Addressing current inflation levels through green energy technologies and techniques: recent developments

Ojo, Marianne

Centre for Innovation and Sustainable Development

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Introduction

The US Inflation Reduction Act 2022, was signed into law in August 2022. It aims amongst other objectives, "to lower energy costs for families and small businesses, accelerate private investment in clean energy solutions in every sector of the economy – as well as nationally, strengthen supply chains, and create good paying jobs and new economic opportunities for workers."

According to the section, "*Investing in Clean Hydrogen*", as provided for in the Inflation Reduction Act Guidebook (2023: see page 74 of 184),

"Clean hydrogen constitutes a major component of President Biden's plan to decarbonize the industrial sector. As well as providing $9.5 billion for clean hydrogen initiatives, through the Bipartisan Infrastructure Law, $1 billion was also set aside for a "Clean Hydrogen Electrolysis program", to reduce the cost of hydrogen produced from clean electricity." Further, $500 million was committed towards "Clean Hydrogen Manufacturing and Recycling/Initiatives" aimed at supporting equipment manufacturing and strong domestic supply chains for clean hydrogen.

Having experienced inflationary levels at unprecedented record highs – globally, in recent months, the possible impacts of recent accommodative monetary policies will be considered in this paper. The paper will aim to highlight why addressing current inflation levels – and particularly through green energy techniques and technologies – which incorporate and embrace the use of green hydrogen, constitute a much welcomed approach in addressing current inflationary levels.

This paper is structured as follows: The next section of this paper considers the literature review and background to the topic. A focus and discussion on the conceptual framework of global stable coins, distinguishing characteristics which delineate them from other more volatile virtual currencies such as bitcoins, as well as the implications of their growth and popularity for monetary policy, will then follow. In jurisdictions such as Sweden, there has been a constant declining use of cash over the years – with growing fears that digital currencies may be dominated by private actors – and even more of a concern, the current framework which is lacking of an acceptable and agreed upon framework for the definition to be attributed to crypto assets. Such definitional and legal uncertainties, further compounded by a lack of central regulatory authority. The next section then considers those issues to be addressed – as pertains to global stable coins whilst also highlighting their potential benefits and the need to enhance their value. Monetary policy implications of stable coins – particularly for open economies and the susceptibility of such open economies to a payments system impacted by digital currencies that are controlled by private actors - in which case countries such as Sweden, along with countries like Australia, New Zealand, Canada and Norway, are categorized, is furthermore illustrated. Against the backdrop of the

vulnerabilities faced by such "open economies", the rationale behind a "temporary" discontinuation of the "Leaning Against the Wind" (LAW) policy adopted in Sweden, following the aftermath of the most recent Global Financial Crisis (GFC) – largely attributed to lower than expected levels of inflation – as well as low levels of confidence and expectations is further accentuated by the notion that "The Lean Against the Wind Policy is difficult to apply in an economic environment in which confidence in the inflation target is threatened". Innovative possibilities and opportunities of e digital currencies are then considered – particularly growing considerations of certain central banks to issue their own central bank digital currencies. Questions which still need to be addressed relating to the interest rates to be attached to such currencies and whether or not such interest rates should apply. Further considerations relate to whether the inflation targets should be raised. These innovative possibilities are considered – with further recommendations for research – before a conclusion is drawn.

Monetary Policy Implications of Global Stable Coins

Brainard (2019:11) adds that some economists have argued that a central bank digital currency could address the problems presented by the zero lower bound by potentially transmitting monetary policy directly to the public and that a transfer in such a manner would imply the elimination of all physical cash and the power to impose a negative rate, or a tax, on households' holdings of digital money. The Executive Summary of the G7 Working Group highlights that whilst technological innovation is transforming the provision of financial services and products, payment services are still faced with challenges – namely speed, cost and lack of transparency – with about 1.7 billion people still with no access (globally) to financial services. It is also highlighted that crypto assets were expected to address some of these challenges – however, they have been limited by factors which include price volatility. In respect of stable coins, these are distinguished – even though regarded as crypto assets (attributed as possessing many of the features of crypto assets) – by "seeking to stabilize the price of the coin through linking its value to that of a pool of assets – and as a result, considered more capable of serving as a means of payment and store of value – with the potential to contribute to the development of global payment arrangements which are faster, cheaper and more inclusive than present arrangements.

Further Brainard (2019:2) adds that:

- Stable coins were designed to specifically overcome the substantial volatility exhibited by first generation crypto currencies – which limits their reach in payments and their utility as a unit of account. Stable coins aim to maintain stable value by tying the digital currency to an asset or basket of assets, such as commercial bank deposits or government issued bonds.

Stable coins, moreover, are further distinguished by Brainard through their differences from the initial set of crypto currencies in that "they may be issued by a central entity and rely on third party institutors for some aspects." Despite the originally intended remedial responses which stable coins were designed to provide, their potential systemic impacts – primarily by virtue of being linked to a basket of commodities – backed by governments bonds, as well as the popularity which Libra,

could generate -being linked to about a third of the world's population and active user accounts, it is not surprising that concerns have been raised by regulators.

