

Stylized Facts about Business Cycles in Sub-Saharan Africa*

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Abstract

We compare business cycle fluctuations in Sub-Saharan African (SSA) countries (distinguishing between resource abundant and non-resource abundant) vis-à-vis the rest of the world (distinguishing among low and lower-middle income, upper-middle-income and high-income countries). Our main results are as follows. In SSA economies, (i) recently reduced output and inflation volatilities have gone in tandem with improved mean growth and inflation performances; (ii) output volatility, a fortiori in resource-abundant countries, has been higher than in any other income group, (iii) private consumption has the highest median volatility relative to that of output than in any other country groups, (iv) inflation consistently exhibits a negative correlation with real output, pointing at a dominance of aggregate supply shocks, (v) the trade balance is approximately acyclical, and (vi) terms of trade are procyclical and lead real output in resource-abundant countries but not in others.

Keywords: business cycles, macroeconomic fluctuations, low income countries, developing economies, comparative studies of countries

JEL Classification: E32, O11, F41, O57

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1 Introduction (TBC)

While the macroeconomic literature has produced some papers on stylized facts concerning business cycle regularities in some emerging market economies (see Agénor et al., 2000; Ahmed and Loungani, 2000; Rand and Tarp, 2002, among others), to our knowledge there is no such systematic analysis for Sub-Saharan Africa (SSA), nor one that compares the features of macroeconomic fluctuations of this group of countries and the rest of the world.

[...]

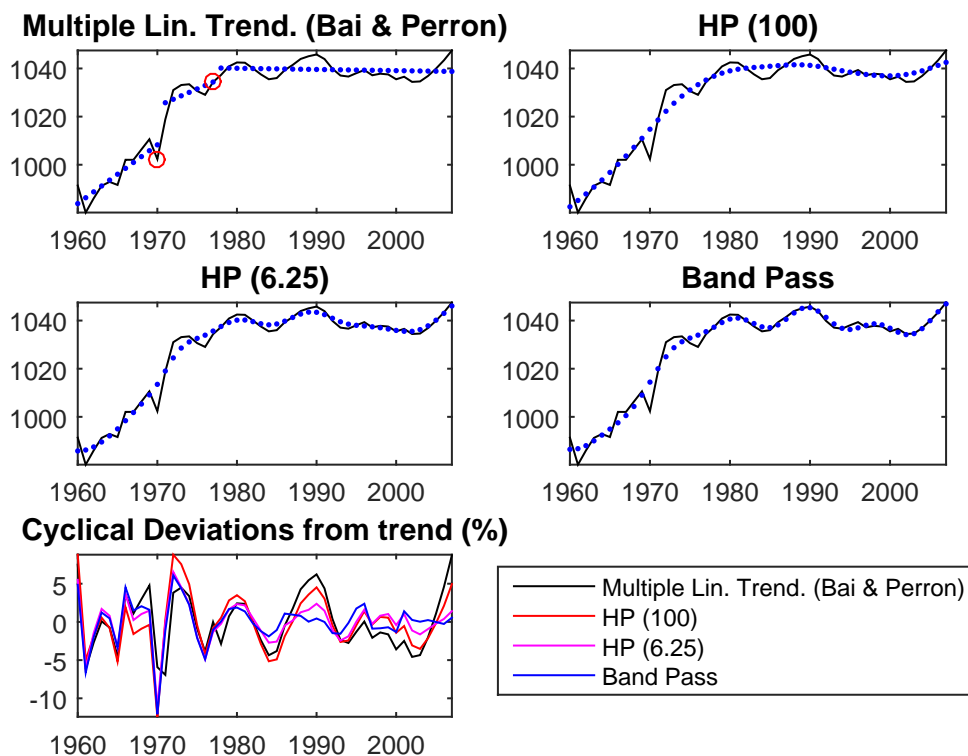
The remainder of the paper is structured as follows. Section 2 discusses the empirical methodology. Section 3 presents the data. Section 4 reports the results. Finally, Section 5 concludes. Data sources are appended to the paper.

2 Methodology

Producing statistics on the fluctuations of macroeconomic variables requires disentangling cyclical components from trends. In the business cycle literature on both advanced and emerging market economies there is no agreement on which is the most appropriate detrending methodology. A further potential difficulty may arise if shocks to trend growth are dominant sources of macroeconomic fluctuations. On this, while Aguiar and Gopinath (2007) argue that these, rather than transitory fluctuations around a stable trend, are the primary source of fluctuations in emerging markets, Garcia-Cicco et al. (2010) estimate a financial-friction model that incorporates shocks to the country premium and find a negligible role for non-stationary productivity shocks.

