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WEST AFRICAN ECONOMIC AND MONETARY UNION

SELECTED ISSUES

March 13, 2018

Approved By
The African Department

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GROWTH ACCELERATION IN THE WEST AFRICAN ECONOMIC AND MONETARY UNION[1]

The West African Economic and Monetary Union (WAEMU) member countries have experienced growth acceleration since 2012. Relative to an earlier reference period in the 1990s, the WAEMU's recent strong growth has coincided with an increase in macroeconomic stability and investment, improvement in political institutions, improvement in the terms of trade, and increase in productivity.

A. Introduction

1. The WAEMU has experienced its longest episode of rapid economic growth since 2012 and member states' national development plans stress the importance of sustainable growth. Achieving the latter objective calls for an understanding of the factors that have likely contributed to WAEMU's recent strong growth performance. While the early literature on the economic successes of Nations (starting from Kormendi and Meguire,1985; and Barro, 1991) focused on cross-country growth regressions to identify such fundamentals, most recent studies (following Hausmann, Pritchett, and Rodrik, 2005) have focused on changes during growth turning points or growth acceleration episodes to do so.

2. This paper examines the fundamentals behind WAEMU's recent economic growth acceleration in comparison to the group of low income developing countries (LIDCs). The paper first presents some stylized facts on growth performance in the WAEMU before providing a survey of the literature on growth regressions and growth accelerations models. It then undertakes a benchmarking exercise to compare changes in key macroeconomic variables in the WAEMU and in its peers during the last six years relative to an earlier reference period in the 1990s. Finally, the paper explores the empirical relationship between the same variables and average GDP growth during growth acceleration episodes.

B. Growth Experience in the WAEMU: Some Stylized Facts

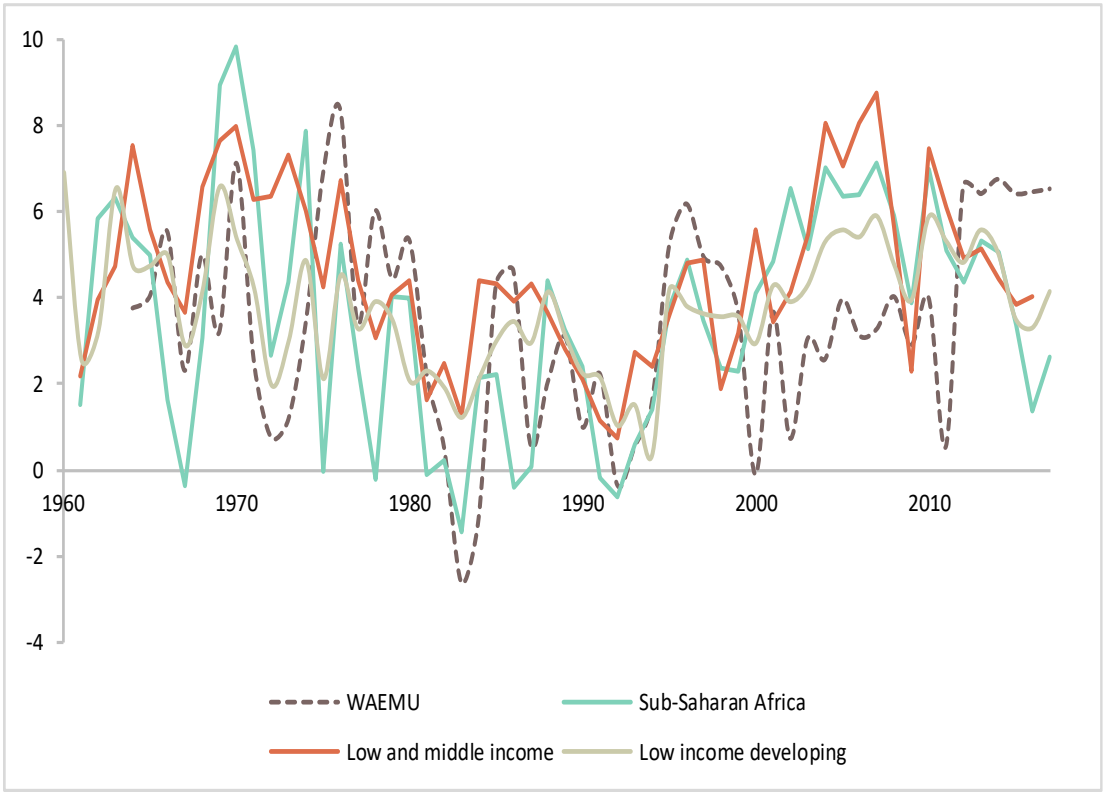
3. The growth performance in WAEMU countries has been variable (Figure 1). The average growth rate (growth volatility) during the period 1960-2017 has been 3.4 percent (4.1 percent) in the WAEMU, compared to 4.0 percent (3.6 percent) in LIDCs.[2] The WAEMU has experienced distinct phases of peaks and troughs in economic growth and growth turning points have been abrupt. Growth fell sharply in 1972, 1983, 1992, 2000 and 2011, corresponding to the periods preceding and following the two oil price shocks of 1974 and 1981, the period preceding

[1] Prepared by Hippolyte Weneyam Balima. The paper has benefitted from comments from Mika Saito, Tim Willems, and Alain Feler.

[2] Growth volatility is defined as the standard deviation of the five-year moving average of the growth rate, using a sample covering the period 1960-2017.

the CFA franc devaluation in 1994 and the more recent period of civil conflict in Côte d'Ivoire. The region has experienced a short-term peak in growth in the years 1970, 1976, and 1996. Since 2012, the WAEMU's real GDP has grown by more than 6 percent a year, that is well above the average growth rate in Sub-Saharan-Africa (SSA) and other developing countries.

Figure 1. WAEMU: Real GDP Growth, 1960-2017

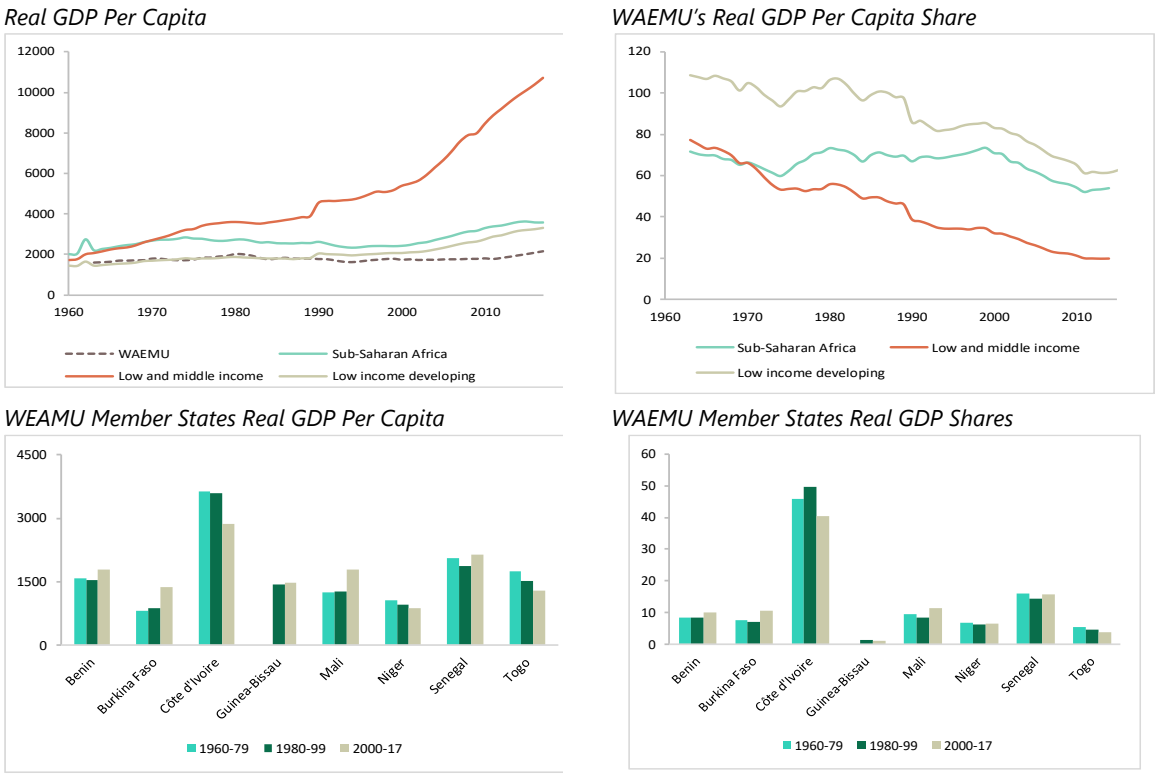


Sources: World Economic Outlook Database (October 2017); and IMF Staff Calculations.

4. Real GDP per capita in WAEMU countries has remained mostly stagnant while it has increased in other LIDCs (Figure 2). Income per capita in the WAEMU was close to that of the group of low and middle-income countries or low income developing countries or SSA in the early 1960s.[3] However, since then, in terms of per capita income, WAEMU's countries have experienced a widening gap relative to other LIDCs. While the share of the WAEMU income per capita in purchasing power parity—PPP—was 108 percent of that of the group of low-income developing countries in the early1960s, it dropped to 65 percent in 2017.

[3] The groups of "low and middle-income countries" and "low income developing countries" are defined following the World Economic Outlook classifications. Details on the latter group are provided in the benchmarking section.

Figure 2. WAEMU: Real GDP Per Capita (in PPP terms) Level and Share, 1960-2017



Sources: World Economic Outlook Database (October 2017); and IMF Staff Calculations. Note: Real GDP per capita is in PPP international dollars.

5. The average per capita income growth in WAEMU hides some heterogeneities across member-countries since the 1960s (Figure 2). A close look at WAEMU's countries suggests that per capita income increased in Benin, Burkina Faso, and Mali, improved slightly in Guinea-Bissau and Senegal, and decreased in Côte d'Ivoire, Niger, and Togo.

6. Côte d'Ivoire is WAEMU's largest economy (Figure 2). Côte d'Ivoire accounts for more than 40 percent of the currency union's GDP, followed by Senegal with about 15 percent. Mali, Burkina Faso and Benin have approximately similar contributions of about 10 percent individually.

C. Growth Regressions versus Growth Accelerations

7. The WAEMU's recent growth experience raises the question as to what has been different during the recent period. Early work on the macroeconomic forces of economic growth have focused on growth regressions and identified a substantial number of growth determinants:

- In a seminal paper, Kormendi and Meguire (1985) demonstrated that macroeconomic factors affecting economic growth operate through the return channel or the investment channel. They showed that growth is negatively associated with monetary variance,

government consumption, and inflation; and positively related with population growth and investment.

- Barro (1991) brought out empirical evidence on growth, fertility, and investment. He showed that the growth rate of real GDP per capita is positively associated with human capital, because high human capital reduces fertility rates and increases physical investments.

- Mankiw, Romer, and Weil (1992) showed that differences in saving, education, and population growth explain most of the international variation in income per capita.

- Subsequent studies extended this literature by including additional control variables to the growth regressions. The additional control variables, among others, include the terms of trade (Easterly, et al. 1993), democracy (Barro, 1996), or investment in transport and communication (Easterly and Rebelo, 1993).

8. The literature based on growth regressions did not explain the sources of variation in the underlying data. The long-term growth performance in many countries tends to be uneven (Easterly et al., 1993), whereas cross-country growth regressions attempted to explain the average growth experience that includes episodes of steep hills and cliffs (Pritchett, 2000; Johnson, Ostry, and Subramanian, 2007). To identify the relevant growth fundamentals, the paper by Hausmann, Pritchett, and Rodrik (2005) suggested to examine episodes where growth experiences a clear turning point.

9. Recent studies, aimed at addressing these shortcomings, have focused on growth acceleration episodes. A growth acceleration episode is defined as a rapid acceleration in economic growth that is long-lasting:

- In a seminal paper, Hausmann, Pritchett, and Rodrik (2005) identified episodes of growth acceleration and estimated the unconditional probability for a country to experience such episode over a decade at around 25 percent. Their findings indicate that the initial episodes of growth acceleration are correlated with increases in investment and trade, exchange rate depreciations, and political-regime changes (defined as a three-unit change in a polity score or a regime interruption).

- Pattillo, Gupta, and Carey (2005) added that accelerations in growth rates are associated with an improvement in the institutional quality (namely the ICRG indicators of political, financial and economic risks)[4], total factor productivity (TFP) growth; and low debt burdens.

[4] ICRG stands for International Country Risk Guide.

- Jones and Olken (2008) found that TFP rather than factor accumulation is correlated with a growth acceleration, and that growth acceleration is strongly associated with international trade and low inflation.

- Berg, Ostry, and Zettelmeyer (2012) highlighted the importance of income inequality, political institutions, and macroeconomic stability during growth acceleration episodes.

- More recently, Arizala and others (2017) focused on a sample of SSA countries and concluded that an increase in investment and trade openness, low inflation, an improved fiscal balance, export diversification, and improvements in the institutional environment are significantly correlated with growth acceleration episodes.

D. A Benchmarking Approach

10. This section compares the WAEMU to the group of LIDCs. LIDCs are defined following the World Economic Outlook (WEO) classifications.[5] This group constitutes 60 countries, including the WAEMU countries. Examining LIDCs allows focus on the development challenges faced by these countries, thereby strengthening the quality of the benchmarking.

11. The benchmarking analysis looks at changes in macroeconomic fundamentals before and during the WAEMU's recent rapid growth episode. WAEMU member countries are benchmarked against LIDCs peers during two different time periods: 1997-99 and 2012-17. The period 2012-17 corresponds to the recent growth acceleration episode in the WAEMU. The period 1997-99 was chosen to avoid capturing the effects of civil conflict and the 1994 CFA franc devaluation. Using these two points in time may help an understanding of WAEMU's recent growth acceleration episode, compared to the previous period.

12. Key macroeconomic fundamentals examined are factors highlighted in the literature as important determinants of a growth acceleration. These fundamentals include (i) macroeconomic stability, (ii) trade performance, (iii) investment, (iv) polity score, (v) terms of trade, and (vi) total factor productivity.

Macroeconomic stability

13. Macroeconomic stability is an important driver of growth acceleration. Countries with macroeconomic stability are better able to anchor expectations and promote high and long-term investment decisions that may help growth to be sustainable. This finding is confirmed by the Arizala and others (2017). Macroeconomic stability in this paper is captured by the inflation rate and volatility, and exchange rate depreciation and volatility. Data show that the WAEMU region has benefitted from greater macroeconomic stability than its peers in LIDCs (Table 1).

[5] Specifically, LIDCs are countries that (i) were classified as Poverty Reduction and Growth Trust (PRGT) eligible in the 2013 PRGT eligibility exercise, and (ii) have a level of per capita gross national income less than the PRGT income graduation level for non-small states. The list of LIDCs is reported in Annex 1.

Table 1. WAEMU: Macroeconomic Stability Before and After the Recent Rapid Growth, 1997-2017

	WAEMU	LIDCs	Benin	Burkina Faso	Côte d'Ivoire	Guinea-Bissau	Mali	Niger	Senegal	Togo
					Inflation rate					
1997-1999	4.2	12.6	3.3	2.3	3.8	18.3	0.7	1.7	1.2	2.1
2012-2017	1.0	5.9	1.3	1.1	1.2	1.3	0.9	0.7	0.7	1.3
Difference	-3.2**	-6.7***	-2.0	-1.2	-2.6*	-17.0	0.2	-1.0	-0.5	-0.8
					Inflation volatility					
1997-1999	5.7	20.4	3.1	3.1	3.1	23.6	3.9	3.5	1.6	3.6
2012-2017	1.7	3.4	2.6	1.5	1.3	1.8	2.1	1.6	1.3	1.0
Difference	-4.0***	-17.0	-0.5	-1.6***	-1.8*	-21.8***	-1.8**	-1.9**	-0.3	-2.6*
					Exchange rate depreciation					
1997-1999	39.1	71.8								
2012-2017	24.2	58.9								
Difference	-14.9	-12.9								
					Exchange rate volatility					
1997-1999	70.4	137.1								
2012-2017	37.1	98.8								
Difference	-33.3***	-38.3								

Sources: World Economic Outlook Database (October 2017); and IMF Staff Calculations. Note: The difference corresponds to the value in 2012-2017 minus the value in 1997-1999. ***, **, and * indicate that the difference is statistically significant at 0.01, 0.05, and 0.10 respectively.

Trade Performance

14. Trade openness grew less in the WAEMU than on average in LIDCs (Table 2)**.** On average, the trade openness (measured by the sum of exports and imports-to-GDP) was about 65 percent in WAEMU countries during 2012-17, compared to 96 percent in LIDCs during the same period. In addition, trade openness increased by 12.6 percentage points in the WAEMU, compared to 14.8 percentage points in LIDCs between the two periods of comparison. The level of trade openness in 1997-99 in the WAEMU was 52 percent, compared to an average of 81 percent in LIDCs.

Investment

15. Growth accelerations are correlated with an increase in investment. Hausmann, Pritchett, and Rodrik, (2005) found that the transition period to a growth acceleration coincides with an increase of the investment ratio, which continues to increase during the growth acceleration episode.

Table 2. WAEMU: Trade Openness-to-GDP Before and After the Recent Rapid Growth, 1997-2017

	WAEMU	LIDCs	Benin	Burkina Faso	Côte d'Ivoire	Guinea-Bissau	Mali	Niger	Senegal	Togo
					Trade-to-GDP					
1997-1999	52.7	81.2	41.6	35.5	75.5	38.2	49.3	43.9	62.7	74.8
2012-2017	65.3	96.0	44.5	60.5	73.4	52.4	61.9	58.7	73.6	97.3
Difference	12.6***	14.8***	2.9	25.0***	-2.1	14.2*	12.6***	14.8***	10.9***	22.5***

Sources: World Economic Outlook Database (October 2017); and IMF Staff Calculations. Note: The difference corresponds to the value in 2012-2017 minus the value in 1997-1999. ***, **, and * indicate that the difference is statistically significant at 0.01, 0.05, and 0.10 respectively.

16. Evidence suggests that investment has increased more in the WAEMU than in LIDCs during the recent period of acceleration, compared to the earlier benchmark period (Table 3). On average, the ratio of total investment-to-GDP increased by 6.7 percent of GDP during 2012-17 compared to 0.6 percent in LIDCs. At the WAEMU's individual member level, investment increased particularly in Niger, Togo, Senegal and Burkina Faso well above the average level of 6.7 percent in the WAEMU.

17. The increase in investment in the WAEMU was partly driven by the public sector. Public investment-to-GDP increased by 3.4 percentage points of GDP in the WAEMU during the two periods of comparison, compared to 1.4 percentage points in LIDCs. This increase in public investment was particularly important in Togo, Niger, Côte d'Ivoire and Senegal.

Table 3. WAEMU: Investment-to-GDP Before and After the Recent Rapid Growth, 1997-2017

	WAEMU	LIDCs	Benin	Burkina Faso	Côte d'Ivoire	Guinea-Bissau	Mali	Niger	Senegal	Togo
					Investment, total (% du PIB)					
1997-1999	15.9	23.5	21.9	24.8	11.0	6.7	23.5	11.8	16.1	11.9
2012-2017	22.6	24.1	26.4	16.3	17.6	9.3	17.9	40.5	26.7	25.7
Difference	6.7***	0.6	4.5*	-8.5***	6.6***	2.6	-5.6**	28.7***	10.6***	13.8***
					Investment, public (% du PIB)					
1997-1999	5.7	5.3	5.8	9.0	4.5	3.8	8.6	6.0	5.3	2.8
2012-2017	9.1	6.7	6.6	7.7	7.0	5.2	9.1	14.1	7.4	15.5
Difference	3.4***	1.4***	0.8	-1.3**	2.5**	1.4	0.5	8.1***	2.1***	12.7***

Sources: World Economic Outlook Database (October 2017); and IMF Staff Calculations. Note: The difference corresponds to the value in 2012-2017 minus the value in 1997-1999. ***, **, and * indicate that the difference is statistically significant at 0.01, 0.05, and 0.10 respectively.

Political Institutions

18. Political stability and sound institutions are correlated with growth acceleration. Using Polity score[6], Jones and Olken (2008) find that growth acceleration can be reversed, often leaving countries worse off compared to the period prior to the acceleration, due to political and institutional factors. Starting from a low base, the WAEMU's Polity Score improved significantly between these periods (Table 4).[7]

Table 4. WAEMU: Polity Changes Before and After the Recent Rapid Growth, 1997-2017

	WAEMU	LIDCs	Benin	Burkina Faso	Côte d'Ivoire	Guinea-Bissau	Mali	Niger	Senegal	Togo
					Polity score					
1997-1999	0.1	3.2	6.0	-4.0	-6.0	5.0	6.0	-2.3	-1.0	-2.0
2012-2017	4.1	4.6	7.0	2.4	4.0	4.0	5.0	5.8	7.0	-2.0
Difference	4.1***	1.4***	1.0	6.4	10.0	-1.0	-1.0	8.1	8.0	0.0

Sources: World Economic Outlook Database (October 2017); and IMF Staff Calculations. Note: The difference corresponds to the value in 2012-2017 minus the value in 1997-1999. ***, **, and * indicate that the difference is statistically significant at 0.01, 0.05, and 0.10 respectively.

Terms of Trade

19. Growth accelerations can be influenced by favorable terms of trade. As highlighted by Singer (1950), terms of trade changes affect funds available to developing countries for capital formation and hence growth. The average change in the terms of trade was 1.2 percent in the WAEMU in 2012-17, compared to -0.3 percent in LIDCs during the same period. Moreover, the terms of trade have somewhat improved between 1997-99 and 2012-17 in the WAEMU (Table 5).

Table 5. WAEMU: Terms of Trade Before and After the Recent Rapid Growth, 1997-2017

	WAEMU	LIDCs	Benin	Burkina Faso	Côte d'Ivoire	Guinea-Bissau	Mali	Niger	Senegal	Togo
					Terms of trade					
1997-1999	0.8	0.8	12.9	-5.8	-4.9	1.5	-3.3	5.8	1.0	-0.6
2012-2017	1.2	-0.3	-10.3	4.8	3.9	13.5	4.6	-5.8	1.0	-1.8
Difference	0.4	-1.1*	-23.2	10.6	8.8	12.0	7.9	-11.6	0.0	-1.2

Sources: World Economic Outlook Database (October 2017); and IMF Staff Calculations. Note: The difference corresponds to the value in 2012-2017 minus the value in 1997-1999. ***, **, and * indicate that the difference is statistically significant at 0.01, 0.05, and 0.10 respectively.

[6] Polity Score is a measure of perceptions of political institutions, compiled by the Center for Systemic Peace using open source information. It combines scores of democracy and autocracy into a unified polity scale ranges from +10 (strongly democratic) to-10 (strongly autocratic). Democracy is conceived as three essential elements: the presence of institutions and procedures through which citizens can express effective preferences about alternative policies and leaders, the existence of institutionalized constraints on the exercise of power by the executive, and the guarantee of civil liberties to all citizens in their daily lives and in acts of political participation. Autocracy captures a set of political characteristics: the competitiveness and regulation of political participation, the openness and competitiveness of executive recruitment, and constraints on the chief executive. Caution is needed when interpreting the results as they may be affected by recording errors, availability of information, and sample size.

[7] These results are corroborated using alternative measures of institutional quality, including the ICRG indicators or the Worldwide Governance Indicators which leads to a similar conclusion.

The terms of trade improved particularly in Guinea-Bissau, Burkina Faso, Mali, and Côte d'Ivoire.

Productivity Gains

20. Productivity gains have been identified as important engines of growth acceleration. This subsection uses a standard growth accounting framework with a Cobb-Douglas production function to disentangle the sources of growth in the WAEMU and LIDCs, looking particularly at the contribution of total factor productivity (TFP). The analysis uses data from Penn World Table during the period 1960-2014 to estimate the contributions of TFP, physical capital, and labor to real economic growth.[8]

21. TFP contribution was important to economic growth in the WAEMU (Table 6). The average contribution of TFP for the WAEMU was 1.03 points in 2012-17 compared to 0.57 points in 1997-99. While the contribution of TFP to LIDCs' economic growth was higher than that of the WAEMU in 1997-99, in 2012-17, TFP contribution turned to negative in this broader group. At the WAEMU's individual countries level, TFP contribution particularly increased in Togo, Côte d'Ivoire, Niger, and Guinea Bissau.

Table 6. WAEMU: Total Factor Productivity Before and After the Recent Rapid Growth, 1997-2017

	WAEMU	LIDCs	Benin	Burkina Faso	Côte d'Ivoire	Guinea-Bissau	Mali	Niger	Senegal	Togo
					Total factor productivity					
1997-1999	0.57	1.03	1.51	1.42	4.02	-3.21	0.37	0.98	3.30	-3.79
2012-2017	1.03	-0.45	1.61	-1.08	6.06	-1.72	-0.42	2.65	-0.71	1.90
Difference	0.46	-1.48***	0.10	-2.50*	2.04*	1.49	-0.79	1.67	-4.01***	5.69***

Sources: Penn World Table Database; and IMF Staff Calculations. Note: The difference corresponds to the value in 2012-2017 minus the value in 1997-1999. ***, **, and * indicate that the difference is statistically significant at 0.01, 0.05, and 0.10 respectively.

E. From the Benchmarking to Regressions

22. This section brings the benchmarking factors to an empirical analysis. Using a regression framework, it assesses whether the factors previously presented have been important determinants of growth accelerations in the sample of LIDCs, including the WAEMU member countries. The section estimates a model where the dependent variable is a dummy variable that takes the value of 1 during a year of a growth acceleration, and 0 otherwise. The independent variables are the factors used in the benchmarking exercise. The model is estimated using a Probit model, and controlling for year-fixed effects to remove external factors that are commonto all countries in the sample. To address the potential of endogeneity, the independent

[8] The latest version of the Penn World Table covers the period 1960-2014.

variables are included in the regressions with a year lag. The robustness of the results is also accessed using a logit and a linear probability models.