Whereas there are potential benefits to be attributed to stable coins and digital currencies – in the sense that they offer greater ease and convenience in payments – as well as facilitate speedier processes – particularly with e commerce transactions, the need for privacy and protection of data – as well as adequate monitoring procedures to ensure that platforms where such transactions are undertaken are not prone to cybersecurity related risks – coupled with control and governance measures, constitute the fore of regulatory and supervisory concerns. Such concerns, in addition to eventual dominance by private actors, as well as possibilities that certain digital currencies could dominate and overshadow sovereign currencies of jurisdictions in which the use of digital currencies becomes a "dollarized" means or alternative for payments, contribute to the impetus being taken by many central banks for considerations in the issue of central bank digital currencies.

Literature Review and background to the Topic

In their paper, "*How Economic Crises Affect Inflation Beliefs: Evidence from the Covid-19 pandemic"* (2021) Journal of Economic Behavior & Organization, 189, 443-469, Armantier, O. et al (Kosar, G., Pomerantz, R., Skandalis, D., Smith, K., Topa, G., & Van der Klaauw, W.) make the following observations in their findings:

- That household inflation expectations responded slowly and mostly at the short-term horizon. Further, they add that "in contrast, data revealed immediate and unprecedented increases in individual inflation uncertainty and in inflation disagreement across respondents";

They also "illustrate the role inflation uncertainty may play in the study of consumer behaviour" – their finding "providing support for the theory of precautionary saving behaviour - under which agents facing higher uncertainty about the future should save more today."

The unprecedentedly unique nature of inflation and the circumstances which have made it

different from that which previously existed, are not only considered to have been triggered through a "drive by pandemic-related imbalances between policy supported demand, which is said to have remained robust, but also COVID disrupted supply, which on the other hand, is regarded as having been slow to recover." Other factors which have contributed to its unique nature from that which existed previously, are considered to include the economy – considered different because of "weaker links between wage and price inflation, greater global price competition, longer term structural factors – including an aging population". Of greater impact and significance is the difference in the approach and style adopted by central banks such as the Federal Reserve, according to Daly (2022:5), who is of the opinion that "one major evolution which separates today's Federal Reserve from that of 50 years ago is a deep understanding that inflation expectations influence future inflation – namely, if people expect inflation to persist, then it does."

In explaining the underlying causes behind inflation, D'Acunto and Weber (2022) add that whilst production stopped, following strict lockdown policies and COVID closures globally, with consumers accumulating savings – fueled by generous fiscal support through different fiscal measures, with a re start in production activities and supply chains, substantial demand pressure was placed on an already "stressed" supply side – resulting ultimately, to a sharp rise in prices.

Further, they add that in addition to demand pressures and supply-chain disruptions, labor market pressures, as well as the fact that a substantial share of the working population were retiring early, following months of inactivity, constituted part of the additional pressures on the recovery and restart of processes worldwide.

Even though D'Acunto and Weber are in agreement with the European Central Bank's prediction that the causes of the post COVID-19 surge in inflation "are likely to be temporary

and resolve in the medium run as supply activities adjust", they raise concerns about what in their opinion, constitutes an unresolved and unincorporated part of the puzzle, namely, the impact of consumers' inflation expectations.

Hence, will the Fed Reserve's approach in engaging the public through greater transparency and communication over the years, a practice and understanding which Daly considers vital in managing actual inflation be key to restoring the commitment to price stability and combating inflation? – *"in order to manage actual inflation, policy makers also have to manage inflation psychology - through the help of households, businesses and market participants."*

In illustrating and asserting the point that:

- i) "inflation today is driven by long run expected inflation plus all current and expected future deviations in real marginal costs plus adjustment costs", with the requirement that inflation-targeting central banks must not only look at expectations, and the costs incurred, and expected to be incurred by firms, if they want to understand how firms are likely to be setting their prices;
- ii) It is also important to "understand and communicate not just recent input price moves, but also how those input prices might be expected to move in the future", as well as understanding the importance of businesses and households expecting these gaps[1] to close in the long run – a role which the central bank has a part to play in;

[1] He adds that "the reason for that is the economy is constantly buffetted by shocks. […] With few huge ones recently with the economic impact of Covid-19, and the related global supply shortages and swings in energy prices. These shocks often move faster than firms and households are willing or able to adjust and lead to short-term inflationary pressures represented by gaps between actual marginal costs and an unobserved theoretical marginal cost mc^* consistent with what we expect marginal costs to be absent these shocks. When these gaps open up, firms are moved away from their desired/required markup and will adjust prices accordingly." (See page 5)

Jonathan Haskel makes reference to the following concepts and equations:

That, namely:

- "for an open economy like the United Kingdom, it's useful to further divide cost drivers into external and internal ones" – illustrating through an equation which accentuates the distinction by "expanding the input price terms with the external terms for energy and import prices " (Haskel, 2021:5):

The Output Gap

In making reference to the assumption is that "if demand moves ahead of what the domestic economy is able to supply, that will tend to put pressure on wages as workers are asked to work harder and are able to move more easily between competing firms seeking to expand, and that similarly, higher utilisation rates of the capital stock [CAPU] leads to higher returns in the short run (higher p_K) but eventually creates costs pressures as the capital stock strains under demand," the output gap is introduced as follows (see Haskel; 2021:6) :

$$\overline{p_l} - \overline{p^*} \approx y - y^* \quad {}_{l,}$$
$$\overline{p_k} - \overline{p^*} \approx CAPU \approx y - y^*$$

- "The proportional relationships between these demand-induced marginal cost gaps and real quantities are folded together, in the summary statistic, that is the output gap [$y - y^*$].

He further adds, that substituting the output gap for the p_l and p_k terms results in a final expression for the determinants of price inflation.

Unprecedented developments in the financial environment are not the only factors that have impacted monetary policy stances in the after math of the GFC, relationships and feedback mechanisms previously unknown to a larger extent, between sovereigns, banks and firms have been revealed through "unprecedented policy packages" such as negative interest rates,

purchases of government bonds; as well as policies adopted by the ECB between 2014 and 2015 to prevent euro area's slide into deflation. The uncertainty involved in adopting these policies is also highlighted (Draghi: 2019) since "interest rates had never gone below zero in a major economy" and further, he adds that it was not known how purchasing government bonds would play out in a "bank based economy ". In this respect, he also highlights how being guided by evidence available to them assisted them in chartering through "those waters of uncertainty" and further and more saliently, "That without new unconventional measures, the ECB would not be able to fulfil its stability mandate."

The Potential of Digital Currencies to Address Regulatory and Monetary Policy Challenges: Inflation targeting and the Effective Lower Bound

Can a central bank digital currency really address problems presented by the zero-lower bound by "potentially" transmitting monetary policy directly to the public? (Brainard, 2019). It is also argued that a transmission in such a manner would imply the elimination of all "physical" cash - as well as necessitate the power to impose a negative rate, or a tax, on households' holdings of digital money.

The above-mentioned proposal may appear increasingly feasible in jurisdictions such as Sweden where the elimination of physical cash appears to be of increased likelihood and possibility. The introduction of digital money, and particularly the e krone has been proposed by its central bank governor. However, in order for such a proposal to be facilitated, this would still necessitate a degree of control (and central regulation in particular) over such platforms as well as a prescribed and globally accepted legal definition of digital currencies and assets.

Though unprecedented and uncertain, sometimes, unconventional monetary policy decisions – and more importantly, timely and pro-active monetary policy decisions may be needed and justified than potentially costly and “reactive” monetary stimuli. In a former ECB President’s words, “without new unconventional measures, the ECB would not be able to fulfil its stability mandate.” This further sums up the policy also implemented by the ECB who several times,

particularly in 2019, was in alignment[2] with the Federal Reserve's monetary policy rate decisions.

The regulatory and legal concerns associated with emerging technologies even though related to the prevailing state and levels of uncertainty, it appeared, was not much of a concern as its other aspect – the control environment. Even though levels of uncertainty could eventually, be mitigated by tried tested procedures undertaken over extended periods of time – with repetitive tasks being assigned to robotics, and much high levels of strategic functions – such as reasoning, judgment and high levels of human competences being assigned at the strategic, more senior level based and decision making levels of management , it is the issue of control that raises a lot of doubts – even given the potential benefits of costs reductions, as highlighted above, as attributed to Artificial Intelligence and machine learning processes – as well as other areas of emerging technologies. Broadly speaking, one can mitigate levels of uncertainties – however when it comes to the issue of control, though related to uncertainty, is a separate area and more distinct discipline on its own.

In fact, uncertainties could result in less discriminatory and biased regulatory practices being applied. In regulatory procedures, it is well incorporated and accepted that information asymmetries and systemic risks of contagion cannot be eliminated to zero – only mitigated. However, with control, there are greater extremes – with potentially more devastating consequences. Further, with regulation, the positive and negative attributes of inadequate regulation – as well as over regulation, are acknowledged. The need for innovation being a primarily reason against practices deemed as being unduly or overly regulatory whilst the need for fairer based competition and matters relating to governance of anti -trust practices being advocated as reasons for breaking up powerful multi-national global enterprises and Big Tech

