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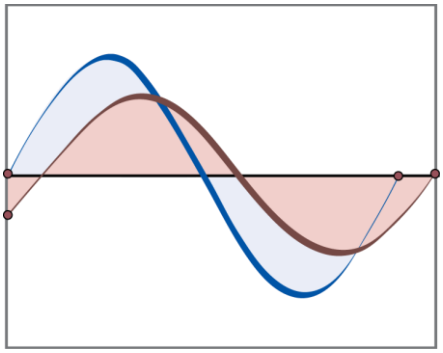

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The Monetary and Financial Stability Implications of Digital Currencies

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Abstract

Private digital currency platforms and the recent popularity of stablecoins, especially Facebook's proposed Libra, have increased regulatory attention concerning the potential impact of these crypto assets on the conduct of monetary policy and financial stability. This paper assesses the potential impact of stablecoins on monetary and financial conditions by examining underlying theories of money demand. For a sample of five countries over the period 1992 to 2019, using the Pedroni Panel Structural VAR model, it was revealed that, on average, interest-bearing stablecoins could significantly impact financial stability conditions, especially if cross-border flows are adversely impacted. Country-specific results based on Structural VAR models for three Caribbean territories suggest that stability effects can vary widely, implying that the resultant monetary and financial conditions are primarily determined by idiosyncratic risk.

JEL Classification Numbers: C32; E42; G15; O33

Keywords: Pedroni PSVAR; stablecoins; monetary policy; financial stability

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1. Introduction

Digital currencies are a transformative force in traditional financial markets. These types of currencies can be loosely defined as a medium of exchange that is generated, stored and transferred electronically. Though there has been an upsurge in interest, since its inception, private digital currencies have been plagued by bouts of extreme price volatility. Thus, at that time, investors and regulators viewed these types of 'assets'[1] as primarily speculative investments. Some advocated for the broad acceptance of these digital payments based on the underlying technological benefits (Berentsen and Schär 2019, CB Insights 2020). Nonetheless, global regulators have cautioned that the wide-scale adoption of private digital currencies could impede price and financial stability objectives (G7 Working Group on Stablecoins 2019).

Now, stablecoins have emerged as a newer form of digital currency which attempts to address price stability issues experienced by its predecessors, such as Bitcoin. It has also spawned a new cycle of research on the possible macro-financial implications should it gain traction. The COVID-19 pandemic provides further impetus to study this phenomenon as payments rapidly migrate to electronic platforms. Compared to other private digital currencies, stablecoins are backed by price stability mechanisms. Currently, there are four main types of stablecoins: fiat-collateralised, asset-collateralised, crypto-collateralised and algorithmic. Collateralised stablecoins are predominantly used by cryptocurrency traders as a 'cash' position which facilitates investment allocation without extreme volatility. However, algorithmic-based (non-collateralised) stablecoins which rely on demand and supply to stabilise the coin value have not had as much success as other types. This is likely since it may not maintain a stable value in the medium to long term.

Regulators and academics are mainly concerned with the risks this innovation could create if there is broad utilisation and increased integration with existing financial infrastructure.[2] Additionally, stablecoins which are close substitutes for mainstream currency and have multi-jurisdictional influence ('global stablecoins') can have systemic implications for international payment systems and financial markets. Potential effects include weaker monetary policy transmission, higher capital flow volatility and increased financial pressures on banking intermediaries. Thus, currency-backed and commodity-backed stablecoins are particularly concerning since these are more likely to be accepted by the public. As a result, these could compete with domestic currencies and create greater avenues for cross-border financial flows. International regulators and standard setters have recognised the urgent need for a proactive supervisory approach[3].

[1] Crypto assets are digital assets which involves the use of cryptography to record transactions and whose users are not identifiable (Bullmann, Klemm and Pinna 2019).

[2] Adrian and Mancini-Griffoli (2019), Financial Stability Board (2019) and G7 Working Group on Stablecoins (2019).

[3] Recognising the dynamic nature of stablecoin and the global payments landscape in June 2019, the G20 mandated the FSB to investigate regulatory issues surrounding stablecoins, taking into account emerging and developing economies (Financial Stability Board 2020). In October 2019, the G7 Working

Unfortunately, policy guidance on stablecoin interactions has been largely based on conjecture, with limited practical scenarios due to the technology's novelty. Nevertheless, this research could provide further insight into the implications of stablecoins. Hence, in order to evaluate how stablecoin features may interact with traditional financial market infrastructures, the paper first discusses the digital currency landscape. An empirical model is then applied to assess the potential size and nature of a shock which a private digital currency could pose to monetary and financial stability, with specific reference to Caribbean economies. The findings are expected to improve regulators' understanding of existing and latent policy interactions so adequate measures can be developed to strengthen economic and financial resilience.

The paper is organised as follows; Section 2 reviews the literature on stablecoins as it relates to monetary policy and financial stability. Section 3 discusses the link between stablecoins and traditional money. Stylised facts on stablecoin markets and global monetary and financial policy frameworks are presented in Section 4. Section 5 introduces the model design, which examines the effect of policy shocks on a monetary authority's objectives. Model results are identified and discussed in Section 6, then Section 7 provides conclusions and policy recommendations.

2. Literature Review

Stablecoins have been present in the cryptocurrency market as early as 2014. Facebook changed the landscape with the announcement of plans to produce a global stablecoin called Libra[4]. This led to an upsurge in interest four years after the creation of stablecoins. Driving the discussions were concerns that a global, hegemonic, private currency could overshadow domestic payment and financial systems, particularly in emerging markets. In order to leverage on the technology, corporate research has largely reflected attempts to improve public awareness of these cryptocurrencies and their capabilities. International regulatory agencies and central banks, on the other hand, have sought to examine the potential risks and benefits of the underpinning technology.

2.1. The Global Perspective

As it stands, stablecoins may promote financial inclusion by targeting the unbanked population and addressing challenges, which restrict the usage of transaction accounts. Additionally, studies suggest that stablecoins have the potential to encourage cross-border payments due to lower costs, global reach and faster processing speed (G7 Working Group on Stablecoins 2019). Despite these immediate advantages, regulators have highlighted several issues stemming from stablecoins.

International regulatory agencies suggest that the widespread use of stablecoins has the potential to become a global systemic threat. Like other forms of private digital currencies, stablecoins are still vulnerable to scalability issues, lack of transparency

Group on Stablecoins on stablecoins recommended that no global stablecoin projects should commence without comprehensive examination of the associated benefits and risks.

[4] The stabilisation mechanism for the Libra, to date, has not been publicly defined. According to the Libra white paper, the stablecoin is expected to offer a single-currency and multi-currency coin that is based on several 'strong' fiat currencies, which attempts to support global, cross border exchange (Libra Association Members 2020).

and interoperability.[5] Additionally, as these types of currencies have less regulatory oversight, they are also more susceptible to inadequate collateralisation, impeding trust in their intrinsic value and risk eroding confidence in the stablecoin ecosystem.[6] According to the Financial Stability Board (FSB) (2019), all stablecoins are vulnerable to regulatory issues regarding governance, cybersecurity, money laundering and the reliability of the underlying payment platforms, regardless of market size. These issues must be addressed before stablecoins can become a mainstream substitute for government-issued currency.

For supervisors, the primary concern has been the impact stablecoins may have on domestic systems (that is, the payment, monetary and financial systems). These concerns include: the impact of unforeseen fluctuations in the money supply, weaker transmission channels of monetary policy as deposits and digital currency become more fungible, and exchange rate pressures if there is a relaxation of capital controls. Particularly for exchanges rates, fiat-backed stablecoins have been touted as the preferred option since there is a claim of improved price stability. However, other research has contradicted this and found that the price stability mechanism associated with stablecoins can be compromised over time if a "crawling[7] or re-adjusted peg" mechanism is applied.

Several regulatory agencies and supervisors' initial conclusions also suggest that stablecoins do not pose a significant threat to monetary policy operations. However, the possibility of a stablecoin anchored by reserve currencies with such a broad client base upended this perspective. As more details emerged, it became clear that the proliferation of a stablecoin on a global scale, backed by hard currency reserves, would have implications for monetary policy and financial stability frameworks. According to the G7 Working Group on Stablecoins (2019) and the European Parliament (2019), if a domestically-issued stablecoin is pegged to several currencies rather than the domestic country's fiat currency, the interest rate channel of the monetary transmission mechanism can potentially be weakened.[8] Additionally, for less developed countries with weak financial systems and unstable exchange rates, the monetary transmission mechanism can be permanently impaired by delayed intervention in dealing with an upsurge in stablecoin holdings. Thus, as stablecoins allow for greater cross-border capital movement, monetary controls placed to contain capital flight (narrowing the differential between the domestic and foreign interest rates) may be ineffective as well. Further, the loss of the sovereign's monetary independence is also a concern in the event stablecoins become fungible with currencies (G7 Working Group on Stablecoins 2019, European Parliament 2019).[9]

[5] The G7 (2019) defines scalability as the extent to which stablecoin technology can quickly expand to process a large increase in the volume of transactions, while interoperability refers to how well the currency can be integrated with the existing payment systems.

[6] Evidence of this is observed in a 2019 disclosure by Tether Limited to the Supreme Court of State of New York. Tether indicated that the composition of the coin's collateral backing was cash and short-term securities equal to 74 per cent of the outstanding coins. This contradicted earlier claims that the stablecoin was 100 per cent pegged to the US dollar. Kharif, Olga. "Tether says stablecoin is only backed 74 per cent by cash, securities". *Bloomberg*, April 30, 2019. https://www.bloomberg.com/news/articles/2019-04-30/tether-says-stablecoin-is-only-backed-74-by-cash-securities

[7] Crawling pegs refers to altering currency in small amounts at a fixed rate or based on inflation differentials (Habermeier and Kokenyne 2009).

[8] Investment decisions depend on the rate of return on the average interest rate of the basket of stablecoin currencies, which may not move in tandem with the rate of return in the domestic currency, thus creating financial frictions. Furthermore, stablecoins which are pegged to multiple currencies could also lead to difficulties in implementing an autonomous monetary policy.

