis assumes that the new

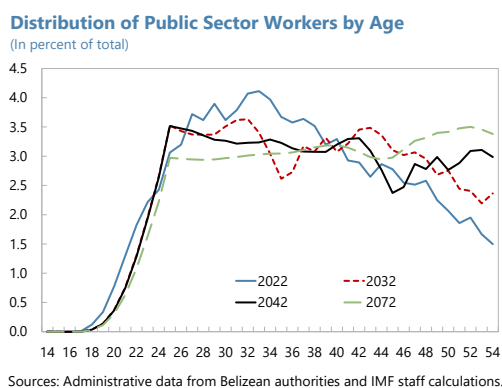
<sup>4</sup> The PPPO currently has a small number of survivor pensions, including children. However, this benefit was canceled and thus it projected to disappear in the coming years.

<sup>5</sup> The public sector is typically larger in small states due to minimum scale requirements to provide public goods and services. As the economy grows, this constraint is less binding, and the public sector typically shrinks relative to the overall economy. Keeping the size of the government constant does not change the results significantly, with the 50-year present value of the PPPO deficits totaling 78.5 percent of GDP instead of 76.2 percent of GDP.

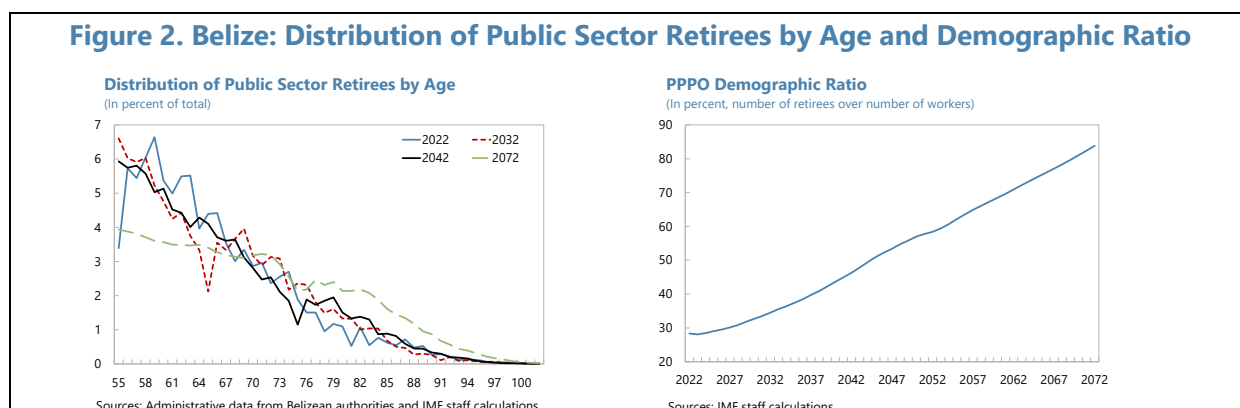
hires are between 18 and 25 years old, distributed in in proportion to the observed age distribution in 2022 ( $\phi_a$ ), such that  $n_a^t = \phi_a N^t$  if the age is between 18 and 25 and zero otherwise.



**11. The model projects that the average age of public workers will increase from 36.3 in 2022 to 38.9 in 2072.** The number of workers of age  $a$  at year  $t$  is the sum of pre-existing workers and new hires:  $\delta_a^t = s_a^t + n_a^t$ . As the survival probabilities rise over time, the number of pre-existing workers grow relative to the new hires. Thus, the age-distribution of public workers becomes more homogeneous over time, while the average age of public workers increases by 2.8 years between 2022 and 2072.



**12. The analysis projects a rise in the average age of retirees and the demographic ratio.** The number of retirees is the sum of pre-existing and new ones. The new retirees are those that turn 55 in each period:  $r_{55}^t = (1 - \psi_{54}^{t-1}) \delta_{54}^{t-1}$ , while the retirees older than 56 is estimated using the last period's distribution of retirees by age and the survival probabilities:  $r_a^t = (1 - \psi_{a-1}^{t-1}) r_{a-1}^{t-1}$ . As the survival probabilities increase over time, the model projects that the average age of retirees will increase from 65.9 in 2022 to 70.0 in 2072, while the demographic ratio would rise from 28.4 percent in 2022 to 83.8 percent in 2072 (Figure 2).



