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Sheshi "Skënderbej", nr. 1, Tiranë, Shqipëri
Tel.: + 355 4 2419301/2/3; + 355 4 2419409/10/11
Fax: + 355 4 2419408
E-mail: public@bankofalbania.org
www.bankofalbania.org

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C O N T E N T

COVID19: ARE SAVINGS AFFECTED DURING PANDEMICS? A LOOK ON THE SAVINGS BEHAVIOR IN THE CESEE REGION

Olta Manjani, Monetary Policy Department, Bank of Albania

1. INTRODUCTION

The fast spread of Covid19 pandemic and the massive loss of lives that it has spawned, along with the social distancing measures undertaken to contain it, have become the biggest source of uncertainty for the future in terms of health, economic, financial and social developments, whether in the short term, or even in the long run. The impact of the pandemics on the economic activity and its chain effects have been at the core of recent analysis. Data on economic activity for the first quarter of the year, but also the forecasts for the rest of the year, indicate a recession in many countries. The decline in aggregate demand, especially during periods of social isolation, but also in its aftermath, coupled with shrinking production, job losses and increased uncertainty are some of the factors that have negatively affected economic activity. They are expected to remain so until the end of the year and / or beyond.

This paper aims to analyze the savings behavior of households in times of pandemics. Savings in the economy are a function of disposable income, the propensity to consume and the consumption smoothing behavior of households over time, as well as their perception of (un)certainties regarding the future. Monitoring this indicator can serve policymakers to better complement the framework of households' financial situation, and consequently address the challenges they may face. The paper follows with a literature review of the economic and financial consequences of the Covid19 pandemic and/or similar pandemics, with sporadic examples of savings performance in the banking system during these times. It goes on to analyze the potential effects of the Covid19 pandemic on savings in the CEE region and closes with some concluding remarks at the end.

2. LITERATURE REVIEW

The nature and duration of the Covid19 pandemic is still unknown. However, there are several studies in the economic literature analyzing the economic costs and consequences of infectious diseases and epidemics. In modern history, they start with the Spanish Flu (1918-1920) in the early 20th century, and continue with smaller epidemics in the 21st century such as the SARS epidemic in 2002, the Swine Flu epidemic in 2009, and the Ebola epidemic in 2014 (Stephany et al., 2020).

Studies on the SARS epidemic consequences in the economy indicate a significant reduction in the consumption of goods and services, an increase in the business operational costs as well as an increase in the risk premia in several countries (McKibbin dhe Fernando, 2020). Further, Goodell (2020) summarizes several articles that focus on the economic and social consequences of Covid-19, as well as other large scale epidemics/pandemics. They are grouped according to their impact on several sectors: the banking sector, insurance sector and the public sector. Baldwin and Mauro (2020) also provide a summary of articles on the potential economic implications of Covid19, including mostly descriptive data, opinions and simulations. They vary from the impact of Covid19 pandemic on trade, labor and financial markets, to the macroeconomic and monetary policies undertaken to smooth and contain its negative effects. Overall, the economists' along with the available data on the first and second quarters of this year, indicate that the economic and financial costs of the Covid19 pandemics are unprecedented in te modern history of epidemics. For instance, referring to Huang et al. (CEPR Press, 2020), in China, the origin of the pandemic, the service and manufacturing sectors are most severely affected by Covid19 crisis. Ramelli and Wagner use a combination of techniques such as Google search intensity of Covid19 and stock market data to measure the economic impact by sector. The results show that energy, retail and transportation sectors have suffered the largest losses, while the health sector has incurred substantial gains in both of them. Another strand of literature focuses on the Covid19 consequences on financial markets. McKibbin and Fernando (2020) build seven different scenarios based on hybrid DSGE/CGE model with six sectors for twenty four countries, factoring the evolution probability of Covid19 to measure its impact on financial markets and macroeconomic indicators at a global level. Their simulations indicate that even in the most contained scenarios, the economic and financial costs are quite significant in terms of GDP losses, reductions in investment, private consumption and trade balance, as well as severe consequences in the capital markets and so on. Stephany et al. (2020) build some co-risk indices to measure in real time the Covid19 risks, by using the database of company risk reports of the US Securities and Exchange Commission (SEC). Their results suggest that – through the use of these risk sentiment indices – businesses risk awareness is ahead of the stock market developments. Further, Lagoarde-Segot and Leoni (2013) construct a theoretical model for developing countries, which indicates that the risk of a banking system failure due to deposit withdrawals in times of pandemics is proportional to the severity of the spread of the epidemics. Banks increase of reserves is also proportional to the latter. Nevertheless, the authors reinstate the fact this is a theoretical model and despite deposit withdrawal episodes during pandemics, there have been no bank runs in these countries. Skoufias (2003), in a summary of twelve papers on household coping strategies with the impact of crisis, epidemics and other similar aggregate shocks, concludes that group-funding of low-income households by micro-finance institutions or banking institutions is reduced as all the group members are similarly affected by the same shock.

Fewer studies are focused on the behavior of household savings during the Covid19 pandemic, or even during other similar pandemics for that matter.

Along these lines, Leoni (2013) analyzes the behavior of deposits in the banking system in the developing countries. The results indicate that the reduction of household savings in the banking system is affected by the spread of the epidemics, which is explained by the need of households to use their savings for medical treatment expenditures. In the meantime, most recent data show that with the widespread of Covid19, households have increased their savings – deposits in the banking system, cash holdings and other investment instruments – while reducing their consumption expenditures[1], which is highly related to increased uncertainties in the future. Likewise, according to McKibbin and Fernando (2020) DSGE/CGE model simulations, the shock assumptions of the pandemic generate a shift of funds from equity markets – due to increased risk premia and expectations of reduced profits in the wake of economic crisis – partly into bonds, cash holdings or overseas, reflecting the particular markets mostly affected.

3. DEVELOPMENTS IN SAVINGS DURING THE COVID19 PANDEMIC IN THE CENTRAL AND SOUTH-EASTERN EUROPEAN (CESEE) COUNTRIES

Household savings include all monetary assets in the form of deposits, cash holdings or investments in government securities, pension funds, private equity or other financial instruments. However, financial markets in some of the Balkan countries are yet in the early stages of development and household investments in such instruments still negligible. Even in developed countries such as the Eurozone, the largest chunk of households' investment portfolio in financial instruments is comprised of deposits in the banking system and cash holdings[2]. In this context, household savings in some of these countries are approximated by the amount of household deposits in the banking system and cash holdings. In other cases they also include investments in government securities. The following equations represent the main assumptions in the approximation of household savings:

$$S_i = D_i + COB_i + GS_i \quad \text{(i)}$$

where, S_i represents household total savings, COB_i the stock of currency outside banks and GS_i the household investments in government securities. Currency outside banks represents households share in the total stock held in Albanian currency, lek[3].

$$COB_i = \alpha_i * COB \quad \text{(ii)}$$

[1] *Applicable to the countries that have provided data in 2020Q1, depending on their availability at the time of the publishing:https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20200806-2?inheritRedirect=true&redirect=/eurostat/web/main/home*

[2] *https://sdw.ecb.europa.eu/reports.do?node=1000004900*

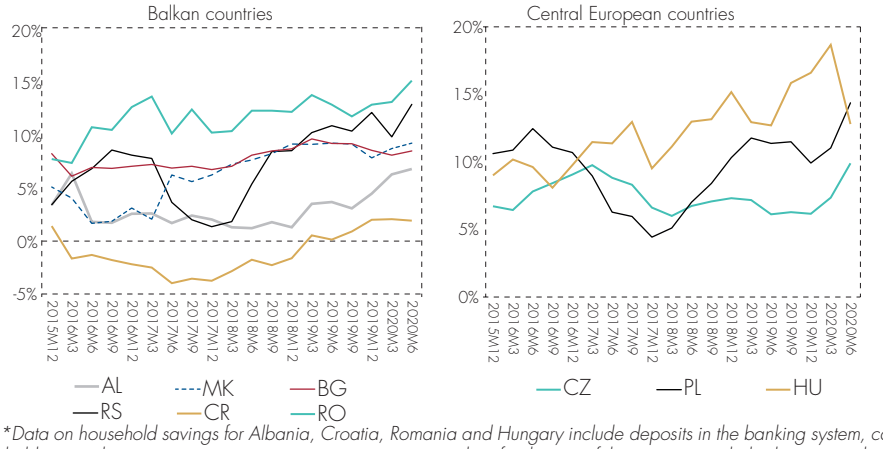
[3] *The stock of currency outside banks in foreign currency is not included. The latter cannot be directly measured, while estimation techniques or indirect measures would require very strong assumptions.*

where, α_i represents the share of cash holdings of households as opposed to other economic agents. We assume keeping the same ratio as that of household deposits to the total stock of deposits for the approximation of the stock of cash outside banks held by households:

$$\alpha_i = D_i/D_t \text{ (iii)}$$

Data on household savings show that most countries in the region experienced an increase in the first half of the year, especially in the second quarter, where the spread and effects of the pandemic have been more concentrated. This performance is in line with developments in the EU region, where all Central European countries are part of, shown on the left-side chart. Similar behavior is observed in the Balkan countries, which display an upward trend in the annual savings rates of households, particularly in the second quarter.