[9] This was realised in Venezuela with the Petro (oil-backed stablecoin issued by the state) which was used as a means to gain monetary sovereignty due to economic sanctions levied by the US and the subsequent spiralling of inflation (European Parliament 2019, Samman and Masanto 2019).

2.2. Theories of Money

Monetary policy addresses price stability objectives and financial stability policies seek to mitigate systemic risk. Nevertheless, the two policies interact and impact macro-financial variables through common channels (**Table 1**). To anchor the paper's analysis, this section reviews theories which can influence traditional stabilisation channels for monetary policy and financial stability. These include, the Monetarist view (mainly through Friedman), some facets of Keynes' views on the store of wealth function of money followed by Brunnermeier and Sannikov's definitions for their I-Theory of Money.

Table 1: Main Policy Transmission Channels

Impact on:	TRANSMISSION CHANNELS:							
	Interest Rate Channel	Money Channel	Exchange Rate Channel	Wealth Channel	Balance Sheet and Profitability Channel	Bank Funding and Lending Channel	Bank Capital Channel	Risk Taking and Expect-ations Channel
Monetary Policy	X	X	X	X	X	X	X	X
Financial Stability	X			X	X	X	X	X

Source: Adapted from Beyer, et. al ((2017)).

Notes: Main transmission variables: interest rate channel (money market rates, bank funding costs and saving and borrowing costs), money channel (money supply which includes the liquidity conditions in the economy which may affect spending), exchange rate channel (prices of imports and competitiveness), wealth channel (asset prices), balance sheet and profitability channel (private sector balance sheets, net worth and collateral value), bank funding and lending channel (bank lending supply and demand), bank capital channel (bank capital and profitability) and the expectation channel (search for yield, lending behaviour and private sector long-term expectations). X highlights which channels have a direct impact on the respective policy.

The economic ideologies of Irving Fisher, John Keynes and Milton Friedman differ based on the origins of changes in price levels and any corresponding effects. All else equal, Fisher's theory suggests that credit is a price-making factor and money is held for transactional purposes only, implying that interest rates have no 'real effect' on money demand. Fisher also believed that the price level is directly proportional to the quantity of money (legal tender) in the economy. Keynes, who departed from this classical view, explained that money is not only held for transactional purposes but for precautionary and speculative (store of wealth) purposes as well. Thus, money demand is affected by interest rates. Following the work of Fisher and Keynes, Friedman's revision of Fisher's quantity theory of money emerged. Like Keynes, Friedman also viewed the demand for money as more than just a medium of exchange for transactional purposes. Friedman postulated that money demand is affected by the same factors as demand for any other asset, whereby money is an asset or capital good and forms part of a theory of wealth.[10] For Friedman, interest rates are assumed to have less of an effect on money demand than the Keynesian view.

Under the assumption that stablecoins (newly added private money)[11] will alter the structure of the stock of money in the system, without direct policy intervention, real-world changes to the quantity of money may, now, reflect changes in fiat and stablecoins. Given that Fisher considered only the transactional aspect of money (fiat), the addition of stablecoins would skew generalisations

[10] Friedman argues that money can be regarded as one of five broad ways of holding wealth—money bonds, bonds, equities, physical goods and human wealth.

[11] Private money facilitates transactions among a network of users versus central bank money (cash and deposits held at a central bank) which represents a reliable and widely accepted settlement asset and bank money (deposits) which also facilitates transactions, but its value is established and preserved by a central bank.

made when using Fisher's 'equation of exchange' for the economy. However, Keynes' and Friedman's ideologies permit an assessment of the implications of stablecoins on price levels and output.

Brunnermeier and Sannikov (2016), extended traditional monetary theories to address the role of financial intermediaries in money creation and risk distribution. The I-Theory of Money connects monetary policy to financial stability by studying core stakeholders in the monetary (financial) system, which include financial institutions and depositors. Stablecoins are still at a nascent stage, and there are multiple ways in which they can affect monetary and financial stability policy. The next section ties these theories to an empirical model and examines the means by which stablecoins may interact with conventional transmission dynamics.

2.3. Empirical Models

Currently, the empirical research on stablecoins is notably meagre when evaluating the impact of stablecoins and cryptocurrency-fuelled shocks on policy. Instead, the stablecoin literature predominantly examines the validity of price stability claims or its impact on portfolio risk. Hence, using a survey of international methods of evaluating financial markets and policies it was revealed that regression and vector autoregression (VAR) models are popular methods (Bwire, Zeman and kecskés 2018). The authors also highlighted that variable selection in these papers is an iterative process that depends on different transmission assumptions and regimes. As a result, Dynamic Stochastic General Equilibrium (DSGE) and Panel Structural Vector Autoregression (PSVAR) models offered by Asimakopoulos, Lorusso and Ravazzolo (2019) and Pedroni (2013), respectively, offer approaches that could examine the substitution of traditional money with stablecoins.

In Asimakopoulos, Lorusso and Ravazzolo (2019), a Dynamic Stochastic General Equilibrium (DSGE) model was used to evaluate the impact of households' cryptocurrency holdings as a substitute for traditional money. Results indicated that cryptocurrency productivity shocks could adversely impact output, particularly if the traditional money supply is expanding as well. However, DSGE models have been criticised as being data and computationally intensive and that the 'steady-state' requirement could limit its application in some countries.

On the other hand, the panel structural vector autoregression (PSVAR) in Pedroni (2013) distinguishes between common and idiosyncratic elements of a global shock using cross-sectional aggregates of country-specific variables. Thus, the common shocks can be used to represent the unobserved structural shock from potentially disruptive technologies like stablecoins. The Pedroni PSVAR found that a common shock indicator was able to better estimate the shocks on aggregate demand when compared to earlier SVAR models. This distinguishing feature of the PSVAR has allowed researchers to identify which shocks will be consistent across countries while accommodating the observation of distinct outcomes as well. Thus, Pedroni's PSVAR model appears better suited to estimating monetary and financial system responses to a global stablecoin, especially for countries with diverse frameworks.

Although still in the early stages, the Caribbean region has been pioneering blockchain applications in the areas of government payments, securities trading and insurance. These projects and published research have focused on using the technology to resolve country-specific issues such as improving financial development or circumventing correspondent banking withdrawals.

But the presence of such enabling infrastructure in the region creates conducive conditions for the adoption of stablecoins. As such, this paper may be the first to examine the empirical impact of digital currencies, specifically stablecoins, on monetary and financial policy.

3. The Money Landscape

Digital currency has the potential to alter the traditional structure of the financial system and, consequently, the role and effectiveness of macro-financial policy. The core functions performed by the financial system include: - the clearance and settlement of payments; the pooling and sub-division of financial funds (among the system's participants); the transference of economic resources (through time, across borders, and among stakeholders); the management of risk and the provision of price information.[12] Other broad functions include capital formation, government financing and economic development. Money plays an essential role in enabling these functions to be executed. Thus, the regulatory oversight of these functions is important to safeguard monetary and financial stability.

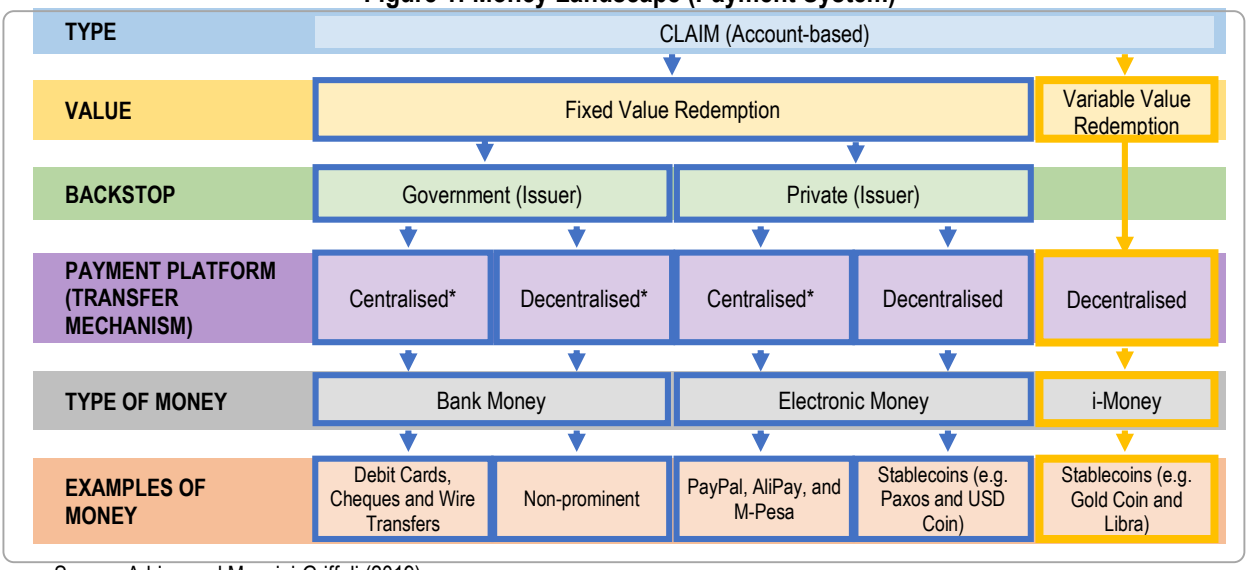
The financial structure of a country consists of the intermediaries and markets that control and/or mobilise monetary instruments, which enable the financial system to achieve its core functions. Traditionally fiat-based money is used in the system as a medium of exchange, a store of value, a standard of deferred payment and a unit of account, but now crypto-based currency has emerged.[13] These new, mostly private cryptocurrencies offer a medium of exchange but are not yet a widely accepted means of payment, nor do they yet rival traditional payment systems. Purchasing power can be easily compromised over time, making this type of money a low substitute as a store of value. However, unlike its predecessors, stablecoins can better manage price volatility, making it a better candidate for a fiat money alternative.