This methodological uncertainty applies also to SSA countries. Therefore, we deem appropriate to remain rather agnostic and search for stylized facts that are robust to treating macroeconomic variables both as trend-stationary and as unit roots. We employ three popular detrending techniques: (i) the HP filter of Hodrick and Prescott (1997) with the conventional smoothing parameter $\lambda = 100$ for annual data; (ii) the Band-Pass (BP) filter recommended by Christiano and Fitzgerald (2003) identifying cyclical components with periods between two and eight years; and finally (iii) the first-difference (FD) filter. While the first two filters are appropriate if trends were stable or at least if changes in trend growth were not too frequent, the last filter treats macroeconomic variables as unit roots, and is more appropriate if shocks to trends were indeed the dominant sources of macroeconomic fluctuations. In addition, in our applications, it turns out that

Figure 1: Kenya's Log-Real-Per-Capita GDP: Smooth and Piecewise Linear Trends (HP and BP refer to the Hodrick-Prescott and the Band-Pass filters, respectively; Red circles represent trend break dates identified by the Bai and Perron (2003) test)



Source: Authors' calculations based on World Bank data.

smooth filters such as the HP and BP produce cyclical deviations with a strong comovement with deviations resulting from an application of piecewise linear trends exploiting break dates identified by a popular statistical test such as that of Bai and Perron (2003) (see, e.g. the case of Kenya's log-real-per-capita GDP in Figure 1).¹

To detect differences and similarities of business cycle facts for SSA countries vis-à-vis the rest of the world, in Section 4 we present median statistics or box plots for SSA and the rest of the world divided into three income groups, using the classification of the World Bank: High-Income Countries, HIC; Upper Middle-Income Countries, UMIC; Lower Middle-Income and Low-Income Countries, LLMIC. The choice of combining lower middle-income and low-income countries into one group representative of poor countries is due to the need of hav-

¹Note that, for robustness, in Figure 1 we report also HP-filtered data with the correction more recently made by Ravn and Uhlig (2002), who suggest a $\lambda = 6.25$.

Table 1: Number of Countries Covered in Each Group

<i>Sub-Saharan Africa</i>	
Resource-abundant	11
Non-resource-abundant	14
<i>Non Sub-Saharan Africa</i>	
HIC	31
UMIC	20
LLMIC	16

ing a sufficient number of countries with enough data availability in each group.² In addition, given that, for many SSA countries, natural resources are—or are projected to become—a major source of national income, within each group we also distinguish between resource-abundant and non-resource-abundant economies, using the classification employed by IMF (2012).³

3 Data

Given the lack of data observed at a quarterly frequency for SSA and LLMIC in general, and for the sake of comparability across country groups, we resort to annual data for all groups covering the period from 1960 to 2007, to avoid contaminating our general conclusions from the peculiarities of the Great Recession. Using mainly the databases of the IMF (International Financial Statistics and World Economic Outlook), the OECD (National Accounts) and the World Bank (World Development Indicators), we include all countries for which there exist at least thirty uninterrupted data points. We exclude “small states” in the computation of median values, given their unique economic characteristics and constraints (see IMF, 2014). The data refers to key macroeconomic indicators such as GDP, its components, rates of inflation, trade balance components, the current account, the real effective exchange rate, government expenditures and revenues, world GDP, and the terms of trade. For this last series we rely on the dataset compiled by Spatafora (2009) for 46 commodities and look for a minimum of twenty available observations. As far as inflation is concerned, from the median calculations we exclude those countries, the average inflation rate of which was above 30%. This prevents us from drawing “average” conclusions from the experience of those countries that suffered from hyperinflation. Data

²The groups defined by the World Bank are four: low-income: US\$1,005 or less; lower-middle income: US\$1,006–\$3,975; upper-middle income: US\$3,976–US\$12,275; and high-income: US\$12,276 or more.

³A country is classified as resource-abundant if its resource revenue or resource exports are at least 20 percent of total fiscal revenue or exports, respectively in 2006-10.

Table 2: Real Output - Median Volatility and Persistence

Country groups	Real output			
	Standard deviation (%)		Autocorrelation	
	Full sample	1995-2007	Full sample	1995-2007
<i>Sub-Saharan Africa</i>				
<i>Resource-abundant</i>				
HP	5.50	3.35	0.55	0.51
BP	2.94	1.82	-0.08	-0.07
FD	5.74	3.09	0.29	0.10
<i>Non-resource-abundant</i>				
HP	4.00	3.53	0.35	0.51
BP	2.91	2.04	-0.04	0.04
FD	4.93	4.28	-0.06	0.30
<i>Non Sub-Saharan Africa</i>				
<i>High income</i>				
HP	2.59	1.65	0.60	0.63
BP	1.44	0.83	0.12	0.18
FD	2.72	1.35	0.32	0.29
<i>Upper-middle income</i>				
HP	4.59	3.34	0.60	0.67
BP	2.63	1.94	0.12	0.19
FD	4.59	2.96	0.29	0.29
<i>Low and lower-middle income</i>				
HP ($\lambda=100$)	3.36	2.19	0.62	0.64
BP	1.98	1.21	0.10	0.10
FD	3.67	2.12	0.32	0.25

Note: HP and BP refers to the cyclical components of real per-capita output using the Hodrick-Prescott and the Band-Pass filters, respectively; FD refers to first differences of the logs of real per-capita output and the price levels.