23. A growth acceleration episode is defined based on a modified variant of Hausmann, Pritchett, and Rodrik (2005). A given country-year observation is considered as a growth acceleration episode if the following three conditions are met:

1. Real GDP growth rate is at least 2 percent;

2. The post-acceleration growth rate is at least 3.5 percent per year, and last for at least 5 years; and

3. The level of the post-acceleration output must exceed the pre-episode peak level of income

24. The above definition differs from the Hausmann, Pritchett, and Rodrik (2005) definition in two ways. First, compared to Hausmann, Pritchett, and Rodrik (2005), the above definition uses a shorter window for the post acceleration growth (five versus seven) in order to capture the recent economic growth performance in the WAEMU member countries which began in 2012. Second, while acceleration is defined using the real GDP growth, Hausmann, Pritchett, and Rodrik (2005) use the growth rate of real GDP per capita.[9]

25. Growth acceleration has been infrequent in LIDCs, including the WAEMU member countries (Table 7). The identification exercise suggests that, out of the 60 LIDCs, 46 countries have experienced, on average, about two episodes of a growth acceleration during the period 1960-17. Regarding the WAEMU member countries, Côte d'Ivoire has performed well (two episodes of growth accelerations in 1964 and 2012). Burkina Faso and Togo have also experienced two acceleration episodes in 2001 and 2009, and 1964 and 2008, respectively. Benin, Niger and Senegal experienced only one episode of acceleration, while Guinea-Bissau and Mali did not experience any episode.

26. Before moving to the empirical results, simple scatter plot analyses suggest that the six fundamentals are correlated with growth accelerations. Figures 3 and 4 show the correlation between each LIDC average growth during its episodes of growth acceleration, if any, and the average level of the fundamentals. The preliminary results indicate that growth accelerations are positively correlated, and in some cases, weakly so, with (i) exchange rate depreciation, (ii) trade openness, (iii) investment-to-GDP, (iv) polity score, (v) favorable terms of trade, and (vi) TFP; and negatively correlated with (i) inflation rate, (ii) inflation volatility, and (iii) exchange rate volatility.

[9] Using the Hausmann, Pritchett and Rodrik (2005) definition yields no growth acceleration episode for the WAEMU member countries.

Table 7. WAEMU: Episodes of Rapid Growth by Country, 1960-2017

Country	Number of growth acceleration episodes	Year of initiation of growth acceleration episodes	Country	Number of growth acceleration episodes	Year of initiation of growth acceleration episodes
Afghanistan	1	2005	Madagascar	2	1996, 2003
Bangladesh	1	1988	Malawi	2	1974, 2005
Benin	1	1994	Mongolia	2	1964, 2001
Bhutan	2	1976, 1994	Mozambique	2	1968, 2001
Bolivia	3	1993, 2003, 2009	Myanmar	1	1999
Burkina Faso	2	2001, 2009	Nepal	1	1988
Burundi	1	2007	Nicaragua	2	1995, 2010
Cambodia	2	1991, 2010	Niger	1	2011
Cameroon	3	1977, 1995, 2010	Nigeria	1	2000
Chad	1	1982	Papua New Guinea	1	1966
Congo, Dem. Rep.	2	2002, 2009	Rwanda	1	2003
Congo, Rep.	1	1968	Senegal	1	2012
Côte d'Ivoire	2	1964, 2012	Sierra Leone	2	2000, 2009
Djibouti	1	2010	Solomon Islands	2	1990, 2003
Ethiopia	1	2004	Sudan	1	1995
Gambia	1	1971	São Tomé and Príncipe	1	2008
Ghana	2	1984, 1990	Tajikistan	1	1998
Guinea	2	1993, 2010	Tanzania	2	1984, 1995
Honduras	1	2001	Togo	2	1964, 2008
Kenya	4	1968, 1976, 1985, 2009	Uganda	1	1992
Lao	1	1989	Uzbekistan	1	1997
Lesotho	3	1968, 1987, 2005	Vietnam	1	1987
Liberia	1	2004	Zambia	2	1964, 1999

27. The empirical analysis confirms these preliminary findings. The baseline regression in column (1) of Table 8 suggests that growth acceleration is significantly related to the fundamentals highlighted in the benchmarking analysis. The estimated coefficients of investment, trade openness, exchange rate depreciation, polity score, terms of trade, and TFP are all positive and statistically significant, suggesting that an improvement in these variables fosters the probability of experiencing a growth acceleration episode. The coefficients on inflation rate and exchange rate volatility are negative and statistically significant suggesting that an elevated level of inflation or exchange rate volatility lower the probability of experiencing a growth acceleration.

28. These baseline results are robust to the method of estimation. Columns 2 and 3 of Table 8 present the baseline results using a logit and a linear probability models, respectively. Irrespective of the model, the signs and statistical significances of the independent variables of interest do not change.

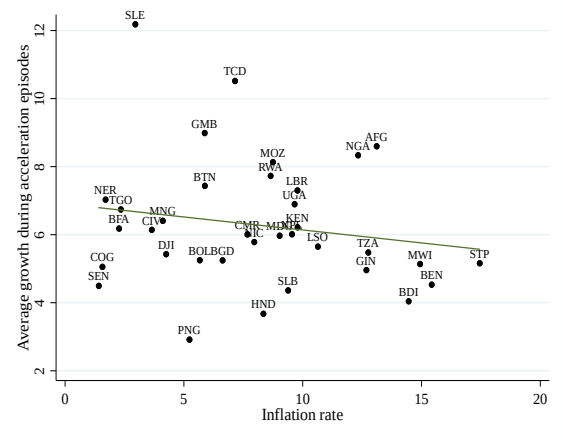
F. Concluding Remarks

29. This paper analyses the fundamental forces behind the WAEMU recent rapid economic growth and compares the WAEMU to the group of LIDCs. It finds that, compared to a period prior to the rapid growth, the WAEMU recent better performance coincides with an increase in) macroeconomic stability and investment, as well as an improvement in institutional quality, terms of trade, and TFP contribution to growth. An empirical analysis concludes that

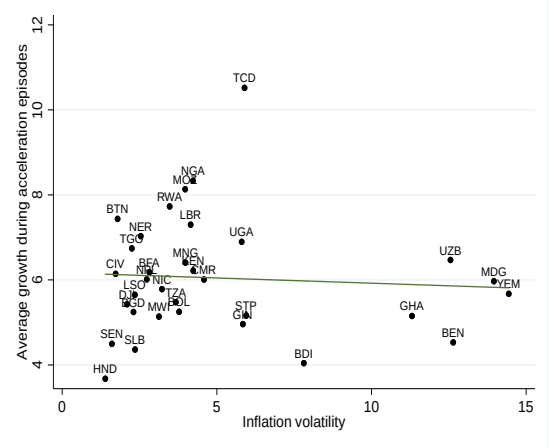
investment, trade openness, exchange rate depreciation, political institutions, terms of trade and TFP are the key favorable drivers of a growth acceleration in LIDCs, while an increase in the inflation rate or the exchange rate volatility lowers the likelihood of experiencing a growth acceleration.

Figure 3. WAEMU: Macroeconomic Stability and Trade, and Average Growth During Acceleration Episodes, 1960-2017

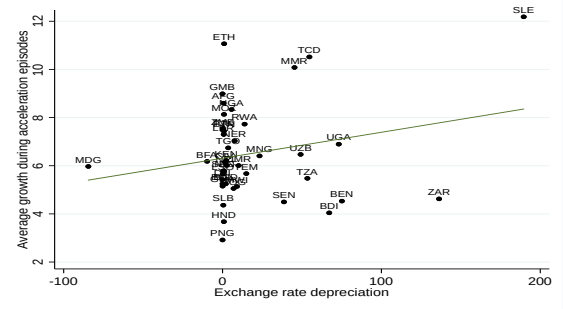
Inflation rate



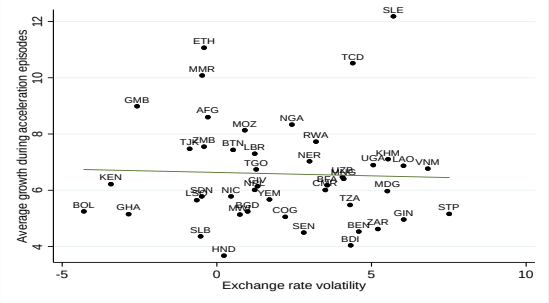
Inflation volatility



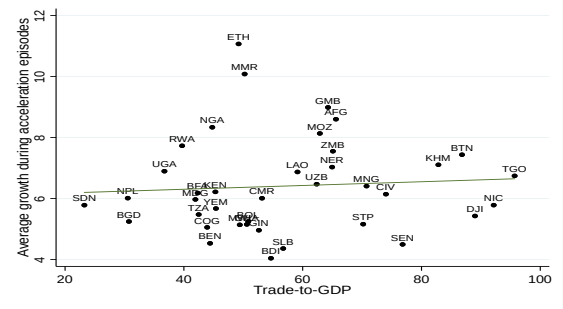
Exchange rate depreciation.



Exchange rate volatility.



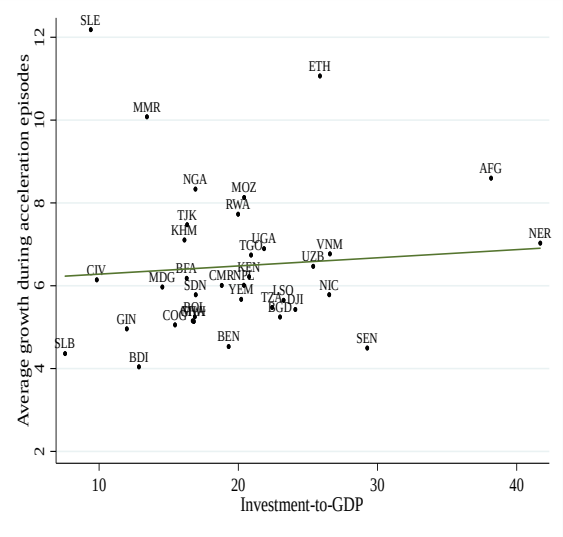
Trade openness-to-GDP



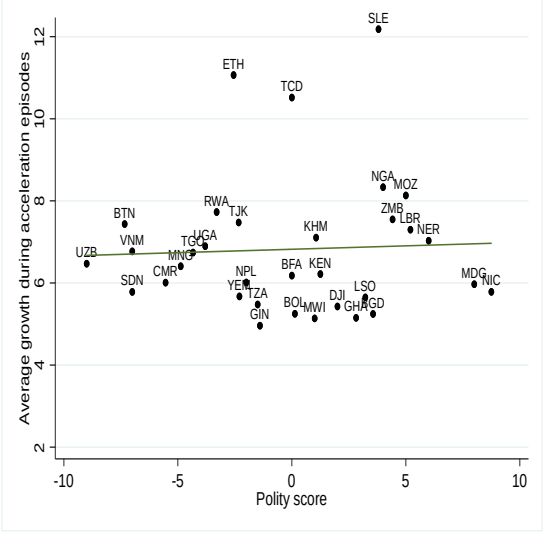
Sources: World Economic Outlook Database (October, 2017); Penn World Table Database; and IMF Staff Calculations.

Figure 4. WAEMU: Investment, Political Changes, Terms of Trade, TFP, and Average Growth During Acceleration Episodes, 1960-2017

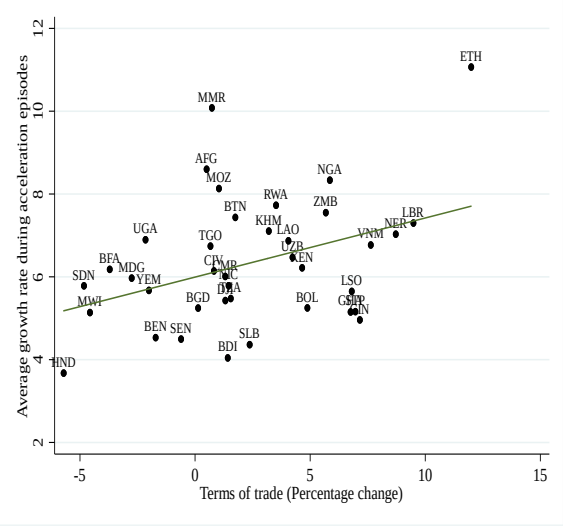
Investment-to-GDP



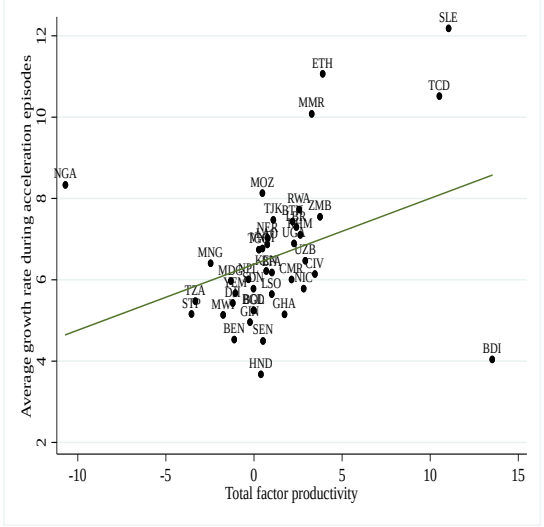
Polity score



Terms of trade



Total factor productivity



Sources: World Economic Outlook Database (October, 2017); Penn World Table Database; and IMF Staff Calculations.

Table 8. WAEMU: Determinants of Growth Accelerations, 1960-2017

	Probit	Logit	Linear Probability
	(1)	(2)	(3)
Investment-to-GDP$_{t-1}$	0.0096***	0.0168***	0.0028***
	(0.0035)	(0.0058)	(0.0011)
Trade openness-to-GDP$_{t-1}$	0.0043**	0.0074**	0.0009**
	(0.0019)	(0.0036)	(0.0004)
Inflation rate$_{t-1}$	-0.0956**	-0.1653**	-0.0201**
	(0.0447)	(0.0809)	(0.0102)
Inflation volatility$_{t-1}$	-0.0342	-0.0473	-0.0076
	(0.0380)	(0.0663)	(0.0097)
Exchange rate depreciation$_{t-1}$	0.0364*	0.0605*	0.0087*
	(0.0188)	(0.0320)	(0.0047)
Exchange rate volatility$_{t-1}$	-0.0437***	-0.0776***	-0.0115***
	(0.0123)	(0.0221)	(0.0032)
Polity score$_{t-1}$	0.0229***	0.0398***	0.0064***
	(0.0051)	(0.0088)	(0.0014)
Terms of trade$_{t-1}$	0.0049*	0.0085*	0.0014*
	(0.0030)	(0.0053)	(0.0009)
Total factor productivity$_{t-1}$	0.0303***	0.0515***	0.0069***
	(0.0071)	(0.0126)	(0.0015)
Constant	-1.1617***	-1.9522***	0.1240***
	(0.1282)	(0.2240)	(0.0328)
Observations	1,850	1,850	1,850
Number of countries	60	60	60
R-squared	0.051	0.050	0.048

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Annex I. List of Countries Included in the Analysis (LIDCs)

List of Countries Included in the Analysis (LIDCs)		
Afghanistan	Guinea	Niger
Bangladesh	Guinea-Bissau	Nigeria
Benin	Haiti	Papua New Guinea
Bhutan	Honduras	Rwanda
Bolivia	Kenya	Senegal
Burkina Faso	Kiribati	Sierra Leone
Burundi	Kyrgyz Republic	Solomon Islands
Cambodia	Lao People's Democratic Republic	Somalia
Cameroon	Lesotho	South Sudan
Central African Republic	Liberia	Sudan
Chad	Madagascar	São Tomé and Príncipe
Comoros	Malawi	Tajikistan
Congo, Democratic Republic of	Mali	Tanzania
Congo, Republic of	Mauritania	Togo
Côte d'Ivoire	Moldova	Uganda
Djibouti	Mongolia	Uzbekistan
Eritrea	Mozambique	Vietnam
Ethiopia	Myanmar	Yemen, Republic of
Gambia, The	Nepal	Zambia
Ghana	Nicaragua	Zimbabwe

Annex II. List of Variables Used, Definitions and Sources

List of Variables Used, Definitions and Sources

	Variable codes	Definitions	Source
Figure 1	NGDP_RPCH	Gross domestic product, constant prices in national currency, percent change.	World Economic Outlook
Figures 2	NGDP_R_PPP	Gross domestic product, constant prices, in PPP international dollars.	World Economic Outlook
	NGDP_R	Gross domestic product, constant prices in national currency.	
Figure 3	PCPI_PCH	Consumer Prices, period average, percent change.	World Economic Outlook
	ENDA	National currency units per U.S. dollar, period average.	
	TX_GDP	Value of exports of goods and services, U.S. dollars, percent of GDP.	
Figure 4	NID_GDP	Gross capital formation, current prices in U.S. dollars, percent of GDP.	World Economic Outlook
	TT_PCH	Terms of trade of goods and services, U.S. dollars, percent change.	
	polity2	Combined polity score of autocracy/democracy. The unified polity scale ranges from +10 (strongly democratic) to -10 (strongly autocratic).	Polity IV Project: Center for Systemic Peace
	rgdpna	Real GDP at constant 2011 national prices (in millions US$).	Penn World Table version 9.0
	ck	Capital stock at current PPPs (in millions 2011 US$).	
	emp	Number of persons engaged (in millions).	
	labsh	Share of labour compensation in GDP at current national prices.	
Table 1	PCPI_PCH	Consumer Prices, period average, percent change.	World Economic Outlook
	ENDA	National currency units per U.S. dollar, period average.	
Table 2	TX_GDP	Value of exports of goods and services, U.S. dollars, percent of GDP.	World Economic Outlook
Table 3	NID_GDP	Gross capital formation, current prices in U.S. dollars, percent of GDP.	World Economic Outlook
Table 4	polity2	Combined polity score of autocracy/democracy. The unified polity scale ranges from +10 (strongly democratic) to -10 (strongly autocratic).	Polity IV Project: Center for Systemic Peace
Table 5	TT_PCH	Terms of trade of goods and services, U.S. dollars, percent change.	World Economic Outlook
Tables 6	rgdpna	Real GDP at constant 2011 national prices (in millions US$).	Penn World Table version 9.0
	ck	Capital stock at current PPPs (in millions 2011 US$).	
	emp	Number of persons engaged (in millions).	
	labsh	Share of labour compensation in GDP at current national prices.	

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WAEMU BANKING SYSTEM'S SOUNDNESS AND MACRO-FINANCIAL LINKAGES[1]

This paper examines the WAEMU banking system's soundness and traces its macro-financial linkages. Stress test results confirmed that the banking system can withstand various shocks, but highlighted that default of the largest borrowers and deterioration of the banks' loan portfolios are the most important risks, particularly for weak public banks. As banks' appetite for government debt varied in direct proportion to the BCEAO refinancing, their demand for newly issued government debt securities declined significantly after the monetary policy tightening at end-2016.

A. Introduction

1. This paper explores banking sector vulnerabilities and resilience to shocks. Rapid expansion of the WAEMU's banking system has contributed to economic growth and extended of financial services to population. Using the results of stress tests conducted by the BCEAO, this paper examines the banking system's resilience to various shocks including deterioration of loan portfolio, liquidity squeeze, and deposit run.

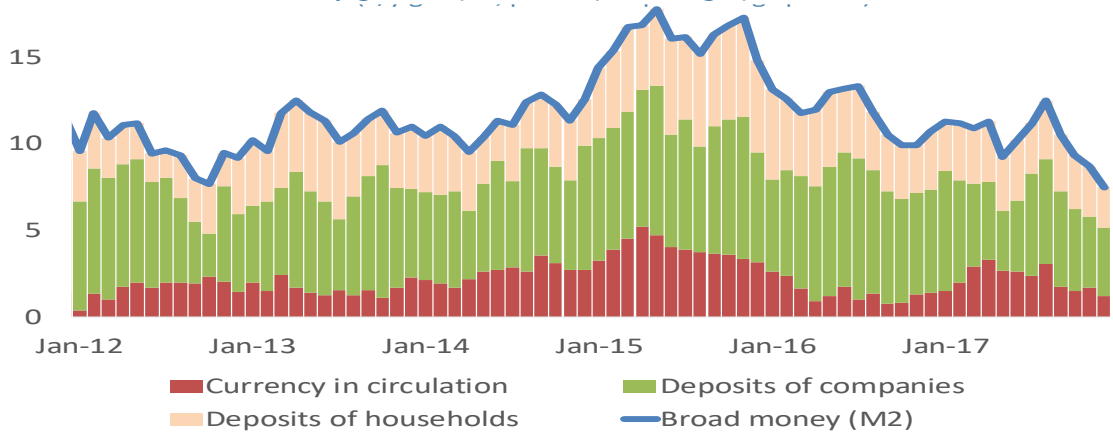
2. The paper traces the main macro-financial linkages of the banking sector and their evolution in recent years. The WAEMU banking system has built up large net claims on the central governments of the zone. In 2015-16, through its refinancing window, the BCEAO provided significant liquidity to the commercial banks against the collateral of government debt securities. This process was reversed in 2017, after the BCEAO tightened monetary policy in December 2016. Banks also have significant net liabilities to households (with more deposits than credits) and net claims on non-financial corporations (where bank loans exceed deposits). The bulk of bank credit goes to the tertiary sector (services), while the credit exposure to industry and agriculture is relatively small. The paper highlights the importance of enforcing compliance with prudential norms, recapitalizing or resolving problem banks, and addressing pockets of vulnerabilities in the banking system

[1] Prepared by Michael Gorbanyov (EUR). Comments from Jad Khallouf (MCM) and Monique Newiak (EUR) are gratefully acknowledged. The author wishes to thank BCEAO staff for the very constructive discussions of the banking sector topics and stress tests conducted by the BCEAO, which contributed to this paper.

B. Financial Sector Overview

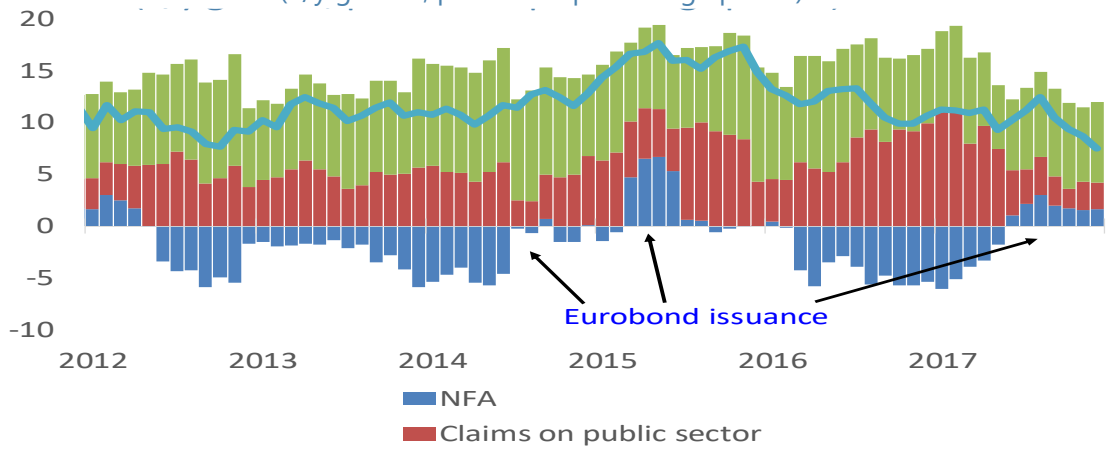
3. WAEMU's expanding banking system contributes to economic growth and extends the reach of financial services to population. Broad money grew by about 12 percent per year on average over 2012-17 (Figures 1-2). Its growth mostly reflected increase in personal and corporate deposits, while credit to economy and public sector contributed to the WAEMU GDP growth. Gross assets of commercial banks reached 56 percent of the regional GDP at end-2016 as compared with 43 percent at end-2013. Over the same period, the number of clients' accounts in the banks increased from 7.8 million to 10.3 million. The estimated share of households with a bank account more than doubled from about 7 percent in 2007 to 16 percent in 2016.

Figure 1. WAEMU: Broad Money and Its Main Components, 2012-17
(Y/y growth, percent or percentage points)



Source: BCEAO, *Integrated Monetary Database*

Figure 2. WAEMU: Broad Money and Its Main Counterparts, 2012-17
(Y/y growth, percent or percentage points)



Source: BCEAO, *Integrated Monetary Database*

4. WAEMU credit institutions can be broadly classified by their size, ownership, and bank or non-bank status. WAEMU banking sector counted 140 credit institutions in 2017, of which 125 banks (including 17 bank branches) and 15 non-bank credit institutions (including 4 branches). Excluding branches and classifying credit institutions by their major owner, there were 94 foreign-owned, 12 public, and 13 privately held regional credit institutions. Classifying active credit institutions by size and relative importance, 31 could be considered as large (accounting for more than 10 percent of banking sector assets in their country of operation), 25 as average (more than 5 percent of assets), and the remaining 63 as relatively small.

C. Banking Sector Vulnerabilities

5. The banking sector is broadly stable, but capital margins are thin. The average capital adequacy ratio (CAR) for the banking system declined to 11.4 percent at mid-2017 from 12.6 percent at end-2015. As of end-2016, 12 banks—accounting for nearly 9 percent of the system's assets—did not meet the minimum CAR of 8 percent (on a Basel I basis; Table 1). Up to 29 banks and credit institutions did not meet the new minimum capital requirement of FCFA 10 billion that became effective at mid-2017 and were given another year (until mid-2018) to comply.

6. WAEMU banking sector is characterized by high concentration and segmentation as well as elevated exposure to a few largest borrowers. At end-September 2017, 27 bank groups operated in the zone, the same as at end-2016. Among them, 12 leading groups accounted for about ¾ of the market share, total assets, and clients' accounts. The ratio of loans to the top-5 borrowers in total loans dropped to 90 percent at mid-2017 from 101 percent at mid-2016.

7. NPLs in WAEMU banks remain relatively large. After dipping to 13.8 percent at end-2016, the ratio of NPLs to total loans increased again to 14.6 percent at mid-2017 and to 15.1 percent at end-September. On the positive side, provisions cover about 63 percent of the NPLs. NPLs net of provisions accounted for 5.9 percent of total loans at mid-2017 and 6.2 percent at end-September.

8. Public banks are mostly weak. Out of 12 public banks in WAEMU, 7 were undercapitalized, and some of them had significantly negative capital. Moreover, one of them was classified as large and another as medium-sized in their countries of operations, which pointed to their systemic importance. Capital shortfall of undercapitalized WAEMU banks equaled to about 0.4 percent of the zone's GDP, of which about 2/3 came from the capital shortfall in public banks.