Chart1 Annual changes of household savings in the CESEE region



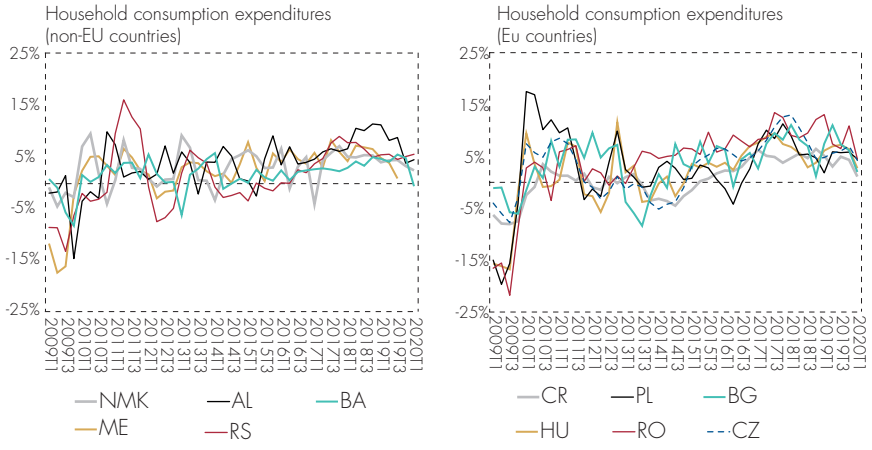
*Data on household savings for Albania, Croatia, Romania and Hungary include deposits in the banking system, cash holdings and investments in government securities; savings data for the rest of the countries include deposits and cash holdings.

Source: Respective central banks; author's own calculations.

Savings data on EU countries for the first quarter of 2020 indicate the largest growth in the last 20 years, by 3.5 pp on average in annual terms. All EU countries[4] experienced an increase in household savings during this period. According to Eurostat data and analysis, these developments reflect the decline in consumption expenditures in annual terms for the same period (-1.7%), compared to their growth rates of over 2% in previous periods. Similar behavior is also observed in the CESEE region, as seen in the chart below. The chart on the left shows the annual consumption rates for non-EU countries, while the one on the right shows EU members of the CESEE region. Apart from Serbia, all CEE countries in the region have incurred a decline in consumption expenditures in the first quarter of the year, which explains the increase in savings over the same period.

[4] *https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Impact_of_Covid-19_crisis_on_non-financial_corporation_and_household_accounts*

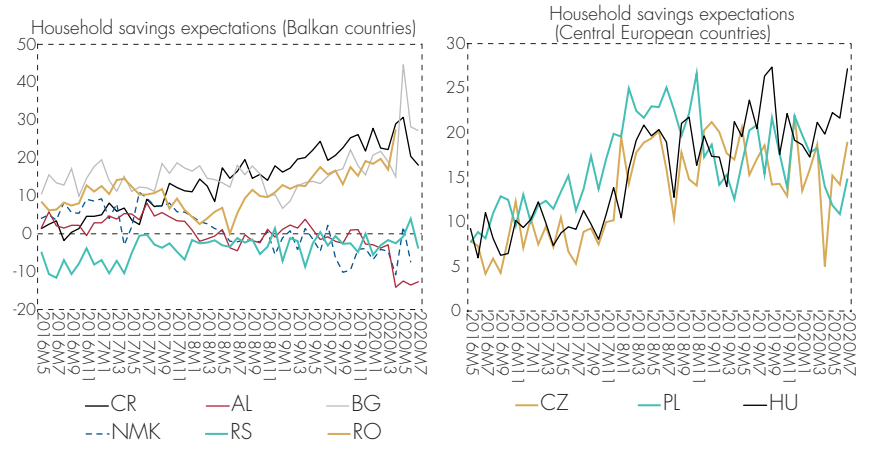
Chart 2 Annual changes of household consumption expenditures



Source: Eurostat.

To further understand whether savings growth is a short-term trend or expected to continue in the future, the chart below shows data from the consumer confidence survey on household expectations regarding their savings in the following 12 months. Savings expectations represent net balances of their responses, represented as the difference from their historical average. Households in the Balkan countries look relatively more pessimistic about their savings in the future compared to the current period. In countries like Northern Macedonia, Albania and Serbia, their savings expectations have continued to fall below their historical average. Meanwhile, households in all EU countries expect to increase savings in the future, and in Central European countries this trend is expected to intensify in the next 12 months. These results can be explained by household expectations and perceptions regarding the duration of the crisis. In non-EU Balkan countries, where income level is lower, expectations on income and economic developments may have affected the downward trend of household expectations regarding savings over the next 12 months.

Chart 3 Household saving expectations in the CESEE region (differences of the net balances from the historic average)



Source: Consumer Confidence Survey; Bank of Albania and the European Commission.

4. CONCLUDING REMARKS

Analyzing the saving behavior of households in times of epidemics / pandemics is important.

Indicators of savings in Albania and in the CESEE region indicate an increase in household savings in the first and second quarters of this year. Households have displayed similar behavior in all EU countries. This behavior reflects the decline in consumption, as indicated by consumption expenditure data for the first quarter of the year, as well as the increase in the uncertainties about the future.

In terms of future developments, survey data on household expectations regarding indicate a slowdown of savings in the next 12 months, in some of the Balkan countries. With the decline in income for extended periods of time, households tend to smooth their consumption over time by preserving a consistent level of the consumption of basic goods and services, thus using their savings to meet such needs over time. This is in line with the findings of Leoni (2011), who shows that the fast spread of epidemics in developing countries has a causal correlation to the reduction of deposits in the banking system. However, the literature also suggests that in times of economic crises, natural disasters or epidemics/pandemics, structural changes in the behavior of households can be expected. The effect of increased uncertainty about the future may outweigh that of declining income, as households attempt to save more and consume less during periods of crisis, but also in normal times.

For this reason, it is rather important for policymakers to monitor the balance of these factors and their long-term trends, in order to complement the general framework of developments with additional information.

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MICROECONOMIC EVIDENCE ON THE PRICE-SETTING BEHAVIOUR IN THE ALBANIAN ECONOMY

Ola Çami, Research Department, Bank of Albania

1. INTRODUCTION

Although classical theory predicts the continuous and complete adjustment of prices in response to changes in supply and demand, price rigidity, or the tendency of prices to not change has been documented consistently in a number of markets (Carlton, 1986). Firms do not adjust their prices in response to every shock in the economy. Based on the "New Keynesian Theory", prices are determined not only by the current economic situation, but also by the expectations of agents for the future. In this context, prices that change less frequently (rigid prices) contain more information on future expectations that prices that change more frequently (flexible prices) (Bryan and Meyer, 2010). The heterogeneity of firms regarding the level of price rigidity of flexibility is also documented in the context of sectors of the economy or different goods/services (Hannan and Berger, 1991; Kashyap, 1995). Studies mainly agree that heterogeneity exists and is particularly more present between goods than services: service prices are significantly more rigid than those of goods.

An ample literature is also dedicated to the analysis of the implications of nominal rigidities on the level of inflation and aggregate output. This literature suggests that these rigidities and the response of the economy to a number of potential noises in the future has implications on the behaviour of monetary policy. In modern macroeconomic theory, price rigidity is an important source of the non-neutrality of money in the short-term and has implications on the dynamics of inflation. In particular, the degree of nominal rigidity is one of the determinants of the slope of the New Keynesian Phillips curve, which is constructed on a microeconomic basis and is widely used in central bank macroeconomic analysis. Consequently, for a central bank that targets inflation, it is useful to have information on the behaviour, expectations and heterogeneity of inflation.

In this context, this paper aims to analyse the frequency of price changes using prices at the micro level contained in the Consumer Price Index (CPI) and to explore the characteristics of the price-setting behaviour in the Albanian economy. Most existing microeconomic studies focus on specific markets or products, for example: Cecchetti (1986) on magazine prices; Lach and Tsiddon (1992) and Eden (2001) on food prices; Kashyap (1995) on catalogue prices; Levy et al. (1997) on prices in supermarkets; and Genesove (2003) on apartment rents. The data used in this study, as well as in the methodologies on which it is based, allow for a more extensive analysis on the ECOICOP[1] expenditure classification and in particular its 12 main categories: food

[1] *European Classification of Individual Consumption by Purpose.*

and non-alcoholic beverages, alcoholic beverages and tobacco, clothing, fuel and energy, housing, medical services, transportation, communication, entertainment, education, hotels and restaurants, other miscellaneous items.

The analysis is focused on the period 2008 Q1 - 2019 Q2 and is relies on the calculation of three main indicators: frequency, size and duration of price spells. The analysis is mainly descriptive in nature and is based on the approach of Erlandsen (2014) and Alvares, Hernando (2004). The main objectives of the analysis are, first, to obtain a quantitative measure of the unconditional level of price rigidity and second, to better understand the qualitative nature of the price-setting process and patterns of price behaviour at the micro level. The results are presented in the form of 4 stylized facts.

The findings suggest that pricing behaviour is heterogeneous in the range of goods and services where in general the prices of services are more rigid than those of goods and therefore it is difficult to reach a clear conclusion regarding the behaviour of aggregate prices.Price behaviour is heterogeneous, not only among the main categories of ECOICOP, but also among different sectors. Nevertheless, in general terms, the results are in line with the description of the four characteristics of Taylor (1999) on the price setting process. First, prices remain constant for relatively long periods of time. Second, the results suggest that prices are moderately rigid and they change on average every 4 to 5 months. Third, the size of the price change, on average, is larger than inflation, which suggests that idiosyncratic shocks are more important than aggregate shocks. Finally, the frequency of price change seems to be dependent on the average inflation rate[2]. The results also suggest that downward price rigidity was not present as a real phenomenon before 2012 and it has become even less likely after 2012.