Source: Authors' calculations based on IMF, OECD and World Bank data.

availability and these considerations lead to a number of countries in each group reported in Table 1. Details on data sources and country coverage are provided in Tables A.1 and A.2 (Appendix A). South Africa is excluded from the SSA group due its more advanced stage in the development process.

4 Business cycle dynamics

4.1 Real output and key macroeconomic aggregates

This subsection provides an overview of the main business cycle features across country groups. Table 2 reports standard deviations and autocorrelation coefficients of the cyclical deviations of log real per-capita GDP. As regards output volatility, across filters results may change considerably, but qualitative conclusions remain unaltered. In SSA, both the cyclical components of real GDP (HP and BP) and its rate of growth are more volatile than in the other country groups. The difference in output volatility becomes even sharper by isolating resource abundant countries: in this group of countries output is twice more volatile than in advanced economies and about 1.5 times more volatile than in non-SSA LLMIC. Across the board, output volatility has decreased over the more recent sample (1995-2007), including in SSA, but SSA still displays more out-

Table 3: Components of GDP as Shares of Real Output (Median Values)

Country groups	Private consumption	Government consumption	Investment	Exports	Imports
	% of GDP				
<i>Sub-Saharan Africa</i>					
Resource-abundant	70.21	11.84	18.71	23.75	32.11
Non-resource-abundant	79.90	14.75	15.40	23.10	30.94
<i>Non Sub-Saharan Africa</i>					
HIC	57.00	18.17	22.57	30.10	29.48
UMIC	66.01	13.73	22.80	27.07	26.66
LLMIC	72.43	11.16	21.65	23.67	29.08

Source: Authors' calculations based on OECD and World Bank data.

put volatility than the rest of the world. The serial correlation of output varies considerably across filters but is generally weaker in SSA.

However, looking at aggregate output is only part of the story. If we decompose real GDP into the main items of the income identity the picture changes considerably as we move from HIC to LLMIC, but SSA exhibits comparable shares as LLMIC in the rest of the world (see Table 3 where we report the components of the income identity in percent of GDP).

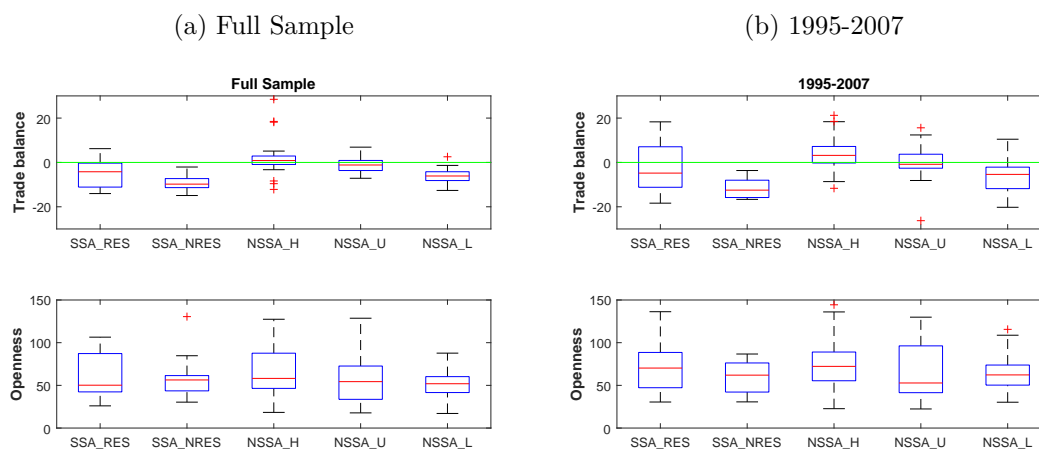
The share of private consumption increases as we move from the highest to the lowest income group, and it ranges from 57% in resource abundant HIC to almost 72% in LLMIC. In non-resource-abundant SSA, private consumption occupies 80% of GDP, while resource-abundant countries display a similar share as non-SSA LLMIC.

In SSA the share of government consumption is comparable to LLMIC and UMIC elsewhere (12-15%), and lower than HIC (18%). In contrast, investment (public and private) is lowest in SSA, with resource-abundant SSA investing more than their non-resource-abundant counterpart (19% versus 15% of GDP).

HIC exhibit the largest shares of exports relative to GDP and the largest trade surplus (Figure 2), while the trade balance is generally close to zero in UMIC and negative in SSA and LLMIC elsewhere. The degree of openness (measured as imports plus exports as shares of GDP) is characterized by a considerable variation across countries. Resource-abundant SSA countries are more open than their non-resource-abundant peers, which display a similar openness as LLMIC in the rest of the world.