Table 1. WAEMU: Financial Soundness Indicators, 2012—2017[1]

	2012 Dec.	2013 Dec.	2014 Dec.	2015 Dec.	2016 Jun.	2016 Dec.	2017 Jun.
	(In percent, unless otherwise indicated)						
Solvency ratios							
Regulatory capital to risk weighted assets	12.8	12.9	12.7	12.6	11.4	11.3	11.4
Tier I capital to risk-weighted assets	12.0	11.8	11.2	10.5	10.3	10.3	10.6
Provisions to risk-weighted assets	10.8	10.3	10.7	11.7	10.6	10.1	9.9
Capital to total assets	7.3	7.2	6.7	5.7	6.1	5.8	6.2
Composition and quality of assets							
Total loans to total assets	55.0	55.9	54.6	53.1	52.5	52.2	52.9
Concentration: loans to 5 largest borrowers to capital[1]	92.3	75.1	88.6	113.1	100.9	101.9	89.6
Sectoral distribution of loans							
Agriculture	2.6	2.8	3.1	3.2	2.6	3.2	4.7
Extractive industries	1.6	1.8	2.0	1.9	1.8	1.6	1.3
Manufacturing	18.2	17.0	17.9	17.2	16.7	15.5	12.7
Electricity, water and gas	3.2	3.7	3.9	4.2	4.1	4.9	5.6
Construction	6.7	7.8	8.6	9.4	10.0	10.8	11.7
Retail and wholesale trade, restaurants and hotels	34.7	33.5	31.1	31.5	30.6	26.7	31.4
Transportation and communication	10.1	11.2	9.8	9.5	10.9	9.9	11.9
Insurance, real estate and services	6.1	5.9	6.5	6.6	7.1	7.2	7.3
Other services	16.8	16.2	17.0	16.4	16.2	20.1	13.3
Gross NPLs to total loans	16.0	15.3	14.9	14.4	15.2	13.8	14.6
Provisioning rate	63.4	61.0	62.8	62.7	63.9	65.5	63.4
Net NPLs to total loans	6.5	6.6	6.1	5.9	6.1	5.2	5.9
Net NPLs to capital	48.8	51.1	50.1	54.9	52.7	47.2	49.7
Earnings and profitability							
Average cost of borrowed funds	2.5	2.8	2.4	2.4	...	2.9	...
Average interest rate on loans	9.8	10.7	9.1	8.8	...	9.8	...
Average interest margin[2]	7.3	7.9	6.7	6.4	...	6.9	...
After-tax return on average assets (ROA)	0.9	0.9	1.1	1.2	...	1.3	...
After-tax return on average equity (ROE)	10.1	11.5	15.5	16.4	...	20.2	...
Noninterest expenses/net banking income	61.0	60.6	58.6	58.6	...	58.5	...
Salaries and wages/net banking income	25.7	26.5	25.4	25.4	...	25.6	...
Liquidity							
Liquid assets to total assets	32.5	32.2	30.9	29.4	27.6	27.1	26.7
Liquid assets to total deposits	45.8	47.1	45.9	43.8	41.0	42.3	40.8
Total loans to total deposits	86.2	90.0	89.5	87.0	86.4	89.5	89.1
Total deposits to total liabilities	71.1	68.5	67.3	67.1	67.3	64.1	65.3
Sight deposits to total liabilities[3]	36.5	35.5	34.5	35.4	35.2	34.4	34.8
Term deposits to total liabilities	34.6	32.9	32.8	31.7	32.1	29.7	30.6

Source: BCEAO.

[1] Indicators do not account for the additional provisions required by the WAEMU Banking Commission.

[2] Excluding tax on bank operations.

[3] Including saving accounts.

9. The structural liquidity deficits in the banking system increased in 2015-16. Though the situation of individual banks varies considerably, net aggregate liquidity of the banking system has been negative since 2014. It deteriorated considerably since mid-2015 and reached about FCFA 3,000 billion at end-2016, which is about 5 percent of the zone's GDP (Figure 3). To maintain their gross liquidity at the sufficient level, banks had to increasingly rely on the BCEAO liquidity support. Among other things, this implied liquidity mismatches in the balance sheets, as banks financed longer-term holdings of government securities and credit to economy with short-term central bank refinancing.

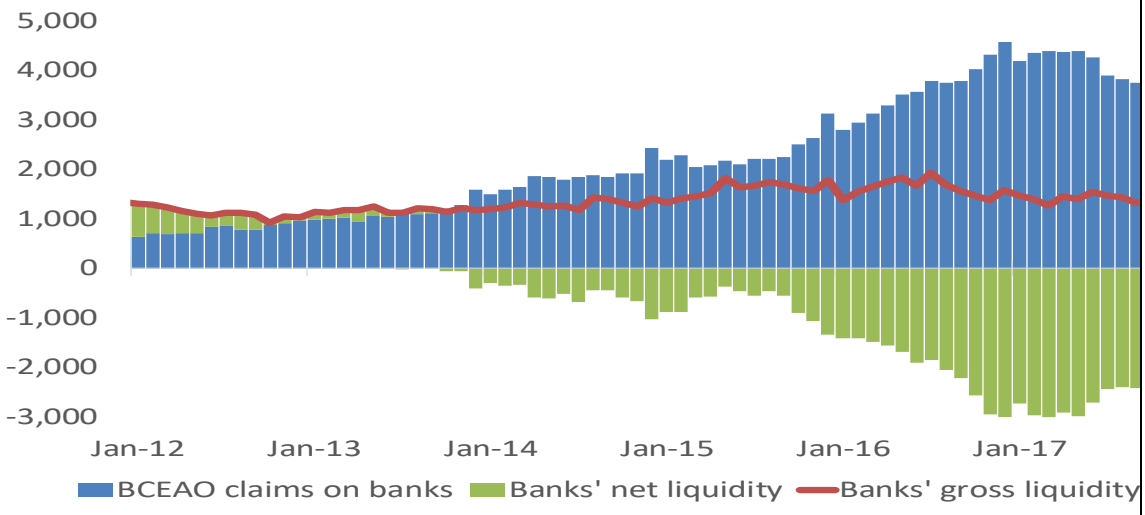
10. Monetary policy tightening by the BCEAO in December 2016 initiated an unwinding of the banks' excessive net negative liquidity positions. The BCEAO limited banks' access to the refinancing facility to twice their own capital effective from June 2017, which gave banks about 6 months to adjust their balance sheets. However, some banks faced challenges in maintaining their liquidity position without BCEAO support. To shore up banking stability, BCEAO lowered the obligatory reserve requirement ratio from 5 percent to 3 percent in March 2017. Overall, the BCEAO's actions resulted in the reduction of the banking system's net liquidity position by about FCFA 600 billion over the first half of 2017.

11. In late 2017, banks' demand for BCEAO refinancing increased again, in part because of seasonal factors. As a sign of building liquidity pressures, banks took all allotted BCEAO refinancing, average interest rate on refinancing operations hit the 4.5 percent ceiling of the BCEAO policy corridor, and the interbank market rate went well above it (Figures 4-5). Responding to pressures, BCEAO re-injected liquidity into the system, increasing its gross claims on banks. Alongside, banks drew down on their deposits with the BCEAO. As an outcome, banking system's net liquidity position vis-à-vis the BCEAO widened by about FCFA 500 billion. Overall, the banking system's net liquidity deficit covered by the BCEAO refinancing came to around FCFA 2,900 billion at end-2017, somewhat below its end-2016 level (Figure 3).

12. Banks' appetite for government debt varied in direct proportion to the availability of the BCEAO refinancing. In 2015-16, when the refinancing was relatively easily available, government debt issuances were typically oversubscribed in the regional debt market dominated by banks. This changed after the BCEAO policy tightening. In February 2017, subscription for debt issuance dipped to about 66 percent (Figure 6), which corresponded to a spike in banks' demand for BCEAO refinancing (Figures 4-5). As the banks' liquidity situation normalized in the middle of the year, their demand for the BCEAO refinancing moderated, and the subscription coverage of debt issuance rebounded to nearly 100 percent. The banks' liquidity situation tightened again in the last months of 2017, which corresponded to a steady drop in subscription for the government debt issuance to 41 percent in December.

Figure 3. WAEMU: Commercial Bank's Liquidity Position, 2012-17

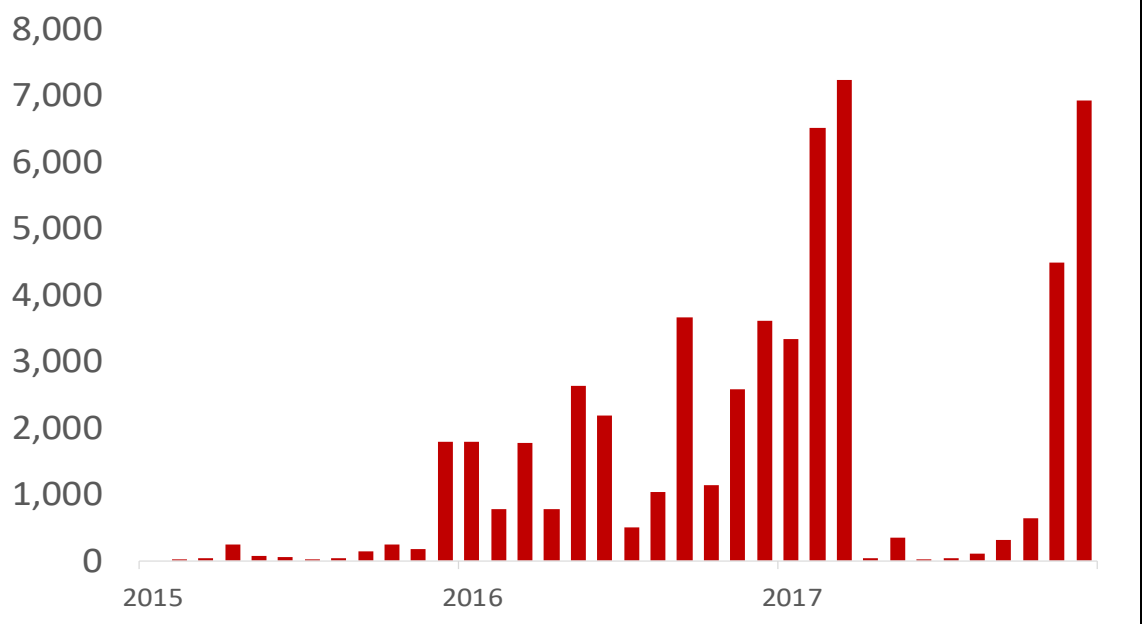
(Billions of CFA Francs)



Source: BCEAO, *Integrated Monetary Database*

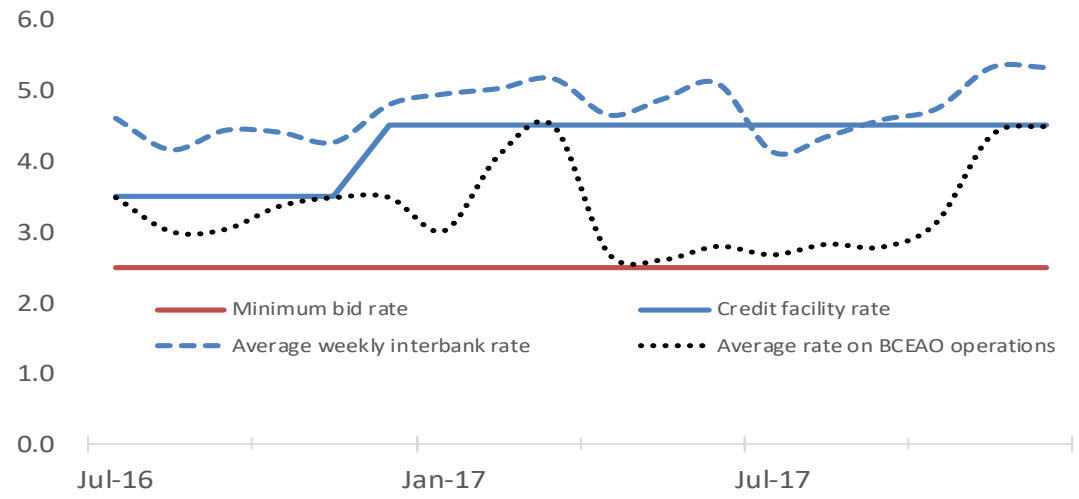
Figure 4. WAEMU: Oversubscription for the BCEAO 7-Day Refinancing Operations, 2015-17

(Billions of CFA Francs)



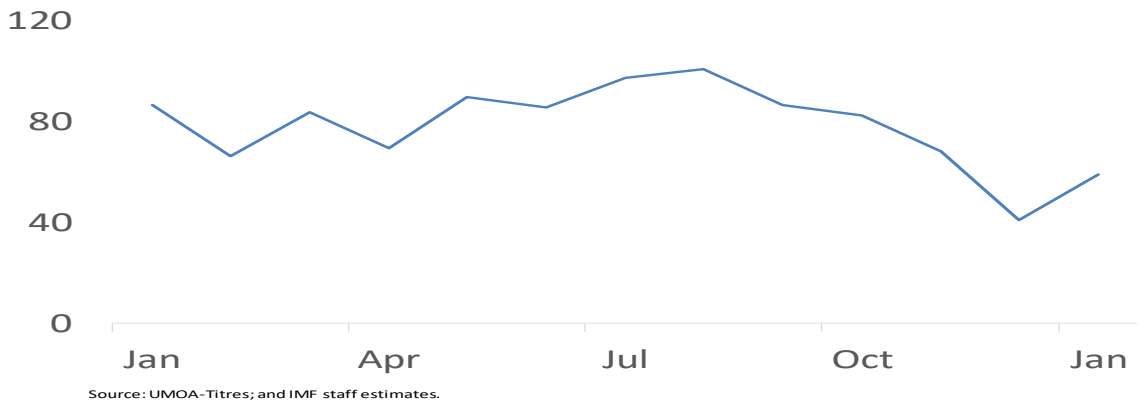
Source: BCEAO; and IMF staff estimates

Figure 5. WAEMU: BCEAO and Money Market Rates, 2016-17
(Percent)



Source: BCEAO

Figure 6. Coverage of Government Debt Issuance in the WAEMU Regional Market, 2017



Source: UMOA-Titres; and IMF staff estimates.

D. Analysis of Vulnerability Scenarios

13. Stress tests regularly conducted by the BCEAO modelled the impact of several shocks on the banking system. The stress scenarios tested banks' resilience to hypothetical shocks such as a steep deterioration of the credit portfolio, default of the largest borrower, and deposit run (Annex 1). Their results confirmed that the banking system can withstand many such shocks, particularly with support from the BCEAO. At the same time, they

accentuated what type of shocks could be particularly severe and which banks would be most vulnerable to them.

14. High loan concentration ratios make WAEMU banks particularly vulnerable to default of their largest borrowers. In the stress test scenario of the largest borrower default in each bank, the number of undercapitalize banks in the zone would increase to 76 (from 15 before the shocks), with combined capital shortfall 1.6 percent of the zone's GDP. And in the most extreme scenario of default by the two largest borrowers, 91 banks would fall below the minimum capital requirement of 8 percent, with their capital shortfall amounting to 2.7 percent of the zone's GDP.

15. Deterioration of banks' loan portfolios is another source of risk. The number of undercapitalized banks would rise sharply in extreme scenarios of NPLs increasing by 50-75 percent or deterioration of the banks' loan portfolio with 15 percent of standard healthy loans migrating into the NPL category (Tables 2 and 3). As the public banks exhibited significant weaknesses before the tests, they are strongly affected by the stress test scenarios. Furthermore, in the case of a sustained deposit run on banks, with progressive withdrawal of up to 35 percent of demand deposits and 19 percent of term deposits over 5 days, up to 79 banks would need liquidity support.

Table 2. Stress Test Results for the WAEMU Commercial Banks: Credit Portfolio Tests
(Data as of June 30, 2017)

	Average CAR	Undercapitalized banks (CAR < 8 percent)	Capital shortfall, FCFA billion	*Of which*: Public banks	
				Undercapi-talized banks	Average CAR
Before stress tests	11.42	15	268.0	7	-1.88
Largest borrower default	3.11	76	995.9	9	-10.79
Two largest borrowers default	-2.57	91	1,667.4	10	-17.16
NPLs increase by 50 percent	6.06	57	684.0	9	-16.51
NPLs increase by 75 percent	3.13	67	1,042.8	12	-25.52
15 percent of standard loans become NPLs	5.14	62	790.3	11	-13.26

Sources: BCEAO; and IMF staff estimates.

Table 3. WAEMU: Stress Test Results for the WAEMU Commercial Banks: Liquidity Test
(Data as of June 30, 2017)

	Day 1	Day 2	Day 3	Day 4	Day 5
Banks cope with liquidity shortages	20	26	33	56	79

Sources: BCEAO; and IMF staff estimates.

E. Macro-Financial Linkages

16. Banking sector has exposure to all the main sectors of the economy. As normal for a banking sector, it operates by transforming deposits into loans. As of end-2017, commercial banks attracted household deposits of about 11.3 percent of regional GDP and returned 6.6 percent of GDP as credits to the households. Banks attracted deposits of about 15.4 percent of GDP from private companies while providing credits of about 18.7 percent of GDP to them, which resulted in net claims on the private non-financial companies of about 3.4 percent of GDP. Banks' credit to public non-financial companies of 2.1 percent of GDP slightly exceeded their deposits of 1.7 percent of GDP. Commercial banks have accumulated net claims of 10.2 percent of GDP on the central governments of the zone. Commercial banks' net claims on the governments was partly made possible by the net liquidity support from BCEAO of about 4.7 percent of GDP, which was provided largely under collateral of government debt securities (Figure 7).

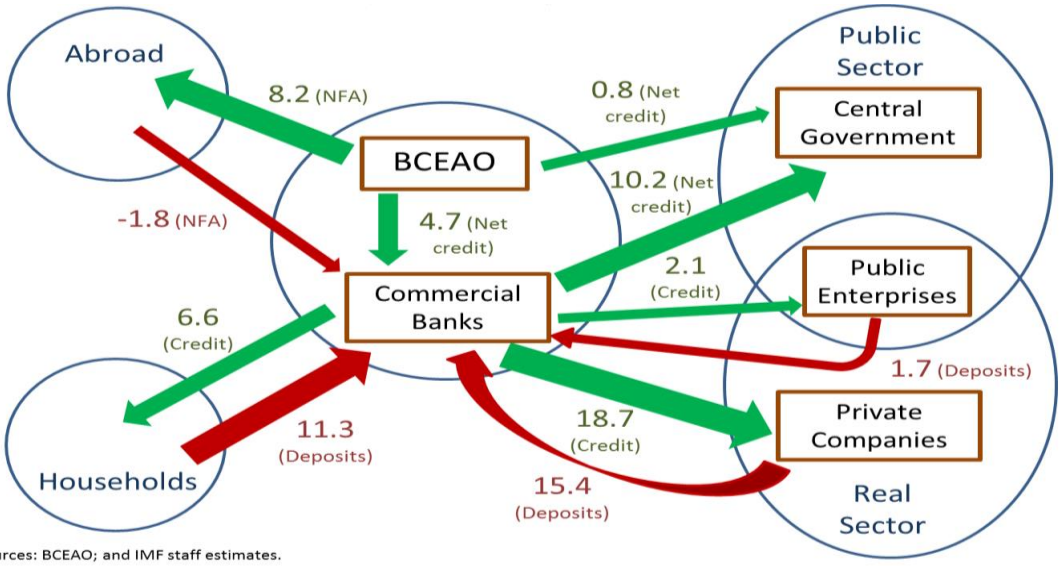
17. Banks' credit to economy is concentrated in trade and other services sectors. As of mid-2017, retail and wholesale trade, restaurants and hotels accounted for nearly 1/3 of the outstanding bank credit. Together with credit to transportation and communication, insurance, real estate, and other services, banking exposure to services sectors accounted for nearly 2/3 of all bank credit to economy. Bank credit to productive sectors—agriculture, manufacturing, electricity, water and gas, extractive industries and construction—together accounted for the remaining 1/3 of the total (Figure 8). This composition of credit remained broadly stable over the last five years, with most significant changes being an increase in credit share of construction and reduction of that of manufacturing.

F. Evolution of Macro-Financial Flows in 2016-17

18. In 2016, monetary expansion coincided with significant international reserves decline. That year, consolidated central government's fiscal deficit amounted to about 4½ percent of GDP, and most of it was financed from the regional debt market. In this market, regional banks are the most important buyers of the government debt holding about 90 percent of the outstanding debt securities. In 2016, BCEAO injected liquidity equivalent to about 2.7 percent of GDP in the banking system through its refinancing window. This liquidity helped banks expand their lending to all sectors of economy, but most notably, commercial

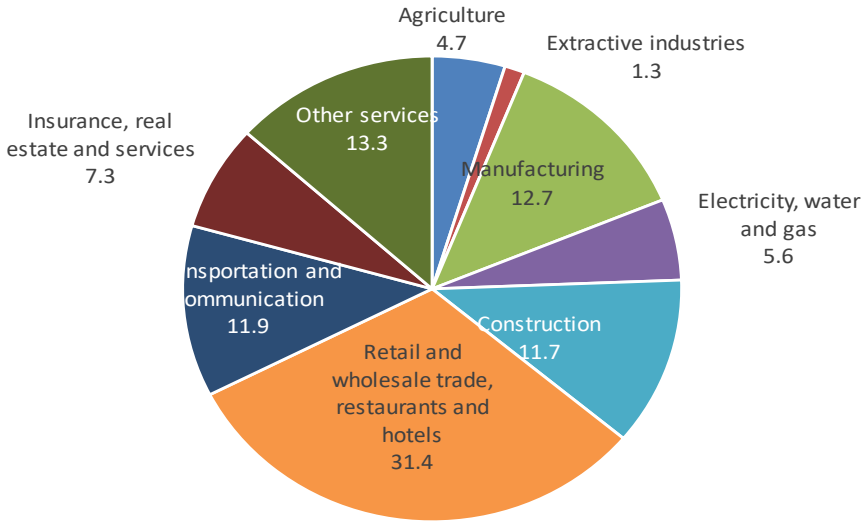
banks extended net credit to government by 3.6 percent of GDP, further increasing their exposure to this sector (Figure 9). With sovereigns financing their fiscal deficits primarily in the regional market, official international reserves declined significantly over the year.

Figure 7. WAEMU Banking System's Main Macro-Financial Linkages, 2017
(End-period stocks; percent of GDP)



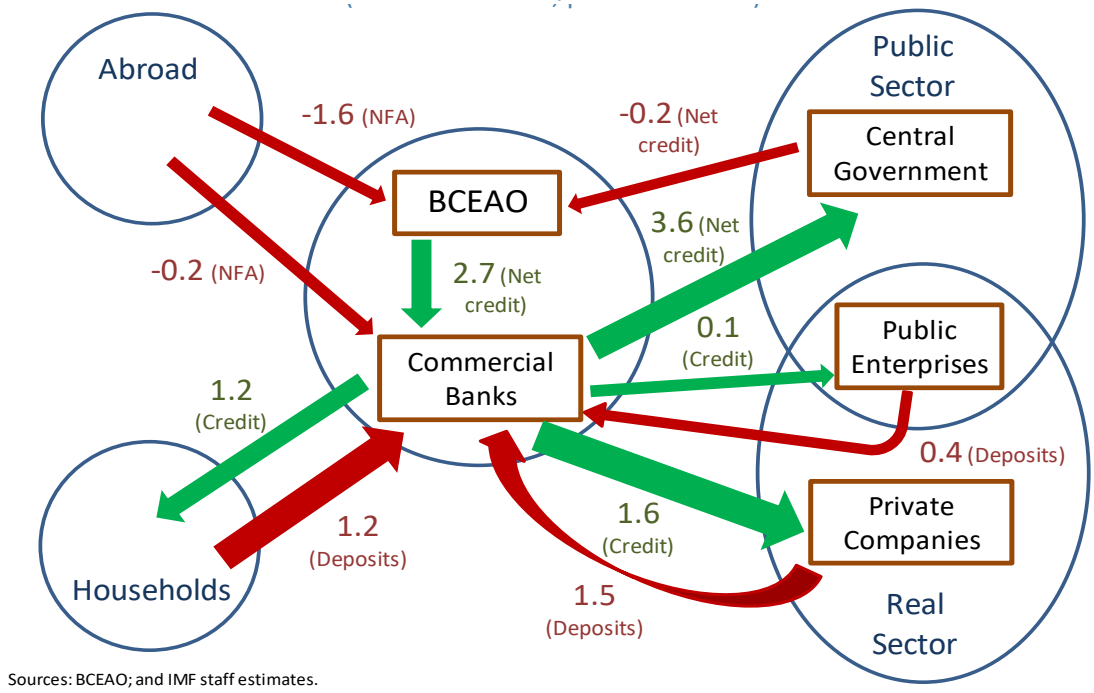
Sources: BCEAO; and IMF staff estimates.