The paper is structured as follows. The second section will describe the behaviour and performance of inflation during the period under review, which makes it possible to illustrate the behaviour of prices and the main trends. Further, in the third and fourth sections will be presented the methodology, data and results. Finally, section 5 provides the conclusions.

INFLATION PERFORMANCE 2008-2019

The period under review is from 2008 Q1 to 2019 Q2. During this period, inflation behaviour can be divided into two main periods. The period 2008 Q1 to 2011 Q2, which is characterized by higher inflation, but within the central bank target and the second period, 2011 Q3 to 2019 Q2, which is characterized by lower inflation[3].

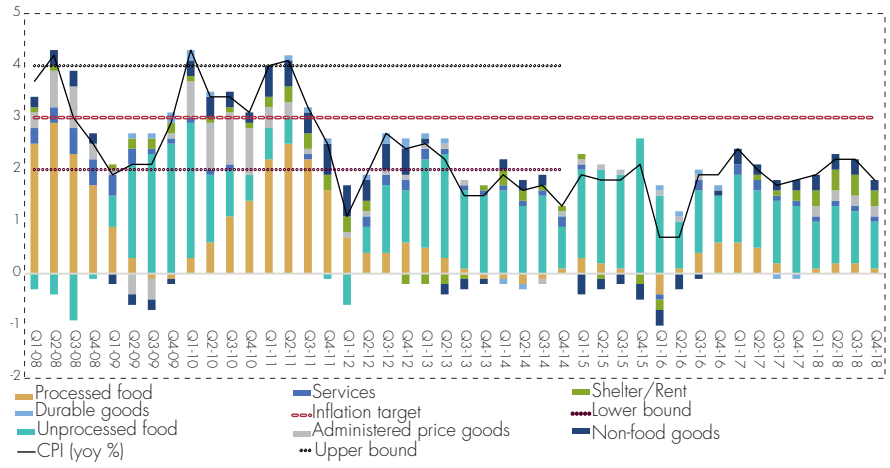
During the first period, the global financial and economic crisis had a significant impact on the Albanian economy, although not from the beginning. During this period, based on surveys conducted by the Bank of Albania, there

[2] *This hypothesis has not been tested by empirical methods.*

[3] *In 2015, the Bank of Albania changed the inflation target value based on its medium-term strategy from 3% with a range of +/-1% to 3% inflation.*

has been an increase in the uncertainty of economic agents related to a quick and strong transmission of the global crisis in the Albanian economy (Bank of Albania, Business and Consumer Confidence Surveys 2008 Q1 - 2009 Q4). Aggregate output suffered shocks as a result of the contraction of private and public investment as well as the significant slowdown in private consumption, affected by the increased uncertainty of economic agents. Developments in credit to the private sector during 2009 H2, indicate a slowdown of credit growth, which has been present throughout the whole period. However, inflation in the period 2008 Q1 to 2011 Q3 was contained within the target of the Bank of Albania. Inflation values were largely conditioned by supply factors. In particular, during this period, the energy crisis and rising energy prices have had a significant contribution in inflation. In addition to the increase in the price of electricity, the limited supply of domestic agricultural produce and the upward trend of commodity prices in the global market, alongside the presence of the depreciation effect of the domestic currency, have exerted upward pressure on inflation. These factors have increased the uncertainty of economic agents as well as risk premiums in financial markets, while high imported inflation from global markets has had a restraining effect on domestic demand and increased inflation expectations in Albania. However, the subsequent low contribution of regulated prices as well as the damping effects of supply shocks recorded during 2010 and early 2011, led to inflation being mainly affected by the negative output gap driven by declining investment and private consumption in the economy. At this point, the Bank of Albania warned for a balance of risks which would shift inflation towards a downward trend in the medium term.

Chart 2.1 Inflation performance 2008-2019



Source: Quarterly Monetary Policy Reports 2008-2019.

Regarding the following period, the low inflation after 2011 Q3 until the beginning of 2016 was strongly driven by the negative output gap and lower lending in the banking sector. On the supply side, the slowdown in the prices of main goods in global markets and inflation in partner countries, alongside a stable exchange rate, resulted in low imported inflation in the Albanian economy. At the same time, the contribution of regulated prices had been lower, almost negligible compared to the first period. During this period, the

economic activity growth in Albania was driven mostly by foreign demand, whereas the domestic economy actors initially showed a moment of contraction and after that, stagnation. Starting from 2016 Q1 a positive trajectory of growth in output has been observed, driven by both the revival of consumption and investment. Meanwhile the period 2017-2018 is characterised by a rapid appreciation of lek, thus affecting price stability. During 2018, the Bank of Albania took measures for intervening in the foreign exchange market, which brought about the curbing of pressures in the inflation indicator (Bank of Albania, 2018). During 2019, inflation showed a non-volatile behaviour, with an average annual inflation of 1.7%. The Bank of Albania maintained an accommodative monetary policy in the market.

In terms of consumer basket components, food prices in general and non-processed foods in particular, are the ones that have guided inflationary pressures. Regulated prices were a significant contributor of inflation up until 2010, but after this period the contribution has been much lower. Non-food products, in general, have had a low contribution in headline inflation Meanwhile, during 2018-2019, there has been an increase in the contribution of fuel prices and housing rents.

2. DATA AND METHODOLOGY

This paper aims to analyse the price behaviour in Albania during the period 2008-2019 based on the calculations of three main indicators: frequency, size and duration of price spells. The methodology is a combination of the two approaches from Erlandsen (2014) and Alvares, Hernando (2004) and it is descriptive in nature, where results are presented in the form of four stylized facts.

The paper uses CPI (Consumer Price Index) disaggregated data and statistical calculations to provide evidence on price rigidity and the heterogeneity of the price behaviour among the different groups of the consumer basket. The data covers over 13.000 individual prices and 135 components of the consumer basket for the period 2008 Q1 - 2019 Q2. The basket used for the analysis represents 85% of the households' final basket and is based on the ECOICOP classification. The data used for the analysis is easy to group and aggregate. The periodicity to which firms change prices represents a key element to characterize their price-setting behaviour. To measure this periodicity we use two different indicators: the frequency of price change (F) and the duration of price spells (T^F) which are closely related to each other.

FREQUENCY OF PRICE CHANGE

The frequency of price change here is defined as the ratio of non-zero (monthly annualized) price changes to total observations. Based on Erlandsen (2014):

$$F_j = \frac{\sum_{i=1}^{n_j} \sum_{t=2}^{\tau} NUM_{ijt}}{\sum_{i=1}^{n_j} \sum_{t=2}^{\tau} DEN_{ijt}}$$

Where NUM is a dummy indicating whether the price of the good has changed at time t, DEN is a dummy indicating whether the good observed at time t has also been observed at time $t-1$, n_j is the number of good observed in the j category and T is the time period in which good j prices are reported.

The frequency indicator will be reported as an indicator on its own, but it's primary purpose is to calculate rigid and flexible price indices. Two steps will be taken to build the indices based on the Erlandsen (2014) approach:

(1) The first step is to calculate the frequency for each subcategory of the components of the consumer basket. Further, based on the median frequency value, the products are classified into two groups, those characterized by rigid prices or those characterized by flexible prices.
(2) The second step consists in calculating the aggregate indices of flexible and rigid prices using the respective CPI weights. Also for the other two indicators we will follow the same weighting protocol to report an aggregate value of the indicators. Since the data for which CPI information is available are those in the 39 subcategories, the frequency indicators are initially calculated using the observations of goods located in each subcategory based on the ECOICOP classification[4]. After, the frequency indicator is aggregated by averaging the values of each subcategory and using the corresponding CPIs as weights.

DURATION OF PRICE SPELLS

As discussed in Alvares and Hernando (2004), assuming stationarity and homogeneity of the price setting behaviour in the cross-section dimension, the inverse of frequency F converges to a large sample, to an average value of T^F. This asymptotic property can be used to evaluate the average F and T^F values.

As for the above:

$$T_j^F = \frac{1}{F_j}$$

The above equation is intuitive: if the prices of 31% of the goods change every month, then average T^F is 1 divided by 0.31, or 3.2 months. If we assume that prices can change at any time, thus the probability that the price will change is the same each day of the month, the average of the duration of price spell indicator can be represented by the following equation:

$$T_j^F = -\frac{1}{\ln(1 - F_j)}$$

[4] *See Table A1 in the Annexes for the description of the main ECOICOP categories and subcategories.*

On the other hand, the above equations stand only if all prices show the same expectation while in reality prices do not have the same frequency of change. Indeed, some products display a very low frequency indicator which means that their prices change very rarely and consequently this can influence the average indicator of the duration of price spells. Therefore, weighing, according to the method described, is a very significant step to be followed in building the aggregate price duration indicator.

SIZE OF PRICE CHANGES

In addition to the indicators of the frequency of price adjustment and the duration of price spells, an indicator of the size of price change is also calculated, which is measured as a difference in logarithm. The assumption is that prices change only once within a given month (or within a quarter for those goods whose prices are collected on a quarterly basis). This assumption seems to be close to reality with the exception of a few non-processed food items for which the duration of price spells is usually shorter than a month. The same approach to weighting is used for this indicator as well.

3. RESULTS

The main findings are presented below. The way they are presented is in the form of four stylized facts which provide information on the characteristics of the price-setting behaviour.