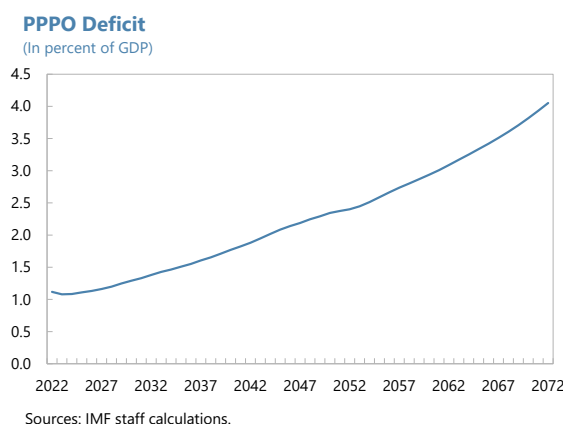


## C. Wages, Pensions, and the PPPO Deficit

**13. Average public sector wages are assumed to grow by 2.5 percent per year.** We assume that the annual wage increments, which were suspended during FY2021-23, will restart in FY2024. Historically, these increments led to an average increase in public sector wages of 2.5 percent per year. The average wage of public workers  $a$  years old in year  $t$  is denoted by  $w_a^t$ . For 2022,  $w_a^t$  is obtained from the administrative data, while beyond 2022 ( $t > 2022$ ) it is estimated as  $w_a^t = 1.025 \cdot w_a^{t-1}$ . The overall wage bill of the public sector is defined as  $W^t = \sum_{a=14}^{54} w_a^t \delta_a^t$ .

**14. The pension benefits remain constant over time.** The average pension of public sector retirees  $a$  years old in year  $t$  is denoted by  $p_a^t$ . For new retirees (those 55 years old), the average pension benefit is calculated as two-thirds of the average salary of those workers that are 54 years old:  $p_{55}^t = (2/3) \cdot w_{54}^t$ . For later years ( $a > 55$ ), the pension benefit remains constant, in line with the current rules:  $p_a^t = p_{a-1}^{t-1}$ . The government's total expenditure on PPPO pensions benefits is defined as  $P^t = \sum_{a=55}^{102} p_a^t r_a^t$ .

**15. The present value of the PPPO deficits during 2022-72 is estimated at 77.3 percent of GDP.** As the PPPO is noncontributory, its deficit corresponds to the total expenditure on pensions  $P^t$ , which is estimated at 1.1 percent of GDP in 2022 and 4.1 percent in 2072. The steady rise in the PPPO deficit is driven by population aging, which increases the number of retirees and thus pension spending, and slower GDP growth in the long run. To calculate the present value, the analysis assumes a real interest rate of 3 percent, with the nominal interest rate falling from 7.2 percent in 2023 to 4.2 percent over the medium term in line with inflation.



## D. Pension Reforms

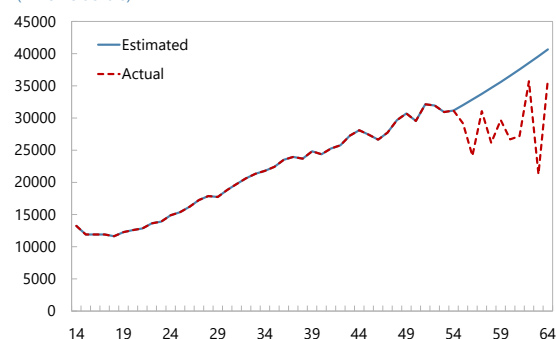
**16. This section studies parametric reforms to the PPPO.** As preferred by the authorities, the analysis does not study fundamental changes to the PPPO such as a switch from a defined benefit to a defined contribution or from pay as you go to individual accounts. Rather, it focuses on parametric reforms, such as raising the contribution rate and the retirement age and reducing the replacement rate. The benchmark reforms are assumed to be implemented gradually over time as follows:

- The replacement rate for new retirees is reduced by 1 percentage point per year starting in 2023 until it reaches 50 percent by 2039.
- The contribution rate is increased by 1 percentage point per year (0.5 point for the workers and 0.5 point for the government), starting in 2023 until it reaches 10 percent by 2032.