Figure 8. WAEMU: Composition of Bank Credit to Economy, June 2017
(Percent)



Source: BCEAO; and IMF staff estimates

Figure 9. WAEMU: Banking System's Main Macro-Financial Flows, 2016
(Flows over 2016; percent of GDP)



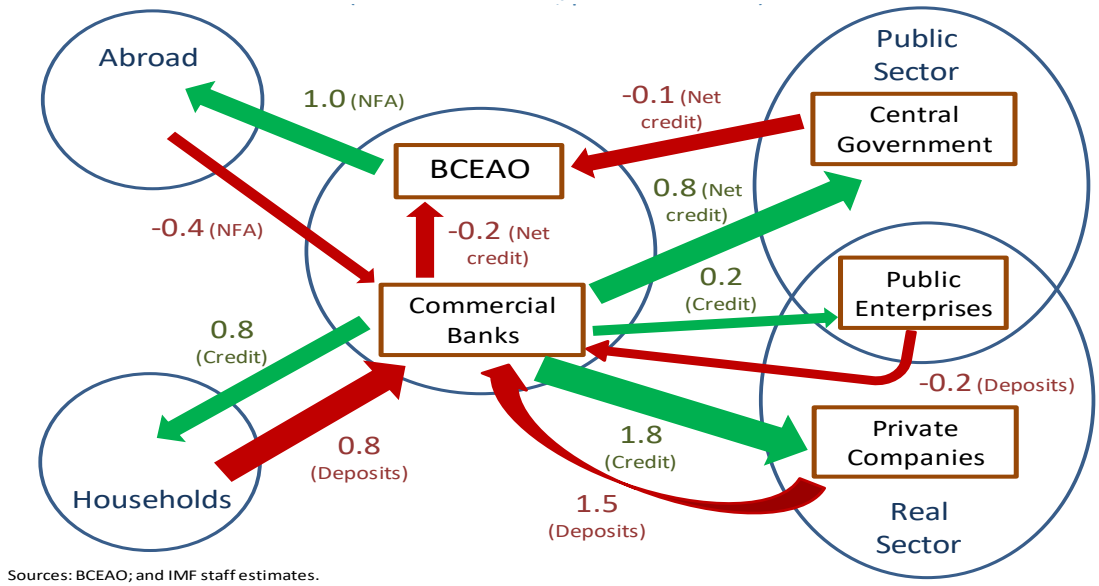
Sources: BCEAO; and IMF staff estimates.

19. The imbalances accumulated in 2016 began to unwind in 2017, after the BCEAO's monetary policy tightening. The policies that enabled the international reserves' depletion and pushed banks' own net liquidity deep into the negative territory had to be reversed. The policy tightening implemented by the BCEAO in December 2016 limited the refinancing that the banks could get from the BCEAO to twice their own capital. As many banks were above that limit at the time, BCEAO gave banks until June 2017 to comply. Effectively, this required commercial banks to repay a part of the refinancing previously received from the BCEAO, which they did by reducing the net credit from the central bank by about 0.2 percent of GDP in 2017. In part because of it, the BCEAO was able to replenish its FX reserves in 2017. For banks, the need to repay BCEAO's financing reduced their potential for extending credit to other sectors of economy. Most notably, the banks provided new net credit to governments of only 0.8 percent of GDP in 2017, which was much less than 3.6 percent of GDP provided in 2016 (Figure 10).

20. Because of tighter liquidity conditions, domestic credit expansion slowed down in 2017 and its composition changed. The pace of domestic credit expansion decelerated from 15-20 percent prevailing in 2016 and previous years to less than 10 percent at end-2017. The contribution of the net credit to government declined to 2 percentage points in 2017 (from 11.2 percentage points in 2016). At the same time, the contribution of the credit to economy remained steady at about 8 percentage points at end-2017, about the same as at end-2016 (Figure 11).

Figure 10. WAEMU: Banking System's Main Macro-Financial Flows, 2017

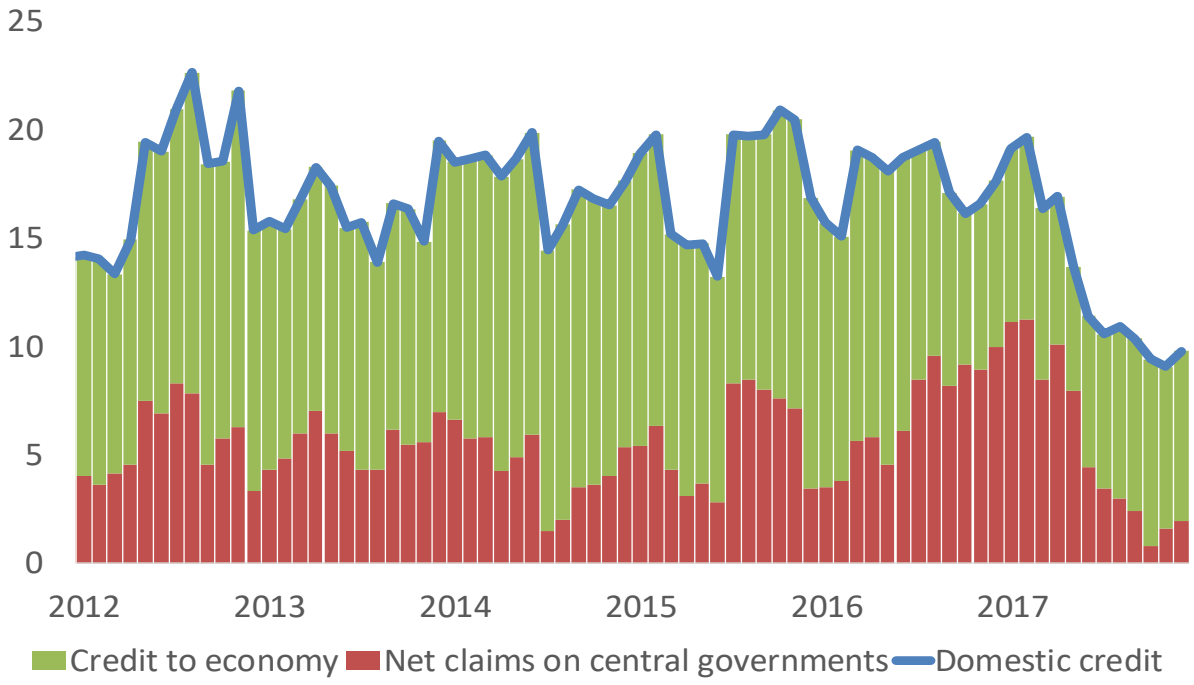
(Flows over 2017, percent of GDP)



Sources: BCEAO; and IMF staff estimates.

Figure 11. WAEMU: Domestic Credit and Its Components, 2012-17

(Y/y growth, percent or percentage points)



Source: BCEAO, *Integrated Monetary Database*

G. Addressing Banking Sector Vulnerabilities

21. Enforcing compliance with prudential regulations is key to addressing banking sector weaknesses. There are weak banks in the zone, including public banks, that did not meet certain prudential requirements for years. In some cases, they expanded their business while under provisional administration and enhanced supervision of the regional authorities. There is a broad range of sanctions that the supervisor can impose on non-compliant banks. It ranges from simple warnings to fines and imposing limits on certain type of operations and transactions to putting the bank under provisional administration and eventually withdrawing its banking license. For example, the supervisor can prohibit weak banks from expanding their business (providing new loans and accepting new deposits) and distributing profits to owners until the identified weakness are resolved.

22. New prudential rules aligned with the Basel II/III principles and phased in from 2018 should help consolidate banks' balance sheets and address vulnerabilities. The reforms involve gradually increasing the minimum capital requirements over several years, introducing new accounting rules, and moving to consolidated supervision of bank groups. Embracing new standards will help improve the quality of banks' credit portfolio, boost their capital and liquidity buffers, and eventually increase the banking system's resilience to shocks. Initially, the CAR will increase from 8.0 percent (under Basel I rules) to 8.6 percent of risk-weighted assets by end-2018. For problem loans, lowering the threshold for classifying loans as NPLs from 180 days of payment delay to the internationally accepted 90 days would increase the reported NPLs.

23. Alongside, bank supervision is shifting to a more risk-sensitive and consolidated approach. The regional Banking Commission is adopting new supervision criteria aligned with Pillar 2 of Basel II/III standards. It has also launched the consolidated supervision of cross-border groups and has readied its tools to that end.

24. Moreover, the Banking Commission has got new bank resolution powers in late 2017. The amendment to the Banking Commission's Statutes ensures that all member countries are committed to cooperate with this institution, based on its independent resolution decision-making. In particular, this should help accelerate progress in the resolution of problem banks with persistent negative capital.

Annex I. Description of Stress Test Scenarios

Stress tests conducted by the BCEAO modelled the impact of several shocks on the banking system. They tested banks' resilience to shocks such as a steep deterioration of the credit portfolio, default of the largest borrower, and large deposit outflows. Parameters of each shock are summarized in Table 4. These shocks were modelled using bank-by-bank data as of end-June 2017.

Table 1. Description of Stress Test Scenarios

Risk category	Scenario	Shocks	Comments
Credit risk	A- Increase in non-performing loans (NPLs)	1- Increase by 50 percent	NPL increase by 50 percent directly affects the capital adequacy ratio (CAR). The additional NPLs are assumed to be 70 percent provisioned, on average, thus impacting own funds and risk-weighted assets.
		2- Increase by 75 percent	NPL increase by 75 percent directly affects the capital adequacy ratio (CAR). The additional NPLs are assumed to be 70 percent provisioned, on average, thus impacting own funds and risk-weighted assets.
	B- Deterioration of the credit portfolio	15 percent of standard loans become unpaid or immobilized; outstanding unpaid or immobilized loans require a level of provisioning of 50 percent and doubtful or disputed loans require a 100 percent provisioning level.	The deterioration of the loan portfolio leads to the migration of 15 percent of the standard loans to the category of non-performing loans (NPLs) and directly affects the the capital adequacy ratio (CAR) through risk-weighted assets. The additional NPLs are assumed to be 20 percent provisioned, while the provisioning of the initially outstanding unpaid or immobilized loans and doubtful or disputed loans require a level of provisioning of 50 percent or 100 percent, respectively.
Credit concentration risk	C- Counterparty concentration risk	1- Delault of the largest borrower	The default of the largest borrower leads to migration of all loans to him to the doubtful or disputed categories and directly affects the capital adequacy ratio (CAR). The additional NPLs are assumed to be 70 percent provisioned on average, thus impacting own funds and risk-weighted assets.
		2- Delault of the two largest borrowers	The default of the two largest borrowers leads to migration of all loans to them to the doubtful or disputed categories and directly affects the capital adequacy ratio (CAR). The additional NPLs are assumed to be 70 percent provisioned on average, thus impacting own funds and risk-weighted assets.
Liquidity risk	D- Deposit flight for five days	Deposit run for five consecutive days (demand deposits outflows: 5 percent, 5 percent, 5 percent, 10 percent, and 10 percent; term deposits outflows: 3 percent, 3 percent, 3 percent, 5 percent and 5 percent)	The impact of the deposit run is measured against banks' liquidity. The liquid assets realization rate is estimated at 90 percent (i.e., 10 percent discount) and the rate of availability of illiquid assets is estimated at 1 percent.

Source: BCEAO

SOURCES OF FISCAL RISKS IN WAEMU COUNTRIES[1]

Fiscal risks in the WAEMU region are mainly related to macro-economic shocks and contingent liabilities linked to state-owned enterprises and public-private partnerships. Weak public financial management systems often contribute to the size of the problem once fiscal risks materialize. One manifestation of this is debt stocks growing much faster than implied by fiscal deficits in recent years (so-called stock-flow discrepancies). Progress is being made, however, with countries moving ahead with PFM reforms in line with regional directives, helped by international organizations (including IMF programs). Given the importance of sound fiscal policy for the region's external stability, it is crucial that the ongoing reform program related to fiscal transparency and fiscal risk management is given priority among the region's decision-makers.

A. Introduction

1. Fiscal policy is the main policy tool available to WAEMU countries, and is critical to the stability of the monetary union. The WAEMU is a region with a common monetary policy and a fixed exchange rate regime. These features make national fiscal policies the main stabilization instrument in a region where macroeconomic volatility remains high. Adherence to fiscal convergence criteria thus becomes one of the main building blocks for macro-economic stability.[2] A key fiscal challenge is to meet WAEMU members' large development needs while preserving debt sustainability and external stability. Managing fiscal risks is crucial in meeting that challenge.

2. The importance of WAEMU's fiscal health for macro-economic stabilization highlights the need for analyzing and managing fiscal risks. Fiscal risks are the possibility of deviations of fiscal outcomes from what was expected at the time of the budget or other forecast (IMF, 2009). Fiscal indicators to which fiscal rules correspond such as the fiscal deficit or public debt, are impacted severely when fiscal risks materialize. This makes it more complicated to adhere to these rules, and underscores the importance of monitoring and managing such risks.[3]

3. Improving fiscal risk management is part of a wider push to improve fiscal transparency which is critical for effective fiscal management and accountability. Fiscal risk analysis and management is one of the four pillars of the IMF's fiscal transparency code, which is the international standard for disclosure of information about public finances. This

[1] The author wishes to thank Miguel Alves, Elena Arjona Perez, Mark De Broeck, Aissatou Diallo, Jemma Dridi, Majdeline El Rayess, Lennart Erickson, Alain Feler, Fabien Gonguet, Michael Gorbanyov, Jason Harris, Bruno Imbert, Francis Kumah, Jules Leichter, Paulo Lopes, Rodolfo Maino, Clement Ncuti, Keyra Primus, Julien Reynaud, Gwenaelle Suc, Rene Tapsoba, and Benoit Wiest for useful comments and discussions. Hilary Devine and Ornella Kaze provided excellent research assistance.

[2] As has been amply demonstrated by other currency unions like the European Monetary Union (EMU).

[3] Fiscal rules can accommodate the materialization of certain fiscal risks. For example, in the EMU, the fiscal balance fiscal rule has a cyclical element to it.

third pillar advocates for *governments to disclose, analyze, and manage risks to the public finances and ensure effective coordination of fiscal decision-making across the public sector* (IMF, 2015, p.3). Fiscal transparency evaluations (FTEs) are the IMF's fiscal transparency diagnostic. It is a comprehensive assessment of a country's fiscal transparency practices against the standards set by the code, and develops a sequenced fiscal transparency action plan to help address reform priorities. A revised fiscal transparency manual is under preparation to provide guidelines on the implementation of the Code's principles and practices (IMF, 2018a).

4. Sources of fiscal risks include shocks to macro-economic variables, contingent liabilities, and weaknesses in fiscal institutions (Table 1)**.** Shocks to macroeconomic variables are the most common source of fiscal risks. Contingent liabilities are *obligations that do not arise unless discrete events occur in the future* (IMF, 2011). Deficient PFM systems could aggravate the situation when fiscal risks materialize. For example, when accounts of loss-making state-owned enterprises are not well integrated into a country's PFM system, and the lack of information allows for a larger build-up of fiscal costs than would otherwise be the case. However, structural deficiencies in PFM systems can be the source of fiscal risks too; for example, when expenditure control is not well established leading to regular arrears problems.

Table 1. WAEMU: Sources of Fiscal Risks

Macro-economic Shocks
- Real GDP growth
- Primary balance
- Terms-of-trade (e.g. commodity price shocks)
- Nominal exchange rate
- Interest rate
- Aid

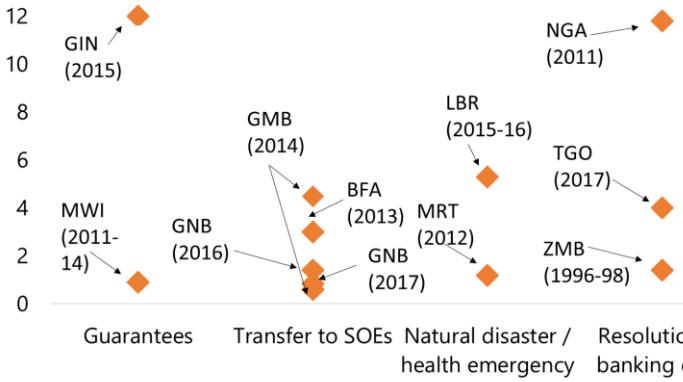
Contingent Liabilities
- State-owned enterprises (guarantees on loans and bail-outs)
- Large infrastructure projects
- PPPs
- Pensions
- Financial system
- Natural disasters

Institutional
- Quality, timeliness and coverage of reported fiscal data
- Expenditure allocation and control
- Oversight of local governments
- Revenue forecasting and administration
- Risks related to natural resource management

Source: IMF (2016) and Mauro et al. (2015).

5. The materialization of fiscal risks can have important consequences for public finances. Recent research shows that public finances are typically hit by a macroeconomic shock, in the form of a sharp decline in nominal GDP growth, once every 12 years, with an average fiscal cost of 9 percent of GDP (IMF, 2016). A new dataset encompassing 80 advanced and emerging market countries identifies 174 episodes of materialization of contingent liabilities, with an average fiscal cost of 6 percent of GDP (Bova et al., 2016). Estimates for low-income countries, including some WAEMU members, point to similarly high fiscal costs (Figure 1).

Figure 1. Fiscal Costs of Contingent Liability Realizations
(selected African countries, % of GDP)



Sources: Baum et al (2017), and IMF staff reports.

6. Developing a comprehensive fiscal risk management framework can help countries deal with future fiscal risks. Measuring the size of fiscal risks that have materialized in the past gives a sense of potential fiscal costs. However, this cannot substitute for a forward-looking strategy as the nature and size of fiscal risks changes rapidly. In the WAEMU context for example, PPP-related risks have been negligible in the past, but could become more important going forward as recent development plans outline an increased reliance on PPP financing (see section C below). The forward-looking fiscal risk management framework developed at the IMF is a reference point for fiscal risk management (IMF, 2016). What does it involve? Governments must have a sound understanding of the risks to public finances before they can be properly managed. This involves both identifying and quantifying expected costs (step 1 in Table 2). Once fiscal risks are understood, governments need to consider whether instruments

Table 2. Fiscal Risk Management Framework

Step 1: Identify and quantify risks
•Identify sources of risk
•Calculate fiscal exposure
•Estimate likelihood of realization
Step 2: Decide whether to mitigate risks
•Direct controls and limits on exposure
•Regulation, incentives and other indirect measures
•Transfer and risk sharing mechanisms
Step 3: Decide whether to provision for funds
•Expense fiscal costs in the budget
•Budget contingencies
•set aside financial assets in buffer funds

Source: IMF (2016, p. 21).

should be used to mitigate them (step 2) and/or whether to provision for such risks (step 3). A fiscal risk toolkit translates these steps into concrete policy options for the contingent liabilities mentioned in Table 1 (see IMF, 2016, Table 3 and appendix 1).

7. Fiscal reporting needs to be expanded. The Government Finance Statistics Manual (GFSM 2014) system is a holistic approach to public finances, aiming to cover all general government transactions (Box 1). Contingent liabilities are typically not part of what is reported as liabilities in this framework because they relate to fiscal events that have not (yet) been realized.[4] In general, a contingent liability becomes debt only when it is called. Nevertheless, the GFSM 2014 advises to report contingent liabilities as memorandum items, and suggests countries draw up a *Summary Statement of Explicit Contingent Liabilities and Net Implicit Obligations for Future Social Security Benefits* to summarize explicit and some implicit contingent liabilities (see GFSM 2014, p.76). In some countries, fiscal risks are disclosed in *fiscal risk statements,* which often accompany budget documents, even though coverage and quantification can vary widely.[5] It should be noted, however, that the full use of GFSM 2014 is still rare (for example, balance sheet data was only reported in 15 percent of IMF staff reports in early 2017, see IMF, 2017, p.8).

Box 1. Government Finance Statistics Manual (GFSM) 2014—Key Concepts

The GFSM 2014 system of fiscal accounts covers all general government transactions. It incorporates the general government's balance sheet, and through opening and closing balances aims at linking stocks and flows in a consistent way (Figure A1 in Annex I). It recommends recording stocks and flows on an accrual basis, while maintaining cash-flow data to allow an assessment of the liquidity constraints of government (as opposed to GFSM 1986 which uses a cash concept throughout).

GFSM 2014 provides guidance with respect to the statistical treatment of transactions related to the materialization of fiscal risks. When used as intended, and when transactions are correctly classified, GFSM 2014 provides a consistent set of fiscal indicators. Certain transactions, however, are not easy to classify and such grey areas are often related to the materialization of fiscal risks. Combined with low capacity in fiscal institutions in some countries, this sometimes implies that information contained in major fiscal indicators can be misleading and not comparable across countries (see also sections D and E).

8. The proper monitoring, tracking, and reporting (when they materialize) of fiscal risks, would provide a fuller picture of their underlying fiscal costs. Incomplete accounting may occur when statistical treatment of fiscal transactions aims to improve headline fiscal numbers without underlying structural improvements. Indications of such incomplete accounting often show up in stock-flow discrepancies, where debt increases much faster than

[4] The exceptions are: (i) guarantees in the form of financial derivatives, and (ii) provisions for calls under standardized guarantee schemes (see schedule Annex I—Figure A3).

[5] Emerging markets and developing countries that consolidate information on fiscal risks in a single published document include Brazil, Chile, Colombia, Georgia, Indonesia, Kenya, Pakistan, Philippines and South Africa.

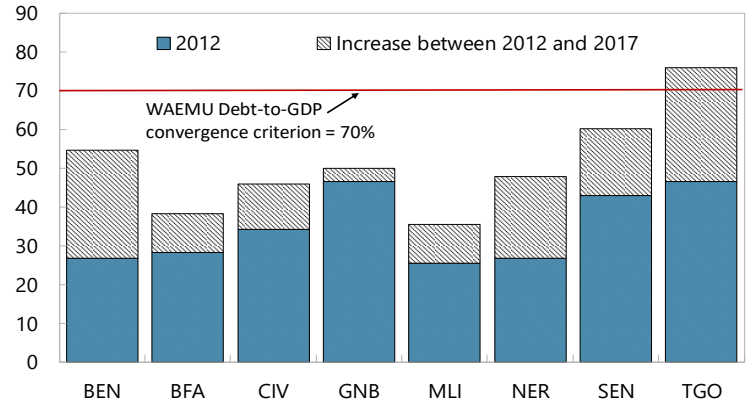
implied by fiscal deficits. While there are mechanical reasons for such discrepancies (e.g., exchange rate movements), they typically point to: (i) deficiencies in public financial management (PFM) systems, including incomplete accounting techniques that allow government operations to remain outside the headline budget deficit, but nonetheless require additional financing, and (ii) the materialization of fiscal risks, which are often not well captured in the central government budget, but add to the debt burden. These two issues often occur in tandem, with the materialization of fiscal risks leading to larger deficits, which then in turn are made to look better through creative accounting.

9. This paper documents the importance of fiscal risks in WAEMU, and gives recommendations on how such risks can be better monitored and managed. One aim is to give a flavor of the most important fiscal risks facing the WAEMU region, without trying to be exhaustive. Macro-economic shocks are not included in the analysis as these are to a considerable extent covered in staff reports and Debt Sustainability Analyses (DSAs).[6] Section B gives an overview of recent fiscal developments and fiscal risks in the WAEMU region. Section C describes the main fiscal risks in WAEMU. Section D looks at the reasons behind large stock-flow discrepancies, a tool that helps to detect fiscal risks outside the fiscal balance. Section E discusses how improving fiscal institutions and PFM systems can help deal with fiscal risks and section F concludes. At several stages, the presentation by Mauro et al. (2015) on fiscal risks in the East African Community is followed.

B. Fiscal Risks in WAEMU: Overview

10. WAEMU debt has increased substantially in recent years (Figure 2). Between 2012 and 2017 the gross debt-to-GDP ratio increased by 17 percentage points of GDP. This was despite region-wide growth rates of more than 6 percent every year since 2012.

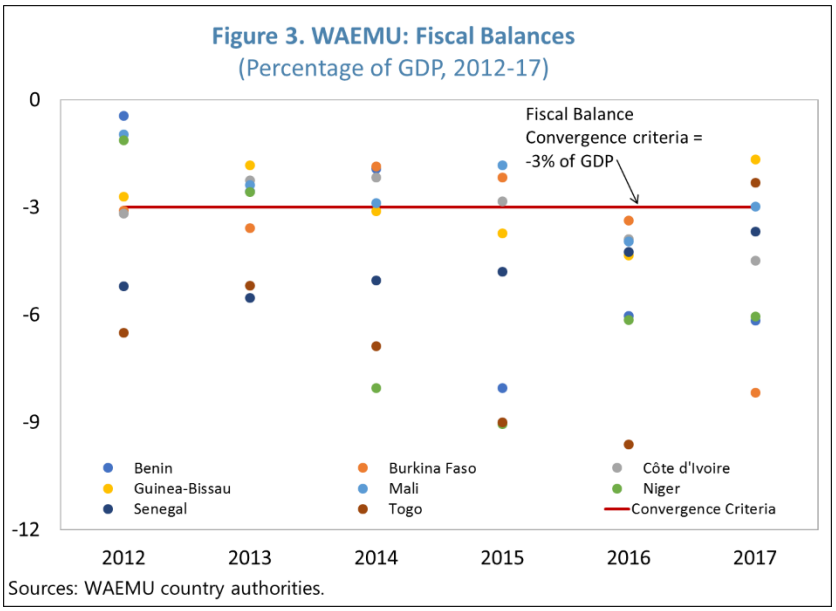
Figure 2. Debt Developments in WAEMU, 2012 and 2017
(Gross Debt, percent of GDP)



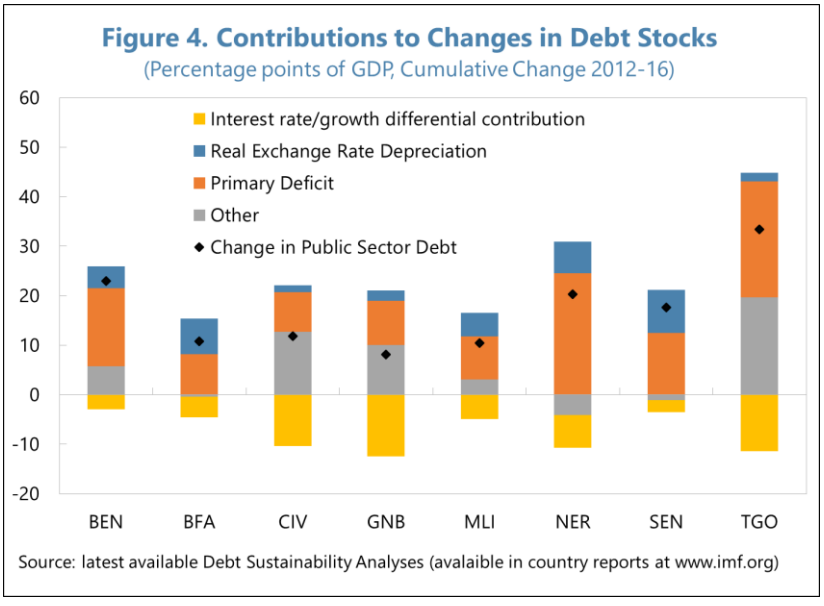
Sources: October 2017 WEO database, except for CIV and GNB where latest Debt Sustainability Analyses were used.