FACT 1: Consumer prices are moderately rigid

The monthly median frequency of price change is 21.4% (the frequency indicator takes values that range between 0 and 1, where 0 means that prices never change while a value of 1 means that prices change every month), and prices change on average once every 4 to 5 months. Flexible prices account for 60% of total prices (above the median 0.214/21.4%) and rigid prices account for 40% of total prices (below the median 0.214/21.4%)[5]. Non-processed food prices are the ones that show the highest frequency of change, every 1.7 months, while the prices of processed food change less frequently, every 5 months.

[5] *See Chart 4.1 on page 8 for more information.*

Table 4.1. Frequency of price adjustments and duration of price spells

	Total	Processed Foods	Unprocessed Foods	Services	Non-food items
Frequency of price changes	21.4	19.9	56.2	6.2	15.2
Frequency of price increases	11.2	11.6	29.1	4.1	5.1
Frequency of price decreases	10.2	8.3	27.1	2.1	4.9
Duration of price spells (months)	4.671	5.022	1.768	16.121	6.569
Duration of price increases (months)	8.918	8.618	3.321	24.311	19.605
Duration of price decreases (months)	9.802	12.01	3.632	47.602	20.408

Source: Consumer Price Index 2008-2019, author's calculations.

On the other hand, although the price behaviour of goods shows an almost symmetrical behaviour at 1:1 ratio between increasing and decreasing prices, this behaviour is not observed for the price of services. According to Table 4.1 above, services change their prices on average every 16 months, in a 1:2 ratio (24 months versus 47 months) of increasing and decreasing prices. Alvarez and Hernando (2005) argue that the differences in cost structure between the two sectors is what may explain the differences in symmetry. Labour costs are the least volatile compared to other inputs and consequently it affects the final price of services. What is more important is that this rigidity in the services sector can translate into a higher level of inflation persistence at the aggregate level (Lunnemann and Matha, 2005b). Of course, this also depends on how the labour market is regulated as well as the degree of formal versus informal employment in the economy.

Referring to Table 4.4 below, decreasing prices are less frequent after 2012, which coincides with the period of downward inflation pressures. In this context, since INSTAT takes into account seasonal discounts and promotions, this value may be slightly lower if we do not take them into account.

Table 4.2 Frequency and duration of price spells before and after 2012Q2

	Frequency of price changes	Duration of price spells	Frequency of price increases	Duration of Price Increases	Frequency of price decrease	Duration of Price Decreases
All items	0.214	4.671	0.112	8.918	0.102	9.802
All items before 2012 Q1	0.218	4.113	0.129	7.748	0.089	4.117
All items after 2012 Q1	0.205	5.902	0.102	9.309	0.112	3.181

Source: Consumer Price Index 2008-2019, author's calculations.

Similar studies found a broad range of values for the frequency indicator. In the euro area, values between countries fluctuate from 10% in Italy to 23% in Luxembourg. Also, in the euro area countries, nominal downward price rigidity in terms of average or median prices has not been documented (Dhyme, Alvarez et al, 2006).

Table 4.3 Frequency of price changes in euro area countries[a]

	Unprocessed food	Processed food	Energy (oil-products)	Non-energy industrial goods	Services	Total country weights [b]	Total euro area weights [c]
Austria	37.5	15.5	72.3	8.4	7.1	15.4	17.1
Belgium	31.5	19.1	81.6	5.9	3.0	17.6	15.6
Germany	25.2	8.9	91.4	5.4	4.3	13.5	15.0
Spain [d]	50.9	17.7	-	6.1	4.6	13.3	11.5
Finland	52.7	12.8	89.3	18.1	11.6	20.3	-
France	24.7	20.3	76.9	18.0	7.4	20.9	20.4
Italy	19.3	9.4	61.6	5.8	4.6	10.0	12.0
Luxembourg	54.6	10.5	73.9	14.5	4.8	23.0	19.2
Netherlands	30.8	17.3	72.6	14.2	7.9	16.2	19.0
Portugal	55.3	24.5	15.9	14.3	13.6	21.1	18.7
Euro area	28.3	13.7	78.0	9.2	5.6	15.1	15.8

Source: Dhyne, Alvarez et al. (2006);

a Figures presented in this table are computed on the basis of the 50-products sample, with an exception for the case of Finland where figures are derived from the entire Consumer Price Index. Euro area figures do not include Greece and Ireland.

b The total is calculated using country-specific weights for each item.

c The total is calculated using common euro area weights for each sub-index. No figures are provided for Finland because of lack of comparability of the sample of products used in this country. In the Spanish database no energy products are included, which biases downwards the aggregate frequency.

There are several factors for which the literature agrees that they may explain heterogeneity in the frequency indicator. A very significant factor is the consumption model which varies from one country to another and consequently has an impact on the calculated frequency. In countries where food dominates the consumer basket, median frequency values are higher. Another significant element is the form of market organization: countries where markets are organized with small shops versus countries where markets are organized with supermarkets, hypermarkets or large stores. A large store is more likely to change prices more often than a small store and as a result, the frequency of price change will be higher. On the other hand, the way prices are regulated is very important. If the price of energy is administered or regulated exclusively by government institutions, hence it does not change freely from the market powers, this will have an impact on the median frequency indicator. Other regulations, such as those for discounts in stores, barriers to market entry and exit, also have an impact in this context, but these factors are difficult to quantify. In this context, an important element is the way in which official statistics agencies collect data on consumer basket prices and especially the way they handle and report promotions and price reductions.

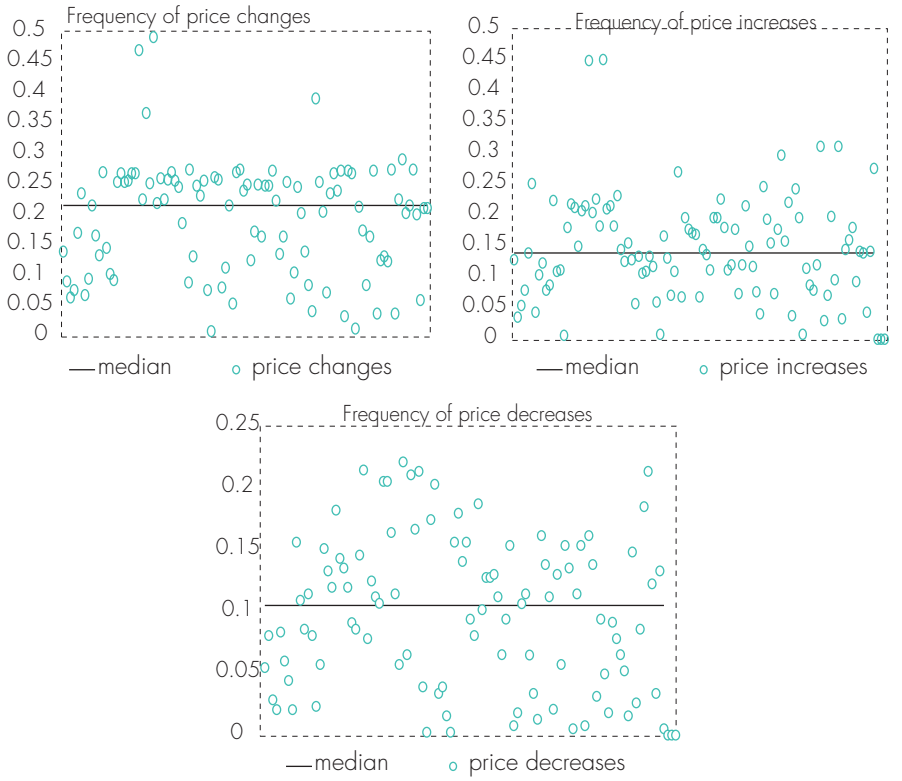
FACT 2: Price behaviour is very heterogeneous

Chart 4.1 below shows the distribution of the frequency indicator for the main ECOICOP sectors as well as the median value. In the first chart are presented the values for the total frequency, while the second and the third charts present the frequency for increasing and decreasing prices, respectively.

As mentioned above, price flexibility is higher for the prices of goods and lower for the prices of services. Heterogeneity is present among the main

categories of ECOICOP as can be seen from the chart, but also among the sectors included within these categories, suggesting that price behaviour is not homogeneous. What has been observed in similar studies is that the heterogeneity between countries is explained to the extent of 90% by the effect of heterogeneity between different sectors and goods.

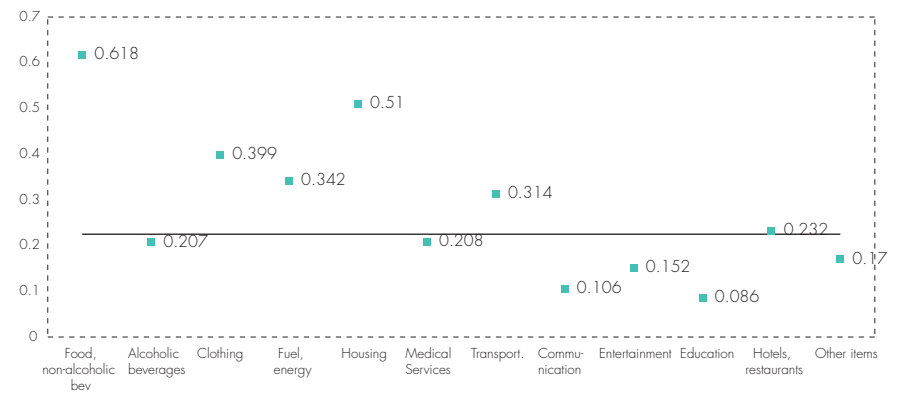
Chart 4.1 Frequency of price change (total, increasing, decreasing)



Source: Consumer Price Index 2008-2019, author's calculations.