[2] "European Central Bank officials signalled at their June policy meeting that they will consider injecting fresh stimulus into the eurozone economy through interest-rate cuts or the relaunch of a €2.6 trillion ($2.9 trillion) bond buying program, amid deep concerns over slowing global growth and trade disputes. The aggressive message, which emerged from minutes of the June 5-6 meeting published on Thursday, came on the heels of remarks Wednesday by Federal Reserve Chairman Jerome Powell that the U.S. central bank will also likely ease policy soon. This puts the world's two biggest central banks on the cusp of injecting fresh stimulus into their economies to ward off a global slowdown and weak inflation. ECB officials were in "broad agreement" at their June meeting that the bank should "be ready and prepared to ease the monetary policy stance further by adjusting all of its instruments," according to the minutes." See WSJ, (2019). "ECB Follows Fed in Signalling Fresh Stimulus"
https://www.wsj.com/articles/ecb-officials-signal-intention-to-launch-fresh-stimulus11562847288?mod=itp_wsj&mod=&mod=djemITP_h

firms. What level of control will eventually be assigned to robotics and emerging technologies? In the case that such robotics and emerging technologies assume levels of human competences and human levels of reasoning – which is already the case with robotics that can play and even win chess competitions, would more organizations be increasingly compelled to delegate much higher levels of functions to such technologies – and should there be regulations prohibiting them from doing so. If so, how would these regulations be justified on an individual basis – adjudged by the nature of the operating environment – particularly with more sensitive areas such as the health care sector – even though other fields are also of great importance? Particularly in respect of systemically and informationally based risk sensitive related information? It is certainly the case that human errors are prevalent within the medical sectors – even with highly qualified experts whose personal level of ethics may also constitute grounds that generate potential conflicts of interests – in respect of professional and personal interests.

From such perspectives, machines and robotic assisted technologies are considered to be more independent, less biased and prone to be impacted by emotions which could ultimately influence decisions. However, to what extent could an absence of emotions prove detrimental in exceptional and unprecedented cases? How would a machine which is accustomed to functions- based on a set of patterns – historical or otherwise, be able to act in exceptional situations? Whilst machine learning processes have assumed immense relevance and significance in forecasting – as techniques involved in predicting even financial cycles and recessions, based on regression techniques – as well as past patterns, certain cases and outcomes may incorporate variables that were not dominant in a previous historical pattern or financial cycle. This is certainly the case with the Global Financial Crisis which occurred over a decade ago – whose impacts still have ramifications for many major economies.

In the face of prevailing global growth rate projections, the impacts also played by other actors – namely, from the real estate and housing markets to Information Technology and the digital economy, is also revealing impacts and consequences for monetary policy and financial regulatory arrangements. It is certainly the case that inflation targeting has been impacted by fluctuations, volatilities in prices – and particularly from the housing sectors, and even more potentially from the increasing resort to, and use of, virtual currencies. Where undefined terms exist to regulate assets which increasingly, are assuming relatively high global market

capitalization – in addition to matters of legal certainty, sound governance and public policy matters, then systemic consequences of the lack of a defined set of universally accepted and multilateral consensual rules, need to be considered. In addition to that important mandate of central banks, the mandate of price stability, the other important mandate of maximum employment has also been impacted through globalization and the rise in automated processes. Such factors – including the impacts of the housing market environment, have not only impacted inflation targeting and consumer expectations, but also central monetary policies in several jurisdictions – hereby prompting the growing use of accommodative unconventional – as well as conventional monetary policies.

The occurrence and persistence of prolonged periods of low levels of inflation has resulted in the implementation of many central bank policies, notably the European Central Bank's quantitative easing programs of 2015. Further, it has also prompted a change in monetary policies of central banks such as the Sveriges Riksbank – and more particularly its " Leaning Against the Wind" policy. As at January 2017, no one knew what to expect from the incoming Trump administration – more importantly in respect of trade and global relations. Some indicators which had already been provided in respect of what could be expected focused primarily on matters such as the Paris Global Agreement on Climate Change, the Trans Pacific Partnership Agreement, NAFTA – as well as greater focus on domestic policy matters – in fulfilment of the campaign promise to "Keep America First".

Post Brexit Developments

Further, it had been expected that there would be a shift in trading policy stances – particularly to a more protectionist nature – and naturally, that these would impact its major trading allies; namely, Mexico, Canada and the European Union. On the other side of the coin, Brexit impacts also implied that since the United Kingdom was intending to break away from the EU, and given the similar nature in which the Brexit Referendum reflected a break from traditional conventions – as typified by the Trump administration's win which also reverberated the wish of voters to break from tradition and convention, it was largely expected that such similarities would consolidate the "Special Relationship" status held between the United States and the United Kingdom. The issue relating to the "Back stop" insurance under Theresa May's

government appeared to have been resolved under the Withdrawal Agreement proposed by Boris Johnson. Complexities have been demonstrated as being evident – primarily owing to the creation of virtual customs borders within the Irish Sea – as a result of the provisions within the Withdrawal Agreement that was agreed upon between Boris Johnson and the European Commission in October 2019.