In the payments landscape, money can be considered from two perspectives, as a claim or object. In the claim (account)-based payment systems, payments occur when numerical entries are made in a ledger. In an object-based payment system (such as cash), payments occur when physical tokens pass directly between users of the system, where physical possession is treated as evidence of ownership (Blandin, et al. 2019). Following the work of the International Monetary Fund (IMF), the G7 and the Bank for International Settlements (BIS), this paper focuses on account-based payments rather than the token-based perspective, **Figure 1**.

[12] See Merton and Bodie (1995), Allen and Gale (2001), Bofinger (2018), OECD (2018), Deutsche Bundesbank (2019).

[13] Money is used as a medium of exchange (ability to trade commodities without the need for barter), a store of value (ability to retain its value over time), a standard of deferred payment (ability to specify future payments for the purchase of current commodities) and a unit of account (ability to express the value of something in a universally acceptable way or offer a common measure). The value and legal status of traditional fiat money are based on a supply/demand relationship and government regulation. Crypto money, on the other hand, is decentralised and it is operated and governed by cryptographic protocols.

Figure 1: Money Landscape (Payment System)



Source: Adrian and Mancini-Griffoli (2019).
Notes: i-money (investment money) refers to a form of electronic money that does not offer a fixed redemption value. It usually entails a claim on assets, typically a commodity such as gold or shares of a portfolio. The asterisk (*) strictly relates to fiat money payment platforms.

As it stands, the centralised payment platform is two-tiered, with the central bank serving as the banker to commercial banks.[14] Within this account-based monetary system, the central bank grants accounts to commercial banks and other (non-bank) payment service providers, so for payments are settled on the central bank's balance sheet (Carstens 2019). For the stablecoin payment structure, operational entities[15] within the system are charged with issuing, redeeming and stabilising the coin's value, transferring coins among users and interacting with users. Notably, this market infrastructure differs according to its design - determined by an underlying claim on an asset or portfolio of assets. According to the G7 (2019), this has three design structures. In the first design, the face value of the stablecoin is expressed in a commonly used unit of account, where users have a direct claim on the issuer or the underlying assets, and the provider pledges to redeem coins at par in the same currency that was used to purchase the coins. In the second design option, there is no specified face value of the stablecoin, instead the value constitutes a share of a portfolio of underlying assets. For the third design option, the coin is backed by a claim against the issuer.

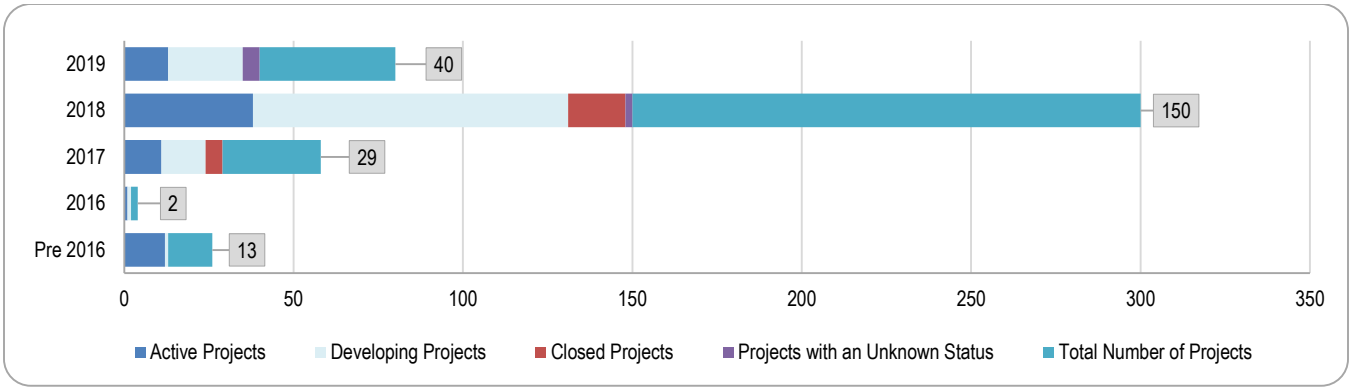
[14] The central bank supports the monetary platform by providing a unit of account for the system (fiat money); settlement finality for payments, liquidity for settlements and an overseer of payment systems (Carstens 2019).

[15] This refers to a governing body, digital currency exchanges, wallet providers and payment system operators.

4. Stylised Facts[16]

Globally, stablecoins have emerged in response to improving universal access to financial markets and cross-border payments. Since 2014 the market has grown significantly, from 9 to approximately 234 projects (**Figure 2**). Among those in the research and development phases are the Libra and the JPM Coin from JPMorgan Chase & Co.[17], the largest bank in the United States of America (US) and among the top ten largest banks worldwide. More established projects include Tether, the market's first reserve-backed stablecoin, the Paxos Standard and the Gemini Dollar – both of which were among the first to be approved and regulated by the New York State Department of Financial Services. Although some have closed due to funding limitations, regulatory bottlenecks and in some cases fraudulent behaviour[18], new stablecoins are still being launched, albeit at a slower rate.

Figure 2: Number of Stablecoin Projects (by year announced)



Source: Company websites and Cement (2020).

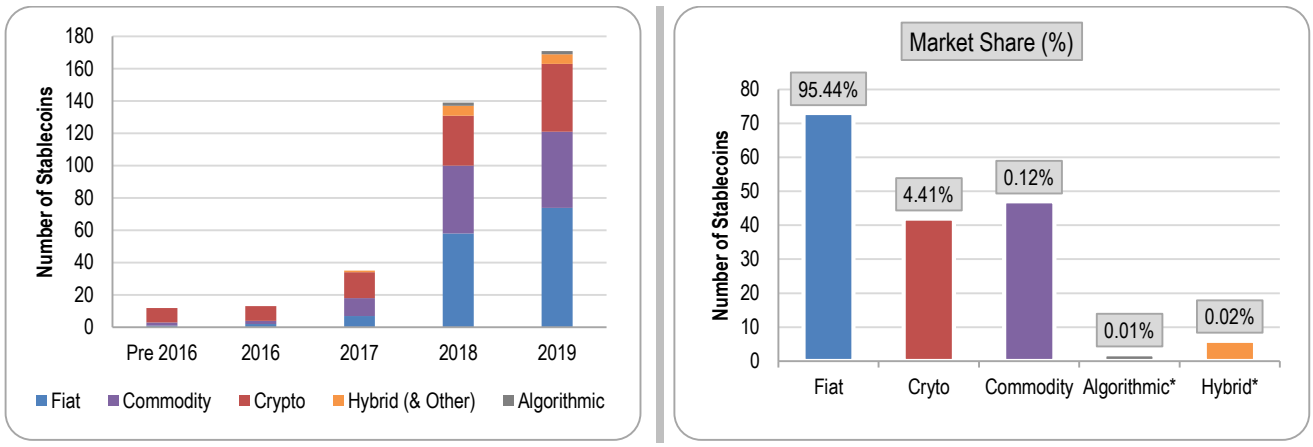
Over the years, the categories of stablecoins have expanded (**Figure 3**). Compared to pre-2016, crypto-backed, fiat-backed and commodity-backed stablecoins are now more prominent, of which fiat-backed stablecoins account for approximately over 90 per cent of market share.

[16] According to the latest available data as at December 2019.

[17] In February 2019, JPMorgan became the first US bank to launch a digital token representing a fiat currency. The JPM Coin is expected to use blockchain technology to facilitate the transfer of payments between institutional clients.

[18] One example is the closure of Cryptopia NZDT, a New Zealand-based cryptocurrency exchange, which was hacked and forced into liquidation (Huillet 2019).

Figure 3: Growth of Stablecoin Projects (by backing)



Source: Selected company and digital exchange websites.
Note: * - represents projects in development

Most of this market share is held by Tether, which is backed by a combination of cash, cash equivalents, cryptocurrency assets, and loans (see **Figure 4** and **Figure 5**). Tether tokens are pegged one-to-one with the US dollar (USD) and account for 80 per cent of all Bitcoin trading by volume. Many studies have credited a significant portion of the stablecoin market's growth to Tether.

Figure 4: Total Stablecoin Market Capitalisation, December 2015 – December 2019

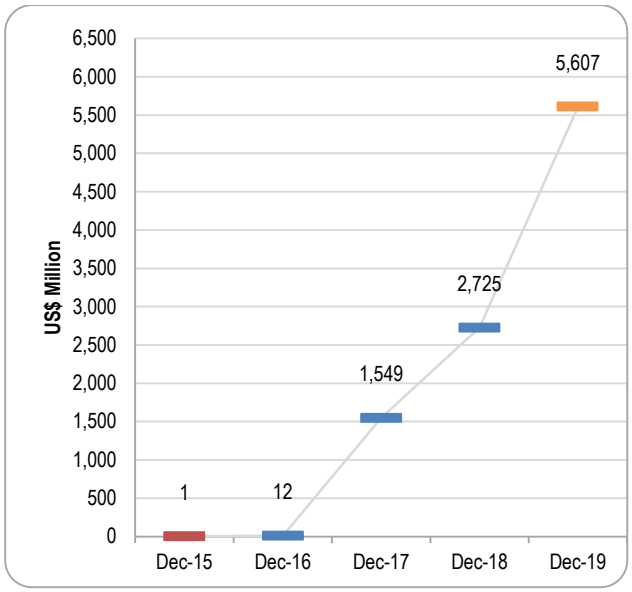
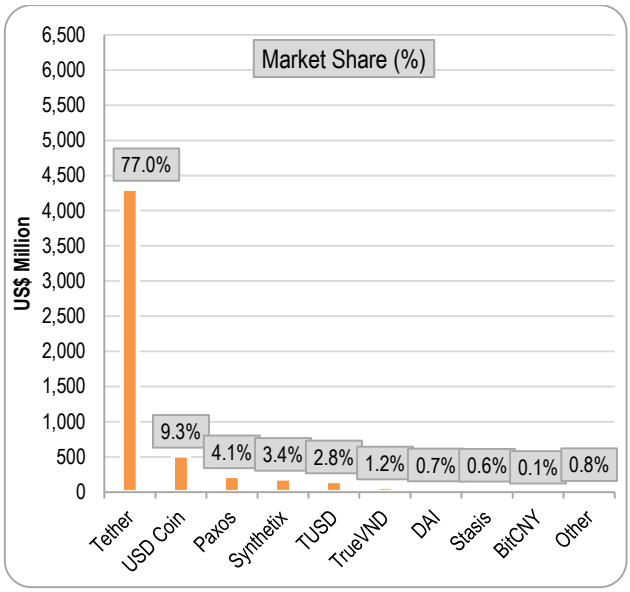