[6] Increasingly, fiscal implications of potential realizations of macro-economic shocks are analyzed through techniques such as fiscal stress tests (see IMF, 2016, p.16), or the fan chart approach (as in Mauro et al., 2015, p.10).

High fiscal deficits have contributed to this debt build-up, with most member states diverging from the deficit convergence criterion of 3 percent of GDP in recent years (Figure 3). The reform of the regional fiscal surveillance framework in 2014 has not fundamentally altered deficit performance (see Basdevant et al., 2015, for more on the 2014 reform), even though it entailed a commitment from individual countries to meet the 3 percent of GDP target by 2019.



11. Another part of the substantial increase in WAEMU debt-to-GDP ratios can be attributed to 'other' debt creating flows. To analyze debt dynamics, the decomposition of debt as is typically done in IMF/World Bank debt sustainability analyses (DSAs) is used (see Annex II for details). It attributes the change in the debt-to-GDP ratio to: (i) primary balance, (ii) exchange rate, (iii) interest/growth differential, and (iv) a residual. This residual includes privatization receipts, recognition of contingent liabilities, debt relief, and bank recapitalizations amongst other things, and is also sometimes referred as the stock-flow discrepancy. It captures the increase in public debt that cannot be explained by the fiscal deficit (adjusted for exchange rate valuations) and GDP growth. (Figure 4).[7,8] Across the eight



[7] Note that there is no attempt here to estimate the exact contribution of each contributing category to the *unanticipated* increase in the debt stock.

[8] The algebra underlying the decomposition can be found in Annex I of IMF (2013).

WAEMU countries, this residual accounted for 5.7 percentage points of GDP of the 16.9 percentage points of GDP increase in gross debt between 2013 and 2017.

12. The materialization of fiscal risks in recent years in WAEMU countries has increased debt stocks above initial projections. The large debt increase over the past couple of years has been largely unanticipated. A measure of this is the difference between a fiscal outcome and what was projected several years earlier. The difference between the most recent 2017 debt-to-GDP projections and 2017 projections made in 2012 for example, is 15 percentage points of GDP (unweighted average), with peaks of more than 30 percent in Benin and Togo (Figure 5).[9] The unanticipated part of the debt increase can be used as a proxy for the materialization of fiscal risks.[10] The share of the unanticipated debt increase can be calculated as:

- $Unanticipated\ share\ of\ debt\ increase\ (2012-2017) = \frac{[debt_{2017} - E_{2012}(debt_{2017})]}{(debt_{2017} - debt_{2012})}$
- For all WAEMU countries, excluding Guinea-Bissau, this share was larger than 65 percent of the total increase. The main reasons behind these unanticipated increases include larger-than-expected spending as new development plans got under way (Côte d'Ivoire, Senegal), shocks to commodity prices (cocoa in Côte d'Ivoire, fuel imports in other countries), reconstruction after conflict and security-related spending (Côte d'Ivoire, Mali), pre-financing arrangements (Togo, Benin—see section C below). Calling of contingent liabilities and public financial management issues have also contributed to these increases, details of which are presented in the sections below.

C. Main Sources of Fiscal Risks in WAEMU

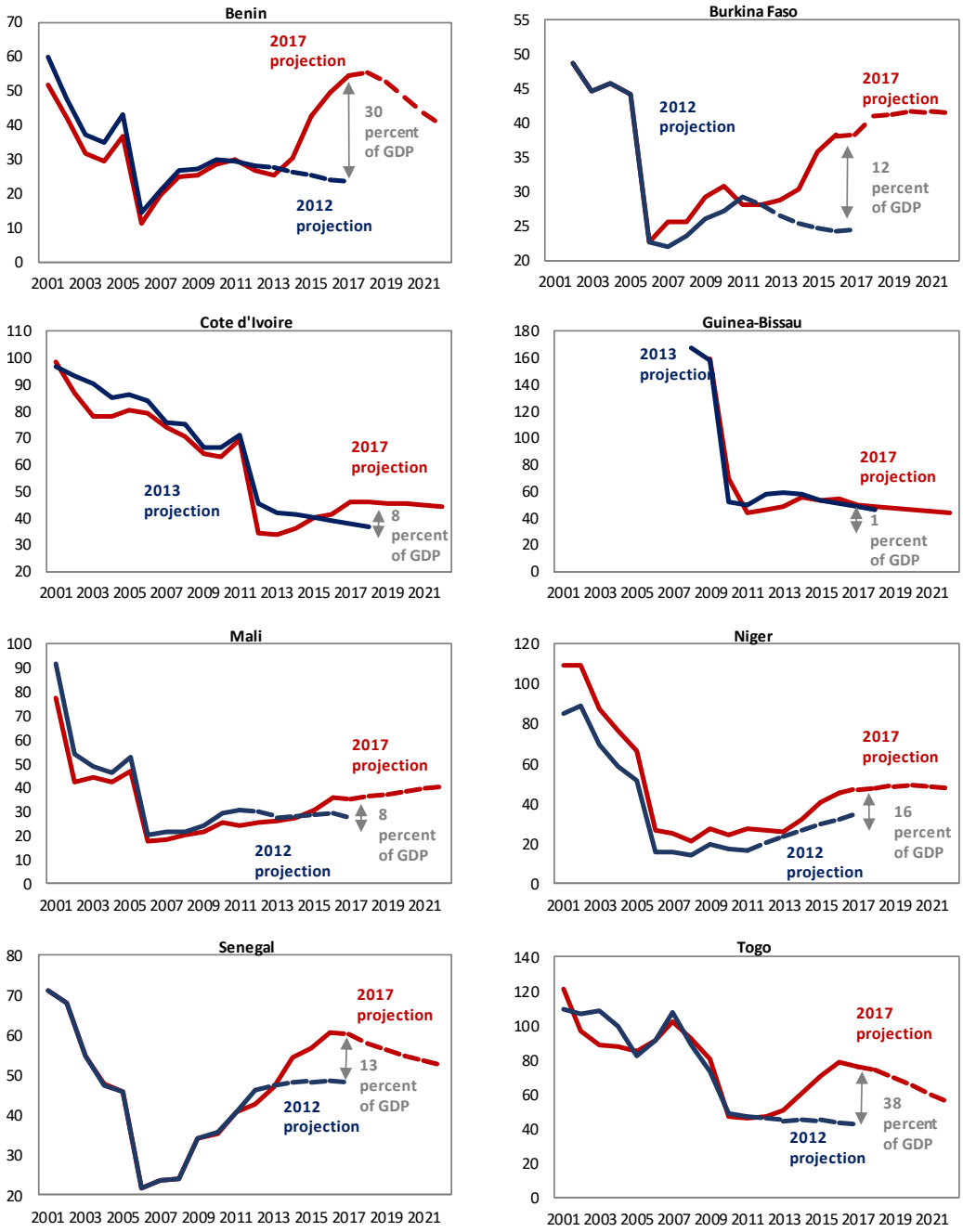
13. The main sources of fiscal risks in WAEMU are macro-economic shocks, some categories of contingent liabilities, and low fiscal institutional quality in certain areas. Table 3 gives an overview of which fiscal risks are to be covered in more detail in this section and why. It is not immediately possible to quantify the relative importance of the various sources of fiscal risks, because of correlation between different risks as well as data limitations.

[9] The choice of vintage does not influence this finding. Five-year ahead forecast errors for 2016 and 2015 give similar orders of magnitude. When taking the 3-year ahead forecast, the discrepancy is about 10 percentage points of GDP (unweighted average for the years 2012-2017).

[10] Two caveats are in order in assessing this indicator: (i) if the unanticipated share of an increase in debt is equal to zero, it does not always imply that no risks have materialized. Positive and negative risk realizations could have cancelled each other out, or government could have actively managed the fall-out of the realized risks. (ii) some of the unanticipated share can typically be explained by discretionary policy changes that may yield longer-term benefits while still being fiscally sustainable (e.g. planned surge in public investment with growth pay-offs occurring further into the future).

Figure 5. WAEMU: Debt Projections in Individual WAEMU Countries

(2001-22, Percent GDP)



Source: World Economic Outlook database, October 2012 and October 2017 vintages, except for Cote d'Ivoire and Guinea Bissau where 2017 and 2013 Debt Sustainability Analyses were used (because of better capture of debt relief operations and issues related to conflict).

It is safe to say, however, that macro-economic shocks play a significant role.[11] But it is not the only source of fiscal risks, as the non-zero residuals in Figure 4 show. Among contingent liabilities, SOEs stand out, while PPPs are likely to become more important going forward. For the fiscal risks related to PFM, this section does not cover 'local governments' as decentralization is relatively limited, nor risks related to natural resource management. The latter is adequately covered elsewhere (see footnote 1 in Table 3).

Table 3. Sources of Fiscal Risks in WAEMU countries

	Covered in detail in section C?	Comments / why (not) covered
Macro-economic Shocks		Covered in staff reports and DSAs.
Contingent Liabilities		
• SOEs	√	
• Large infrastructure projects		Often related to SOEs and PPPs - hence not covered.
• PPPs	√	Potential to become important in near future.
• Pensions		Not an immediate issue as WAEMU populations relatively young.
• Financial system		Potentially large, but should be dealt with at WAEMU regional level.
• Natural disasters		
Institutional		
• Quality, timeliness & coverage	√	
• Expenditure allocation and control	√	
• Oversight of local governments		Decentralization in WAEMU relatively limited (possible exception Mali).
• Revenue forecasting and administration	√	
• Risks related to natural resource mgt.		Only touches some WAEMU members and adequately covered elsewhere. 1/

1/ Among WAEMU countries, only Burkina Faso, Mali and Niger are classified as resource rich (defined by the IMF's African REO as countries whose exports from non-renewable resources > 25% of gross exports). Advice on how to deal with fiscal risks emanating from natural resources can be found in IMF country report No. 14/230 (Burkina Faso), No. 15/348 and 16/84 (both Mali), and No. 15/64 (Niger). Recent oil and gas discoveries in Senegal will necessitate fiscal risk management in this area in the near future.

Source: IMF (2016), Mauro et al. (2015).

Contingent Liabilities: State Owned Enterprises

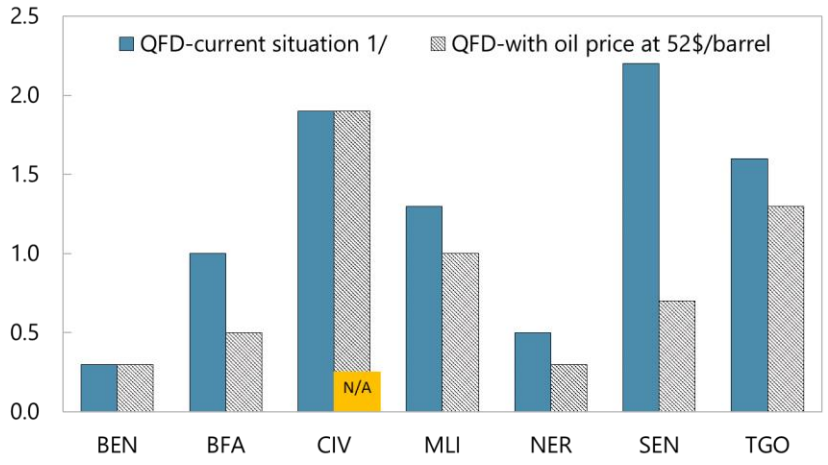
14. State-owned enterprises (SOEs) are an important source of fiscal risk in WAEMU countries. Frequently, SOE liabilities are explicitly or implicitly guaranteed by the state. SOEs are often tasked to carry out quasi-fiscal operations, which are operations carried out by public corporations to further a public policy objective that may worsen their financial position relative to a strictly commercial profit-maximizing level (Allen and Alves, 2016, p.12). For advanced economies and emerging markets, the average cost of government intervention in SOEs over the period 1990-2014 amounted to about 3 percent of GDP (see, Bova and others, 2016). Examples of realizations of fiscal risks for in sub-Saharan Africa, including in WAEMU countries are shown in figure 1

15. Fiscal risks related to SOEs in the energy sector are important in the WAEMU region. In most WAEMU countries, electricity and fuel prices are subsidized by the state, with

[11] Some potential macro-economic shocks to the WAEMU region are discussed in Yontcheva et al. (2015). The final paragraph of section B also gives some examples of recent macro-economic shocks hitting the region.

related SOEs not as profitable. For example, quasi-fiscal deficits in the electricity sector averaged around 1.3 percent of GDP across 7 WAEMU countries in 2013-2014 (blue bars in Figure 6). Even though fuel is often an important share of total operating costs in electricity SOEs, quasi-fiscal deficits would still average almost 1 percent of GDP if oil prices were much lower than in the 2013-14 reference years (lined bars in figure 6).

Figure 6. Quasi-Fiscal Deficits of WAEMU Countries' Electricity Sectors
(percent of current GDP)



1/ Current situation refers to reference year which is 2013 or 2014 for WAEMU countries (with reference oil price for 2013 and 2014 around 100$ per barrel).
Source: Trimble et al. (2016), tables 7 and 13 - no data reported for Guinea-Bissau.

16. Improving data collection and improved coverage in fiscal transactions involving SOEs is important for improving fiscal risk management. Reporting of SOE activities and their financial situation is a first step (equivalent to step 1 in Table 2). This includes properly classifying SOEs, and clearly defining what constitutes an SOE. GFSM 2014 makes a distinction between public corporations, which are government entities that are market producers, and other SOEs which are effectively noncommercial government entities (Box 2). In practice, this distinction is not always easy to make.

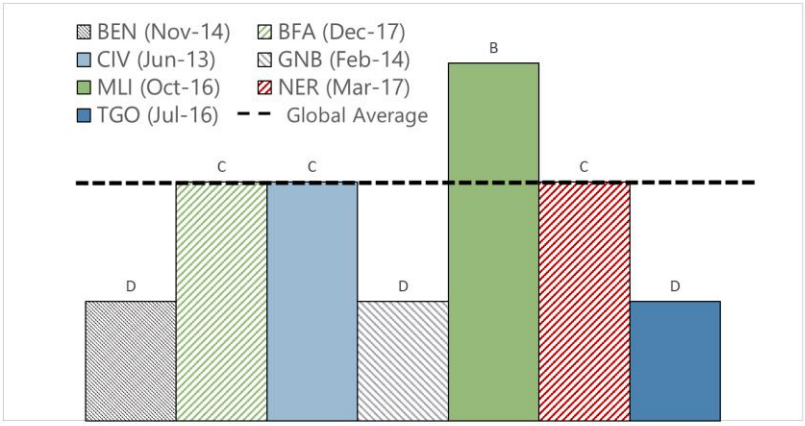
Box 2: What is a Public Corporation?

Public corporations should be classified based on their economic nature. GFSM 2014 defines corporations as "*entities that are capable of generating a profit or other financial gain for their owners, are recognized by law as separate legal entities from their owners, and are set up for purposes of engaging in market production*". A corporation is classified as a public corporation if it is controlled by the government. Control is to be interpreted broadly as the ability to determine the general corporate policy of the entity (box 2.2 in GFSM 2014 indicates how this might be assessed). However, entities that are controlled by the government should be classified as public corporations only if they are market producers. This is in general determined by the so-called market test which says that a unit be classified as a market producer if the value of its sales averages at least half of the production costs, over a period of at least three years. In practice, however, difficulties of valuation may arise. In sectors such as utilities and nuclear energy production, for example, prices are often difficult to determine or are not strongly linked with production costs.

17. WAEMU fiscal indicators refer mostly to central government. Collection of data related to SOEs is improving. The GFSM 2014 concept of general government does not include public enterprises, but does include "extra-budgetary units" (see Annex I—Figure A2. As countries improve data collection, and move towards using GFSM 2014 and the general government concept, this distinction will become more important.[12] At this juncture, WAEMU countries are mainly focused on improving the availability of SOE data, with several countries facing challenges with SOE monitoring, as evidenced by the low scores on the relevant PEFA indicator (Figure 7—see Annex III for more details on how PEFA indicators used in this paper are defined).[13] However, recently, WAEMU countries have made substantial progress in SOE monitoring, in some cases through technical assistance from international institutions. For example:

- **Benin:** authorities are collecting and analyzing the financial statements and questionnaire responses of all 22 SOEs and 140 autonomous agencies to assess their indebtedness.
- **Côte d'Ivoire:** a database has been put together with data on debt servicing from 23 public enterprises. Aggregate debt figures for these SOEs are being reported.

Figure 7. Monitoring of public enterprises in WAEMU
(2013-2017, PEFA grade indicated 1/)



1/ For BEN, CIV, GNB and MLI indicator 9(i) from the 2011 PEFA methodology was used, while for BFA, NER and TGO indicator 10(i) from the new (2016) PEFA methodology was used. Senegal excluded due to most recent PEFA vintage already 7 years old (2011). Details in footnote 14 and PEFA Annex.
Source: Various PEFA reports.

[12] GFSM 2014 acknowledges potential risks related to public enterprises: "*even when statistics are compiled for only the general government sector, some information on public corporations is required. To reflect transactions with public corporations, the change in the level of equity ownership held by units of the general government sector and the exposure to risks associated with guarantees provided to these corporations should be recorded*". (GFSM, 2014, p.2).

[13] The PEFA partnership is a multi-donor partnership that assesses the condition of a country's public expenditure, procurement and financial accountability systems, and develops a practical sequence for reform and capacity-building actions. The assessments cover a range of PFM indicators, and in each country each indicator is assessed against a four-point scale from A to D (see Annex III for details). For WAEMU countries, it should be noted that Senegal is not included as its last PEFA was in 2011. PEFA surveys for Benin (2014), Côte d'Ivoire (2013), and Guinea-Bissau (2014) could similarly fail to pick up recent reforms. Senegal's recent accession to the IMF's Special Data Dissemination Standard is indicative of good-practice PFM performance.

(continued)

- **Guinea-Bissau:** comprehensive audits, covering both financial and management aspects, for 8 SOEs completed in 2017.
- **Senegal:** As part of the process to qualify for the IMF's Special Data Dissemination Standard (SDDS) which demands general government coverage, authorities have started to produce data related to SOEs in TOFE format. Senegal also reports some summary statistics related to public enterprises and semi-autonomies agencies (like universities and hospitals) in its annual budget framework paper.[14]
- **Togo:** SOE debt is routinely reported as part of wider debt statistics and included in debt sustainability analyses.

18. The IMF is playing a prominent role, both in terms of standard setting and in giving such incentives in the programs in the region. For example, as of February 2018, most disbursing IMF programs in WAEMU countries had some structural benchmark related to SOEs, and countries like Côte d'Ivoire have benefited from IMF technical assistance on these matters.

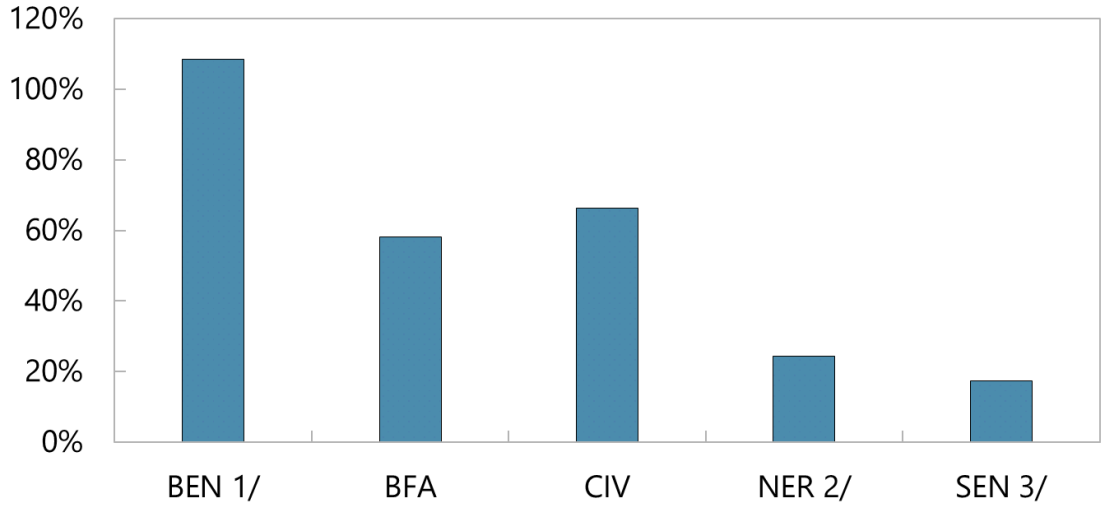
Contingent Liabilities: Public Private Partnerships

19. Public Private Partnerships (PPPs) have the potential to contribute to infrastructure provision, but they can also be a source of fiscal risk. PPPs refer to long-term contracts between a private party and a government entity, for providing a public asset or service, in which the private party bears risks and management responsibility and remuneration is linked to performance (ADB et al., 2017). PPPs allow for deferred spending compared with public investment projects undertaken through standard public procurement, as the expenditures implied by PPPs tend to be recorded later—often at project completion rather than as the investment is carried out (Mauro et al., 2015, p.18). PPPs can also create debt-like obligations for the government where the latter commits to paying for services over the life of the contract which may commit the government to a range of contingent obligations. The main risks emanate from delays in construction, litigation and increases in financing costs, while assumptions regarding project implementation could be optimistic. Frequently, these debt- and guarantee-like obligations are not included in the government's fiscal aggregates (IMF, 2016, p38).

20. In WAEMU countries, PPPs are not widespread. The region has large infrastructure needs, while fiscal space is limited. Hence, the latest development plans of WAEMU members almost invariably aim to make use of PPPs as an alternative financing source, with the envisaged resource envelope potentially large (Figure 8).

[14] For the latest version see http://www.dgf.finances.gouv.sn/dgf/documentation/DB/dpbep_2018_2020.pdf

Figure 8. Prospective Cost of PPPs in National Development Plans
(Percent of 2016 GDP)



1/ Based on debt sustainability considerations, investment for 2017-19 was reduced from CFAF 2,254 billion to 1,400 billion.
2/ Sum of 17.8% outstanding value of PPPs, plus 6.5% envisaged for next 4 years for road projects.
3/ For comparability purposes, Senegal number corresponds to the 2016-2020 period (see PSE, table on p.128).

Sources: GAP 2016-2021 (Benin), PNDES 2016-20 (Burkina Faso), NDP 2016-20 (Côte d'Ivoire), IMF Country report 17/233 (Niger), PSE (Senegal). No data available for Mali and Togo.

21. PPP-related legal frameworks and institutional capacity are being updated throughout the region. Countries plan on expanding PPP projects, and are in the process of updating legal texts, while setting up the institutions and capacity to monitor related fiscal risks—such as dedicated PPP units within the Ministry of Finance. International institutions are helping the authorities on these issues with technical assistance, and program-related benchmarks, to ensure that PPPs do not jeopardize debt sustainability (Table 4). From Table 4 and Figure 8, it appears that PPPs are relatively underdeveloped (both in quantity and as pertains institutional frameworks) in Guinea-Bissau, Mali and Togo. At the WAEMU level, work is ongoing on a region-wide directive on PPPs. Some countries are also making progress in improving transparency surrounding the PPP process. Côte d'Ivoire for example plans to include all PPP projects in its 2018-20 multiyear investment plan.

Table 4. PPP Frameworks in WAEMU.

	Legal Framework	Recent Technical Assistance 1/	Structural benchmark in IMF program?
Benin	New law adopted in 2016.	PIMA IMF mission, Oct-17.	Yes. Setting up Strategic Support Unit, responsbile i.a. for PPP evaluation (done in June 2017).
Burkina Faso	Revision of PPP law ongoing.	PIMA IMF mission, Mar-17. PPP IMF mission, Nov-17.	A potential new ECF arrangement is likely to feature PPP-related Structural Benchmarks.
Côte d'Ivoire	New law adopted in 2012.	PPP IMF mission, January 2017.	Yes. Develop PPP database (set for December 2017).
Guinea-Bissau	New law adopted in 2009.	None.	No.
Mali	New law adopted in 2016.	PIMA IMF mission, June 2017.	No.
Niger	PPP law adopted in 2011, being amended in 2018.	PPP IMF mission, April 2017.	Yes. New PPP law consistent with the investment code and the 2012 budget law, is to be sent to National Assembly.
Senegal	New law adopted in 2014.	Peer-learning event organized by IMF, April 2017.	Yes, but only in current PSI first and second review.
Togo	No dedicated PPP law.	None.	No.

1/ Other partners such as the World Bank Group are also providing PPP-related TA (e.g. through the Public-Private Infrastructure Advisory Facility - see www.ppiaf.org).

Source: Various IMF staff reports for the respective countries.

PFM: Quality and Coverage of Reported Fiscal Data

22. Government's decision-making may be adversely affected by weak quality fiscal data with incomplete coverage. Most WAEMU countries still use elements of the cash-based GFSM 1986 system, the predecessor of GFSM 2001/2014, for fiscal reporting. They currently use a mixed reporting system where some items are reported on a cash basis while most spending items are recorded at the commitment ('*ordonnancement*') stage. Coverage is mostly limited to central government, implying that important information related to SOEs and local governments is often not part of the standard

Table 5. Coverage of Public Sector in Fiscal Data in WAEMU Countries

	GFSM 2001	Coverage of stocks	Coverage 2/	Deficit reported on accrual basis? 3/
Benin	NO	NO	Central Government (excl. SSF)	no
Burkina Faso	NO	NO	Central Government (excl. SSF)	no
Côte d'Ivoire	NO	NO	Central Government (incl. SSF)	no
Guinea-Bissau	NO	NO	Central Government (excl. SSF)	no
Mali	NO	NO	Central Government (excl. SSF)	no
Niger	NO	NO	Central Government (excl. SSF)	no
Senegal 4/	YES	NO	Central Government (incl. SSF)	no
Togo	NO	NO	Central Government (excl. SSF)	no

1/ As represented in the government budget operations table.

2/ SSF = Social Security Fund.