Hence, unless rules and conditions are established to address sections within the Agreement – which have great potential to create a customs border between Northern Ireland and the rest of the Union, it is certainly the case that the division created, through a lack of provision for the applicable "territorial waters of the United Kingdom", and namely the Irish Sea, will risk undermining the Union.

In all honesty, Brexit in itself was always going to be a complex task – particularly in respect of forging new rules and alliances. Given the period assigned to undertake the task, there were certain to be "unresolved issues". One of the questions and major concerns, however being related to how long it would take for those issues to be resolved – and if at all, they could be resolved. The uncertainty relating to this – as well as the possibilities of such uncertainties compounding a Hard Deal Brexit scenario, all generated climate sentiments which is considered, will have economic and possible long term repercussions – not just for the United Kingdom, but also for the European Union. The consequences of a second possible Referendum - as well as the Scottish and Northern Ireland position have economic as well as diplomatic and trade repercussions. The Northern Ireland position – which was further complicated by the minority coalition between the present Government and the DUP, also constitutes a threat to the Good Friday Agreement and as recently revealed, may also impact UK and US trade relations.

Despite the progress made by the current government with the Windsor Framework, as well as formal adoption of the Framework by the United Kingdom and the European Commission in March 2023, it is highlighted as follows (see Financial Times, 2023):

- *"London, Dublin, Brussels and Washington insist Prime Minister Rishi Sunak's new Windsor framework, which is intended to smooth implementation of post-Brexit trading rules, will unlock huge investment in Northern Ireland.*

But the DUP says it does not remove all hurdles to trade with Britain. It also objects to some EU legislation remaining in force in the region. The party supported the UK leaving the EU but says the deal — which left Northern Ireland within the bloc's single market for goods and put a customs border in the Irish Sea — undermines the region's place in the UK."

Inflationary Impacts Since the 2019 Global Pandemic Crisis

There were, as is still the case, currently, calls for possible consideration of further accommodative and expansive monetary policies which include macro prudential tools. Interest rate adjustments in other jurisdictions; as well as fears of retaliatory responses – as previously highlighted - which include the use of currency devaluations, also all added to the heighted and increased levels of uncertainty, which not only impacted central bank policy instruments of other jurisdictions, but also global stock markets. The effects of lower interest rates on the central bank's inflation targeting policies – as well as consumer expectations, constituted a subject of contentious debates. Whilst lower interest rates are needed to stimulate economic activity – even where it appears that reasons for doing so are not immediately apparent, there were also concerns that such actions may impact consumer expectations by delaying spending in the hopes of lower rates or even worse, trigger fears and concerns amongst investors.

Main Issues to be addressed

Global stable coins (GSCs) are considered to present "significant adverse effects" domestically and internationally in terms of monetary policy - as well as financial stability. "Further, their challenges to cross jurisdictional efforts to combat money laundering and terrorist financing presents further issues for international monetary systems- with implications for monetary sovereignty.

In accentuating the potential effects and impacts of stable coins, the following have been observed (Brainard, 2019:8): 1) Widespread adoption of stable coins could have implications for the role of central banks and monetary policy. 2) The central bank's approach to implementing monetary policy may be complicated to the extent that bank's participation in short term funding markets is affected. Reference is made to open economies and their

susceptibility to a payments system impacted by digital currencies that are controlled by private actors - in which case it is highlighted that Sweden, along with countries like Australia, New Zealand, Canada and Norway, fall within a category of countries - a group of small open economies with floating exchange rates and inflation targets which experience relatively similar challenges and problems (Ingves, 2019: 2). It is further added: - Through free capital movement, low real interest rates have been imported, and a downward pressure on inflation, generated through processes such as globalization.

Questions that have been brought to light, center round whether central banks considering the issue of digital currencies should also assign interest rates to such currencies - as well as conditions and factors which would impact such currencies. Would those rates be more flexible and volatile than the previous floating exchange and inflation targeting rates? Why should governments back stable coins which have the potential to trigger risks of systemic nature, relevance and importance where there were options to support their central banks with much needed stability? Why should governments back private actors engaged in crypto assets and global stable coins' issue where regulatory, legal uncertainty, sound governance and public policy issues - amongst several other challenges still needed to be resolved? Why not render support to, and consolidate on the measures, mechanisms and existing mechanisms available to central banks? Governments can be criticized for engaging in purely politically motivated and political interests where regulatory safeguards appear to be overlooked as a means of endorsing certain actors which may ultimately benefit their political interests. Certain actors, by virtue of their national values, as well as their significance, relevance, and impact on stock markets, may be accorded preferential treatment - a kind of "too big to fail institution ". However, providing assistance and support to prevent a systemic failure does not necessarily infer that license is permitted to carry on with unregulated activities. This is precisely why moral hazard issues arise - sometimes politically motivated interests may end up undermining central bank stability mandates.