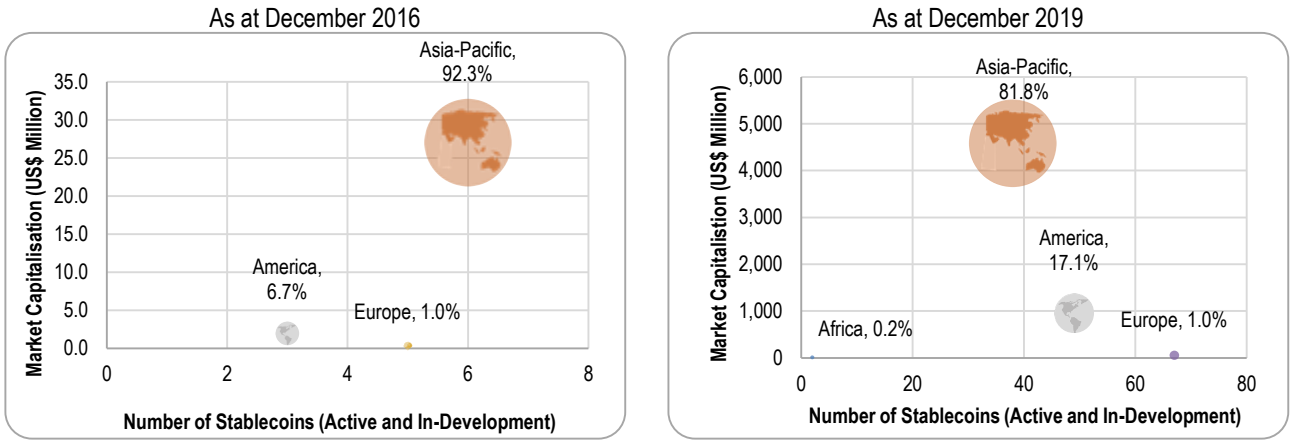
Figure 5: Stablecoin Projects Market Share, as at December 2019



Source: Selected company and digital exchange websites.

Across the globe, the Asia-Pacific region hosts the majority of stablecoin projects (the home of the most well-known stablecoin, Tether) (**Figure 6**). Additionally, growing interest in America has contributed to the market's expansion over the years.

Figure 6: Stablecoin Market Growth (by region) *



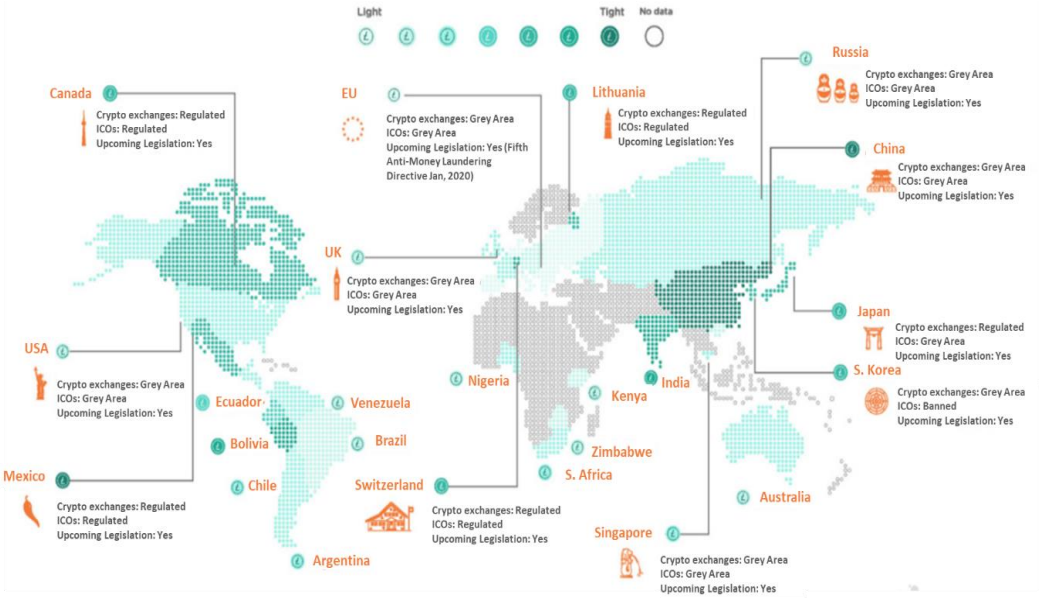
Source: Selected company and digital exchange websites.
Market capitalisation is expressed in dollar figures (left axes) and as a percentage the total market capitalisation (%). Hence size of the bubble (region) (*) represents the market share (%) of projects in that region.

Consequently, as the crypto market grows (on a global scale and scope), domestic and cross-border regulatory ramifications are emerging (**Figure 7**)**.** In the Americas region, the sentiment regarding crypto regulations varies from open ( ) – that is cryptocurrencies are widely accepted, and some countries have launched projects – to tightly closed ( ) – where some countries have banned cryptocurrencies and exchanges. While in Europe, regulation is mostly light as the region seems open to the growing presence and use of cryptocurrencies.[19] In the Asia-Pacific region, the views concerning the regulation of cryptocurrencies and exchanges are divergent. In large countries such as India and even China cryptocurrencies are not legal tender and the exchanges are illegal (with the possibility that regulations will be considered). In contrast, although cryptocurrencies are not legal tender in South Korea and Singapore, the exchanges are legal (registration required). While in Japan[20] both cryptocurrencies and exchanges are legal.

[19] Cryptocurrencies in Switzerland are legal and accepted in some contexts (in 2016, the city of Zug, known as "Crypto Valley", started accepting bitcoin as payment for city fees); and crypto exchanges are legal and regulated by Swiss Federal Tax Administration.

[20] One of the world's most progressive regulatory climate for cryptocurrencies.

Figure 7: Crypto Regulations by Country



KEY	CRITERIA 1			CRITERIA 2		CRITERIA 3	
The light ( ) -to-tight ( ) regulation scale is based on the following criteria:	Are cryptocurrency exchanges and initial coin offerings banned; regulated or operating in a grey area?			Legal Tender?		Is there any planned legislation to increase crypto regulation?	
	Ban	Regulated	Grey Area	Yes	No	Yes	No
	3 points	2 points	1 point	1 point	0 points	1 point	0 points

Source: Comply Advantage (2020).

Although regulation may vary significantly between countries (and regions), studies suggest that stablecoins, in particular, have the potential to raise specific regulatory issues concerning activities surrounding: the movement of money, investment and trading and banking (Clifford Chance & R3 2019). Moreover, given that these activities almost mirror traditional market activities defining these types of currencies remains a priority. Also important in addressing these issues are the prevailing framework(s) – the chosen exchange rate regime, monetary policy target and the type of financial system. [21]

The literature references two main classifications, bank-based and market-based financial systems when classifying financial frameworks. In bank-based financial systems, banks play a leading role "in mobilising savings, allocating capital, overseeing the investment decisions of corporate managers, and in providing risk management vehicles" (Demirguc-Kunt and Maksimovic 2002). While in market-based financial systems, the securities markets share centre stage with banks in the intermediation process. For the purposes of this paper, the taxonomy of the dominant financial frameworks was guided by a combination of size[22], performance[23] and concentration[24] indicators, **Appendix I - A**.

[21] See Appendix I - B Demirguc-Kunt and Levine (1999), Demirguc-Kunt and Maksimovic (2002), Deltuvaitė and Sineviciene (2014), International Monetary Fund (2018b) and World Bank (2020).

[22] Bank deposit -to-GDP and stock market capitalisation-to-GDP were used to estimate the size of the country's financial system.

[23] The country's bank Z-score and stock market turnover ratio were used to assess performance.

[24] Financial framework concentration was measured by bank concentration compared to the number of listed companies per 10,000 population.

5. Data and Methodology

The examination of monetary policy and financial stability effects are especially relevant since financial structures "can alter the overall strength of monetary impulses to the economy, the relative importance of the channels of transmission and the incidence of policy across sectors" (Bank for International Settlements 1995). As it stands, the appeal of stablecoins is assumed to be driven by speculative demand and transactional demand within a given country. Under the Keynesian (1937) view, the money demanded (liquidity preference) is more likely to affect the market price[25] and expectation transmission channels in the first instance, given that it is highly responsive to real and expected changes in economic variables and conditions. While for Friedman (1960), money demand primarily affects the expectation, balance sheet and profitability channels. When considering the role of financial intermediaries in monetary transmission channels, the I-Theory of Money establishes the link between the impact of stablecoins on banks' balance sheet and profitability channels.

Thus, via the Pedroni PSVAR model, these monetary theories were used to construct hypothetical scenarios to evaluate the impact of stablecoins on monetary policy regimes and financial system frameworks. Asia and the Americas have been the regions at the forefront of stablecoin technology adoption, based on market share growth in 2019. Furthermore, international regulators have also expressed concerns that stablecoins are more likely to adversely affect policy autonomy in emerging markets, especially those with weak frameworks (Adrian and Mancini-Griffoli , The Rise of Digital Money 2019). Based on this and several other factors which include countries' access to stablecoin markets, such as the USD Coin platform[26], and sufficient data coverage a sample of five EMEs of varying size and development[27], The Bahamas, Barbados, Brazil, Trinidad and Tobago and Singapore were selected. Although Tether is one of the longest standing stablecoins with the largest market share, the USD Coin is favoured by emerging market businesses for its price stability, transparency and decentralised platform.[28]

Within the sample, exchange-rate targeting regimes are the most common monetary framework in the sample, followed by inflation targeting. Bank-based financial systems also dominate the sample, except in Singapore, which is market-based. Singapore was selected as the representative country for Asia since it is a major financial technology hub for the South-East Asian region and stablecoins have already been introduced to the public[29]. In Brazil, higher demand for US currency over domestic currency has resulted in a boom in stablecoin traders making it an appropriate candidate for this stablecoin analysis[30]. Regionally, The Bahamas and Barbados have been among the Caribbean countries which are notably pioneering digital

[25] Market prices can refer to interest rates, exchange rates and asset prices.