- The retirement age remains at 55 for workers that are 50 or older in 2022, and is raised to 56 for those that are 49, 57 for those that are 48, 58 for those that are 47, 59 for those that are 46, 60 for those that are 45, 61 for those that are 44, 62 for those that are 43, 63 for those that are 42, 64 for those that are 41, and 65 for those that are 40 or younger.

**17. Working an extra year is estimated to raise the worker wage by 2.7 percent.** There is no data on wages of workers older than 54 as most public workers retire at 55. Instead, the analysis uses the administrative micro data and estimates the increase in annual wages for working one extra year in the public sector. Table 1, Columns (1)-(3), show that working an extra year increases annual wages by between 2.85 and 2.70 percent. The analysis uses 2.7 percent, which controls for age, gender, and the position within the government.

**Average Annual Wage of Public Sector Workers by Age**  
(In Belize dollars)



Sources: IMF staff calculations.

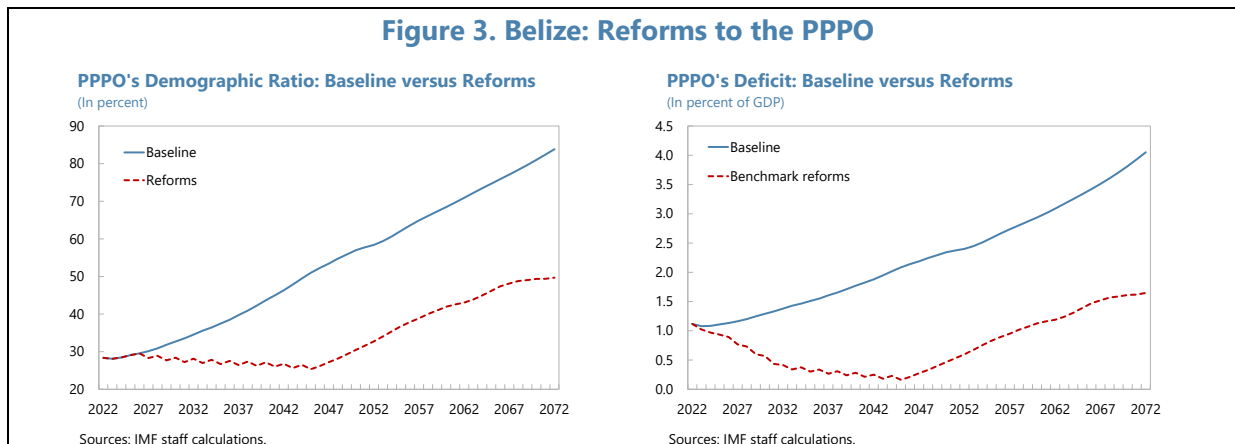
**Table 1. Belize: Increase in Wages for Working One Extra Year**

Dependent variable: log annual salary	(1)	(2)	(3)
Tenure	0.0285*** (0.000521)	0.0282*** (0.000639)	0.0269*** (0.000597)
Age		0.000423 (0.000529)	0.000603 (0.000519)
Age squared		5.64e-07 (5.87e-07)	6.52e-07 (5.73e-07)
Male dummy		-0.0571*** (0.00893)	0.0442*** (0.00947)
Ministry-department FEs	No	No	Yes
Observations	15,044	15,044	15,044
R-squared	0.166	0.168	0.330

Standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.  
Sources: IMF staff calculations.