Chart 4.2 below presents the aggregate frequency of the main ECOICOP categories and the calculated median on aggregate values.

Chart 4.2 Frequency of price changes by main ECOICOP categories



Source: Consumer Price Index 2008-2019, author's calculations.

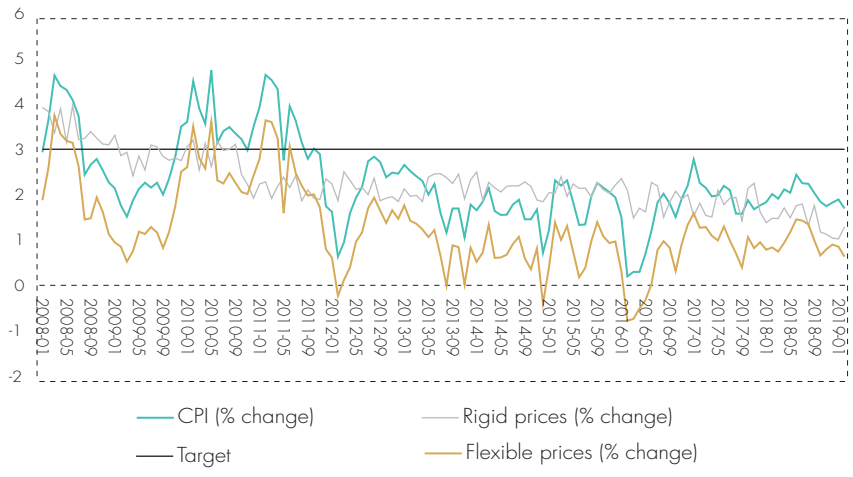
The category which displays the most flexible prices is the category of food and non-alcoholic beverages, mainly reflecting the price behaviour of non-processed food. ECOICOP categories that in aggregate terms also exhibit flexible prices are: housing, clothing, fuel and energy, transportation and hotels and restaurants.

On the other hand, the ECOICOP categories, which display in aggregate terms a rigid price behaviour, are: education, communication, entertainment, other services and healthcare. Given that the 12 categories of ECOICOP consist of a variety of goods and services, aggregate behaviour may be driven by the behaviour of some sectors at this level which are very flexible or very rigid regardless of weighing methods. One such example is the behaviour of the transportation category which is actually influenced by the price of flights and ferry tickets and fuel which are very flexible, while the prices of public transport and taxies are very rigid. Therefore, sub-category level analysis has a lower bias in interpretation.

FACT 3: Flexible price inflation is strongly correlated to headline inflation

Chart 4.3 below presents the headline inflation chart disaggregated by flexible and rigid price inflation values. Flexible price inflation is what has largely driven inflation behaviour over the years. Rigid price inflation generally has a trajectory independent of headline inflation and is more stable, so it does not show large fluctuations over time, which is expected as rigid prices change less frequently.

Chart 4.3 Rigid and flexible price inflation



Source: Consumer Price Index 2008-2019, author's calculations.

Overall, rigid price inflation, before 2012 has an average growth rate of 3-4% while after 2012, it is lower at 2%. Since rigid prices in aggregate terms are adjusted more slowly, this is consistent with the hypothesis that rigid prices contain more information about inflation expectations. In the face of a shock to the economy, expectations for the future are generally smoothed

over time, compared to the current economic situation. Excluding the period from 01-2011 to 09-2011, rigid prices have generally been higher than flexible prices. One of the main reasons for this behaviour may be the fact that the flexibility of rigid prices is driven by the prices of services which, although change less frequently, they present higher inflation than the prices of goods. Therefore, prices that respond more strongly to inflation expectations will therefore be less volatile and more persistent than other prices.

In Table 4.2 below we present the Pearson correlation coefficients between the three main series. The results are statistically significant at the 1% level without rejecting the hypothesis that flexible price inflation and headline inflation are strongly correlated with each other.

Table 4.4 Correlation between flexible and rigid inflation to total

	CPI inflation	Flexible inflation	Rigid inflation
CPI inflation	1		
Flexible inflation	0.992***	1	
Rigid inflation	0,466*	0,459*	1

Source: Consumer Price Index 2008-2019, author's calculations.

This suggests that flexible price inflation contains more information on total inflation than rigid price inflation. Meanwhile prices that react more strongly to inflation expectations than to the current economic situation are less volatile and more persistent than other prices.

FACT 4: Changes in prices are larger than the inflation rate

Based on the literature, in an environment with inflation, price increases are expected to exceed price decreases in average terms. However, this has not been observed often in practice. The magnitude of the change in increasing or decreasing prices may take similar values, but it has also been estimated often that prices decrease to a greater extent than they increase. One of the arguments is that firms are generally not inclined to lower prices so there is "downward price rigidity". Firms generally lower prices as a result of a large negative shock while small shocks are generally not transmitted to prices. Consequently, the size of price changes may be bigger in the case of decreasing prices.

Table 4.3 presents the indicator of the size of price changes for the consumer basket as a whole as well as for its main components. The results for the average change of the size of price increases and decreases are also reported. The size of the change in an average price is equal to 4.51%, which is a higher than headline inflation. Meanwhile, the indicator of the size of price increases and decreases do not have a big difference from the average value, standing at 4.54% and -4.2%, respectively.

Table 4.5 Size of price changes by sector

	Size of Price Changes	Size of Price Increases	Size of Price Decreases
All items	4.509	4.541	-4.191
1. Food and non-alcoholic beverages	6.879	6.881	-6.426
2. Alcoholic beverages and tobacco	6.181	6.08	-0.801
3. Clothing	4.092	4.989	-5.285
4. Fuel and energy	3.298	4.112	-0.701
5. Housing	1.544	1.701	-1.824
6. Medical Services	2.431	3.461	-1.426
7. Transportation	5.024	6.073	-2.525
8. Communication	0.779	0.893	-0.681
9. Entertainment	2.254	2.379	-1.294
10. Education	2.709	2.898	-1.574
11. Hotels and Restaurants	3.242	3.277	-2.936
12. Other items	1.362	2.110	-0.664

Source: Consumer Price Index 2008-2019, author's calculations.

We find the presence of heterogeneity between sectors, although not as strong as for the indicators of frequency and duration of price spells. We find a very high value of the size of price change for non-processed foods. In this case, a factor which has a significant impact on price is the weather. Given that the demand for these goods is relatively inelastic and shelf life is short, price changes are not only more frequent but also larger.

As the frequency indicator, the size of price changes depends on a number of factors, which also bring about the difference between different sectors and countries: seasonality, indirect taxes such as VAT and excises, inflation rate and attractive prices. In the case of Albania, especially the relationship between the size of price change and inflation (periods characterized by high inflation are associated with higher price increases and periods characterized by low inflation are associated with higher price decreases), may have an impact on the symmetry between the two indicators.

4. CONCLUSIONS

This paper uses disaggregated Consumer Price Index data to study price behaviour from a microeconomic perspective. In recent years, studies of inflation behaviour using micro data have gained importance in both academia and central banks. These studies mainly show that price adjustment is strongly heterogeneous between different sectors in the economy. The paper is particularly interested in discussing this issue in the context of the Albanian economy. The analysis is descriptive in nature and uses the results from the calculation of three main indicators: the frequency of price adjustment, the duration of price spells and the size of price adjustment, to present four stylized facts about the behaviour of prices.

The results suggest that the way prices change is very heterogeneous among different ECOICOP categories but also among the different sectors within these categories. Consequently, no definitive answer can be given to the question of whether prices are rigid or flexible. Based on our results, it is possible to argue that prices are moderately rigid, where 60% of prices are flexible while 40% of them are rigid. On average, the consumer basket calculated flexibility equal 21% and prices change every 4 to 5 months. Prices do not change often but when they do, they change by a larger extent than inflation. These results suggest that the price-setting behaviour in the Albanian economy is consistent with the description of the four characteristics of Taylor (1999) on the price-setting process. The results also suggest that the behaviour of prices in Albania does not indicate for downward price rigidity.

The results of the analysis have significant implications for monetary policy. From the perspective of an optimal monetary policy, a potential implication is that the central bank should pay particular attention to inflation in the sectors that show rigid prices (Aoki, 2001), and particularly services. The results of this paper also have implications for the way inflation is modelled and analysed in a central bank. In this context, the calculated values of the frequency of price changes for the CPI basket suggest that the traditional HICP method of measuring core inflation, excluding non-processed foods, would be sensible to be considered in the context of the Albanian economy. In this context, there is a need for future research to better understand the price-setting behaviour at the micro level.