[26] To date, traders have predominantly used stablecoins such as USD Coin as an easily convertible safe-haven asset to hedge against risks associated with holding other volatile cryptocurrencies. Coindesk. "Dollar-backed stablecoins are holding their own amid coronavirus chaos". March 18, 2020. https://www.coindesk.com/dollar-backed-stablecoins-are-holding-their-own-amid-coronavirus-chaos.

[27] There is some disparity in the classification of Singapore as a developed or developing nation. The World Trade Organisation and the United Nations both classify the country as a developing nation based on economic development and G7 membership, while other organisations such as the IMF classify it as a developed nation due to the level of financial market development.

[28] Coindesk. "Circle CEO Claims 'Explosive' Stablecoin Demand From Everyday Businesses". June 15, 2020. https://www.coindesk.com/circle-ceo-claims-explosive-stablecoin-demand-from-everyday-businesses

[29] Fintech News Singapore. "Singapore Gets First SGD-Backed Stablecoins". January 8, 2019 https://fintechnews.sg/27878/blockchain/singapore-gets-first-sgd-backed-stablecoins/.

[30] Cuen, Leigh. "Brazil's ailing economy is helping dollar-pegged stablecoins find traction." Coindesk. July 8, 2020. https://www.coindesk.com/brazil-real-usd-stablecoin-growth-usdt-dai-busd.

currency technology.[31] Moreover, de-risking of banks by international correspondent banks has also motivated the Caribbean region to contemplate alternative payment systems. This trend, coupled with high mobile phone and internet subscription rates, suggests that the three Caribbean countries selected have the potential to be some of the early adopters of stablecoins (Rhone 2009).

The sample spanned the period 1992Q1 to 2019Q4, which included 560 observations across 27 years of data. The data was obtained from the IMF's and BIS' online platforms to ensure consistent coverage and definitions. Any further gaps were supplemented by statistical data from central bank websites. In the model, the policy rate is used to proxy the monetary policy response. Although several monetary instruments can capture monetary policy objectives, the policy rate is the most dominant measure[32] across jurisdictions. The money supply was estimated by the Monetary Base to Broad Money ratio[33]. This proxy was based on the assumption that stablecoins are now a viable medium of exchange and thus a fiat currency substitute, which can have knock-on effects for monetary policy transmission. The interest rate differential was estimated by the spread between the country's three-month treasury rates and the US' three-month treasury bill rate[34]. IMF International Financial Statistics provided the time series data for commercial bank time, savings and foreign currency deposits with central banking statistical data supplementing any country data gaps. This was especially the case for The Bahamas and Barbados.

Private sector credit (PSC) was considered as the representative measure of financial imbalances. This is not an unreasonable assumption, as many researchers have linked credit boom-bust cycles to the build-up of imbalances in the financial system prior to banking crises (Fendoglu 2016). Therefore, changes in the PSC as a percentage of GDP (gross domestic product) imply that although credit growth supports economic growth, credit growth in excess of productive capacity can lead to financial sector vulnerability. Research by Ramlogan (2004) found that monetary policy is likely to affect the real sector by altering the quantity and availability of credit rather than the price of credit in less developed financial markets. This result implied that narrow credit (loanable funds supply) and exchange rate channels had a greater influence on the real sector in small, emerging economies.

According to the BIS Committee on Payments and Market Infrastructures (2015), stablecoins must be widely used and accepted to have any substantial impact on the financial system. Therefore, if there is a rapid surge in the use of stablecoins for transactions and investment, it can be a source of structural shocks. For this paper, stablecoins represent a possible exogenous shock to countries arising from disruptive technology, which is external to the financial system.

The specification of the PSVAR requires the a priori definition of the transmission channel to determine the structural shocks. Three specifications of the model were derived based on the respective theories of monetary transmission identified in the

[31] Several other Caribbean countries, such as the Eastern Caribbean Central Bank and Bermuda, have also explored digital currencies but were not included in the sample due to limited data.

[32] Although the countries had different monetary policy targets, data availability for the official monetary policy variable was available for all five countries at the longest period in contrast to any other monetary policy proxies.

[33] The monetary base is defined as currency in circulation and deposit holdings at the central bank (International Monetary Fund 2016). Broad money is the sum of all financial instruments held by money-holding sectors that are: (1) medium of exchange widely used in an economy, or (2) close substitutes for the medium of exchange that are a reliable store of value. It can be interpreted as the monetary base plus commercial bank deposits. This ratio assumes that digital currency is causing money in circulation (which in this sense comprises digital and fiat currency) to expand at a faster rate than traditional forms of monetary instruments.

[34] Singapore's one-year treasury rate was substituted for the country's risk-free rate since the Monetary Authority of Singapore has retired the use of the three-month and six-month bills over the period of review.

Literature Review. The Monetarist theory was investigated using the Monetary Base to Broad Money ratio. The Keynesian transmission channel was examined using the interest rate differential, and the I-Theory of Money used changes in savings instruments (deposits) as a proxy. This approach is consistent with the G7 Working Group on Stablecoins (2019), which suggests that stablecoin effects will vary depending on the application as either a medium of exchange, unit of account or store of value.

The PSVAR then estimated the sequence of mean responses to the respective shocks and plots this over time, depicting the median of the common responses to each of the shocks[35]. The respective quantiles associated with each period of the impulse responses can be reported as confidence intervals for the mean response relative to the cross-member sample distribution. However, due to the heterogeneity of the panel, these confidence intervals should be interpreted as statements about the confidence of where the median lies with respect to the estimated cross-sectional distribution of member responses. Although SVAR models are often criticised for low dimensionality and subjective identifying restrictions, the application of the monetary and financial transmission channels theory is assumed to impose the theoretical structure required to make the analysis robust.

6. Results and Discussion

Table 2 summarises the expected transmission of the effects from a global stablecoin, as well as the optimal lag length and adequacy checks for the three PSVAR scenarios. The Monetarist theory asserts that once the stablecoin results in an expansion in the money supply, higher inflation can tighten the monetary policy stance, reducing credit availability. The Keynesian and I-Theory of Money also examine the response of policy and credit. However, Keynes' approach assumes that higher stablecoin demand is likely to influence interest rate differentials through greater demand for US reserve assets, especially in developing economies with weak currencies. Policymakers are likely to tighten rates to address higher portfolio outflows. The I-Theory of Money outlines the potential impact of stablecoins through their interaction with traditional bank deposits and financial intermediaries. As the stock of inside money increases through the growth of bank-issued stablecoins or the use of bank deposits for stablecoin reserves, this can result in increased inflation expectations and credit booms. These transmission channels were then incorporated into the specifications of the PSVAR. Prior to estimation, stationarity and cointegration results indicated that the models appeared stable and the impulse response functions (IRFs) produced were statistically valid[36].

[35] Representation of the PSVAR's model dynamics, structural shock and estimation is detailed in a Technical Summary in Appendix II.

[36] A more detailed interpretation and results for the respective lag truncation, stationarity and cointegration tests are located in Appendix II - A.

Table 2: PSVAR Transmission Channels and Model Specification Tests.

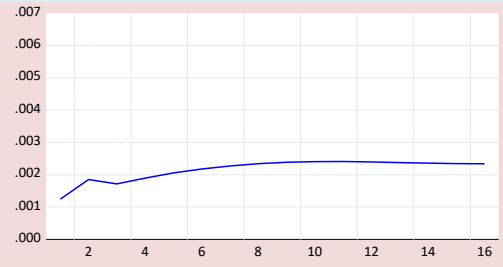
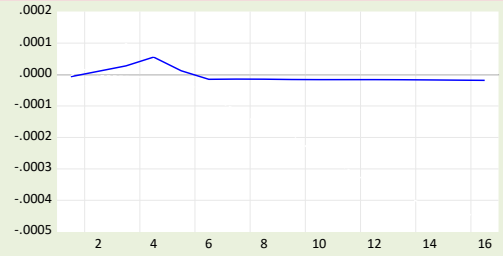
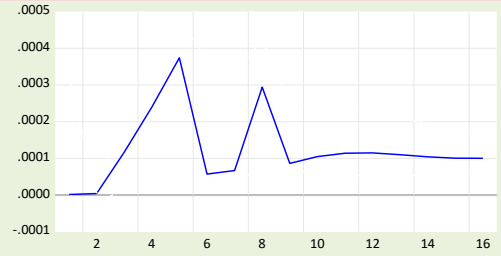
	Monetarist Money Supply	Keynesian Interest Rate Differential	I-Theory of Money Deposits
Shock transmission channel*	Money Supply shock -> Inflation increases -> Change in policy rate **(Impact)** -> Effect on credit **(Impact)**	Interest rate differential-> Change in Portfolio flows -> Change in policy rate **(Impact)**-> Effect on credit **(Impact)**	Change in bank deposits -> Change in inflation expectations as broad money increases -> Change in policy rate **(Impact)** -> Effect on credit **(Impact)** ->
Optimal Lag length – Identified by Hannan-Quin (HQ) criteria	3	2	5
Cointegration results	The null of no cointegration cannot be rejected at a 5 per cent level	The null of no cointegration is rejected at a 5 per cent level for 6 of the tests and conclude that this specification has common within-dimension autoregressive (AR) coefficients.**	The null of no cointegration cannot be rejected at a 5 per cent level
Stationarity	No root lies outside the unit circle. VAR satisfies the stability condition.	No root lies outside the unit circle. VAR satisfies the stability condition.	No root lies outside the unit circle. VAR satisfies the stability condition.