Getting more granular, in the same spirit as what Stock and Watson (1999) did for the US, we compute the standard deviations of key macroeconomic variables relative to that of real output and dynamic correlations of real output with leads and lags of the same variables. This exercise allows us to assess how volatile macroeconomic aggregates are relative to GDP, whether they lead, lag or move approximately coincidentally with aggregate cycle, and perhaps most importantly whether there are significant differences across country groups. Results

Figure 2: Box Plots of the Trade Balance and Openness to International Trade (% of GDP).



Notes: The trade balance is computed as exports/GDP minus imports/GDP. Openness is computed as exports/GDP plus imports/GDP. RES and NRES refer to resource-abundant and non-resource-abundant, respectively. H, U and L refer to HIC, UMIC and LLMIC, respectively. Source: Authors' calculations based on OECD and World Bank data.

are reported in Table 4.

Private consumption and investment are procyclical and move approximately coincidentally with aggregate cycle everywhere. While private consumption is approximately as volatile as output in HIC, in the other income groups it exhibits greater relative volatility. SSA has the highest median relative volatility of private consumption (up to 1.5 times more volatile than output in resource abundant SSA). Investment is greatly more volatile than output in all income groups (4-5 times more volatile than output), especially in SSA, which displays a comparable relative volatility as LLMIC in the rest of the world.

Government consumption is also procyclical. While there is a relatively strong degree of synchronization with aggregate output everywhere, in HIC it has also a leading role (with the correlation at time $t-1$) being stronger; in SSA the contemporaneous correlation is stronger, particularly in resource-abundant countries.

There are no obvious cross-group differences in the relative volatilities of exports and imports (2.5-4 times more volatile than output). These are also procyclical and move approximately coincidentally with aggregate cycle everywhere. If we take the difference between exports and imports to compute the trade balance, SSA displays a higher relative volatility than HIC and UMIC, comparable to LLMIC in the rest of the world. The trade balance moves approximately coincidentally with the aggregate cycle and is countercyclical in HIC and UMIC, while in SSA and LLMIC (see Figure 3) it is largely acyclical (it be-

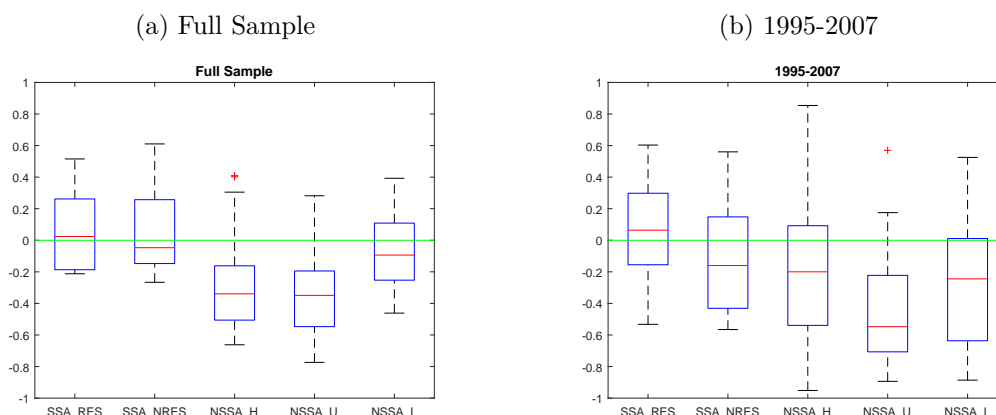
Table 4: Standard Deviations of Key Macroeconomic Variables relative to that of Real Output and Correlations of Real Output with Leads and Lags of the Same Variables (Detrending Method: HP100)