Which is why the engagement of accommodative unconventional and conventional monetary policies does not necessarily undermine central bank independence. Sometimes asset backed government programs do not compromise independence - rather it is the support of governments for unregulated untested ventures which have potentially devastating systemic

consequences that poses serious matters of concern. It is welcomed that the Financial Stability Board is currently engaged in initiatives aimed at considering the regulatory issues of stable coins. In accentuating what sets Libra apart from other stable coins, Brainard (2019: 5) states that "the issuance of a private digital currency opaquely tied to a basket of sovereign currencies, through an active user network representing more than a third of the global population " necessitated the responsibility of addressing fundamental sets of legal and regulatory challenges before initial payment could be facilitated.

As a means of addressing public policy challenges, Beau (2019: 4) proposes the following responses: 1) Ignoring crypto assets - however this in his view, is not recommended on the basis of risks presented- more so in the case of stable coins 2) Banning crypto assets;
3) Promoting innovations with the potential to change the payment services market, namely establishing appropriate regulations that make it possible to reconcile the following two fundamentals: reconciling i) Risks already highlighted. ii) Preserving the potential for technological innovation offered by crypto assets.

Hence financial stability concerns constitute just one aspect to crypto assets.

The innovative possibilities - as well as those of distributed ledger technologies constitute benefits which can be harnessed to enhance digital possibilities of the Fourth Industrial Revolution.
Such benefits are as follows (Beau, 2019: 2,3)

- Block chain technology and more broadly, the distributed ledger technologies (DLT), could help address the market's needs and demands - particularly demand for quick and safe cross border payment solutions which are available 24-7

- DLT (distributed ledger technologies) could help remedy the current limits of the existing wholesale market infrastructures

- Crypto assets undergoing technical and economical trials bring about not only opportunities to improve payment systems, but also material risks which on the contrary, might weaken them, if not addressed.

Forecasting Techniques as a Means of Mitigating Uncertainties: Artificial Intelligence and Block chain Technologies

The use of machine learning techniques as a means of predicting bank distress in the United Kingdom, is highlighted by Treitel, H.and Suss .J., (2019, in their paper "Predicting Bank Distress in the UK with Machine Learning."[3]

In their analysis, they compare and contrast classic linear regression techniques with modern machine learning approaches that are able to "capture complex non-linearities and interactions." They find that the random forest algorithm "significantly and substantively outperforms other models" when utilizing the AUC and Brier Score as performance metrics (Treitel and Suss, 2019).

Other findings are as follows (2019:3,4):

- In justifying their argument that conventional approaches, such as logistic regression models, are unable to account for complex interactions and non-linearities, thereby tending to perform worse than their more flexible machine learning counterparts, they compare pooled logistic regression with a linear random effects model, the k nearest neigbours (KNN) algorithm, two classification tree ensembles (random forest and boosting), and a support vector machine (SVM).
- In order to measure performance, they estimate out-of-sample predicted probabilities using a unique cross validation design that accounts for various potential sources of bias - repeating the entire cross validation exercise ten times to account for the variability that arises due to the specific initial random split performed.

- Even though they find that the random forest algorithm significantly outperforms the other approaches examined in terms of the area under the ROC curve (AUC) and Brier score, the cost benefit analysis of implementation is also highlighted in the sense that "the performance advantage of the random forest algorithm comes with a transparency cost relative to the pooled logit model which, depending on the requirements of regulators, could outweigh the benefits."

They further, conclude that that lagged macroeconomic variables are very important for predicting distress and that for the random forest, a measure of average real UK earnings constitutes the single most important variable – the average earnings, in contrast, not being as important.[4]

[3] Treitel.,H. and Suss .J, (2019). "Predicting Bank Distress in the UK with Machine Learning" Bank of England Staff Working Paper No 831

[4] "relatively speaking, for the pooled logit model."

Should Inflation Targets have been Raised Earlier than Instigated in Several Jurisdictions?

As well as highlighting that better policy coordination or policy mix is pivotal to better economic outcomes, "especially since monetary policy space is limited ", Rehn also argues that "the lower the natural interest rate level is, the higher is the probability that nominal interest rates are near the Effective Lower Bound."[5] He further accentuates the dangers of a prolonged period of zero interest rates, warning that a combination of such rate levels - combined with low inflation ; Could, in turn, trap the economy in a "profoundly harmful equilibrium ", which would undermine the effectiveness of monetary policy, constrain economic growth below its potential, and hinder efforts to boost employment. As well as the above mentioned salient points, the need for interaction between different policy areas - given current global economic situation - as well as limited monetary policy space, is accentuated.