Source: Authors' estimates.
Note: * The transmission channel traces the theoretical impact of the shock according to each theory.
** Large negative values cause rejection of null (Pedroni 2004). The Kao residual cointegration test was used to corroborate the results and it was concluded there was no integration at a 5 per cent level (Churchill and Ivanovski 2020).

The resultant common shock IRFs were summarised in **Table 3**. The findings can be interpreted as the median response of monetary policy or financial stability, common across countries, to a one standard deviation shock[37] in the expected transmission channel variable, all other things constant.

[37] Although stablecoins can have distortionary effects, for the purposes of the paper a one standard deviation shock is assumed to represent a structural change to monetary and financial conditions. There is insufficient evidence at this time to suggest that widespread stablecoin use would result in a financial crisis, which would warrant the application of a greater magnitude shock.

Table 3: PSVAR Common shock Impulse Response Functions

Scenario	Impact on the Policy Rate	Impact on Credit
Monetarist Money Supply		
Keynesian Interest Rate Differential		
I-Theory of Money Deposits		

Source: Authors' estimates.

In the case of the Monetarist theory, the findings show that if stablecoins result in a one standard deviation shock to the money supply, the policy rate is expected to increase marginally three quarters later and settle at a higher rate. For credit, the response was an immediate, albeit a minor decrease, in response and a slight improvement which peaks approximately a year after. This is consistent with expectations, given that, in theory if the banks' money multiplier is reduced it would eventually lower PSC-to-GDP. Although caution must be taken not to interpret this as a decline in overall credit, it could indicate the migration of funds to unregulated credit channels, which could be a potential source of instability if risk-taking and debt increases.

The Keynesian scenarios used the interest rate differential to consider the impact of shocks to the relative return on financial flows. Supervisors worry that stablecoins can circumvent scrutiny on capital outflows since the currency is beyond the scope of host country regulatory oversight. If stablecoins result in the increased demand for US short-term instruments, then it is likely that the interest rate differentials will widen. Results indicated that the median policy rate is anticipated to increase slightly in response and remain consistently tighter in the later periods. Conversely, median PSC-to-GDP immediately decreased in response to a stablecoin shock and then returned to pre-shock conditions approximately three quarters after. However, this was soon followed by a contraction in PSC-to-GDP, which moderated two years after the initial shock. Credit recovered after two and a half years but never regained its initial level. These results are also consistent with Keynes' theory of money demand. Following Keynes, if higher interest rate differentials result in more cross-border flows, then it is likely that monetary policy will be required to tighten, reducing the demand for bank credit.

The last scenario examined the role of financial intermediaries in monetary policy and financial stability. In a scenario where stablecoin accounts earn interest and compete with traditional savings instruments, the monetary transmission can be adversely impacted as these instruments will be less responsive to policy changes. As data on Other Financial Corporations[38] is sparse for all countries in the sample, this was modelled as, a one standard deviation shock to commercial banks deposits. Results indicated that this would result in a negligible policy rate increase in a year. In later periods, the median policy rate is expected to end up at the same or slightly more accommodative rate than previously. Compared to the other two methods, PSC-to-GDP increased over time with the financial system formalising stablecoin accounts as deposits. Notably, there were large swings in PSC-to-GDP in the medium-term and the presence of stablecoins appeared to magnify the boom-bust cycle, which suggests greater risks to financial stability. Overall, stablecoin interactions with interest rate differentials were comparatively more substantial, but its potential interaction with bank deposits will have significant ramifications for financial stability. This presents a compelling case that if stablecoins become a substitute for bank money, their holdings should be unremunerated.

Empirical results indicated that stablecoins do have the potential to affect a country's monetary policy implementation through its impact on the money supply, bank deposits and cross-border financial flows. However, the extent of this impact is conditional on several factors, including, but not limited, to the effectiveness of the respective monetary transmission channels, the level and scope of financial sector development and the nature of the domestic exchange rate regimes. Although the sample consisted of EMEs, the variety of monetary policy frameworks is likely to have resulted in diverse responses of monetary policy to a common shock. Additionally, it is notable that almost all of the countries had exchange rate constraints and a bank-centric financial infrastructure. This offers preliminary evidence to support regulatory concerns that stablecoins can further restrict policy autonomy in emerging markets, particularly regarding capital flows.

6.1. Country-specific SVAR Impulse Response Functions

PSVAR models have allowed researchers to examine the global impact of structural shocks, as well as overcome challenges associated with small datasets. However, for policymakers, country-specific outcomes from structural shocks are, at times, more relevant. In such an instance, country-specific outcomes can be analysed with a standard SVAR and the associated restrictions. With this in mind, for this paper, the three Caribbean countries were extracted from the PSVAR group to compare the country-specific response to a potential digital currency shock using similar shocks.

Model diagnostics and adequacy checks were summarised in Appendix II-B. Time series length varied across the selected countries and variables, ranging from a minimum of 71 observations per time series to a maximum of 112. Stability tests indicated that the inverse roots of the characteristic AR polynomial were all of modulus less than one, indicating that the SVAR models were stable. Lag length criteria differed across the countries selected and was based on the Hannan-Quinn Criterion (HQC) [39]. The HQC method indicated that all the Trinidad and Tobago SVAR scenarios had a lag length of 1. For Barbados, the money

[38] According to the IMF's 2017 Monetary and Financial Statistics Manual and Compilation Guide, Other Financial Corporations include the following subsectors: non-money market investment funds, other financial intermediaries except insurance corporations and pension funds (ICPFs), financial auxiliaries, captive financial institutions and money lenders, insurance corporations, and pension funds.

[39] The HQ method minimised the mean square error of impulse response estimates in samples of quarterly data (Ventzislav and Kilian 2005).

supply shock scenario required a lag length of 3, while the interest rate differential and deposit models required 5 lag lengths. In the case of The Bahamas, optimal lag lengths for the money supply and interest rate differential models were 1, and 2 for the deposit scenario. Out of the six SVAR models, cointegration tests indicated that two of the SVARs rejected the null of no cointegrating equations at a 5 per cent significance level. The presence of cointegration required long-run restrictions on the model, which could be estimated by restrictions on the F matrix[40]. The other four SVARs were estimated using the standard recursive restrictions on the A-B model, and all of the models were just-identified.

Appendix II - C shows the unaccumulated IRFs for the country SVARs compared to the idiosyncratic shocks for the PSVAR. Similar to Pedroni (2013), the IRFs have been derived using the Cholesky orthogonalisation to create the causal structure for the shocks. It should be noted that the results from the PSVAR will not always correspond perfectly with the country estimates due to varying responses on members' monetary policy and credit conditions, as well as data availability.

In response to a money supply shock, the median idiosyncratic monetary policy IRF was initially negative for one lagged period after the shock, but the policy rate response increased thereafter and resulted in a persistently higher policy. Caribbean monetary policy rates, on the other hand, had an opposite response to the money supply shock. However, this can be explained by the limited monetary independence of fixed regimes and the nature of the money supply indicator used. If the monetary base increases at a faster rate than the broad money supply due to a rise in stablecoins held for transactional purposes, then the central bank may interpret this as a reduction in the money multiplier and support banks by decreasing the policy rate[41]. The response of credit to a money supply shock is consistent for all countries, in that a shock to the money supply results in an increase in credit as a result of the changing composition of household wealth and lower policy rates.

The median idiosyncratic monetary policy IRF in response to an interest rate differential shock indicated that generally countries would tighten monetary policy rates to limit capital outflows. However, Trinidad and Tobago had a negligible response to a one standard deviation shock in the interest rate differential, while The Bahamas' and Barbados' policy rates are expected to decline, with the latter experiencing a greater decline. This can be attributed to policymaker's efforts to mitigate exchange rate imbalances in pegged regimes. The median idiosyncratic credit IRFs in response to an interest differential experiences a severe decline as the increased use of stablecoins as saving products will compete with banks and challenge their role as credit intermediaries. Trinidad and Tobago's PSC-to-GDP IRF behaved in a similar manner in response to the shock. The Bahamas' PSC-to-GDP is unresponsive to a one standard deviation shock in the interest rate differential, while there is a significant increase in Barbados's PSC-to-GDP in response to an interest rate differential shock. This can be explained by the different policies the two countries use to maintain pegged exchange rates.[42] A study on the Mundell-Fleming policy trilemma[43], Devereux

[40] Pagan and Pesaran (2008) suggested permanent shocks cannot contain error correction terms in structural equations and that these terms could be used in parameter estimation where there were cointegrated equations. Results indicated that structural equations with more than one permanent shock can use error correction terms in restrictions to estimate parameters.

[41] In countries characterised by persistently low economic growth, higher broad monetary aggregates are more likely to increase inflation than growth in the monetary base (European Central Bank 2012).

[42] According to a study by Jordan, et al. (2009), Barbados has generally less capital flow restrictions than The Bahamas.

[43] Also known as the 'impossible trinity' this concept in international economics states that it is not possible to successfully maintain a fixed foreign exchange rate, no capital control and independent monetary policy all at the same time.

and Yu (2017) confirms that countries with pegged exchange rates are subject to less credit volatility if some measure of capital controls exists.

The I-Theory of Money incorporates stablecoin deposits and reveals that a one standard deviation shock to commercial bank deposits will result in a small, initial increase in the monetary policy rate which peaks six months later but eventually stabilises at a lower rate than pre-shock levels for the period. This indicates that monetary policy is not significantly responsive to changes in bank deposits. All three countries IRFs are within the expected range indicated by the idiosyncratic results. Barbados' monetary policy responds in a similar manner, while Trinidad and Tobago's and Barbados' monetary policy rates stabilise at a consistently lower rate. The idiosyncratic shock to deposits is expected to have a sustained increase in PSC-to-GDP growth which peaked a year and a half later. Although PSC-to-GDP declined thereafter, it stayed above pre-shock levels for the period under review. Barbados' PSC-to-GDP IRF responds in a similar manner to the idiosyncratic IRF. However, Trinidad and Tobago and The Bahamas IRFs reveal that that PSC growth is relatively inelastic to changes in deposits. A study by Drechsler, Savov and Schnabl (2017) offers an explanation by introducing the deposit channel[44]. The authors suggest that in bank-based financial systems with higher frictions or greater monopoly power[45] the credit channel is more sensitive to changes in deposits.