	Sub-Saharan Africa						Non Sub-Saharan Africa									
	Resource			Non-Resource			HIC			UMIC			LLMIC			
	SD	<i>corr</i> (y_t, x_{t+i})	$i = -1$ $i = 0$ $i = 1$	SD	<i>corr</i> (y_t, x_{t+i})	$i = -1$ $i = 0$ $i = 1$	SD	<i>corr</i> (y_t, x_{t+i})	$i = -1$ $i = 0$ $i = 1$	SD	<i>corr</i> (y_t, x_{t+i})	$i = -1$ $i = 0$ $i = 1$	SD	<i>corr</i> (y_t, x_{t+i})	$i = -1$ $i = 0$ $i = 1$	
Private consumption	1.24	0.41	0.47	0.18	1.48	0.32	0.67	0.19	1.02	0.47	0.70	0.40	1.17	0.38	0.74	0.44
	<i>1.62</i>	<i>0.30</i>	<i>0.39</i>	<i>0.17</i>	<i>1.54</i>	<i>0.40</i>	<i>0.54</i>	<i>0.31</i>	<i>1.10</i>	<i>0.54</i>	<i>0.70</i>	<i>0.42</i>	<i>1.27</i>	<i>0.39</i>	<i>0.75</i>	<i>0.42</i>
Government consumption	2.62	0.18	0.22	0.11	3.35	0.19	0.34	0.08	1.40	0.28	0.21	-0.10	1.97	0.45	0.47	0.22
	<i>4.65</i>	<i>0.32</i>	<i>0.20</i>	<i>-0.23</i>	<i>3.26</i>	<i>0.25</i>	<i>0.21</i>	<i>0.05</i>	<i>1.32</i>	<i>0.32</i>	<i>0.18</i>	<i>-0.07</i>	<i>1.84</i>	<i>0.64</i>	<i>0.51</i>	<i>0.37</i>
Investment	4.41	0.21	0.34	0.25	5.28	0.09	0.33	0.28	3.90	0.43	0.80	0.45	3.56	0.39	0.74	0.41
	<i>4.87</i>	<i>-0.09</i>	<i>0.03</i>	<i>0.19</i>	<i>6.31</i>	<i>0.06</i>	<i>0.39</i>	<i>0.27</i>	<i>3.30</i>	<i>0.45</i>	<i>0.85</i>	<i>0.57</i>	<i>3.49</i>	<i>0.48</i>	<i>0.79</i>	<i>0.54</i>
Exports	2.58	0.16	0.52	0.43	3.63	0.02	0.34	0.26	2.87	0.14	0.41	0.19	3.09	0.17	0.31	0.19
	<i>3.81</i>	<i>-0.03</i>	<i>0.45</i>	<i>0.15</i>	<i>4.60</i>	<i>0.03</i>	<i>0.19</i>	<i>0.27</i>	<i>3.45</i>	<i>0.20</i>	<i>0.62</i>	<i>0.54</i>	<i>3.19</i>	<i>0.18</i>	<i>0.12</i>	<i>0.25</i>
Imports	3.01	0.18	0.34	0.24	3.15	0.15	0.37	0.29	3.23	0.29	0.51	0.27	3.02	0.36	0.55	0.38
	<i>4.19</i>	<i>0.17</i>	<i>0.24</i>	<i>0.27</i>	<i>4.01</i>	<i>0.15</i>	<i>0.31</i>	<i>0.35</i>	<i>3.70</i>	<i>0.41</i>	<i>0.69</i>	<i>0.45</i>	<i>2.73</i>	<i>0.33</i>	<i>0.70</i>	<i>0.52</i>
Trade balance	0.89	0.01	0.02	0.08	0.81	-0.06	-0.05	0.02	0.64	-0.22	-0.34	-0.05	0.74	-0.21	-0.35	-0.12
	<i>1.57</i>	<i>0.00</i>	<i>0.06</i>	<i>-0.13</i>	<i>0.85</i>	<i>-0.10</i>	<i>-0.16</i>	<i>-0.11</i>	<i>0.70</i>	<i>-0.13</i>	<i>-0.20</i>	<i>-0.05</i>	<i>0.77</i>	<i>-0.38</i>	<i>-0.55</i>	<i>-0.22</i>
Current account balance	0.74	-0.11	-0.11	0.06	1.04	-0.09	-0.09	0.01	0.67	-0.29	-0.33	-0.09	0.81	-0.39	-0.44	-0.13
	<i>1.21</i>	<i>-0.03</i>	<i>0.01</i>	<i>-0.06</i>	<i>0.84</i>	<i>-0.11</i>	<i>-0.20</i>	<i>-0.03</i>	<i>0.74</i>	<i>-0.23</i>	<i>-0.21</i>	<i>-0.20</i>	<i>0.73</i>	<i>-0.38</i>	<i>-0.61</i>	<i>-0.39</i>
Real eff. exchange rate	3.20	0.11	0.05	-0.16	3.24	0.17	-0.08	-0.18	2.39	0.11	0.05	-0.19	2.95	0.25	0.28	0.21
	<i>2.32</i>	<i>0.23</i>	<i>0.24</i>	<i>-0.09</i>	<i>2.79</i>	<i>0.10</i>	<i>0.15</i>	<i>0.01</i>	<i>2.36</i>	<i>-0.31</i>	<i>-0.43</i>	<i>-0.40</i>	<i>2.35</i>	<i>0.26</i>	<i>0.15</i>	<i>0.11</i>
Global output	0.22	0.14	0.19	0.16	0.30	0.12	0.09	0.18	0.47	0.16	0.48	0.37	0.28	0.02	0.11	0.01
	<i>0.24</i>	<i>0.23</i>	<i>0.21</i>	<i>0.14</i>	<i>0.24</i>	<i>0.24</i>	<i>0.26</i>	<i>0.17</i>	<i>0.48</i>	<i>0.06</i>	<i>0.41</i>	<i>0.39</i>	<i>0.27</i>	<i>0.34</i>	<i>0.46</i>	<i>0.09</i>
Terms of trade	5.42	0.01	0.11	0.19	7.91	-0.07	-0.05	-0.03	5.69	-0.06	-0.01	0.12	4.23	0.07	0.04	0.01
	<i>6.36</i>	<i>0.18</i>	<i>0.26</i>	<i>0.29</i>	<i>9.03</i>	<i>0.05</i>	<i>0.00</i>	<i>-0.06</i>	<i>5.74</i>	<i>0.01</i>	<i>-0.09</i>	<i>0.07</i>	<i>3.97</i>	<i>0.17</i>	<i>0.09</i>	<i>0.08</i>
Total govt. expenditures	3.58	0.15	0.24	0.01	3.51	0.23	0.32	0.10	2.49	0.12	-0.04	-0.04	2.44	0.24	0.51	0.27
	<i>4.25</i>	<i>-0.01</i>	<i>0.00</i>	<i>-0.05</i>	<i>3.28</i>	<i>-0.09</i>	<i>0.27</i>	<i>-0.05</i>	<i>1.69</i>	<i>0.16</i>	<i>-0.03</i>	<i>-0.15</i>	<i>2.32</i>	<i>0.32</i>	<i>0.55</i>	<i>0.30</i>
Total govt. revenues	3.03	0.19	0.35	0.18	4.00	0.23	0.58	0.17	2.60	0.35	0.42	0.22	2.13	0.36	0.57	0.42
	<i>3.51</i>	<i>0.19</i>	<i>0.23</i>	<i>-0.10</i>	<i>4.42</i>	<i>0.18</i>	<i>0.50</i>	<i>0.05</i>	<i>2.29</i>	<i>0.34</i>	<i>0.64</i>	<i>0.45</i>	<i>2.19</i>	<i>0.37</i>	<i>0.56</i>	<i>0.46</i>