In their paper, Borio et al[6] also reiterate that "the zero (effective) lower bound and unconventional monetary policy, may affect the term spread's informational content to forecast recession risk, since the lower bound constrains short rates and unconventional monetary policy depresses the term premium in long rates." In this respect reference is also made to work undertaken by Coroneo and Pastorello (2017)[7] – as well as Fendel et al (2018).[8]

Amidst an environment currently dominated by high levels of uncertainty, the impacts of trade wars, Brexit and trade retaliations, have certainly impacted the timing and manner of various central bank monetary policy setting mechanisms, as remarked in respect of Brexit negotiations and likelihood of resolving the matter – as well as its impact on the Bank of England's monetary policy decisions – particularly quantitative easing measures, whereby it was (then) stated that:

[5] See Rehn, O. (2019) . "On Conventional and Unconventional Monetary Policies " http://www.bis.org/review/r191011b.htm

[6] See BIS (2019). Borio, C., Drehmann, M., and Xia, D, "Predicting Recessions: Financial Cycle versus term spread" BIS Working Papers No 818 October 2019

[7] Coroneo, L. and S Pastorello (2017): "European Spreads at the Interest Rate Lower Bound" unpublished manuscript

[8] Fendel, R., N Mai, and O Mohr (2018). "Recession probabilities for the Eurozone at the Zero Lower Bound", WHU Working Paper Series in Economics, no 18/04

- Only when Brexit is resolved will any fiscal boost or further BOE stimulus be determined. The U.K.'s yield curve inversion is worthy of concern but it's as much about a shortage of available bonds than any sure sign of trouble ahead."[9]

Conclusion

Important lessons which were drawn from the most recent GFC - notably, the growing need for accommodative policies (unconventional and conventional) to facilitate appropriate responses - given limited monetary policy spaces, the emergence, rise and evolution of private actors and their implications for monetary policies and financial stability. Unregulated and without legal certainty, there are potential causes for concerns in respect of the global adoption of stable coins - even though when harnessed and regulated appropriately, these could provide much needed innovative changes and benefits. Central banks should still assume vital monetary policy setting functions - even amidst uncertainties relating to how central bank digital currencies should be issued - particularly in respect of which and whether interest rates should be attached to these. Rehn states that a key lesson of monetary policy of the last ten years is that timely action is essential to avoid the zero lower bound - as well as an extended period of extremely low levels of inflation. The incorporation of innovative forecasting techniques with monetary policy setting may greatly mitigate current uncertainties linked to particular accommodative monetary policies. Contrasted to the policy of leaning against the wind, such techniques - along with more relevant, applicable, tried and tested techniques, and up to date indices, could generate greater confidence in the data being used - as well as expectation and inflation levels.

Incorporating Uncertainty in Forward Looking Monetary Policy Tools

"Because it takes time before monetary policy has its full impact on inflation, monetary policy is guided by forecasts for the economy and inflation. In addition, the Riksbank publishes, among other things, its own assessment of the likely future path for the repo rate and the degree of uncertainty surrounding that path. This interest rate path "is a forecast, not a promise". In connection with every monetary policy decision, "the Executive Board makes an assessment of the repo-rate path needed for monetary policy to be well-balanced. A well-balanced monetary policy is normally a question of finding an appropriate balance between stabilizing inflation around the inflation target and stabilizing the real economy"(Goodfriend and King, 2015:21). The journey since the most recent GFC has highlighted the need for several considerations, including, namely: the need to consider pro cyclical effects – as well as business and financial cycle risks, risks attributed to the changing financial environment – in form of emerging technological risks – and particularly unregulated blockchain technologies and platforms through which crypto currency markets are currently dependent on – as well as protectionist risks.

[9] See Bloomberg (2019). "U.K.'s Johnson to Double Down on Brexit in Germany, France Trip" https://www.bloomberg.com/news/articles/2019-08-17/u-k-s-johnson-to-double-down-on-brexit-in-germany-francetrip?srnd=premium-europe

Trade relations and Information technology are areas which not only having been impacted by globalization, have contributed immensely to the changing financial landscape over the years. Whilst the benefits attributed to globalization and Information Technology cannot be denied, the unequal distribution of gains attributed therefrom have constituted much debates in matters relating to the Modern Economy and the Knowledge Based Economy – prompting recent calls from several jurisdictions to approve digital taxes . Of greater concern however are levels of uncertainty attributed to unquantifiable, unregulated and emerging industries such as crypto assets. Although its global market capitalization at present, can be considered relatively small, its potential effects and magnitude of systemic effects – in the event of a bubble burst, particularly when linked to commodities, is illustrated thus, and with particular reference to Facebook's coin, Libra (WSJ, 2019):

- The size of Facebook's network means it could be, essentially, immediately systemically important. This should be subject to the highest level, the highest expectations in terms of privacy but also prudential regulation - Jerome Powell

As recently highlighted, Facebook's coin, Libra, is not only raising concerns because it will be "pegged to a basket of government-issued currencies", but also because "users could send it to each other and use it to make purchases on Facebook and across the internet."