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ANNEX

Table A1 ECOICOP classification

ECOICOP: breakdown of individual consumption
Expenditure of households
01 food and non-alcoholic beverages
01.1 food
01.2 non-alcoholic beverages
02 alcoholic beverages, tobacco
02.1 alcoholic beverages
02.2 tobacco
03 clothing and footwear
03.1 clothing
03.2 footwear
04 housing, water, electricity, gas and other fuels
04.1 actual rentals for housing
04.2 imputed rentals for housing
04.3 maintenance and repair of the dwelling
04.4 water supply and miscellaneous services relating to the dwelling
04.5 electricity, gas and other fuels
05 furnishings, household equipment and routine household maintenance
05.1 furniture and furnishings, carpets and other floor coverings
05.2 household textiles
05.3 household appliances
05.4 glassware, tableware and household utensils
05.5 tools and equipment for house and garden
05.6 goods and services for routine household maintenance
06 health
06.1 medical products, appliances and equipment
06.2 outpatient services
06.3 hospital services
07 transport
07.1 purchase of vehicles
07.2 operation of personal transport equipment
07.3 transport services
08 communication
08.1 postal services
08.2 telephone and telefax equipment
08.3 telephone and telefax services
09 recreation and culture
09.1 audio-visual, photographic and information processing equipment
09.2 other major durables for recreation and culture
09.3 other recreational items and equipment, gardens and pets
09.4 recreational and cultural services
09.5 newspapers, books and stationery
09.6 package holidays
10 education
10.1 pre-primary and primary education
10.2 secondary education
10.3 post-secondary non-tertiary education
10.4 tertiary education
10.5 education not definable by level
11 restaurants and hotels
11.1 catering services
11.2 accommodation services
12 miscellaneous goods and services
12.1 personal care
12.3 personal effects n.e.c.
12.4 social protection
12.5 insurance
12.6 financial services n.e.c.
12.7 other services n.e.c.

Source: Statistics institution (2006)

BLOCKCHAINS AND THE BANK OF ALBANIA

Margerita Topalli, Research Department, Bank of Albania

In the past decade, the terms blockchain and distributed ledger technology (DLT) have become buzzwords in economic, policy, and business circles, despite still being poorly understood[1]. DLTs are distinct part of the overall Financial Technology (FinTech) developments which aim to disrupt and improve the effectiveness, speed, and costs associated with traditional financial services. DLTs certainly possess the disruptive characteristics as they are introducing fundamentally different methods of conducting transactions between multiple parties and doing away with the hindrances and costs of intermediaries and middlemen. This memo provides a short overview of these technologies, their advantages and limitations as well as the potential applications to the BoA's activities.

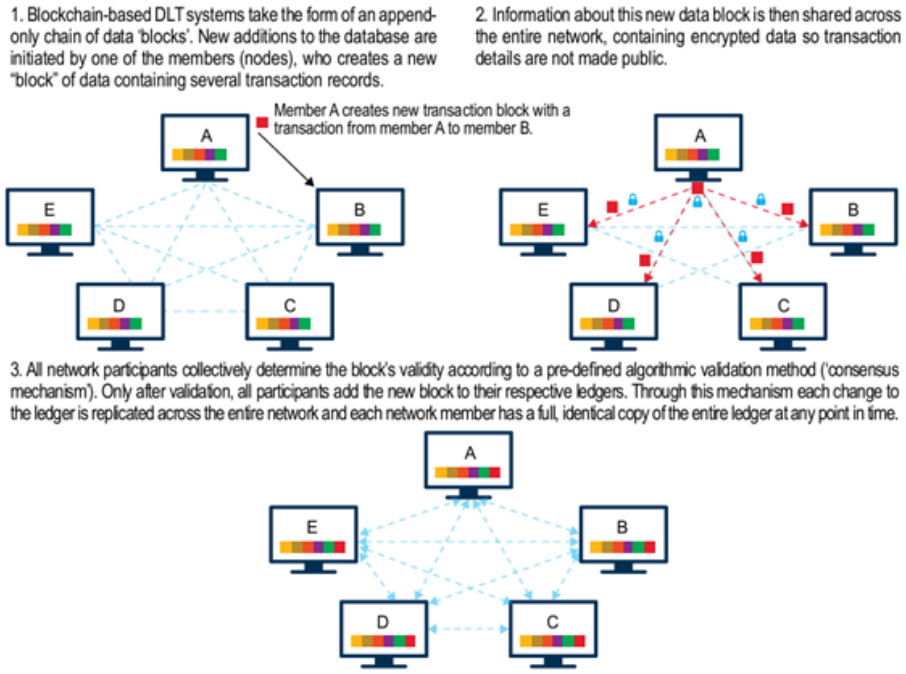
1. WHAT IS DISTRIBUTED LEDGER TECHNOLOGY (DLT) AND BLOCKCHAIN?

DLT refers to all the new systems that are built on the premise of enabling multiple parties to share a ledger database that seeks to reduce the need for trust or depending on any centralised or intermediating party. Blockchains can be thought of as a special subset of DLT that bundles transactions into blocks and broadcasts the data to all participants.

Blockchains are blocks (groups) that contain a set number of validated transactions, each transaction having the unique user's (the individual who obtained a transaction) hash-key assigned to it. Each block itself has a unique hash code, and the hash-codes are interconnected together to form a blockchain in a linear and sequential order of all transactions. The figure below visually demonstrates both the concept of a block and the connection of each hashed block (i.e. the chain).

[1] *HSBC (2017), Trust in Technology, available at http://www.hsbc.com/news-and-insight/mediaresources/media-releases/2017/~/media/hsbc-com/newsroomassets/2017/pdfs/170609- updated-trust-in-technology-final-report.pdf*

Figure 1. Schematic representation of the Blockchain DLT



Source: The World Bank, 2017

Every user (commonly known as a node) within the blockchain network obtains a copy of a new transaction and updates the blockchain ledger; only when a majority (51%) of the users review and validate a new transaction is the transaction recorded within the ledger (it is important to note that most of the "verification" by users is not actually done by users but rather automatically via the specific blockchain software). Since blockchain is a distributed ledger, a copy of each transaction is stored by all users that are within that specific blockchain network (or ledger).[2]

As such, blockchain technology works without a central authority and is virtually temper-proof.

DLTs can be open (such as in the case of crypto currencies) and 'closed' (or 'private') in which access is restricted to a specific set of vetted participants. The key differences between the two types relate to their security and threat model. Open DLTs allow anyone that has a copy of the ledger to contribute to the ledger and are thus designed for censorship-resistance (Cambridge, 2017). On the other hand, closed, or permissioned, ledgers only allow contributions to the ledger by those who have been given access to it (typically via an access key) – closed ledgers can allow the public to view it and its contents, but not to alter it.

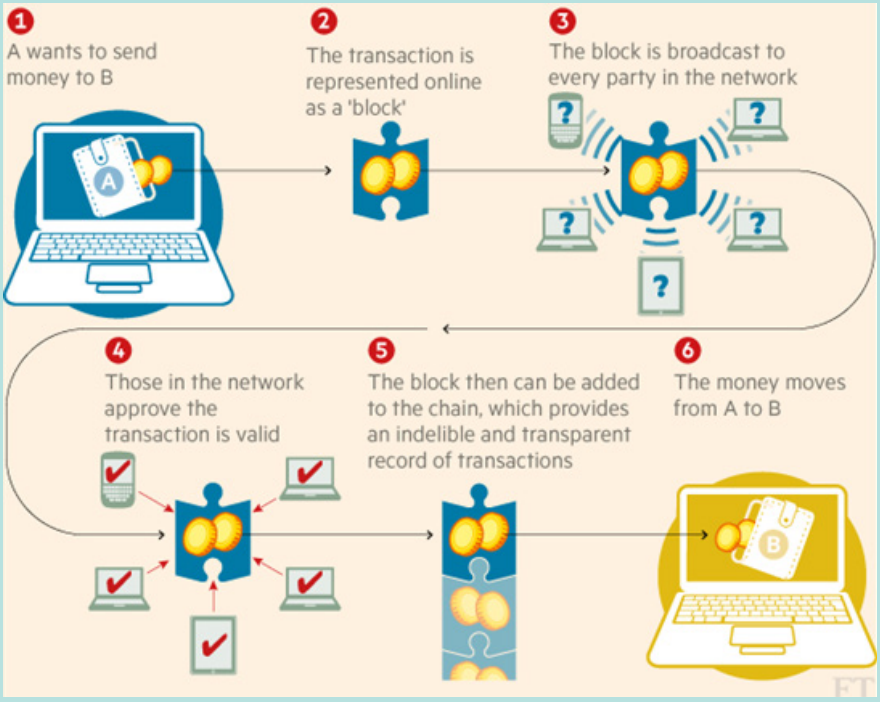
The benefits of blockchain are varied and can include transactions involving value such as money, goods and property (titles). It has limitless potential uses: from collecting taxes to enabling migrants to send money back to family in countries where banking is difficult. The main advantages of using blockchain

[2] *Berryhill, Jamie, Theo Bourgery, and Angela Hanson (2018), Blockchain Technology and its Use in the Public Sector, OECD publications, Paris.*

technology include reducing the need for trust between stakeholders, ensuring enhanced transparency, authentication and ease of auditability. According to Gee and Button (2017): "The rules governing a blockchain can effectively eliminate the types of unauthorised transfers or fraudulent activity that have become all to-common in many areas of business and society with the global financial cost of fraud estimated at more than $4 trillion in 2016 alone".[3]

BOX 1 BITCOIN: THE ADVENT OF BLOCKCHAIN

In 2009, the blockchain technology was put in a spotlight after the launch of Bitcoin by anonymous author Satoshi Nakamoto in the paper "Bitcoin: a Peer-to-peer electronic cash system." Bitcoin utilises blockchain as a transaction ledger to securely record transfers of bitcoins from one party to another. Nakamoto did not invent Blockchain technology as such, but used a combination of existing technologies (P2P networking, distributed timestamping, cryptographic hashing functions, digital signatures, and Merkle trees, among others) that have in some cases existed for decades to create Bitcoin as an alternative currency and store of value (which is only one of endless applications of blockchain technology)