Source: Authors' calculations based on IMF, OECD and World Bank data.

Notes: For each variable, the cross-sectional median within the country group is reported; the first line refers to the full sample, while the second line refers (in italic) refers to the more recent subsample (1995-2007). SD refers to the standard deviation of each macroeconomic variable relative to that of real output, while *corr* (y_t, x_{t+i}) denotes the correlation between real output (y_t) and leads and lags of each variable x_{t+i} .

Figure 3: Box Plots of Correlations between Real Output and the Trade Balance. Detrending Method: HP(100)



The trade balance is computed as exports/GDP minus imports/GDP. RES and NRES refer to resource-abundant and non-resource-abundant, respectively. H, U and L refer to HIC, UMIC and LLMIC, respectively. Source: Authors' calculations based on OECD and World Bank data.

comes more countercyclical in the recent subsample). Results are similar for the current account balance.

The real effective exchange rate is more volatile than output everywhere. In SSA output has a stronger leading role for the REER than in LMIC elsewhere (comparable to HIC) and positive (negative) output fluctuations are associated with current or subsequent depreciations (appreciations).

In non-resource-abundant SSA countries and the country groups in the rest of the world real output is virtually uncorrelated to the terms of trade, while these are procyclical in resource-abundant SSA economies and lead real output.

Two fiscal policy indicators—total government expenditures and revenues—are more volatile than output and their median relative volatility is highest in SSA and LLMIC. While total government expenditures lead output in HICs, they are procyclical and move approximately coincidentally with the aggregate cycle in all other income groups. Total government revenues are procyclical everywhere.

4.2 Inflation and its relation with output fluctuations

Also when we turn to inflation, contrasting SSA with non-SSA countries yields tangible differences with the former displaying greater inflation volatility than the latter, especially in the case of GDP-deflator inflation and for resource-abundant countries (see Table 5). For CPI inflation the volatility displayed by non-resource-abundant SSA countries is of similar magnitude as LLMIC in the rest of the world. Inflation persistence (measured by the autocorrelation of FD) is highest

Table 5: Inflation - Median Volatility and Persistence

Country groups	Inflation - GDP Deflator				Inflation - CPI			
	Standard deviation (%)		Autocorrelation		Standard deviation (%)		Autocorrelation	
	Full sample	1995-2007	Full sample	1995-2007	Full sample	1995-2007	Full sample	1995-2007
Sub-Saharan Africa								
<i>Resource-abundant</i>								
HP	8.14	6.14	0.03	0.04	5.94	3.14	0.14	-0.01
BP	7.05	5.03	-0.21	0.00	5.12	3.01	-0.16	0.00
FD	9.33	6.38	0.26	0.12	7.15	3.52	0.48	0.14
<i>Non-resource-abundant</i>								
HP	7.73	7.81	0.01	-0.13	6.83	4.80	0.08	0.16
BP	7.11	6.45	-0.22	-0.26	5.77	4.57	-0.18	-0.02
FD	9.42	7.75	0.35	-0.01	8.54	6.13	0.32	0.27
Non Sub-Saharan Africa								
<i>High income</i>								
HP	2.43	1.07	0.31	0.19	2.25	0.82	0.46	0.36
BP	1.99	1.08	-0.03	0.06	1.54	0.68	0.11	0.23
FD	4.50	1.45	0.79	0.40	4.01	0.86	0.84	0.40
<i>Upper-middle income</i>								
HP	6.63	4.05	0.05	0.15	5.24	3.78	0.33	0.42
BP	6.00	4.25	-0.11	0.08	3.52	2.55	0.06	0.12
FD	9.72	6.04	0.41	0.28	8.48	5.62	0.65	0.65
<i>Low and lower-middle income</i>								
HP	5.33	4.33	0.06	0.05	4.91	3.13	0.22	0.14
BP	4.50	4.26	-0.15	-0.21	4.30	2.49	-0.01	-0.03
FD	6.57	3.62	0.42	0.17	7.56	3.43	0.59	0.36