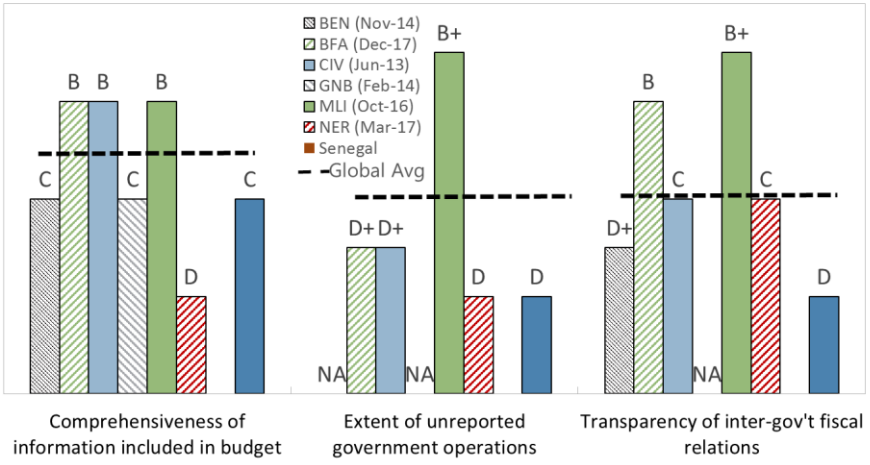
3/ Most countries report on a commitment (in French '*ordonnancement*') basis. The equivalent of accrual in French would be '*liquidation*'.

4/ General government available for 2015. Full general government reporting expected by 2020.

Source: IMF (2017).

budgetary presentation, creating the risk that fiscal pressures can develop in these sectors without the knowledge of decision-makers (Table 5). The PEFA methodology has also indicators that give some indication of fiscal data quality and coverage. On the indicator 'Comprehensiveness of information included in the budget' and 'Transparency of intergovernmental fiscal relations', WAEMU countries like Burkina Faso, Côte d'Ivoire and Mali score better than the global average, but most WAEMU countries for which data are available score poorly on 'extent of unreported government operations' indicating fiscal risks linked to incompleteness of data coverage (Figure 9).

Figure 9. Transparency of public finances in WAEMU
(2013-2017, PEFA grade indicated 1/)

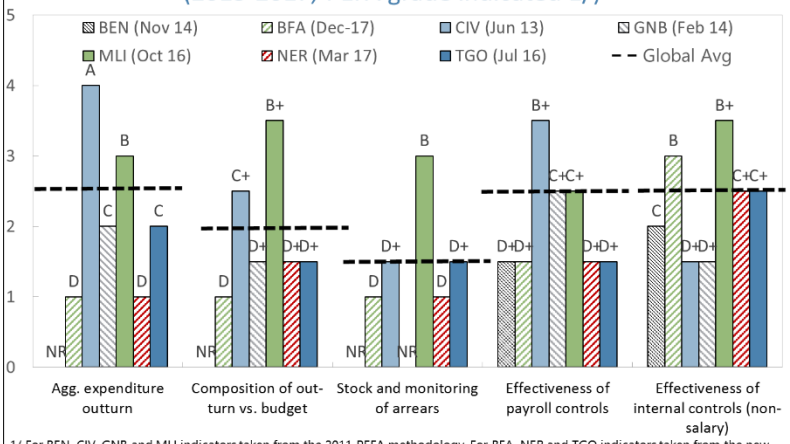


1/ For BEN, CIV, GNB and MLI indicators taken from the 2011 PEFA methodology. For BFA, NER and TGO indicators taken from the new (2016) PEFA methodology. Senegal excluded due to most recent PEFA vintage 7 years old. Details in footnote 14 and PEFA Annex.
Source: Various PEFA reports.

PFM: Expenditure Allocation and Control

23. Internal controls related to expenditures are important to ensure there are no systematic spending overruns. Of course, certain spending pressures related to exogenous events cannot always be foreseen, but here the issue is of weaknesses in spending controls that result in spending patterns not following agreed budgetary outlays, leading to weak budget execution. The PEFA methodology tracks the quality of expenditure control along the dimensions shown in Figure 10, where global averages are also shown for each indicator. More than 50 percent of the data points show the lowest levels ('D' or 'D+')

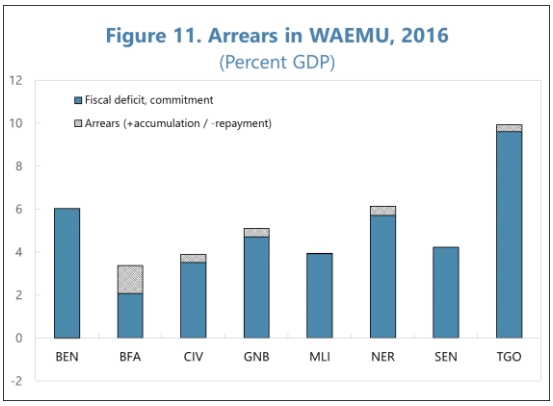
Figure 10. Expenditure Control in WAEMU
(2013-2017, PEFA grade indicated 1/)



1/ For BEN, CIV, GNB and MLI indicators taken from the 2011 PEFA methodology. For BFA, NER and TGO indicators taken from the new (2016) PEFA methodology. Senegal excluded due to most recent PEFA vintage 7 years old. Details in footnote 14 and PEFA Annex.
Source: Various PEFA reports.

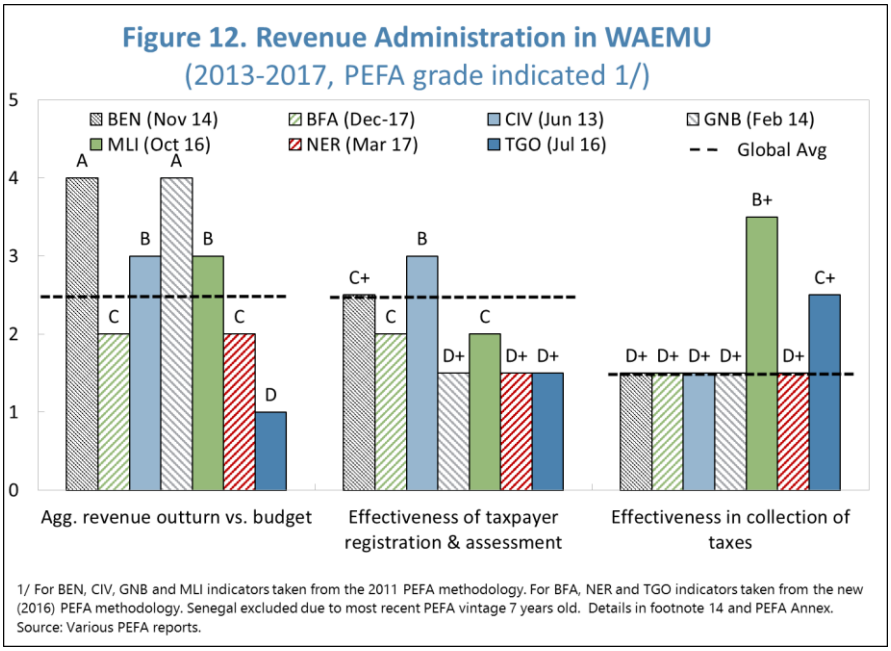
implying that expenditure control for the respective indicator falls below the basic level (or that not enough information is available to establish a score). The issues that need most work according to this picture are 'stock and monitoring of arrears' and 'effectiveness of payroll controls.'

24. Domestic arrears add to the deficit when measured on a commitment basis. Weak expenditure controls can lead to the build-up of arrears, which occur when no financing can be made available for certain spending items. In some case, arrears payments relate to legacy arrears, which adds to contemporaneous financing requirements.



PFM: Revenue Forecasting and Administration

25. Government revenues falling short of forecasts is another source of fiscal risks. This is typically related to growth coming in lower than expected, but can also be important when tax reforms are introduced with optimistic yield forecast. In WAEMU, forecasting, as measured by the relevant PEFA indicator, is actually reasonably acurate, with more than half of countries above the global average and only 1 country-system deemed inadequate ('D' score). For revenue administration, the picture looks less favorable, with more than half of WAEMU countries' systems assessed as inadequate across the two relevant PEFA indicators. The difference in performance between the forecasting indicator and the effectiveness in tax collection can be explained by the distance to tax potential.



D. Detecting Fiscal Risks Outside the Fiscal Balance: A Stock-Flow Exercise

Fiscal rules, Non-Structural Fiscal Adjustment and Institutional Capacity

26. Statistical treatment of fiscal transactions can be used to mask underlying challenges in the measurement of fiscal indicators. The literature uses terminologies like "non-structural adjustments" (Milesi-Ferretti and Moriyama, 2006), "fiscal gimmicks" (Koen and van den Noord, 2005), or "fiscal devices" (Irwin, 2012), which are practices which improve key fiscal indicators, while leaving the government's net worth not (or much less) changed. In most cases, these improvements are short-lived and are offset by future losses. One example is bringing tax receipts forward into an earlier fiscal year. This improves the current year fiscal position, but worsens it in the next year. Such transactions are often a response to cover worse-than-expected fiscal results caused by the materialization of fiscal risks. The way some of these transactions are accounted for do not necessarily go against international accounting standards, although misclassification of transactions does happen too. In what follows, all these transactions are referred to as non-structural fiscal adjustments.

27. The practice of non-structural fiscal adjustment has been documented in countries with fiscal rules. The use of fiscal gimmicks is not the outcome of an effective and well-calibrated fiscal rule.[15] In general, deficit rules have created more challenges than breaches of the debt rule, as gross debt is typically well above or below its threshold and the authorities cannot do much about this in the short run. Deficits, however, can be adjusted more rapidly and are hence subject to closer scrutiny.

Measurement of Non-structural Fiscal Adjustment: Stock-Flow Residuals

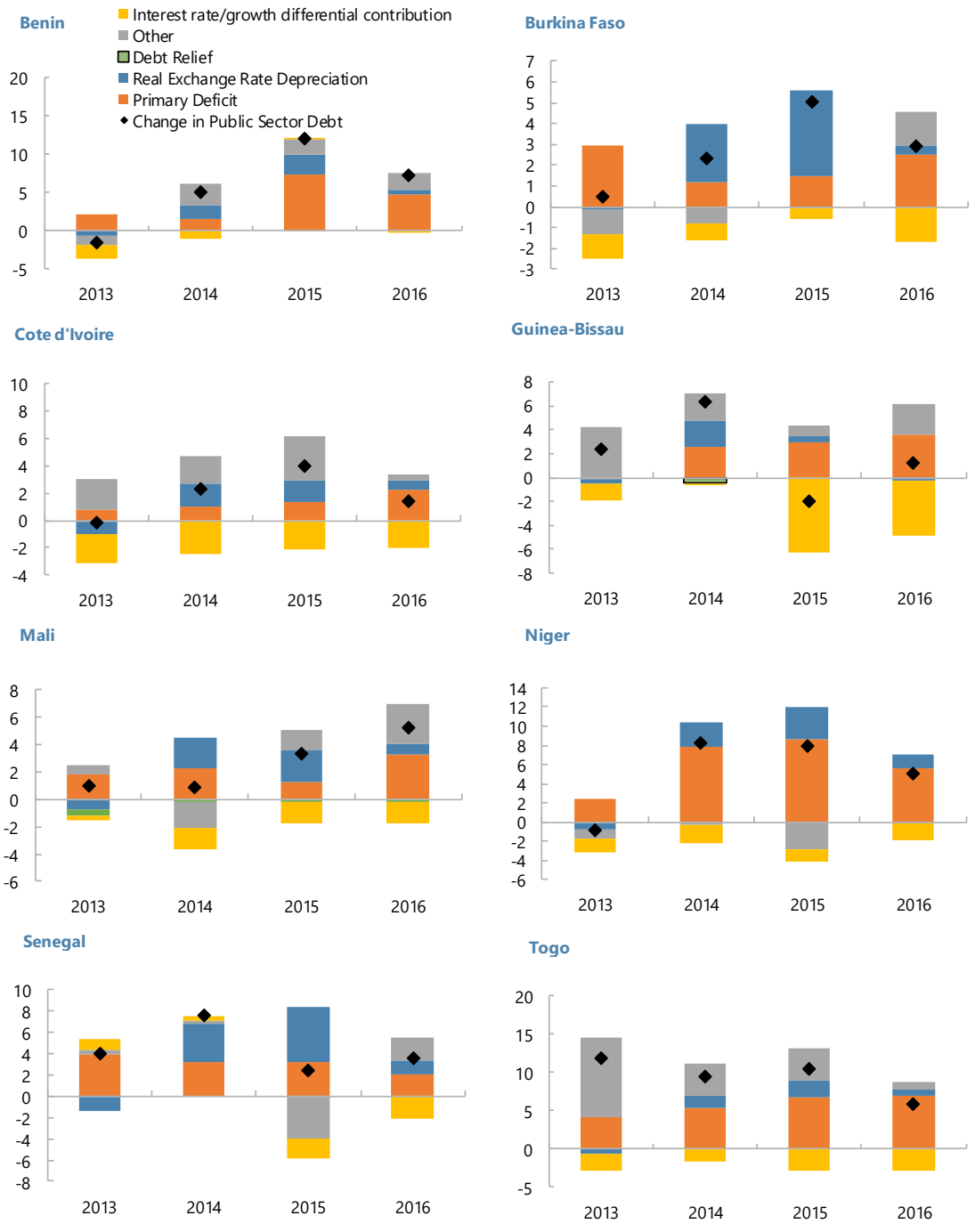
28. A proxy for the presence of non-structural fiscal adjustment is the size of stock-flow discrepancies. An indication that accounting devices are being used, is when the debt stock increases faster than what is implied by fiscal deficits.[16] In formula (1) this would imply that the residual is larger than zero. There are valid reasons why this residual can be different from zero, such as valuation changes in assets or liabilities, cash versus accrual accounting, privatization, or below the line treatment of past liabilities, including arrears clearance/accumulation. But even when the reasons are 'correct' from an accounting perspective, large residuals can still give a muddled picture of the fiscal position. Calculating the 'residual + other identified debt-creating flows' variable from equation (1) above for WAEMU countries, the (unweighted) annual average for all eight countries over the four-year

[15] Indeed, fiscal gimmicks have been used in countries without fiscal rules. Recent research at the IMF shows that well-designed fiscal rules can constrain excessive deficits (see Eyraud, et al., 2018).

[16] This has been the standard approach to uncover fiscal gimmicks in the literature—see for example Weber (2012) or Seiferling (2013).

period 2013-2016 is 1.3 percent of GDP. Residuals have also tended to increase over the period, peaking at 1.6 percent in 2016 (Figure 13, grey bars).

Figure 13. WAEMU: Contributions to Changes in Debt-to-GDP Ratio
(percentage points of GDP)



Source: latest available Debt Sustainability Analyses (avalaible in country reports at www.imf.org)

Analysis of Positive Stock-Flow Residuals

29. Reasons behind the positive stock-flow residuals include pre-financing, SOE-related fiscal transactions, multi-year investment projects, and coverage and data issues, including arrears. Even though equation (1) is an identity, data limitations preclude a full reconciliation of stocks and flows, as is done for example by Seiferling (2013) for advanced economies. Hence, the need to look country-by-country for the main reasons behind discrepancies. Table 6 gives an overview, with more details to be found in the discussion below, though a full reconciliation is not possible. It also implies that an empty cell in Table 6 could well signal a lack of information rather than not being an issue in a specific country. Also, since the sources identified in the table are based on recent history, other potential sources could materialize in the future.

Table 6. Sources of Positive Stock-Flow Residuals.

	Pre-financing	Coverage 1/	Roll-over of appropriations	Pensions	Arrears	Data issues 2/
Benin	√				√	
Burkina Faso					√	√
Côte d'Ivoire		√				
Guinea-Bissau					√	√
Mali					√	
Niger	Not applicable as stock-flow discrepancies small.					
Senegal		√	√	√	√	
Togo	√	√			√	√

1/ Mainly SOEs and other extra-budgetary units covered in debt stocks, but not in deficit, including treatment of previously unbudgeted arrears.
2/ Implies statistical discrepancies in the fiscal table are large (not necessarily independent from the other categories).

30. Pre-financing has been a source of stock-flow residuals in Benin and Togo. In a typical pre-financing arrangement, a private company is granted a public works contract by the government, and obtains a loan from a domestic commercial bank or a group of commercial banks. The Finance Ministry guarantees this loan and, at the same time, agrees to service all principle and interest, which are to be paid automatically from the Treasury account.[17] The full liability of these loans thus rests with the government. In Benin, approved road projects worth 24 percent of GDP were approved without corresponding budgetary allocations through such pre-financing schemes. Even though most of these contracts were subsequently cancelled, execution of some of these projects totaled about 3 percent of GDP in

[17] Definition adapted from Togo's first review under the ECF (IMF country report 17/379).

2016, adding to the debt stock. In Togo, pre-financed expenditures averaged 3.5 percent of GDP during 2013-16.

31. Arrears also contribute to the stock-flow residual. Typically, arrears build-up over a certain period after which an audit is organized to distinguish genuine from superfluous claims. Once this is done, a clearance plan is agreed with creditors for the government to pay off these claims over several years. This adds to a country's gross financing needs (i.e. adds to gross debt), but does not add to the deficit.[18] In Côte d'Ivoire for example, government bonds were issued in 2014 to pay off past domestic arrears incurred prior to 2011 (worth 1 percent of GDP). This was not captured in debt numbers as these arrears were only verified through an audit in 2014.

32. Changes in government deposits and the way in which fiscal data is recorded and reported can also have an influence on stock-flow residuals. Withdrawals from government bank deposits are included in domestic bank financing, but are not reflected in the debt stock (Côte d'Ivoire and Togo). Explanations of the residual are often very country-specific. In Burkina Faso and Guinea-Bissau, the reconciliation between budgetary data and financing data remains a work in progress.

33. Debt stocks are reported on a cash basis, while the fiscal balance in WAEMU countries is reported on a commitment basis. In practice, most WAEMU countries still report certain items on a cash basis, but most spending items are reported on a commitment basis, and this can create non-zero stock-flow residuals.

34. In Senegal, sources of stock-flow discrepancies are mainly related to *La Poste*, pensions, and roll-over of past budgetary appropriations. Senegal's so-called treasury operations have lately come under increased scrutiny, as they contributed substantially to the government's gross financing needs. Thanks to improved data availability and transparency, a large part of Senegal's 2015-16 stock-flow discrepancy can be explained. There are three main sources: (i) the *La Poste* which is an example of how certain fiscal operations are not straightforward to classify, (ii) civil service pensions which have recently gone into deficit (i.e. payments have been larger than contributions – on a flow basis), and (iii) financing of unutilized appropriations from past budgets (*comptes de depôt*).[19]

[18] Technically, once arrears are identified, they should be accounted for in the year where they were supposed to have been committed. However, as it is often difficult to identify exactly when commitments were made, previous fiscal accounts are not changed and settlement of arrears are mostly accounted for through below-the-line operations in current and future years.

[19] For further analysis of Senegal's treasury operations and their statistical treatment, see box 1 in the IMF staff report for the 4th review of Senegal's Policy Support Instrument (PSI) (IMF country report 17/230).

35. IMF programs are playing a key role in improving some of the aspects related to positive stock-flow residuals. IMF programs are helping countries with PFM issues in general, but also address very specifically some of the causes of positive stock-flow residuals highlighted in Table 6. For example, in Benin and Togo, IMF programs have set conditionality related to pre-financing.[20] In Senegal, the IMF program (PSI) has conditionality to help reduce sources of stock-flow discrepancies described above. Most programs include incentives to improve coverage and transactions of SOEs. In Côte d'Ivoire, the program includes conditionality on SOEs and PPP risks. Overall, the starting point for reducing positive stock-flow residuals is improving data coverage and transparency. The status of WAEMU countries' PFM systems is the topic of the next section.

E. Improving Fiscal Risk Management in WAEMU

36. A PFM system itself can be the source of fiscal risks, but, when functioning properly, can reduce other types of fiscal risks. The main tenets of such a system are outlined in the aforementioned recent IMF paper on the subject (IMF, 2016), which has, in turn, a close relationship with countries' PFM systems. Box 3 repeats the recommendations from that paper for SOEs and PPPs. Section C discussed PFM aspects that could be sources of fiscal risks in themselves, but a well-functioning PFM system can also reduce the likelihood and impact of other sources of fiscal risks. In this respect, a (non-exhaustive) list of PFM issues that are important for fiscal risk management would include:

- Moving to accrual accounting and audited financial statements at the government level would greatly enhance disclosure of fiscal risks and contingent liabilities. Moreover, PPPs would appear on the balance sheet;
- Improving fiscal projections and medium-term fiscal frameworks, expenditure allocation and controls;
- Developing the stocks aspect of the fiscal table, notably through reporting opening and closing public sector balance sheets;
- Moving to 2001-2014 GFS table, and broadening the scope of the fiscal table (at least to the general government level).

37. WAEMU countries are improving their PFM systems through implementation of six regionally agreed directives. At the regional level, the WAEMU commission developed 6 directives reflecting international standards to improve PFM in the region:

1. Directive dealing with PFM Transparency Code;
2. Directive dealing with the State's Finance Laws;
3. Directive dealing with the general regulations regarding the State's Public Accounting;

[20] See IMF country reports 17/379 (for Togo) and 18/1 (for Benin).

4. Directive dealing with the State's Budget Nomenclature;
5. Directive dealing with the State's Public Accounting Plan;
6. Directive dealing with the State's Table of Financial Transactions (TOFE);

- The PFM aspects mentioned in the bullet points in the previous paragraph are all part of these directives. By the end of 2012, all 6 directives had been incorporated into member countries' legislative texts. However, implementation will require capacity upgrades, which in turn would benefit from technical assistance from development partners. The application of PFM principles is an on-going task and is by no means a linear process, as can be seen for example from PEFA indicators that worsen over time in certain countries.

Box 3. Fiscal Risk Management for SOEs and PPPs

SOEs

How to build a good oversight regime for SOEs? Management of SOE fiscal risks requires careful planning. Allen and Alves (2016, p.14) develop a road-map with different time-horizons. Elements of such a regime that could be prioritized in the short term include: (i) develop an inventory of SOEs, (ii) establish basic reporting framework for SOEs that present fiscal risks, (iii) clarify the role of other public entities such as Ministry of Finance, line ministries, Presidency, etc. in SOE oversight.

PPPs

The envisaged build-up of PPPs in the region calls for careful planning. The recent development of a WAEMU PPP directive will help in this respect, as will the Public Fiscal Risk Assessment Model (or P-FRAM), which is newly developed analytical tool for assessing the fiscal implications of PPPs. The recently developed IMF fiscal risk management framework provides a toolkit to deal with PPP-related fiscal risks, the main elements of which are (IMF, 2016, p.38):

- Ensure central control over PPP approvals, ceilings on overall fiscal exposure, and appropriate gatekeeping role for the government;
- Systematically subject projects to appraisal, undertaking independent review of project feasibility and charge risk-related guarantee fees where they are provided;
- Ensure the risk-allocation framework allocates risks to the parties best able to influence or control the risk, and introduce upper bounds where payments are linked to demand;
- Ensure that the full lifetime costs and the potential fiscal exposure are accurately identified and budgeted for during the decision-making process.

Source: IMF (2016).

38. International organizations, including the IMF, play a key role in setting and disseminating fiscal transparency standards, and helping countries apply them. Recent research shows that one of the four main factors affecting prospects for fiscal openness across countries is the positive influence of donors and international agencies and initiatives

(Khagram et al., 2013). The IMF plays a key role in the donor landscape through standard-setting (Fiscal Transparency Code), and associated Technical Assistance delivery (Fiscal Transparency Evaluation). In WAEMU countries, it plays a key role regarding fiscal transparency through its ECF (disbursing) and PSI (non-disbursing) programs. With attention also focused on issues related to contingent liabilities and fiscal risks, the Fund's revamped debt sustainability framework will help progress in assessing these issues, including broadening debt coverage (IMF, 2018b, p.33)**.**

F. Conclusion

39. Fiscal risks in the WAEMU region are mainly related to macro-economic shocks and contingent liabilities linked to state-owned enterprises and public-private partnerships. Weak public financial management systems often contribute to the size of the problem once fiscal risks materialize. One manifestation of this is debt stocks growing much faster than implied by fiscal deficits in recent years (so-called stock-flow discrepancies). The main factors explaining this are pre-financing, SOE-related fiscal transactions, multi-year investment projects, and coverage and data issues, including arrears.