Even though such cross border services, could facilitate financial inclusion – greater access and convenience for users, there are serious regulatory concerns – as well as matters of legal un/certainty -which are yet to be addressed. In addressing the rationales for financial regulation, recent reforms have made tremendous progress in deterring risk appetites and discouraging incentives for excess risk taking initiatives. Information uncertainty still constitutes great challenges in addressing information asymmetries – however it does appear that once one rationale can be addressed, the levels of systemic contagion can be contained, or the potentials for systemic contagion to occur can be addressed, then uncertainty levels related to concerns with interest rate adjustments, as well as investor concerns, can at least, to an extent, be mitigated.

What effects will near previously applied zero level interest rates have on inflation targeting policies in the months to come? Why should investors be unduly concerned that current neighbouring wars around the globe may generate greater uncertainty than anticipated? Particularly in respect of the impact of such wars on inflationary levels – such inflationary levels having reached as high as 11% in 2022 in the U.K. – even though this has been greatly reduced, as of the 20th March 2024, to an impressive level of 3.4%?

"The greatest innovations in finance are unstoppable, but often lead to crises as they find their feet" (The Economist, 2019):

- In the 18th century, the joint stock company created bubbles, before going on to make large scale business possible in the 19th century. - Securitization, caused the subprime debacle, but is today an important tool for laying off risk. “The broad principles of market regulation are eternal: equal treatment of all customers, equal access to information and the promotion of competition”.

What lessons can we draw from the above? That great innovations, discoveries and revolutionizing breakthroughs, sometimes require great risks and as popularly reiterated, “Great achievements involve great risks.” However, at what expense are, or rather, should applicable sectors be willing to pay the price? Even unbiased features of machines – features and characteristics that are supposed to contribute to their benefits, could sometimes end up being discriminatory – particularly in respect of predictive techniques – and more specifically in processes involving predictive crime mapping. Should reliance on historical data and patterns which usually highlight certain races or geographical areas as being more prone to crime be inferred or interpreted to imply that anyone associated with such an areas is a possible criminal – even decades or months after such evaluations have been undertaken, as well as relied upon to conclude that such classifications, categories, groups or related peoples are all criminals? To what extent are “associations” and categorizations affecting and impacting decisions and life changing outcomes? What of so-called wealth re distributions and the impacts of globalization that have taken place over the decades? It is probable that certain jurisdictions have not been impacted at all – relative to other jurisdictions whose demographics have been significantly transformed by the advents of globalization. Which is why it is expected – based on moral and ethical considerations, that those residents of areas which have been impacted and have benefited from globalization , should be made “better off” and not worse off – in terms of employment prospects, house and rent costs – as contrasted with pushing away – and displacing large groups – by virtue of such technological advancements. Indeed, “The broad principles of market regulation are eternal: equal treatment of all customers, equal access to information and the promotion of competition.”

Technological Advances and the Role of Innovative Techniques

Just how far are emerging technologies – and particularly machine learning techniques and processes, techniques used in forecasting and predictive analyses, striving to promote the afore mentioned principles of regulation? Is data or rather processed information facilitating discriminatory goals and bias – rather than promoting the goal of equal treatment of customers? It is not surprising that information – where unregulated – or in the wrong hands, could ultimately be used against the purposes or intended benefits of regulation, The dangers of lack of data privacy and protection – not only in terms of potential consequences for financial stability, are instrumental in the enactment and promulgation of the General Data Protections Regulations.

Perhaps there is also hope that machines could eventually teach humans to be less discriminatory and biased - particularly in certain cases where certain technologies are outsmarted in the event that technological errors and outdated information are incorporated into their systems - such that it becomes difficult to categorize subjects based on their real attributes or origins. In such a case incorporating chaos into a system which is deemed as being stable or "perfect", may eventually generate better outcomes and fairer treatment. Sometimes perfectly programmed computers could still, by virtue of irrelevant and unknown incorporated outdated or obsolete data (generating unreliable results), eventually be "tamed" to become less discriminatory than initially intended. This is the other aspect of machines, asides control, which gives cause for concern – namely its "perfect" image and non human side. Even though the inability to exercise or exhibit emotions may result in unbiased decision making processes, it could also be detrimental where emotions are needed – particularly in the fields of medicine. This machine learning process – though not originally programmed or intentionally designed, could incorporate learning by "errors" – although it is hoped that such errors are not significant enough to destabilize – with potentially irreversible ramifications. Of equal importance, the machine learning process should incorporate morals and ethics in its design. Even though it is highlighted that "the computing revolution looks as if it will make today's rules look horribly out of date – with human investors about to discover that they are no longer the smartest guys in the room", it should also be realized – and more importantly, promptly, on the basis of a remedial sense of urgency, that even the smartest instruments need to be regulated – and can be regulated where appropriate mechanisms are acknowledged as being in need of incorporation.

The important role of green energy technologies in addressing inflation levels, and particularly, "green hydrogen" – in the form of renewable hydrogen production, are increasingly being recognised and incorporated into many government initiatives and programmes. The role and potentials of hydrogen in facilitating decarbonisation, is also being explored in high energy intensive processes.

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