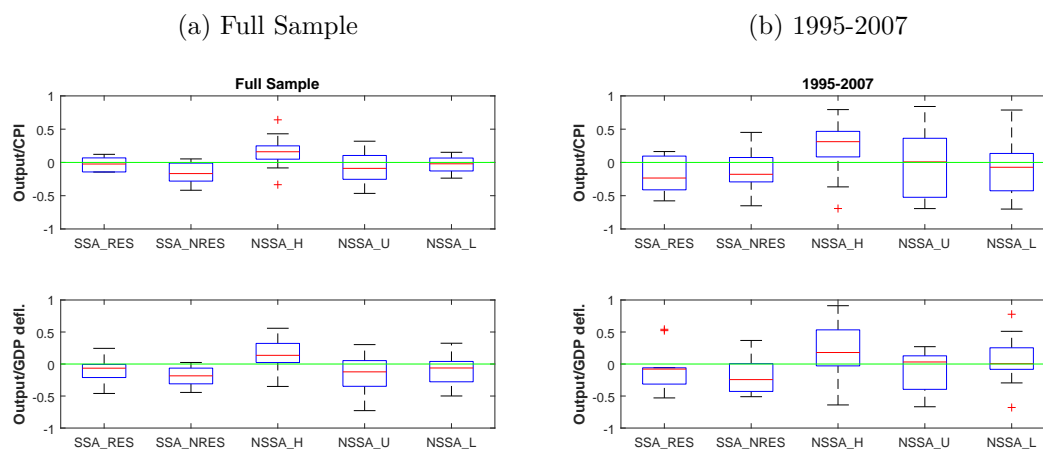
Note: HP and BP refers to the cyclical components of the GDP-deflator and CPI inflation rate using the Hodrick-Prescott and the Band-Pass filters, respectively; FD refers to first differences of the logs of the price levels, i.e. the inflation rate itself.

Source: Authors' calculations based on IMF, OECD and World Bank data.

in non-resource abundant HIC and smaller anywhere else, particularly in SSA economies. The persistence of CPI inflation, in particular, falls as we move from the richest to the poorest group, and it is smallest in non-resource-abundant SSA economies. Persistences of cyclical components of the inflation rates are generally small or negative (for BP) and do not exhibit a clear-cut pattern as far as country groups are concerned. As for output, also for inflation, across the board, the volatility is lower in the more recent subsample.

But how does inflation relate with output fluctuations? The answer to this question heavily depends on the income group. In Figure 4, we report box-plots of correlations between the cyclical deviations of output and inflation. An interesting pattern that stands out from the figure is that while output correlates positively with inflation in HIC, the correlation falls—and turns negative—as we move to poorer country groups. In particular, in virtually all SSA countries this correlation is systematically negative. Although such a finding does not imply that aggregate demand shocks are not at play in SSA or LLMIC, it may be an indication of a dominance of aggregate supply shocks.

Figure 4: Box Plots of Correlations between Real Output and Inflation Rate (CPI and GDP deflator based). Detrending Method: HP(100)



Notes: RES and NRES refer to resource-abundant and non-resource-abundant, respectively. H, U and L refer to HIC, UMIC and LLMIC, respectively.
 Source: Authors' calculations based on IMF, OECD and World Bank data.

4.3 Is volatility related to growth and inflation performances?

Table 6 reports the median annual real per-capita output growth and inflation rates for the five country groups.

As regards output growth, three regularities stand out from the table. First, SSA unconditionally exhibits the lowest median growth rate of per-capita GDP, although the gap is narrower in the more recent subsample. Second, resource-abundant SSA countries have grown less than their non-resource-abundant peers over the full sample, but at a double rate than non-resource-abundant countries in the recent subsample. Third, poorer countries have grown faster across the board in the recent sample. As far as inflation is concerned, SSA countries experienced median inflation rates of comparable magnitude to UMIC and LLMIC in the rest of the world. However, while in the rest of the world median inflation has dropped significantly across the board in the recent subsample, in SSA the drop was more modest.