Overall, simulated policy and credit to GDP responses indicate that stablecoins can impact Caribbean economies, but the outcomes are strongly regime dependent. These findings are similar to those by Clarida and Gali (1994), which found that in macro models, responses to monetary shocks in the short-term are strongly dependent on the type of exchange rate framework. Limited monetary independence in the region has resulted in responses in some cases which are contrary to theoretical frameworks. On the other hand, the potential impact of stablecoins on financial stability is greater in countries with high private sector debt and higher price elasticity of credit.

Large scale substitution of stablecoins will directly affect authorities' control over the macro-financial system by limiting monetary independence and impeding policy transmission channels. Specifically, transmission theory suggests that if stablecoins become close substitutes for traditional fiat and savings instruments, then this can erode authorities' control over standard monetary processes. For monetary authorities', the money channel, considered as the wide credit channel within an economy, may be less controlled. This can be attributed to changes in fiat-based monetary aggregates, interest rates or the exchange rate being neutralised since stablecoins are likely to change the use of fiat and the role of banks and other credit providers. For countries where banks play an important role within the financial system, stablecoins could severely affect the pace and potency of this monetary transmission channel. From this aspect, this reduces the regulator's ability to control risky behaviour directly.[46]

In the narrow credit channel or balance sheet channel, the effect of policy changes on the cash flow and net value of end-borrowers will be dependent on interest rate sensitivity of asset allocation and income distribution. Similarly, for the wealth channel, the impact on the financial system and economy from policy changes that affect asset prices will be dependent on the

[44] The deposit channel can be considered a sub-set of the balance sheet channel identified earlier.

[45] The authors define market or monopoly power by the number of institutions and the substitutability of deposits.

[46] In the I-Theory of Money, "monetary policy softens the blow of negative shocks and helps the intermediary sector to maintain the capacity to diversify idiosyncratic risk. Thus, it reduces endogenous (self-generated) risk and overall risk premia" (Brunnermeier and Sannikov 2016).

composition of the financial portfolios of end-borrowers. Thus, for both channels, increased demand for stablecoins could change the expected impact of the monetary stance (whether expansionary or contractionary) of a country.

Interest-earning stablecoins are likely to compete with banks and other financial institutions which can lead to deposit funding fragilities and reduce profitability. This will have a direct impact on retail borrowers, their balance sheet and income positions if credit rationing occurs. Consequently, wide-scale adoption of stablecoins can have knock-on effects on the wealth channel (via fluctuations in asset prices), the funding and lending channel of credit providers and the capital channel of banks. Adverse interactions can lead to increased credit and liquidity risks to the financial system. Feedback loops can further promulgate the transmission of risks throughout the domestic financial system. Regulators are also concerned that these disturbances can extend to other countries, thus increasing contagion risk as well.

7. Conclusion and Policy Recommendations

Stablecoins can potentially distort conventional transmission mechanics and ultimately affect the roles and functions of market players such as supervisors, banks and other financial service providers. In particular, global stablecoins' ability to act as a more readily accepted medium of exchange and advanced cross-border commerce can undermine domestic policies. Presently, the full range of effects a global stablecoin can have on monetary policy and financial systems is still somewhat obscure. Nevertheless, international standard-setters and regulatory agencies continue to advocate for more integrated cross-border supervision and oversight among national supervisors.

Results of the empirical investigation have suggested that the nature of stablecoins interaction with monetary and financial frameworks will be strongly dependent on the type of monetary regime and financial system. Adverse reactions are more likely for financial conditions than monetary policy. Additionally, if stablecoin monetary functions and characteristics are in direct competition with traditional instruments, then the impact on the monetary and financial policies will be more pronounced. While there is some degree of commonality in country reactions, it is possible for stablecoin effects to diverge subject to the unique characteristics of domestic systems.

Despite growing publicity, the foregoing results have indicated that in its current form stablecoins are not a severe threat but can exploit existing financial system vulnerabilities. These findings are consistent with BIS and FSB guidance. Nevertheless, cryptocurrency technology has the ability to scale up quickly, especially with interest from global technology companies. A hegemonic stablecoin will undoubtedly have lasting implications for countries' policy autonomy and transmission channels. This is especially the case for countries which struggle with economic volatility, weak policy frameworks and inadequate digital currency regulation. Such diverse and far-reaching effects strongly warrant closer examination as the global payment landscape rapidly evolves.

Should stablecoins usage become ubiquitous, countries should be prepared for the potential impact. These include limiting potential dollarisation and burgeoning global tech company monopolies. Furthermore, policymakers should improve oversight to balance private currency innovations and, at the same time, mitigate the risks of funding illicit activities, such as tax evasion,

money laundering and terrorist financing. Supervisors should also monitor consumer protection issues since stablecoin cyber-attack, fraud or 'runs' could have wide-ranging financial stability effects.

Greater co-ordination will ensure a consistent regulatory approach across countries and thus curb the potential for arbitrage. All authorities should ensure that if stablecoins are to be integrated/permissioned, arrangements should have comprehensive risk management frameworks, transparent operations and appropriate recovery and resolution planning. These recommendations are aimed at developing a holistic and consistent supervisory framework which maintains a technology-neutral stance.

Monetary authorities can consider the use of alternative policy tools to ensure that stablecoins do not undermine long-run policy objectives. Direct regulatory measures include improving the oversight of digital currencies and requiring providers to maintain sufficient liquidity and capital. Authorities can also designate stablecoin providers as narrow banks, which require platforms to hold central bank reserves, allow supervisory oversight and authorise the use of monetary stabilisers. One disadvantage of direct regulatory measures is that it may restrict financial innovation and discourage interest. More indirect measures ensure that the rest of the financial system is cushioned against the effects of stablecoin market instability. This includes central bank liquidity support for traditional banks if stablecoin companies draw down deposits en masse. Additionally, macroprudential policies can also be implemented to protect the financial system from stablecoin contagion risk.

Caribbean macro-financial policies can have multiple competing objectives, which can make them more vulnerable to the impact of stablecoins. As a final recommendation, central banks can consider developing their own digital currency.[47] A Central Bank Digital Currency (CBDC) provides similar benefits of a regular stablecoin but has additional features such as a lender of last resort function, increased financial access for the unbanked and higher cross border trade. This seems to be the preferred approach in the Caribbean where a few CBDC projects have been commissioned and piloted, such as the Bahamian Sand Dollar project and the Eastern Caribbean DXCD project. Nonetheless, given that many Caribbean countries are small, open economies and several have offshore financial services hubs, the eventual integration of stablecoins with the Caribbean financial ecosystem seems inevitable. In closing, cryptocurrency platforms continue to evolve rapidly and scale up within a relatively short time frame. As such, authorities should remain vigilant on the matter, particularly where there are significant consequences for countries struggling with volatile currencies and weak legislation.

[47] The development of CBDCs has been suggested as a mean of countering potential currency substitution pressures posed by hegemonic private currencies. Georgieva, Kristalina. "Cross-Border Payments--A Vision for the Future" Panel discussion, IMF Virtual Conference on Cross-border Payments, October 19, 2020.