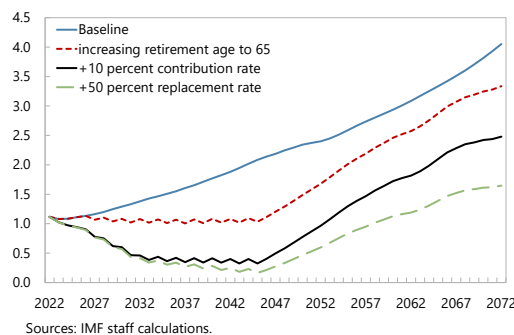
**18. The benchmark reforms reduce the present value of the PPPO’s deficit by two thirds**  
Figure 3, Panel 1, shows that raising the retirement age reduces the demographic ratio significantly, keeping it under 50 percent in the long run. Figure 3, Panel 2, shows that when put together, the three benchmark reforms reduce the deficit of the PPPO to 1.6 percent of GDP over the long run, with the present value of these deficits during 2022-72 falling from 77.3 percent of GDP without reforms to 26.1 percent of GDP with reforms.

**Figure 3. Belize: Reforms to the PPPO**



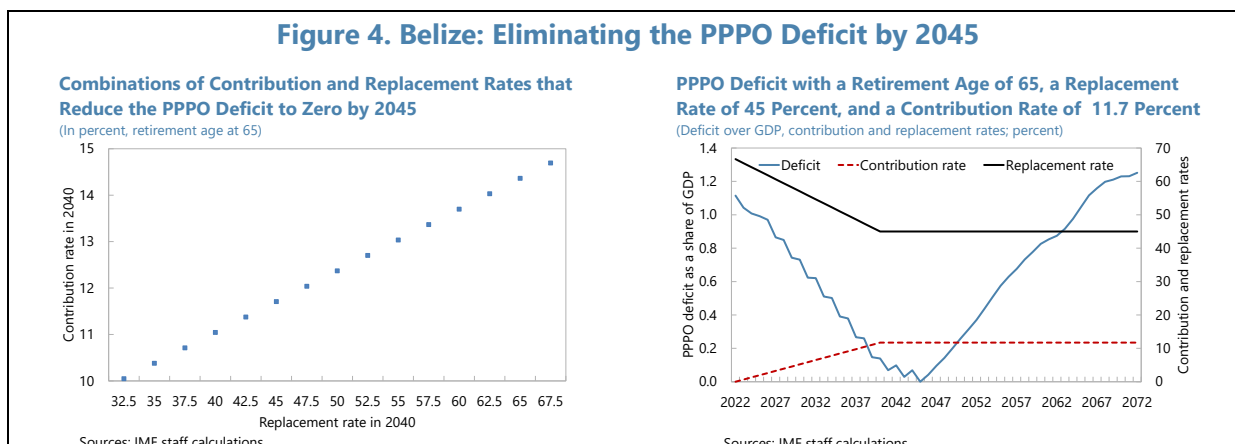
**19. All reforms contribute substantially to the reduction in the PPPO deficit.** In line with the gradual implementation of reforms, the reduction in the PPPO deficit is small in the near term but grows over time. Most of the near-term savings come from raising the contribution rate, which is implemented over a shorter period (10 years). The other reforms take longer to implement (15 to 18 years) but contribute roughly the same amount to the reduction of the deficit in the long run (about 0.8 percentage point of GDP each).

**Contributions to the Reduction in the PPPO Deficit**  
(In percent of GDP)



**20. Different combinations of parametric reforms can yield the same deficit reduction in the long run.** Given a gradual increase in the retirement age of 65, this section studies different combinations of hikes in the contribution rate and reductions in the replacement rate that reduce the PPPO deficit to zero in the long run. Figure 4, Panel 1, shows that the smaller is the reduction in the replacement rate, the larger is the necessary increase in the contribution rate to reduce the PPPO deficit to zero by 2045. For example, when the retirement age is gradually raised to 65 and the replacement rate is reduced to 45 percent by 2040, a contribution rate of 11.7 percent in 2040 will be necessary to eliminate the PPPO deficit (Figure 4, Panel 2).