40. Analysis and monitoring of fiscal risks is improving in most WAEMU countries. In this respect, IMF (2016, p. 33) provides practical advice for LICs:

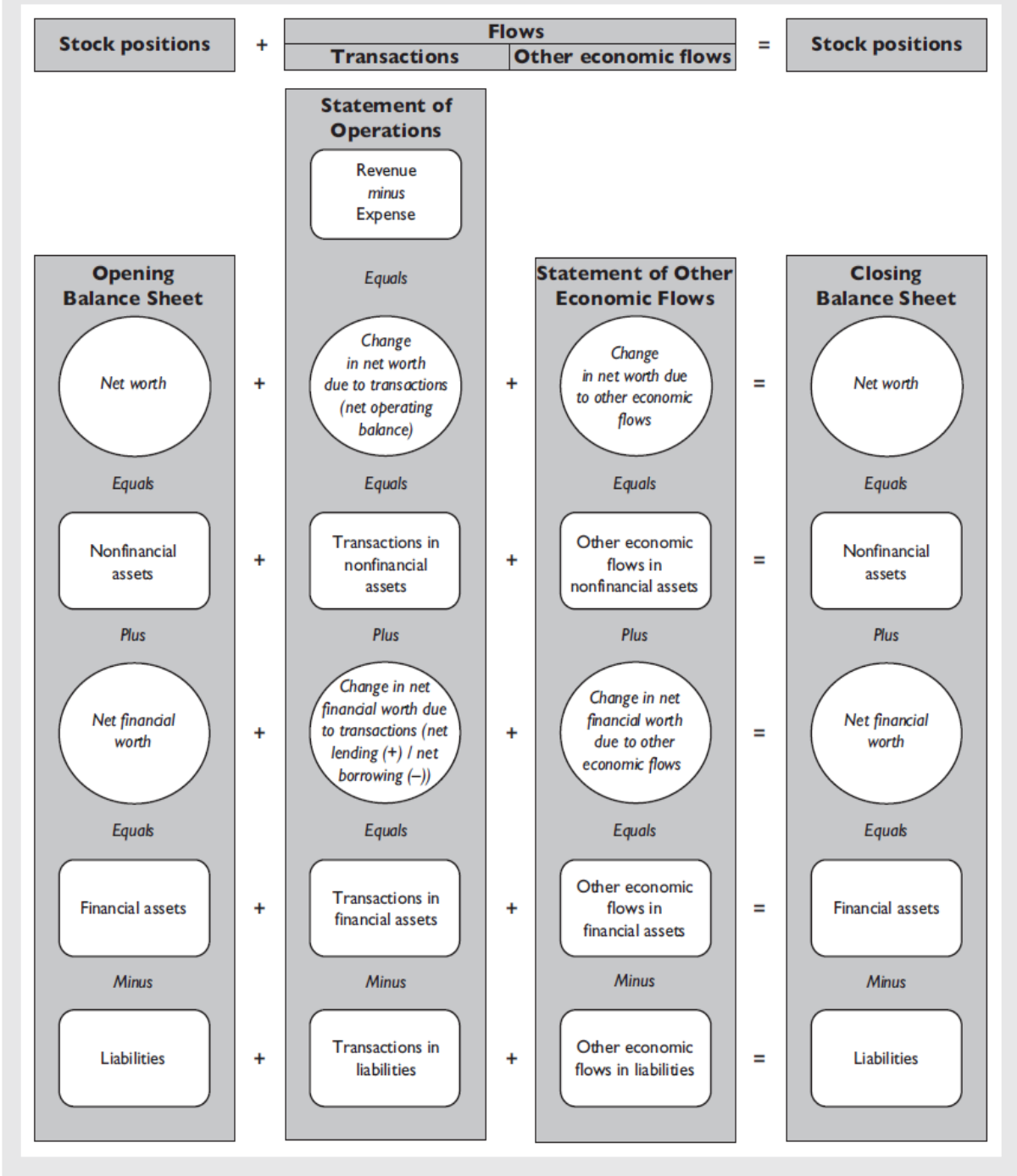
> LICs "*should prioritize the development of macro-fiscal sensitivity analysis (..). Efforts should also be made to construct a basic financial balance sheet (..) Finally, these countries need to improve their understanding and disclosure of major explicit liabilities such as guarantees, PPPs, and disaster and insurance schemes*."
>
> As for expanding capacity to manage and mitigate risks, LICs should focus on developing "*approaches that rely on stronger direct controls over the creation of potential exposures including through legally-binding limits and centralized authorization of guarantees, PPPs, sub-national and SOE borrowing, and other explicit contingent liabilities*".

There has been progress along a number of these issues in WAEMU countries. Information availability regarding SOEs is improving, and there is substantial progress on frameworks governing PPPs. Côte d'Ivoire recently completed a stock-taking report on fiscal risks. Other countries have made progress on various aspects of fiscal risk management—e.g. Senegal's improvement of public finance statistics as echoed in its adherence to SDDS. In most countries however, there is a need to assess overall risks to fiscal frameworks. The Fiscal Transparency Code is ideally suited as the guiding framework to accomplish this. Given the importance of sound fiscal policy for the region's external stability, it is crucial that the ongoing reform program related to fiscal transparency and fiscal risk management is given priority among the region's decision-makers.

41. This paper shows that addressing fiscal risks and improving fiscal transparency are complementary to fiscal rules in safeguarding the fiscal health of WAEMU. The fiscal health of the monetary union encompasses more than just meeting the 3 percent deficit target. Systems need to be put in place to identify, monitor and manage fiscal risks. Part of this agenda involves improving PFM systems further, including through ways to reduce discrepancies between debt stock dynamics and annual deficits. Improving the reporting of fiscal risks will help improve fiscal management and attract private investment.

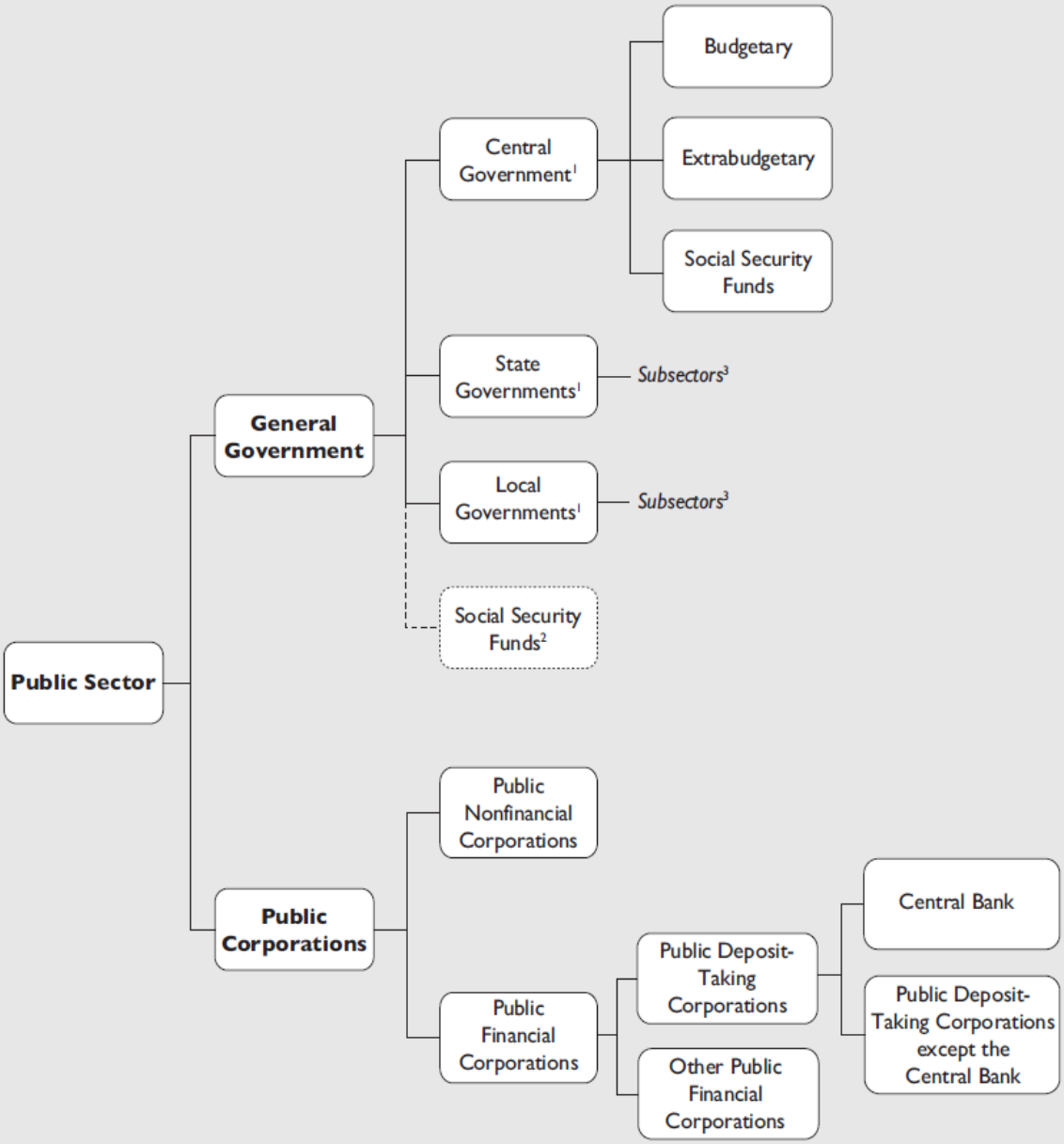
Annex I. GFSM 2014 Schedules

Figure A1. Structure of the GFS Analytic Framework



Source: GFSM 2014, figure 4.1.

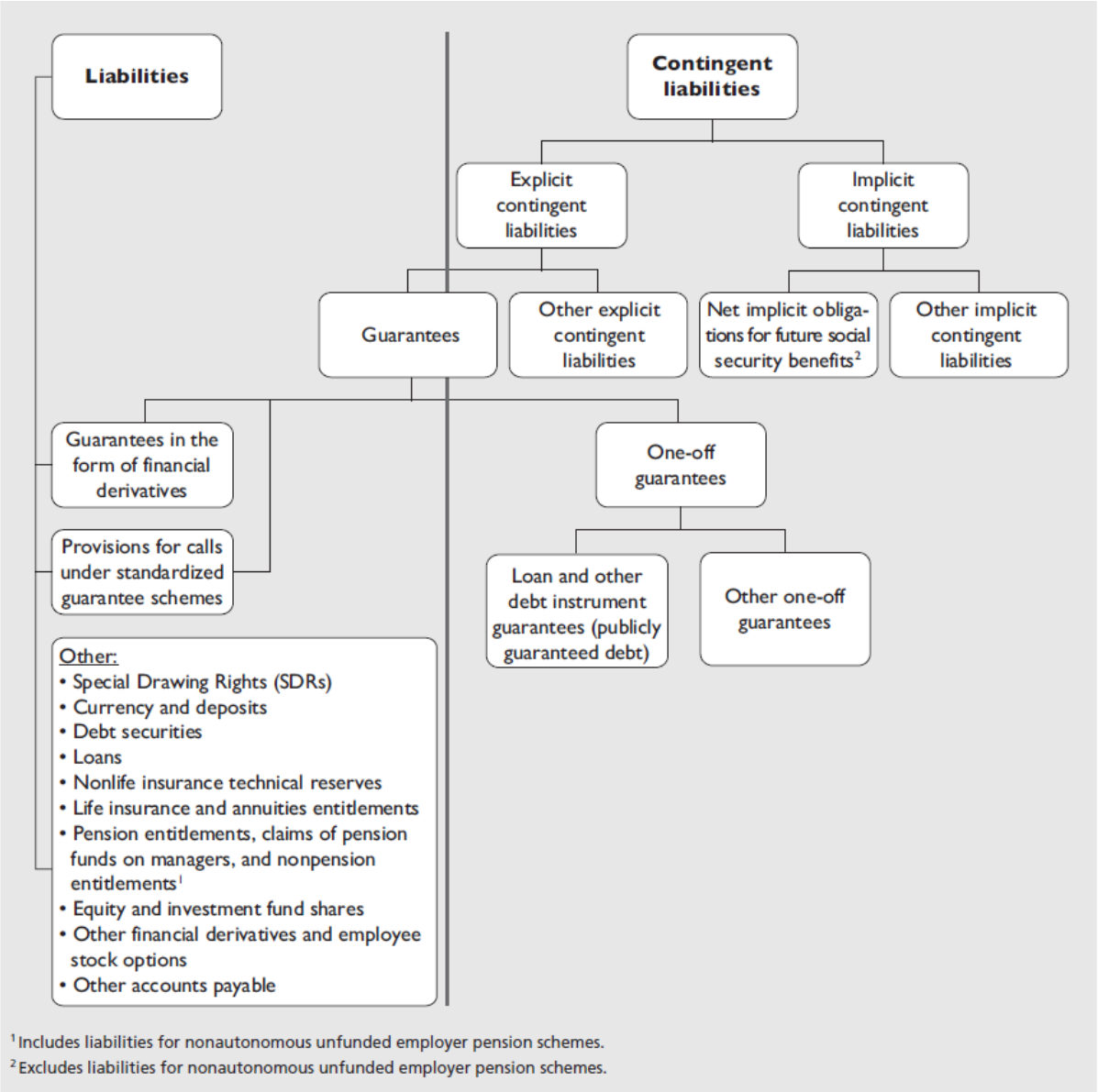
Figure A2. The Public Sector and It's Main Component



[1]Includes social security funds.
[2]Alternatively, social security funds can be combined into a separate subsector, as shown in the box with dashed lines.
[3]Budgetary units, extrabudgetary units, and social security funds may also exist in state and local governments.

Source: GFSM 2014, figure 2.3.

Figure A3. Overview of Liabilities & Contingent Liabilities in Macroeconomic Statistics



[1] Includes liabilities for nonautonomous unfunded employer pension schemes.
[2] Excludes liabilities for nonautonomous unfunded employer pension schemes.

Source: GFSM 2014, figure 7.2.

Annex II. Debt Dynamics

The analysis of debt dynamics in section B is based on the typical debt stock decomposition that is used in IMF/World Bank debt sustainability analyses (DSAs). The determinants of the change in the debt stock between two years depicted in Figures 4 and 13, can be written down in the following equation (the full derivation of this formula can be found in Annex I of IMF, 2013):

$$d_{t+1} - d_t = \left(\frac{1}{1+g_{t+1}}\right) * \left(d_t * \left[r^d_{t+1} \frac{d^d_t}{d_t} + r^f_{t+1} * \frac{d^f_t}{d_t} \right] - d_t * g_{t+1} + d^f_t * \vartheta_{t+1} * \left(1 + r^f_{t+1}\right) \right) - pb_{t+1} + o_{t+1} + res_{t+1} \quad (1)$$

Where lower case roman letters indicate ratios to contemporary nominal GDP. Further:

- d = nominal debt
- g = real GDP growth
- r = effective real interest rate (superscripts 'f' and 'd' denote foreign and domestic currency denominated)
- pb = primary balance
- o = other identified debt-creating flows
- θ = change in the real exchange rate
- res = residual ensuring that the identity holds (should be as close to zero as possible)

Going over the above formula from left to right, the 'balloons' indicate the contribution to the change in debt-to-GDP coming from: (i) the effective real interest rate, (ii) real GDP growth, (iii) the real exchange rate, (iv) the primary balance, (v) other debt creating flows, and (vi) a residual. This exercise is done for the 8 WAEMU countries using the latest available DSAs, where the contributions of growth and the interest rate have been summarized in the variable 'interest/growth differential'. Similarly, the contribution of other debt creating flows and the residual have been put in the same category. This variable, is sometimes referred to as the stock-flow discrepancy, and captures the increase in public debt that cannot be explained by the fiscal deficit (adjusted for exchange rate valuations and GDP growth). The analysis of this variable is the subject of section D above.

Annex III. PEFA—Public Expenditure and Financial Accountability, Framework for Assessment of Public Financial Management[1]

Figures in the paper utilizes the Public Expenditure and Financial Accountability (PEFA) Framework. The following information outlines how the fiscal indicators presented are assessed and reported with numeric grades (A-D). These are taken from the latest 2016 PEFA.

A. Monitoring of public enterprises in WAEMU

Figure 7 presents PI-10 Oversight of aggregate fiscal risk from other public-sector entities for available WAEMU countries.

PI-10. Fiscal risk reporting

Description: This indicator measures the extent to which fiscal risks to central government are reported. Fiscal risks can arise from adverse macroeconomic situations, financial positions of subnational governments or public corporations, and contingent liabilities from the central government's own programs and activities, including extrabudgetary units. They can also arise from other implicit and external risks such as market failure and natural disasters. This indicator contains three dimensions and uses the M2 (AV) method for aggregating dimension scores.

1. Transparency of public finances in WAEMU

Figure 9 present indicators on: P1-5 Comprehensiveness of information included in budget; PI-6 Central government operations outside financial reports; and PI-7 Transfers to subnational governments.

PI-5. Budget documentation

Description: This indicator assesses the comprehensiveness of the information provided in the annual budget documentation, as measured against a specified list of basic and additional elements. There is one dimension for this indicator.

PI-6. Central government operations outside financial reports

Description: This indicator measures the extent to which government revenue and expenditure are reported outside central government financial reports. It contains three dimensions and uses the M2 (AV) method for aggregating dimension scores.

PI-7. Transfers to subnational governments

Description: This indicator assesses the transparency and timeliness of transfers from central government to subnational governments with direct financial relationships to it. It considers the basis for transfers from central government and whether subnational governments receive

[1] PEFA Framework: https://pefa.org/content/pefa-framework

information on their allocations in time to facilitate budget planning. It contains two dimensions and uses the M2 (AV) method for aggregating dimension scores.

2. Expenditure Control in WAEMU

Figure 10 present indicators including: PI-1 Aggregate expenditure outturn; PI-2. Expenditure composition outturn; PI-22. Expenditure arrears; PI-23. Payroll controls; and PI-25. Internal controls on non-salary expenditure.

PI-1. Aggregate expenditure outturn
Description: This indicator measures the extent to which aggregate budget expenditure outturn reflects the amount originally approved, as defined in government budget documentation and fiscal reports. There is one dimension for this indicator.

PI-2. Expenditure composition outturn

Description: This indicator measures the extent to which reallocations between the main budget categories during execution have contributed to variance in expenditure composition. It contains three dimensions and uses the M1 (WL) method for aggregating dimension scores.

PI-22. Expenditure arrears

Description: This indicator measures the extent to which there is a stock of arrears, and the extent to which a systemic problem in this regard is being addressed and brought under control. It contains two dimensions and uses the M1 (WL) method for aggregating dimension scores.

PI-23. Payroll controls

Description: This indicator is concerned with the payroll for public servants only: how it is managed, how changes are handled, and how consistency with personnel records management is achieved. Wages for casual labor and discretionary allowances that do not form part of the payroll system are included in the assessment of non-salary internal controls, PI-25. This indicator contains four dimensions and uses the M1 (WL) method for aggregating dimension scores.

PI-25. Internal controls on non-salary expenditure

Description: This indicator measures the effectiveness of general internal controls for non-salary expenditures. Specific expenditure controls on public service salaries are considered in PI-23. The present indicator contains three dimensions and uses the M2 (AV) method for aggregating dimension scores.

3. Revenue Administration in WAEMU

Figure 12 present indicators PI-3. Revenue outturn; PI-19. Revenue administration; and PI-20. Accounting for revenue.

PI-3. Revenue outturn

Description: This indicator measures the change in revenue between the original approved budget and end-of-year outturn. It contains two dimensions and uses the M2 (AV) method for aggregating dimension scores.

PI-19. Revenue administration

Description: This indicator relates to the entities that administer central government revenues, which may include tax administration, customs administration, and social security contribution administration. It also covers agencies administering revenues from other significant sources such as natural resources extraction. These may include public corporations that operate as regulators and holding companies for government interests. In such cases the assessment will require information to be collected from entities outside the government sector. The indicator assesses the procedures used to collect and monitor central government revenues. It contains four dimensions and uses M2 (AV) method for aggregating dimension scores.

PI-20. Accounting for revenue

Description: This indicator assesses procedures for recording and reporting revenue collections, consolidating revenues collected, and reconciling tax revenue accounts. It covers both tax and nontax revenues collected by the central government. This indicator contains three dimensions and uses M1 (WL) for aggregating dimension scores.

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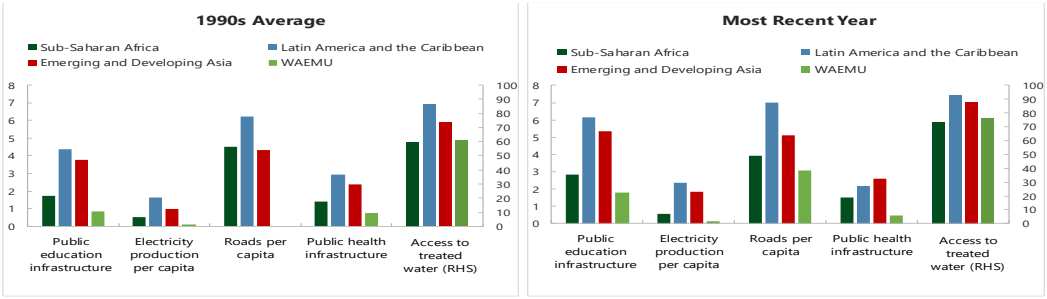
PUBLIC INVESTMENT EFFICIENCY IN WAEMU: AN EMPIRICAL ASSESSMENT[1]

The analysis presents stylized facts on the infrastructure gap in the WAEMU and examines the efficiency of public investment. It finds that, despite the high level of public investment during the past decade, infrastructure level and quality remain relatively low in the region. The WAEMU's public investment efficiency level is lower than the benchmark groups, including sub-Saharan African. Econometric results suggest that institutions play a role in fostering the efficiency of public investment. WAEMU countries need to improve public investment management (PIM) institutions that could reduce the efficiency gap.

A. Introduction

1. WAEMU countries' infrastructure gap poses a bottleneck to sustained growth (Figures 1 and 2). WAEMU's infrastructure needs are substantial (Dominguez-Torres and Foster 2011), particularly in electricity supply, paved road density and telecommunication infrastructure. Insufficient or inefficient infrastructure reduces the return to trade and economic activity and constrains growth prospects (Commission for Africa 2005; Foster and Briceño-Garmendia 2009).

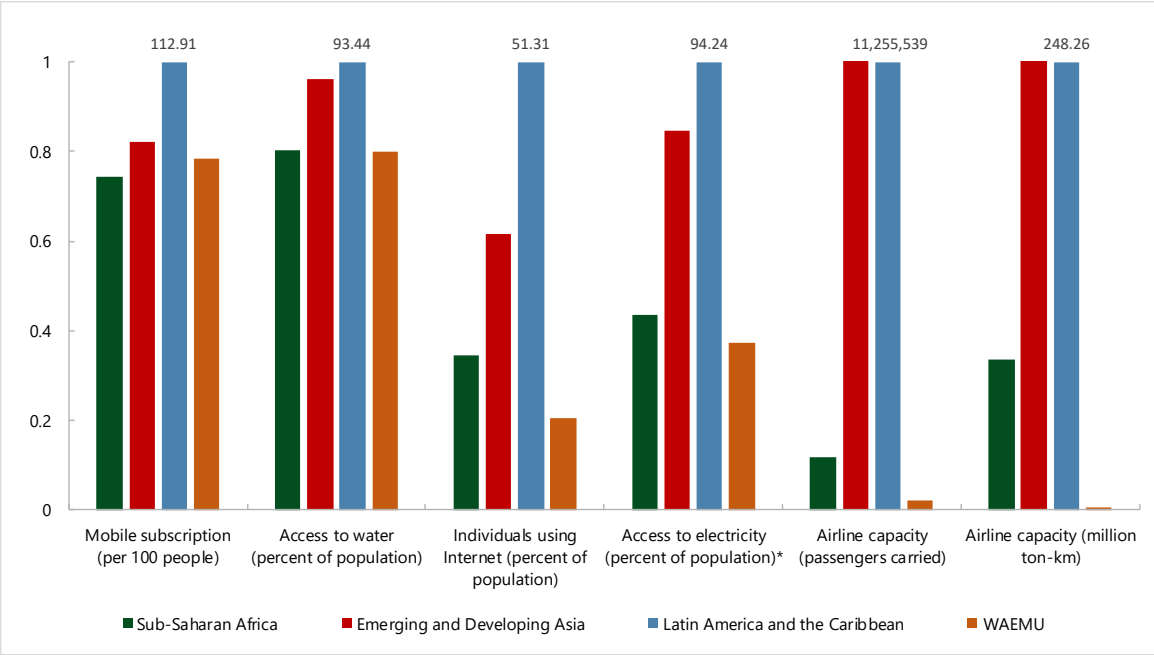
Figure 1. WAEMU: Measures of Infrastructure, 2000-2015



Source: World Development Indicators; and IMF staff estimates.
*Units vary to fit scale. Left hand axis: Public education infrastructure is measured as secondary teachers per 1,000 persons; Electricity production per capita as kWh per 1,000 persons; Roads per capita as km per 1,000 persons; and Public health infrastructure as hospital beds per 1,000 persons. Right hand axis: Access to treated water is measured as percent of population.

[1] Prepared by Karim Barhoumi and Shirin Nikaein Towfighian. The paper has benefitted from comments from Matthieu Bellon.

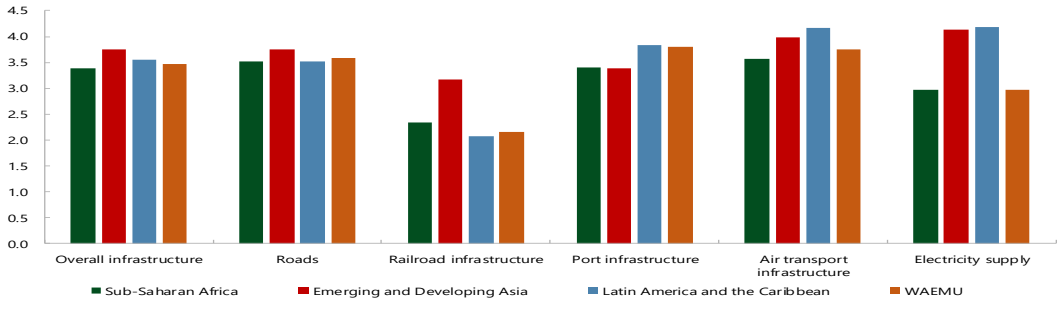
Figure 2. WAEMU: Selected Quantitative Indicators of Infrastructure 2015



Sources: World Development Indicators, and IMF Staff estimates.
* Latest available data for Access to electricity is from 2014.
** EDA's value for airline capacity is 3.6 (40,456,902 passengers) and 5.7 (1,410.90 million ton-km), but it's not shown in the graph so that smaller values are visible.

2. The region's infrastructure is also perceived to be of low quality and investment efficiency appears low (Figure 3). The World Economic Forum's (WEF) Global Competitiveness Indicators ranks WAEMU behind the sub-Saharan African average and regional comparator groups. The quality of electricity supply, railroads and roads scored below regional comparator groups as well. At a comparable level of real public capital stock, WAEMU's overall infrastructure quality is perceived to be lower than that of regional peers.

Figure 3. WAEMU: Selected Qualitative Indicators of Infrastructure, 2015



3. This chapter empirically assesses public investment efficiency for the WAEMU. This chapter assesses the infrastructure gap in WAEMU based on the efficiency frontier analysis, and examines the determinants of public investment efficiency using panel regressions.

B. Assessing Public Investment Efficiency in WAEMU

4. The efficiency frontier assesses the relative efficiency of WAEMU countries in translating public investment (inputs) into infrastructure (outputs). Following, IMF (2015), Grigoli and Kapsoli, 2013 and Albino-War and others (2014), we use the data envelopment analysis (DEA) methodology— the standard approach in the literature using non-parametric methods—to determine the efficiency of public investment. The DEA is a deterministic algorithm that calculates the efficient frontier through linear approximations involving decision-making units (DMU) performance observations. Efficiency scores are then calculated relative to a peer group consisting of linear combinations of input-output observations for efficient DMUs. We derive efficiency scores using an output-oriented model.

5. The assessment of the efficiency of public investment is carried out with a two input-one output model over the period 2000-2015.