Source: Financial Times

2. BLOCKCHAIN'S CURRENT LIMITATIONS

Still a fairly recent technology, blockchain has a number of limitations, many of which are likely to be solved or significantly improved on in the coming years. For now, the full impact and potential of blockchain is still unknown as the limited availability of technical skills and expertise in DLT hinders the roll out of its different applications. The current DLT landscape is highly fragmented with dozens of competitors promoting their own protocol frameworks (underlying

[3] *Gee, Jim, and Mark Button (2017), The Financial Cost of Fraud 2017: The Latest Data from around the World, Crowe Clark Whitehall*

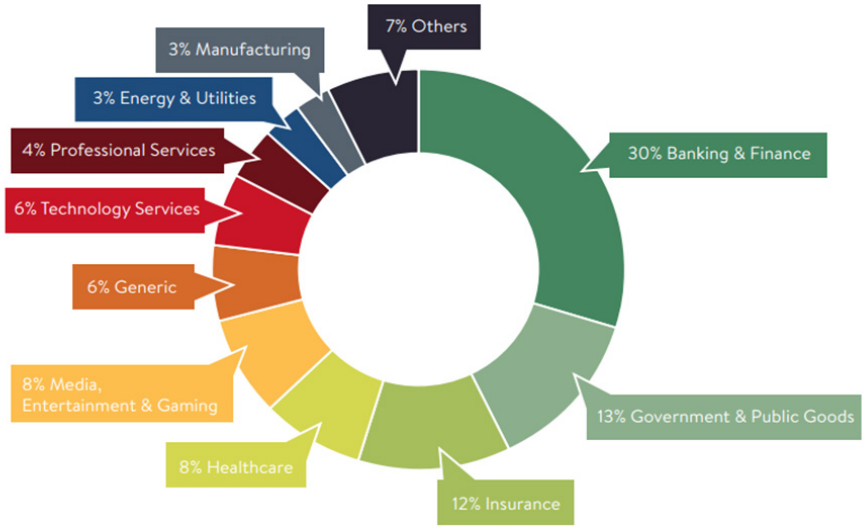
technologies). At this stage it is unclear which technology will win and become best suited for delivering production-level networks and applications.

Regarding the remaining technical issues, scalability of blockchain technologies remains limited as for now they are not designed to accommodate large volume of transactions. The processing time of transactions is also problematic: for example, it takes around ten minutes to process a block of Bitcoin transactions as it requires a consensus across all the different nodes. In addition, the laws and regulations regarding the (mis)use of DLT are still in their infancy, which can make the systems (especially closed blockchains) more vulnerable to colluding behaviour. Similarly, there is a need to better secure access keys to closed blockchain systems so that no attackers can get full access to the shared database. Finally, the mining[4] required to support a quickly growing blockchain network entails heavy energy consumption.

3. PRIMARY USERS OF BLOCKCHAIN TECHNOLOGY

The Blockchain is likely to disrupt many industries in the coming 5 to 10 years. According to a study of the University of Cambridge [5], around one third of all DLT use cases can be found in the banking and finance industry. Government and public goods providers come second, closely followed by the insurance industry. We are also witnessing an increasing interest towards non-monetary use for blockchain technology (such as establishing protected voting systems, secure transfer of retail and real estate certificates, enhancing supply chain links between trade partners, etc.).

Figure 2. The landscape of 132 DLT use cases



Source: Garrick and Rauchs, 2017

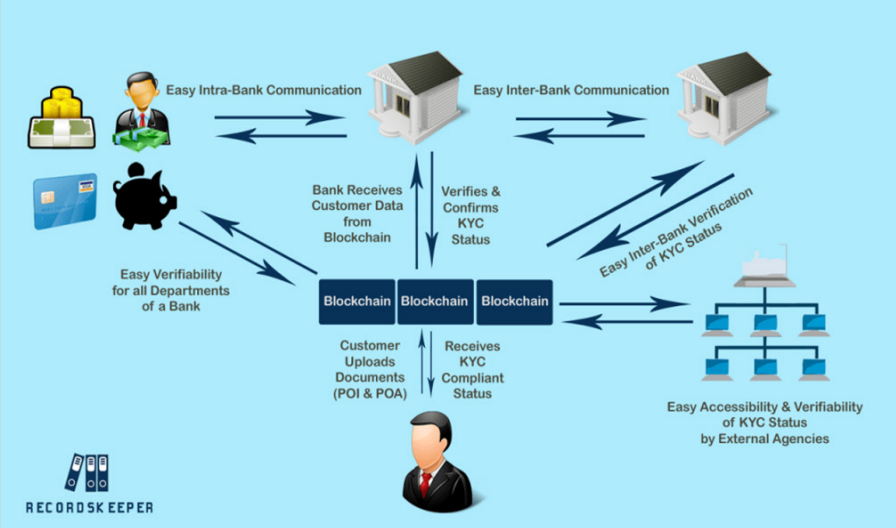
[4] *Within each ledger some nodes (or users) use a set of high-performance computers to publish new blocks within a blockchain. The "mining" process uses these computers to validate that each transaction has been correctly cryptographically signed (i.e. the hash-key) and then publish the new transactions into newly formed blocks.*

[5] *Hileman, Garrick, and Michel Rauchs (2017), 2017 Global Blockchain Benchmarking Study, Cambridge Centre for Alternative Finance (CCAF), available at https://www.jbs.cam.ac.uk/fileadmin/user_upload/research/centres/alternative-finance/downloads/2017-09-27-ccaf-globalbchain.pdf*

Blockchain technology is increasingly being examined and applied in the private sector for various uses. Cyrpotcurrencies are being employed to reduce the costs and increase the security of international money transfers. Multinational banks, such as Barclays, and venture capitalists have begun investing in blockchain related projects and start-ups. Moreover, blockchain is being employed for various non-financial applications, such as private transport (arcade city, La'zooz, UBS), creating secure voting systems, distribution of public benefits, protecting real-estate deeds and intellectual property, and helping strengthen and coordinate international supply chains.

BOX 2. BLOCKCHAIN DLT EXAMPLE IN KNOW-YOUR-CUSTOMER (KYC) INFORMATION PROCESSING

Today a bank customer has to fill out the KYC documents each time he requires services from different financial institutions or those institutions have to buy expensive data storage and transmission services from a central database to ensure customer confidentiality and privacy. This results in poor customer experience and/or high operational costs for financial institutions. Blockchain technology ('Recordskeeper') allows financial institutions to securely search for the customer information, generate requests for KYC documents from other institutions that have already verified customers, store validated customer documents and re-use them where required. The blockchain based sharing infrastructure can also be used to trigger alerts on customer profiles which can, in turn, lead to the appropriate mitigation procedures between various financial institutions.



Source: Appscrip.com

4. HOW DLT TECHNOLOGY CAN BENEFIT THE BOA

It is important to realise that the frameworks that lay behind DLT are still in their infancy and wide-scale commercial applications are still limited. While there are some nascent private sector applications, the bank's key counterparties (public sector entities) are in a few limited cases experimenting or investigating the usefulness of DLT for primarily non-financial uses. A 2017 University of Cambridge report showed that the handful of public actors looking into DLT are doing so to improve database management, recording keeping/identity management, benefits distribution, and securing voting systems. Moreover, most public entities

currently do not possess the technical capacities to employ DLT nor do they have the resources to improve said capacities. Just as importantly, there is a high degree of DLT uncertainty due to the limited/unclear regulatory environment of the technology, which is limiting public sector adoption. However, the UK Government Office for Science perhaps made the most compelling summary of the lack of public sector DLT adoption when they wrote, "if government waits for 'perfect' solutions, it will miss the opportunity to shape and procure implementations of the technology that will provide maximum benefit to the public sector, and the UK may lose opportunities for economic benefit as well".[6]

Thus even if the BoA wants to invest in the resources to develop a DLT financing infrastructure the effort would serve a limited scope unless there was wide-scale DLT usage by our counterparties. In fact the process of migrating existing and longstanding IT systems, operational arrangements, and institutional frameworks to DLT based infrastructure hold substantial costs. However, many of the issues cited above and in section 2, will be overcome over time: technology will become more efficient and necessary regulations will be adopted. In the current DLT environment, it would be to the BoA's advantage to closely monitor technological developments, participate in the various DLT standard-setting working groups and launch small scale experiments internally or in cooperation with other partners. As the potential for DLT develops, it would be important for the BoA to begin developing a long-term strategy on how to leverage DLT for its operations. Any focus/investment towards the technology should be seen as a means to improve the long-term competitiveness of the bank in an era of fast technological change.

The remainder of this section will highlight what other IFIs are doing with DLTs, its financing applications of DLT, and examples for BoA applications.

A) DLTS AND IFIS

The current use of DLT in the IFI community is extremely limited and much like many public sector actors, it is in the experimental/investigatory phase; implementation has been limited due to lack of institutional knowledge, organisational/operational obstacles, existing issues rooted in the technology itself and lack of tools to help DLTs be more usable for IFIs.

The most notable IFI issuance of a DLT backed security was launched by the World Bank in partnership with the Commonwealth Bank of Australia in August of 2018 valued at USD 73 million. This issuance is not a direct use of DLT to finance specific projects, but instead merely a public bond issuance that solely operates using DLT. Most importantly this DLT bond issuance is simply a prototype to explore how DLT may improve/change the sale of bonds (i.e to shift the market towards automation) in line with the WB historical role in pioneering new bond schemes.