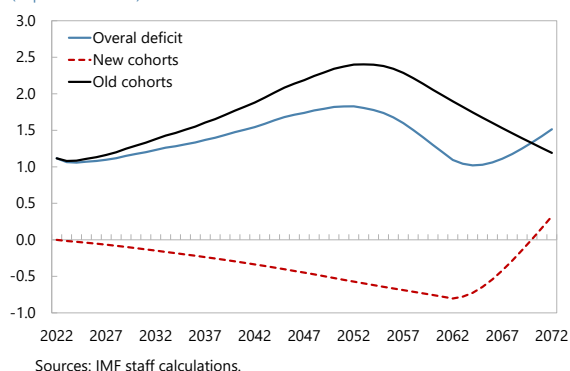
**Figure 4. Belize: Eliminating the PPPO Deficit by 2045**



**21. Implementing the reforms only on new workers would keep the PPPO deficit below 2 percent of GDP and reduce its 50-year present value to 52.2 percent of GDP.**

Keeping the parameters of the PPPO unchanged for existing public sector workers in 2022 and imposing a contribution rate of 10 percent, a replacement rate of 50 percent, and a retirement age of 65 on public workers hired after 2022 would produce smaller reductions in the PPPO deficit than the benchmark reforms but would maintain the PPPO deficit below 2 percent of GDP in the long run and reduce its 50-year present value by about one-third.

**PPPO Deficit with Reforms on New Workers Only**  
(In percent of GDP)



**22. Indexing the retirement age to life expectancy would lower the impact of population aging on fiscal spending and avoid frequent changes to the PPPO parameters.** Figures 3 and 4 show that one-time parametric reforms reduce or stabilize the PPPO deficit for some time, but the deficit eventually rises again later as population continues to age. For example, Figure 3, Panel 2, shows that gradually raising the retirement age to 65, increasing the contribution rate to 10 percent, and reducing the replacement rate to 50 percent, lowers the PPPO deficit from 1.1 percent of GDP in 2022 to 0.2 percent of GDP in 2046. However, as the reform effort stops, the PPPO deficit increases again, reaching 1.6 percent of GDP in 2072. Indexing the retirement age to life expectancy would keep the PPPO deficit low, mitigating the impact of population aging. Containing the wage bill would also help moderate the increase in the PPPO deficits.

## E. Conclusions

**23. Without reforms, the deficit in Belize's PPPO is projected to grow substantially over time.** Using a demographic model, this chapter estimates that population aging together with the lack of contributions, a low retirement age, and generous benefits, would increase the PPPO's deficit from 1.1 percent of GDP in 2022 to 4.1 percent of GDP by 2072, with the present value of these deficits over the next 50 years amounting to 77.3 percent of GDP.

**24. Prompt implementation of parametric reforms would reduce the PPPO's deficit significantly.** A reform package that increases the PPPO contribution rates by 1 percentage point per year, from zero in 2022 to 10 in 2032, gradually raises the retirement age from 55 in 2022 to 65 in 2036 and reduces the replacement rate by 1 percentage point per year, from 67.5 percent in 2022 to 50 by 2039, would reduce the 50-year present value of the PPPO's deficit to 26.1 percent of GDP. The savings in the near term are modest given the gradual implementation of reforms, but they are sizable in the long run. Implementing the reforms only in new public sector workers would reduce the 50-year present value of the PPPO's deficit to 52.1 percent of GDP. The analysis also highlights the tradeoffs among reforms. The less ambitious is the increase in the retirement age or the hike in contribution rates, the larger will the reduction in the pension benefits need to be to reach the same reduction in the PPO deficit. Finally, indexing the retirement age to life expectancy would mitigate the impact of population aging on the PPPO deficit over time.

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OECD (2014), *Pensions at a Glance: Latin America and the Caribbean*, OECD Publishing, Paris, [http://dx.doi.org/10.1787/pension\\_glance-2014-en](http://dx.doi.org/10.1787/pension_glance-2014-en).

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