The big picture of these statistics is that the significant drop in output and inflation volatility observed in SSA and poorer economies has gone in tandem with improved output growth and inflation performances.

Table 6: Median Real Output Growth and Inflation Rates

Country groups	Real output (%)		Inflation - GDP Deflator (%)		Inflation - CPI (%)	
	Full sample	1995-2007	Full sample	1995-2007	Full sample	1995-2007
Sub-Saharan Africa						
<i>Resource</i>	0.57	1.58	7.23	8.41	6.82	6.13
<i>Non-Resource</i>	0.37	0.74	9.02	6.55	8.62	7.67
Non Sub-Saharan Africa						
HIC	2.58	2.15	5.48	2.78	5.13	2.19
UMIC	2.26	2.68	8.79	7.38	11.26	8.64
LLMIC	1.43	2.25	9.02	7.03	8.93	6.94

Source: Authors' calculations based on IMF, OECD and World Bank data.

5 Concluding Remarks

We compare business cycle fluctuations in Sub-Saharan African (SSA) countries (distinguishing between resource abundant and non-resource abundant) vis-à-vis the rest of the world (distinguishing among low and lower-middle income, upper-middle-income and high-income countries). Our main results are as follows. In SSA economies, (i) recently reduced output and inflation volatilities have gone in tandem with improved mean growth and inflation performances; (ii) output volatility, a fortiori in resource-abundant countries, has been higher than in any other income group, (iii) private consumption has the highest median volatility relative to that of output than in any other country groups, (iv) inflation consistently exhibits a negative correlation with real output, pointing at a dominance of aggregate supply shocks, (v) the trade balance is approximately acyclical, and (vi) terms of trade are procyclical and lead real output in resource-abundant countries but not in others.

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Appendix

A Data Sources and Country Coverage

Table A.1: Data Sources

Variables	Sources
GDP per capita	World Bank, World Development Indicators and OECD National Accounts
Gross capital formation	World Bank, World Development Indicators and OECD National Accounts
Government consumption expenditure	World Bank, World Development Indicators and OECD National Accounts
Exports of goods and services	World Bank, World Development Indicators and OECD National Accounts
Imports of goods and services	World Bank, World Development Indicators and OECD National Accounts
Household final cons. expend.	World Bank, World Development Indicators and OECD National Accounts
GDP deflator	World Bank, World Development Indicators and OECD National Accounts
Inflation, GDP deflator	World Bank, World Development Indicators and OECD National Accounts
Inflation, consumer prices	IMF, International Financial Statistics
Consumer price index	IMF, International Financial Statistics
Real effective exchange rate index	IMF, International Financial Statistics
GDP (current US\$)	World Bank, World Development Indicators and OECD National Accounts
Current account (US Dollars)	IMF, International Financial Statistics
Total government expenditure	IMF, International Financial Statistics and IMF World Economic Outlook
Total government revenue	IMF, International Financial Statistics and IMF World Economic Outlook
World GDP (constant 2005 US\$)	World Bank, World Development Indicators and OECD National Accounts
Terms of trade index (2005=100)	Estimates based on 46 commodities by Spatafora (2009)

Table A.2: Country Coverage

Sub-Saharan Africa	Resource-abundant	Botswana; Cameroon; Chad; Democratic Republic of the Congo; Republic of Congo; Côte d'Ivoire; Liberia; Mali; Mauritania; Niger; Nigeria; Sudan; Zambia;
	Non-resource-abundant	Benin; Burkina Faso; Burundi; Central African Republic; Ethiopia; Gambia; Ghana; Kenya; Lesotho; Madagascar; Malawi; Republic of Rwanda; Senegal; Sierra Leone; Somalia; Tanzania; Togo; Zimbabwe
Non Sub-Saharan Africa	HIC	Australia; Austria; Belgium; Canada; Republic of Chile; Denmark; Finland; France; Germany; Greece; Hong Kong; Ireland; Israel; Italy; Japan; Korea; Kuwait; Latvia; Netherlands; New Zealand; Norway; Oman; Poland; Portugal; Puerto Rico; Saudi Arabia; Singapore; Spain; Sweden; Switzerland; United Arab Emirates; United Kingdom; United States of America; Uruguay
	UMIC	Algeria; Argentina; Brazil; China; Colombia; Costa Rica; Cuba; Dominican Republic; Ecuador; Hungary; Iran; Iraq; Jamaica; Jordan; Libya; Malaysia; Mexico; Panama; Peru; South Africa; Thailand; Tunisia; Turkey; Venezuela
	LLMIC	Bangladesh; Bolivia; Egypt; El Salvador; Georgia; Guatemala; Haiti; Honduras; India; Indonesia; Morocco; Myanmar; Nepal; Nicaragua; Pakistan; Papua New Guinea; Paraguay; Philippines; Sri Lanka; Syria