- ***Input:*** The first input is the real public capital stock per capita;[2] the second is per capita GDP, used as a proxy for the contributions of the private sector to infrastructure services[3].
- ***Output:*** To measure infrastructure output, we follow IMF's (2015) approach by using two measures of infrastructure quality and access:[4]
  - *A physical indicator* which combines data on the volume of economic infrastructure (length of road network, electricity production, and access to water) and social infrastructure (number of secondary teachers and hospital beds)[5].
  - *A hybrid indicator*, which combines the physical and survey-based indicators into a synthetic index of the coverage and quality of infrastructure networks.

[2] Details regarding the estimations of public capital stocks, see IMF Policy Paper Making Public Investment More Efficient (2015).

[3] See IMF Staff Discussion Note (2014), Making the Most of Public Investment in MENA and CCA Oil-Exporting Countries.

[4] Data are provided by the Investment and Capital Stock Template prepared by IMF Fiscal Affairs Department.

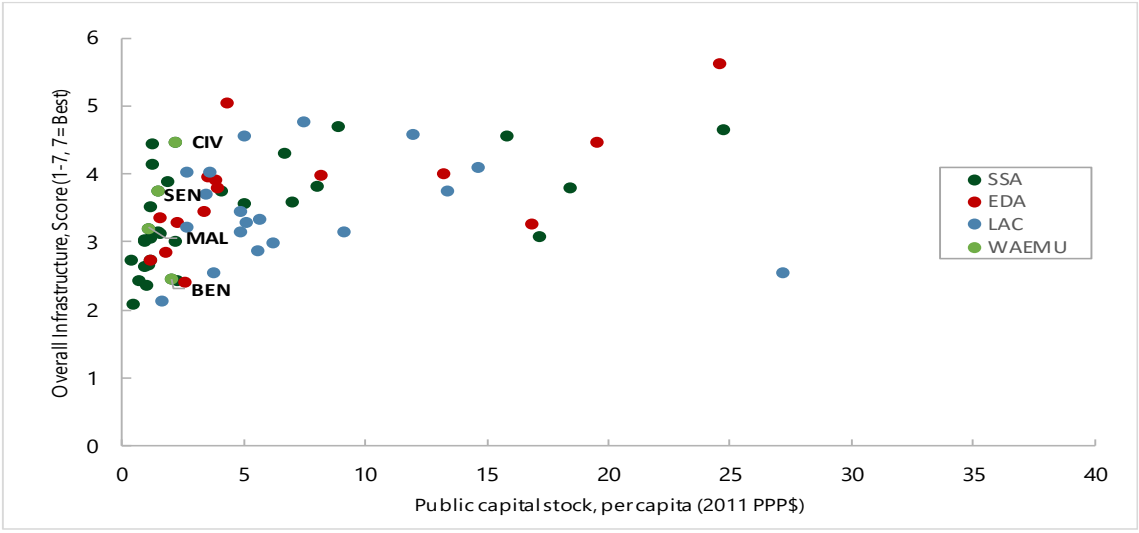
[5] While this indicator provides a sense of the coverage of infrastructure networks and physical output of public investments, it does not fully measure the quality of the infrastructure.

6. Estimated efficiency scores clearly show that WAEMU's public investment efficiency compares unfavorably with regional comparators and there is scope to improve efficiency. We estimate for each infrastructure output index mentioned above its corresponding efficiency score. Overall, WAEMU's performance lags that of all comparator groups, and the magnitude of the inefficiency depends on the efficiency score index (Table 1). Under the two-efficiency scores index, the results indicate that WAEMU countries could increase investment efficiency with the same amount of investment. The relationship between per capita public capital stock and perceptions of infrastructure quality is positive but weak (Figure 4). The correlation between real GDP growth and investment has been weaker than in regional comparator groups (Figure 5).

Table 1. Efficiency Scores in WAEMU

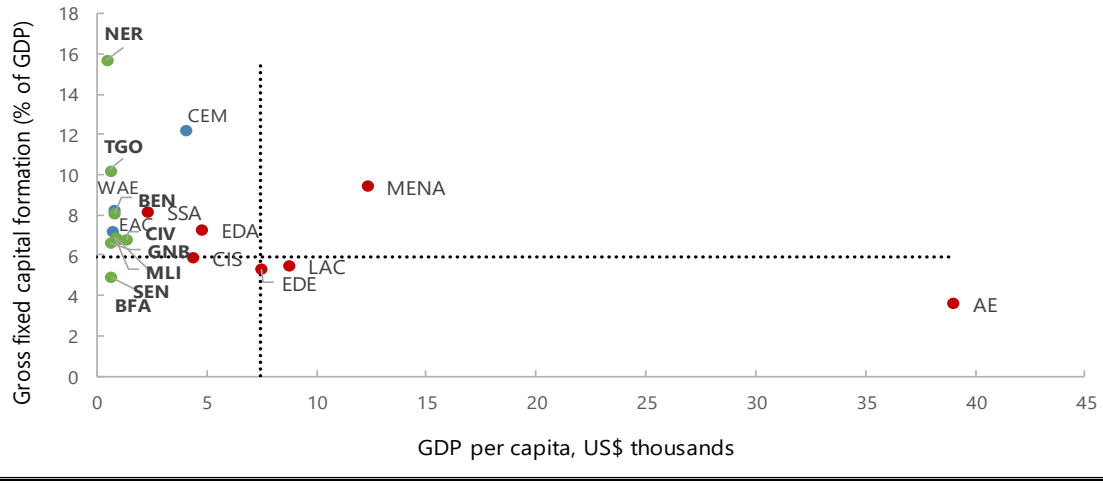
Region	Physical Infrastructure	Hybrid Indicator
Sub-Saharan Africa	0.4597	0.6417
CEMAC	0.3046	0.5108
EAC	0.4875	0.7351
WAEMU	0.3694	0.6188
Oil exporters	0.1958	0.2687
Non-resource-intensive	0.4464	0.6981
Other resource-intensive	0.6019	0.6563

Figure 4. WAEMU: Real Public Investment and Quality of Overall Infrastructure, 2015
Scale: 1-7 (best)



Sources: World Development Indicators, and IMF Staff estimates.
* Equatorial Guinea and Trinidad and Tobago are not shown in the graph as they are outliers.

Figure 5. WAEMU: GDP per Capita Versus Gross Fixed Capital Formation



C. Explaining Public Investment Efficiency in WAEMU

7. The empirical literature highlights that higher public investment efficiency is generally associated with stronger institutions and low dependency on natural resource revenues.[6] To examine factors explaining public investment efficiency in SSA countries, we regress over the period 2000-2015 the efficiency scores[7], estimated previously, on the: (i) quality of institutions: measured by two governance indicators namely control of corruption and regulatory quality[8], (ii) Official Development Assistance (ODA), (iii) percentage of urban population[9], and (iv) natural resources dependency.[10]

[6] See, for example, Albino-War et al (2014), Grigoli and Mills (2014) and Gleb and Grassman (2010).

[7] The sample includes 154 countries including 45 SSA countries.

[8] Control of corruption and regulatory quality are measures of perceptions of the quality of institutions. Control of corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5. Regulatory quality measures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5. Caution is needed when interpreting the results as they may be affected by perceptions, recording errors, availability of information and small sample.

[9] Urban population refers to people living in urban areas as defined by national statistical offices. The data are collected and processed by United Nations Population Division.

[10] Represented by a dummy variable with 1 being a LIC or LMIC rich in non-renewable natural.

8. The empirical estimates suggest that the quality of institutions public investment efficiency in the WAEMU are strongly correlated. The results show a positive correlation between the public investment efficiency and the quality of institution and a negative association between the dependency on natural resource and public investment efficiency (Table 2).

Table 2. WAEMU: Determinants of Public Investment Efficiency

Dependent Variable Hybrid Efficiency score	1	2
Quality of institutions		
Control of Corruption	**0.11292**	
	(3.13)	
Regulatory Quality		**0.11552**
		(3.130)
ODA	-0.00000	-0.00000
	(-0.225)	(-0.696)
Proportion of Urban Population	-0.00002	-0.00045
	(-0.021)	(-0.416)
Natural Resource dependency	**-0.12216**	**-0.11708**
	(-2.129)	(-2.030)
Constant	**0.7533**	**0.77387**
	(11.065)	(11.043)
Observations	93	93
R-squared	0.216	0.220

t-statistics in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

9. The results are robust to an alternative empirical methodology and different indicators of institutional quality. The empirical analysis considers an alternative estimation method[11] (Table 3). The impact of institutional quality on public investment efficiency remains statistically significant under both alternative measures of efficiency scores as well as indicators of institutional quality[12].

10. Institutional improvements can play a crucial role in fostering the efficiency of public investment in WAEMU countries. Based on various specifications, a 10 percent

[11] As an alternative approach, we estimate a Tobit Model.

[12] The different indicators of institutional quality are highly correlated, see Annex III. The results are corroborated using alternative measures of institutional quality including the Country Policy and Institutional Assessments (CPIA). Nonetheless, caution is needed when interpreting the results as these indicators y may be affected by perceptions, recording errors, availability of information and small sample.

increase in the control of corruption index or the regulatory quality index could improve public investment efficiency in WAEMU by about 15 percent on average.

Table 3. WAEMU: Determinants of Public Investment Efficiency
(Alternative estimation method)

Dependent Variable Hybrid Efficiency scores	**1**	**2**
Quality of institutions		
Control of Corruption	**0.11783**	
	(4.588)	
Regulatory Quality		**0.10568**
		(4.148)
ODA	0.00000	0.00000
	(1.443)	(0.934)
Proportion of Urban Population	**-0.00146**	**-0.00159**
	(-2.066)	(-2.180)
Natural Resource Receipts	-0.02733	-0.02801
	(-0.748)	(-0.750)
Constant	**0.89319**	**0.88955**
	(19.280)	(18.940)
Observations	103	103
R-squared	0.224	0.206
t-statistics in parentheses.		
*** p<0.01, ** p<0.05, * p<0.1		

D. Improving Public Investment Management to Reduce Efficiency Gap in WAEMU countries

11. Fund staff has developed a new Public Investment Management Assessment (PIMA) to identify principal areas for strengthening public investment efficiency. The PIMA evaluates 15 key institutions for planning, allocation, and implementation of public investment. These PIM institutions are a subset of the broader framework of "budget institutions" that govern the public financial management process (Figure 6).

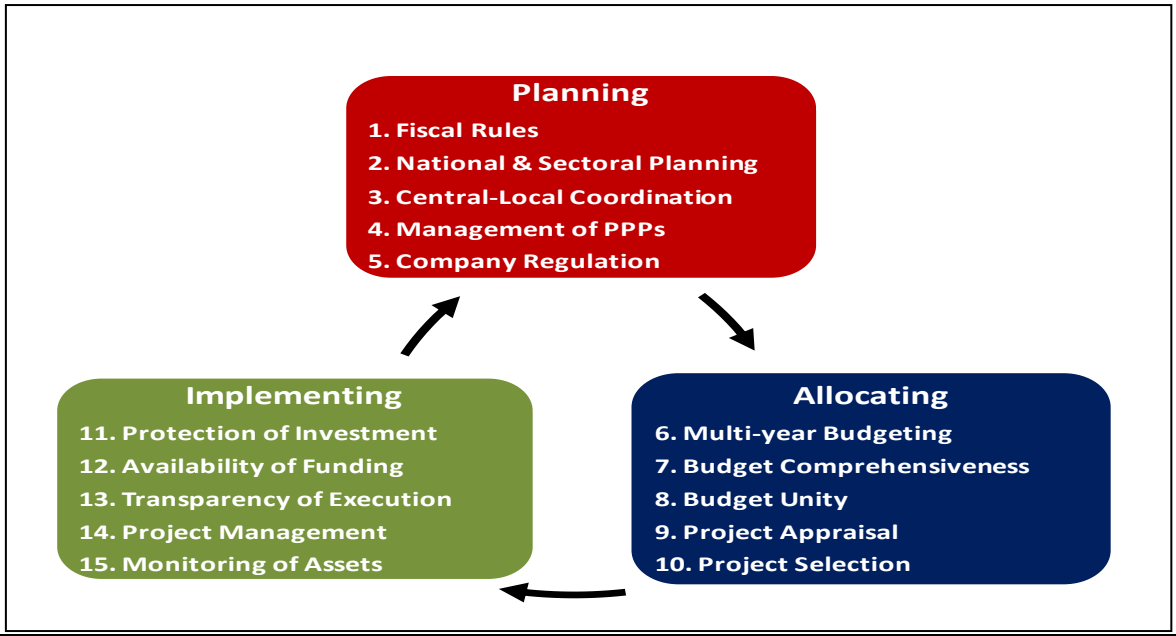
12. The initial PIMA results (for 23 piloted countries) show that WAEMU[13] has generally similar regulatory framework to the average in SSA and other regions. Figure 7 shows the average scores for regulatory framework for WAEMU and comparators. The WAEMU

[13] The WAEMU sample consists of Burkina Faso, Côte D'Ivoire, and Togo. The SSA sample consists of Cameroon, Ghana, Liberia, Madagascar, Mozambique, and Zambia (developing SSA), and Botswana and Mauritius (emerging SSA). Other countries are Thailand, Maldives, Timor Leste and Mongolia (emerging and developing Asia), Kosovo, Serbia, Ukraine and Albania and Kyrgyz (emerging and developing Europe).

(continued)

countries for which the PIMA has been conducted have slightly better regulatory framework[14] in the areas of national and sectoral planning, budget comprehensiveness and protection of investment. However, on average, WAEMU has weaker regulations in the areas of central-local coordination, management of PPPs, company regulation and monitoring of assets.
Figure 8 compares PIMA scores for WAEMU on regulatory framework and effectiveness. In the areas of multiyear budgeting, budget comprehensiveness and unity, protection of investment, availability of funding and transparency of execution including procurement, certain regulations exist but are not used effectively to achieve public investment efficiency. For example, procurement law requires that all projects, in principle, shall be tendered in a competitive and transparent manner but in practice most projects are not.

Figure 6. WAEMU: PIMA Framework



13. Potential exists to strengthen public investment management. WAEMU countries could improve public investment efficiency by strengthening the planning and selection of PPPs, effectiveness of central-local coordination, the credibility of multiyear budgeting, the effectiveness of project appraisal and selection, the monitoring of project during implementation, and the registration of infrastructure assets.

[14] Regulatory framework refers to the objective facts that an organization, policies, rules and procedures are in place. Effectiveness refers to the degree to which the intended purpose is being achieved or there is a clear useful impact.

Figure 7. WAEMU: PIMA Scores: Regulatory Framework

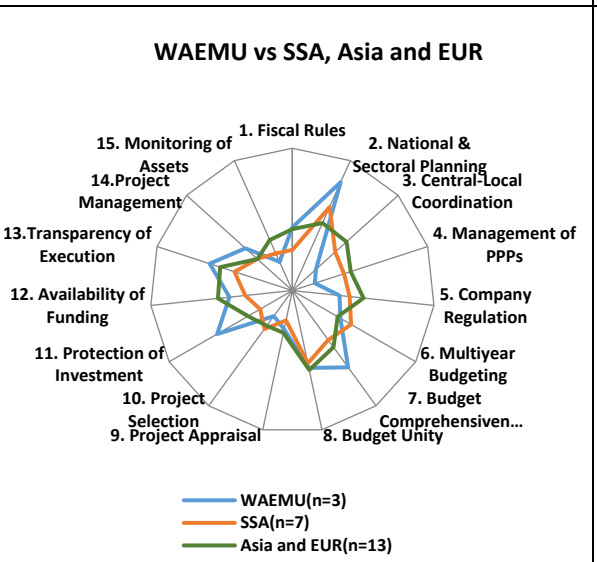
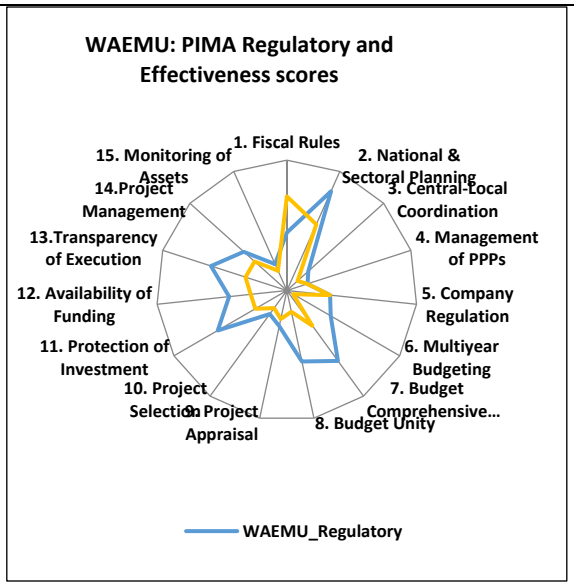


Figure 8. WAEMU: PIMA Scores: Regulatory Framework and Effectiveness



Source: PIMA missions (October 2015–June 2017).

E. Conclusions

14. Stronger institutions could foster more efficient public investment. Regression results show that public investment efficiency is positively correlated with the quality of institution and negatively correlated with the dependency on natural resource. There is thus scope for improvements in institutions to deliver greater returns on planned capital investments.

15. Improvement in public investment management practices in WAEMU countries could reduce their efficiency gaps. WAEMU countries have relatively good regulatory framework in the areas of national and sectoral planning, multiyear budgeting and project management, but could improve public investment efficiency by strengthening the: planning and selection of PPPs; multiyear budgeting; project appraisal, selection, and monitoring; and registration of infrastructure assets.

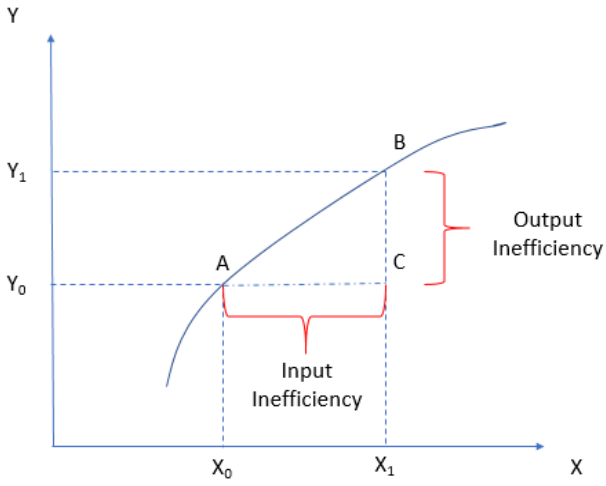
Annex I. Data Description

Variable	Unit	Source
General government capital stock, per capita	2011 PPP$-adjusted, per capita	WEO\Investment and Capital Stock Dataset (Ecos)\PWT\FADEP Calculation
Gross domestic product, current prices, in U.S. dollars, per capita	US$ dollars per capita	WEO
Public gross fixed capital formation, current prices, percent of GDP	Percent of GDP	Calculation
Quality of overall infrastructure	Scale (1 - 7), 7 = best	World Economic Forum, Global Competitiveness Index
Quality of roads	Scale (1 - 7), 7 = best	World Economic Forum, Global Competitiveness Index
Quality of railroad infrastructure	Scale (1 - 7), 7 = best	World Economic Forum, Global Competitiveness Index
Quality of port infrastructure	Scale (1 - 7), 7 = best	World Economic Forum, Global Competitiveness Index
Quality of air transport infrastructure	Scale (1 - 7), 7 = best	World Economic Forum, Global Competitiveness Index
Quality of electricity supply	Scale (1 - 7), 7 = best	World Economic Forum, Global Competitiveness Index
Mobile cellular subscriptions	Percent of population	World Development Indicators
Access to improved water source	Percent of population	World Development Indicators
Individuals using the Internet	Percent of population	World Development Indicators
Access to electricity	Percent of population	World Development Indicators
Air transport, passengers carried	Passengers	World Development Indicators
Air transport, freight	Million metric tons times kilometers traveled	World Development Indicators
Hospital beds (per 1,000 people)	Per 1000 people	World Development Indicators
Roads, total network (km) (per 1000 people)	Per 1000 people	International Roads Federation
Electricity production (1000 kWh per person)	1000 kWh per person	World Development Indicators
Secondary teachers (per 1000 people)	Per 1000 people	World Development Indicators
Physical Infrastructure Index	Units (100 = AE average)	Calculation
Physical Public Investment Efficiency Indicator (PIE-X)	Scale (0 - 1), 1 = highest levels of infrastructure coverage and quality	Calculation
Survey-Based Infrastructure Index	Units (100 = AE average)	Calculation
Survey-Based Public Investment Efficiency Indicator (PIE-X)	Scale (0 - 1), 1 = highest levels of infrastructure coverage and quality	Calculation
Hybrid Infrastructure Index	Units (100 = AE average)	Calculation
Hybrid Public Investment Efficiency Indicator (PIE-X)	Scale (0 - 1), 1 = highest levels of infrastructure coverage and quality	Calculation
CPIA macroeconomic management	Rating (1=low to 6=high)	World Development Indicators
Control of Corruption	Estimate	World Development Indicators
Regulatory Quality	Estimate	World Development Indicators
LICs and LMICs Rich in Non-Renewable Natural Resources	Dummy, 1=Rich or 0=Non-Rich	Tiwari et al. (2012), IMF Working Paper "Macroeconomic Policy Frameworks for Resource-Rich Developing Countries"
Urban population	Percent of population	World Development Indicators
Net official development assistance received	US Dollars	World Development Indicators

Annex II. The Data Envelope Analysis (DEA) Methodology

The methodological framework for measuring the efficiency of production units is based on a production function approach, characterizing the technical efficiency frontier. This frontier provides the benchmark for measuring the relative efficiency of observed production units. In the figure, the distance AC shows the proportional amounts by which output could be increased while leaving input consumption unchanged (distance BC), measuring efficiency.

Annex Figure 1. The Efficiency Frontier

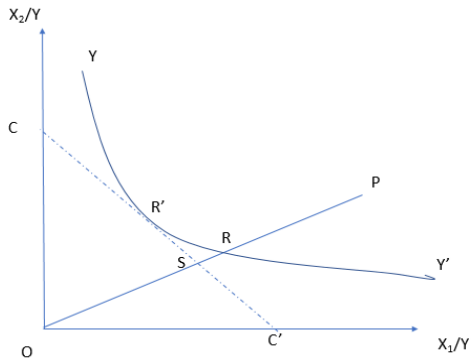


The measurement of economic efficiency is linked to the use of frontier functions, elaborated in a seminal paper by Farrell (1957). Farrell's paper was influenced by Koopmans's (1951) formal definition and Debreu's (1951) measure of technical efficiency. He introduced a method to decompose the overall efficiency of a production unit into its technical and allocative components.[1]

Following Farrell (1957) and assuming constant returns to scale (CRS), the technological set is described by the unit isoquant YY' that captures the minimum combination of inputs per unit of output needed to produce a unit of output. Hence, the set of inputs along the unit isoquant is considered as technically efficient while any point above and to the right of it (i.e., point P) defines a technically inefficient producer since the combination of inputs is more than enough to produce a unit of output. Hence, the distance RP along the ray OP measures the technical inefficiency of producer located at point P, representing the amount by which all inputs can be divided without decreasing the amount of output. The technical inefficiency level associated the combination of inputs P can be expressed by the ratio RP/OP, and the technical efficiency (TE) of the producer under analysis (1-RP/OP) would be given by the ratio OR/OP.

[1] Murillo-Zamorano (2004) provides a comprehensive review of both methods.

Annex Figure 2. Technical and Allocative Efficiency Measures



Given market prices and pursuing cost minimization, the input price ratio is reflected by the slope of the isocost-line CC′, allocative inefficiency can also be derived from the unit isoquant plotted in Figure 2. The relevant distance is given by the line segment SR, which in relative terms would be the ratio SR/OR. With respect to the least cost combination of inputs given by point R′, the above ratio indicates the cost reduction that a producer would be able to reach if it moved from a technically but not allocative efficient input package (R) to a both technically and allocative efficient one (R′). Therefore, the allocative efficiency (AE) that characterizes the producer at point P is given by the ratio OS/OR and economic efficiency (EE) is measured as the multiplicative interaction of both technical and allocative components,

$$EE = TE \times AE = OR/OP \times OS/OR = OS/OP$$

where the distance involved in its definition (SP) can also be analyzed in terms of cost reduction.

The efficiency frontiers can be estimated based on parametric or nonparametric methods. Under parametric methods, an econometric model is estimated, assuming that input-output combinations lie below the efficiency frontier, requiring assumptions on the stochastic distribution of errors and the functional form underlining the model, and controlling for the variation in output unexplained by the inputs. The nonparametric approach is based on linear programming methods but is sensitive to the presence of measurement errors and outliers.

The data envelopment analysis (DEA) methodology is based on nonparametric methods, estimating the efficient frontier through linear approximations enveloping all decision-making units (DMU) performance observations.[2] Efficiency scores are calculated relative to a peer group consisting of linear combinations of input-output observations for efficient DMUs.

[2] The original DEA model assumes constant return to scale, which implies that all DMUs in the sample are performing at an optimal scale. This paper uses a DEA with variable return to scale, allowing comparisons of DMU with other counties with similar characteristics.

Efficiency scores indicate the proportional amount by which countries could raise the quality of their infrastructure while leaving public capital (and other inputs) unchanged. The estimation assumes factor homogeneity (the quality of inputs is similar among countries) and adds per capita GPD as a control variable. Two different indicators are used to measure infrastructure output:

- *A physical indicator*. A quantitative index that captures the use of public investment (construction of infrastructure and the provision of social services such as health and education), which are standardized and combined as follows using similar weights to obtain the output indicator (yi).

$$y_i = \sum_{j=1}^{4} \left(\frac{1}{5}\right)\left(\frac{x_{ij} - \bar{x}_j}{\sigma_{ij}}\right)$$

  where xij is the value of the variable j in country i, xj and $\bar{x}_j$and σ_{ij} are the mean and standard deviation of variable j, respectively, over the considered period.

- A hybrid indicator, which is the mean of the two previously described indicators and provides a measure of both the coverage and quality of public infrastructure.

Annex III. Institutional Quality Indicators Correlation

	Control of Corruption	Regulatory Index
Control of corruption	1.00	**0.83**
Regulatory index	**0.83**	1.00

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