[6] *Government Office for Science (2016), Distributed Ledger Technology: beyond block chain. A report by the UK Government Chief Scientific Adviser, available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/492972/gs-16-1-distributed-ledger-technology.pdf*

The EIB[7] has also begun exploring DLT usage by organising a two day coding "challenge" conference (August 2018) that invited a number of teams to compete by coding and designing financing solutions using DLT. The winners from EY[8] were awarded a contract with the EIB to further explore its design (a blockchain/AI tool to optimise issuances process and decrease the number of transactions between the EIB and its counterparties) and develop it into a proof on concept.

B) FINANCING APPLICATIONS OF DLT

The table below from the World Bank[9] outlines financial and non-financial applications of DLT technology in various sectors

Overview of Potential DLT Applications (at varying stages of development)	
Financial Sector Applications	
Money & Payments	• Digital currencies • Payment authorization, clearance & settlement • International remittances and cross-border payments (alternative to correspondent banking) • Foreign exchange • Micropayments
Financial Services & Infrastructure (beyond payments)	• Capital markets: digital issuance, trading & settlements of securities • Commodities trading • Notarization services (e.g. for mortgages) • Collateral registries • Movable asset registries • Syndicated loans • Crowdfunding (as initial coin offerings) • Insurance (in combination with smart contracts) for automating insurance payouts and validation of occurrence of insured event
Collateral registries and ownership registers	• Land registries, property titles & other collateral registries
Internal systems of financial service providers	• Replacing internal ledgers maintained by large, multinational financial service providers that record information across different departments, subsidiaries, or geographies
DLT-based applications in other sectors	
Identity	• Digital identity platforms • Storing personal records: birth, marriage & death certificates
Trade & Commerce	• Supply chain management (management of inventory and disputes) • Product provenance & authenticity (e.g. artworks, pharmaceuticals, diamonds) • Trade finance • Post-trade processing • Rewards & loyalty programs • Invoice management • Intellectual property registration • Internet of Things
Agriculture	• Financial services in the agricultural sector like insurance, crop finance and warehouse receipts • Provenance of cash crops • Safety net programs related to delivery of seeds, fertilizers and other agricultural inputs
Governance	• E-voting systems • E-Residence • Government record-keeping, e.g. criminal records • Reducing fraud and error in government payments • Reducing tax fraud • Protection of critical infrastructure against cyberattacks
Healthcare	• Electronic medical records
Humanitarian & Aid	• Tracking delivery & distribution of food, vaccinations, medications, etc. • Tracking distribution and expenditure of aid money

Source: World Bank, 2017

[7] *European Investment Bank*

[8] *Ernst & Young*

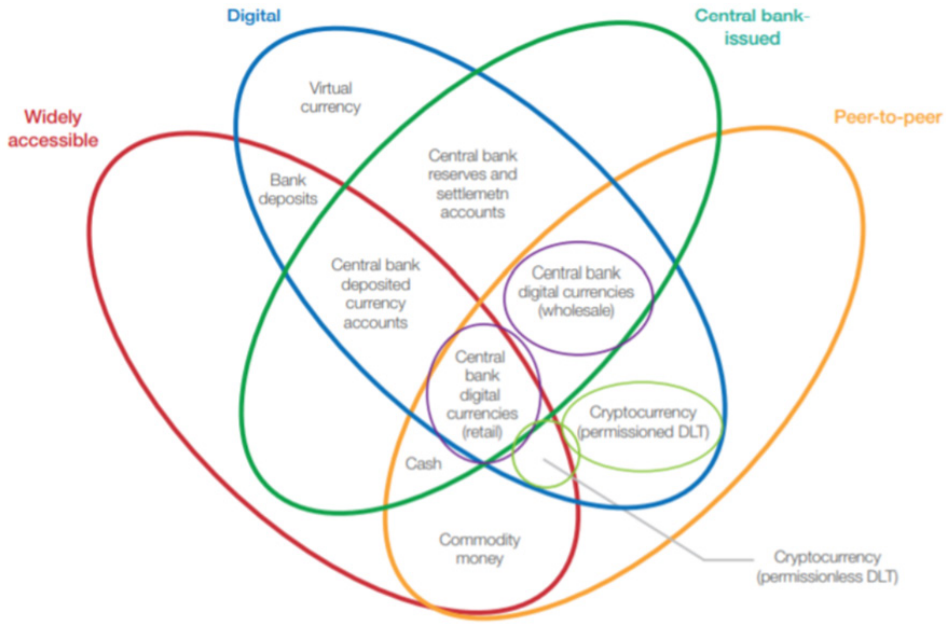
[9] *World Bank (2017), Distributed Ledger Technology (DLT) and Blockchain, available at http://documents.worldbank.org/curated/en/177911513714062215/pdf/122140-WP-PUBLIC-Distributed-Ledger-Technology-and-Blockchain-Fintech-Notes.pdf*

In the context of the BoA, any project application of DLT would have to be in the form of a closed/private distributed ledger (as outlined in section 1) with only the bank and relevant project counterparties having access to the ledger. Smart contract, a subset of tools with the DLT environment, can help streamline funding or projects, priorities where liquidity should flow within a project, and to monitor or program rules related to conditional transfers. As an example, payments related to cash-for-work programs can be executed automatically once the work is completed. Such smart contracts may be more applicable in institutions with a high frequency of daily transactions (e.g. commercial banks, public welfare/pension transfer bodies). For instance the Department for Work and Pensions in the UK started a trial in June 2016 to use DLT for welfare benefit payments, with start-up and private sector partnerships, to create a more efficient and fraud-proof welfare payment system.

C) DLT APPLICATIONS FOR THE BOA

While the current applications of DLT technology appear to be limited in scope, it is worthwhile to introduce a few potential conceptual applications for the BoA's own current external and internal operations. As the Banks relative size is small there is no pressing need to introduce bank-wide DLT operations/ applications. However, as stated earlier, it may be of benefit to utilise DLT in a limited trial experiment to analyse how it can be applied to our operations and/or to solve long-standing issues such as payment-system efficiency, payment security and resilience. It can also play a critical role in increasing the effectiveness of financial inclusion.

Figure 3. The money flower: a taxonomy of money



Source: WEF, 2019 (Image adapted from M. Bech and R. Garratt, "Central bank cryptocurrencies", BIS, 2017)

A quick summary of potential BoA's applications (and for considerations for a trial project) are:

- Retail and wholesale central bank digital currency (CBDC): A central bank-issued digital currency that is operated and settled in a peer-to-peer and decentralized manner (with no intermediary) and is widely available for consumer (Retail CBDC) and/or commercial banks and clearing houses for use in the wholesale interbank market. (Central banks from Sweden, the Bahamas and Cambodia, South Africa, Canada, Japan, Thailand, Saudi Arabia, and Singapore).
- Interbank securities settlement: Rapid interbank clearing and settlement of securities for cash, developing a "delivery versus payment" interbank systems. (Bank of Japan, Monetary Authority of Singapore, Bank of England and Bank of Canada).
- Payment system resiliency and contingency: The use of DLT to provide safety and continuity from threats, including technical or network failure, natural disaster, cybercrime and other threats. (The Central Bank of Brazil and the Eastern Caribbean Central Bank).
- Bond issuance and lifecycle management: DLTs can be employed as "novel" way in the bond auction, issuance or other lifecycle processes to reduce costs and increase efficiency. Central banks or government regulators could be "observer nodes" to monitor activity where relevant. However, the practical and even theoretical concept behind such an issuance is still not fully understood and the only current example (the WB blockchain-based bond issuance, called the "bond-i", in August 2018) is primarily a pilot project.
- Know your customer (KYC) and anti-money-laundering (AML): DLT to track and share relevant customer payment and identity information to streamline processes (cf. Box 2). (Hong Kong Monetary Authority)
- Information exchange and data-sharing between or within related government or private sector institutions. (The Central Bank of Brazil)
- Trade finance: The use of DLT to enable faster, more efficient and more inclusive trade financing, sharing customer information and transaction histories, while maintaining privacy and confidentiality where needed. International organisations and commercial banks are already moving into the field, for instance, the Digital Trade Chain network was established by seven of Europe's largest commercial banks to facilitate SME trade financing. (Hong Kong Monetary Authority)
- Cash money supply chain: The use of DLT for issuing, tracking and managing the delivery and movement of cash from production facilities to the central bank and commercial bank branches. This could include the ordering, depositing or movement of funds, and could simplify regulatory reporting. (Eastern Caribbean Central Bank)
- Customer Single Euro Payment Area (SEPA) Creditor Identifier (SCI) provisioning: The use of DLT could offer a faster, more streamlined, decentralized system for identity provisioning and sharing. (Bank of France with the Madre project, one of the rare cases where a central bank has successfully deployed a DLT-based application.)

CONCLUDING REMARKS

It is sufficient to say that the DLT is still in its early development stage and testing phase, hence the bank must carefully consider all known and unknown risks to implementation.

As of this moment DLT is not yet adequately robust and scalable in becoming a widely used BoA's instrument, given the systemic importance of central bank processes.

However, the position of this paper stands that DLT is evolving and developing rapidly and the BoA should observe and participate in those forums that allow us to track its development among peer institutions and within the private cryptocurrency markets.

Moreover it may be to the BoA's benefit to consider launching a DLT pilot project to assess the technology's viability, which may come with considerable gains or even some setbacks. Either way, this would allow the bank to build institutional knowledge of DLT and help us formulate a long-term strategy on how to apply it to our operations, helping us to improve our processes and economic welfare. The bank would be acting as trailblazers and would become an experienced authority on the topic.

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