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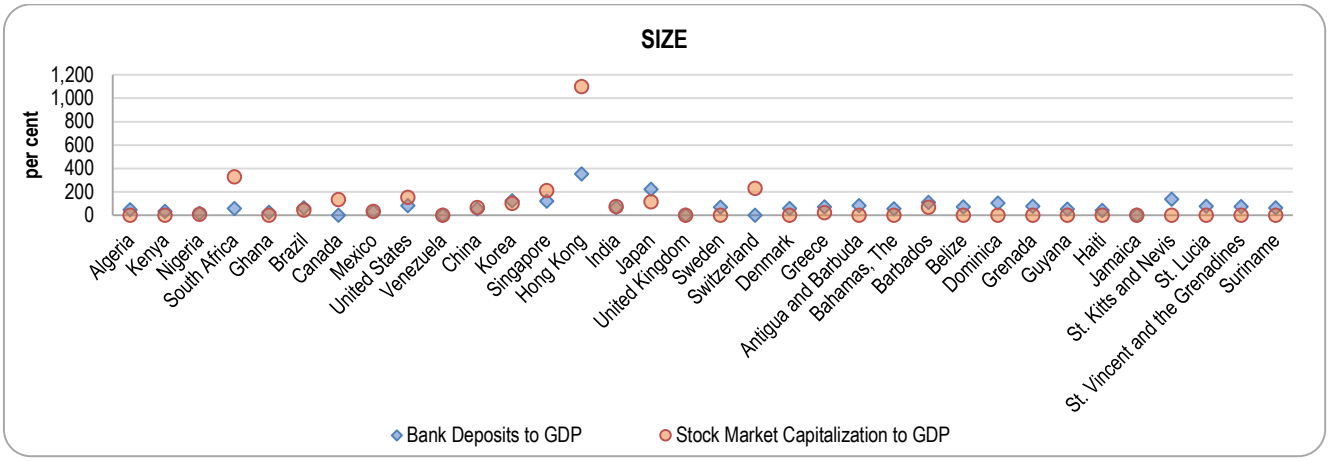
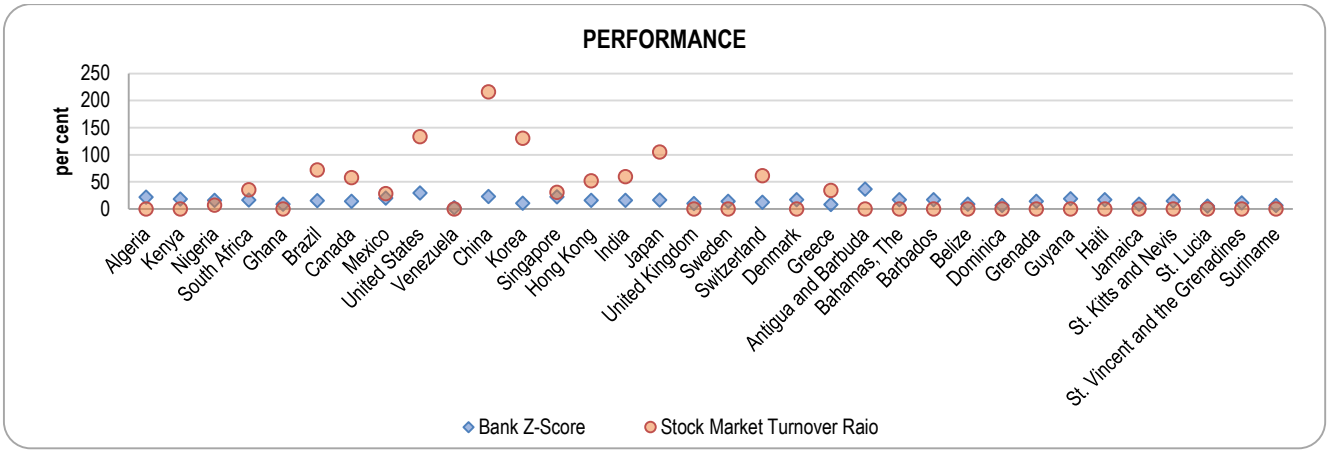
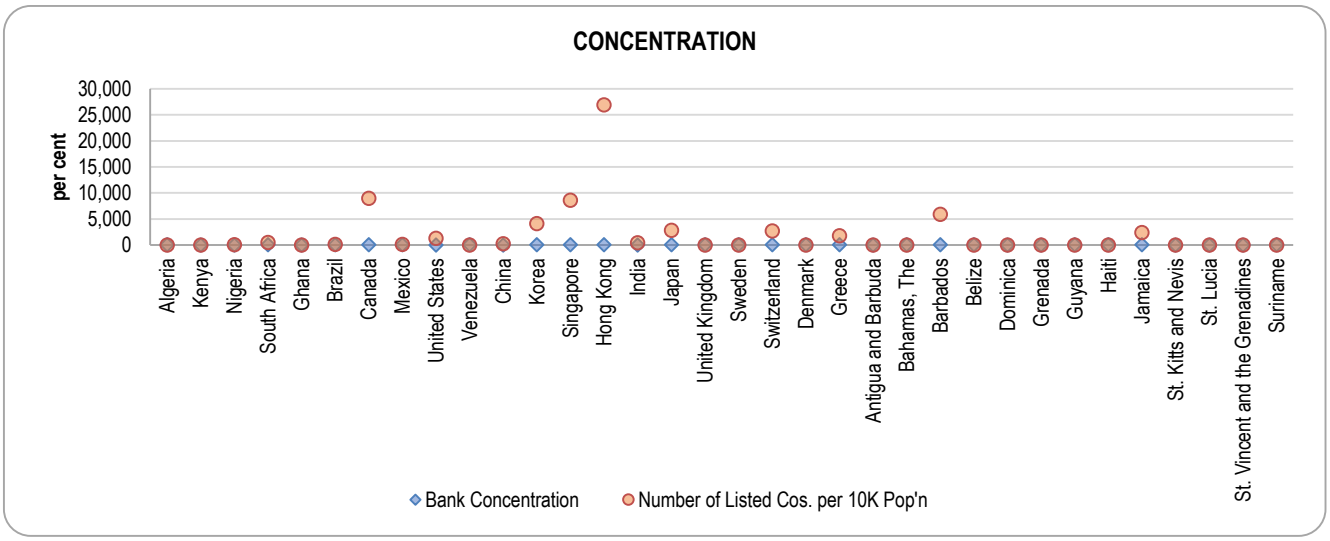
Appendix I: Classification of Monetary Frameworks and Financial Markets

A. Financial Structure Determination Factors, 2017







Source: (World Bank 2020).
* Latest available data.

B. Monetary and Financial Frameworks by Country

REGION[A]	SELECTED COUNTRIES	FRAMEWORK[B]		
		EXCHANGE RATE REGIME	MONETARY POLICY (Currency)	FINANCIAL MARKET
Americas		**Free Floating**	**Inflation Targeting and Other**	**Market-Based**
	Canada	Free Floating	Inflation Targeting	Market-Based
	United States of America	Free Floating	Other	Market-Based
	Brazil	Managed Float	Inflation Targeting	Market-Based
	Mexico	Free Floating	Inflation Targeting	Market-Based
	Venezuela	Other Managed Arrangement	Other	Bank-based
Of which CARICOM		**Conventional Peg**	**Exchange Rate Targeting (USD)**	**Bank-Based**
	Bahamas, The	Conventional Peg	Exchange Rate Targeting (USD)	Bank-Based
	Barbados	Conventional Peg	Exchange Rate Targeting (USD)	Bank-Based
	Belize	Conventional Peg	Exchange Rate Targeting (USD)	Bank-Based
	Eastern Caribbean Union	Currency Board	Exchange Rate Targeting (USD)	Bank-Based
	Guyana	Stabilised Arrangement	Exchange Rate Targeting (USD)	Bank-Based
	Haiti	Crawling Band	Other	Bank-Based
	Jamaica	Managed Float	Inflation Targeting	Market-Based
	Suriname	Stabilised Arrangement	Monetary Targeting	Bank-Based
	Trinidad and Tobago	Stabilised Arrangement	Other	Bank-Based
Europe		**Free Floating**	**Other**	**Bank-Based**
	Greece	Free Floating	Other	Bank-Based
	Denmark	Conventional Peg	Exchange Rate Targeting (Euro)	Bank-Based
	Switzerland	Managed Float	Other	Bank-Based
	Sweden	Free Floating	Inflation Targeting	Market-Based
	United Kingdom	Free Floating	Inflation Targeting	Market-Based
Asia-Pacific		**Managed Float**	**Inflation Targeting**	**Market-Based**
	China	Crawling Band	Monetary Targeting	Bank-Based
	Hong Kong	Currency Board	Exchange Rate Targeting (USD)	Market-Based
	India	Managed Float	Inflation Targeting	Bank-Based
	Korea	Managed Float	Inflation Targeting	Market-Based
	Singapore	Stabilised Arrangement	Exchange Rate Targeting (Composites)	Market-Based
Africa		**Managed Float**	**Inflation Targeting**	**Bank-Based**
	Nigeria	Stabilised Arrangement	Monetary Targeting	Bank-Based
	South Africa	Managed Float	Inflation Targeting	Bank-Based
	Ghana	Managed Float	Inflation Targeting	Market-Based
	Algeria	Other Managed Arrangement	Monetary Targeting	Bank-Based
	Kenya	Stabilised Arrangement	Other	Bank-Based

Source: Demirguc-Kunt and Levine (1999), Demirguc-Kunt and Maksimovic (2002), International Monetary Fund (2018) and World Bank (2020).

Appendix II: Technical Summary for PSVAR and Country SVAR Model Adequacy check and Results[48]

For each country i, the structural form of macro-financial dynamics can be described by:

$$y_{m,it} = A_i(L)y_{m,it-1} + \epsilon_{it} \quad (1)$$

Given that i = 1, ..., N individual countries, each of which consists of an M x 1 vector of observed endogenous variables, y_{it}, for $y_{m,it}$, m = 1, ..., M and observed over t = 1, ..., T_i time periods. The vector $y_{m,it}$ can be re-written as z_{it} = ($z_{1,it}$, ..., $z_{M,it}$)', where $z_{it} = y_{it} - \bar{y_i}$ and represent the demeaned values of the panel data, with $\bar{y}_{m,it} = T_i^{-1}\sum_{t=1}^{T_i} y_{m,it} \forall\, i, m$. The endogenous variables are z_{it} = (TV_{it}, MP_{it}, FS_{it}), where TV_t is the target variable according to the respective theory[49], MP_t is the monetary policy variable and FS_{it} is the financial stability proxy. $A_i(L)$ is a polynomial in the lag operator L and ϵ_{it} is a M x 1 vector of composite white noise shocks which are distributed independently over time but may be cross-sectionally dependent.

The PSVAR approach then outlines the structural shock representation, which decomposes the composite shock into common ($\bar{\epsilon_t}$) and idiosyncratic ($\tilde{\epsilon}_t$) elements in the form:

$$\epsilon_{it} = \Lambda_i\bar{\epsilon}_t + \tilde{\epsilon}_t \quad (2)$$

where $E\left[\xi_{it}\xi'_{it}\right] = \begin{bmatrix}\Omega_{i,\bar{\epsilon}} & 0\\ 0 & \Omega_{i,\tilde{\epsilon}}\end{bmatrix} \forall\, i, t, E[\xi_{it}] = 0\ \forall\ i, t$ given that $\xi_{it} = (\bar{\epsilon}'_t, \tilde{\epsilon}'_t)$. Also, Λ_i is an M x M diagonal matrix such that the diagonal elements are the loading coefficients for the common shock and the matrix $E[\epsilon_{it}\epsilon'_{it}] = \Omega_{i,\epsilon}$ is also a diagonal covariance matrix with arbitrarily normalisable variances subject to the adding up constraint implied by the composite shock representation. Analogous to the structural VAR literature, the structural shocks are assumed to be orthogonal to each other for each type. That is, idiosyncratic shocks are mutually orthogonal to each other and so are common shocks.

In order to represent the underlying model dynamics, short-run and long-run identifying restrictions of the model entail the stationary form of the variables and an appropriate error correction model (ECM) specification, where required. Additionally, standard panel cointegration tests which accommodate dynamic heterogeneity can be used to confirm whether or not cointegrating relationships exist among the variables. Thus, the PSVAR be estimated by typical structural autoregressive form, by representing $\Delta z_{it} = A_i(L)\epsilon_{it}$, $B_i(L)\Delta z_{it} = \epsilon_{it}$ and $\Delta\bar{z}_{it} = \bar{A}_i(L)\bar{\epsilon}_{it}$,

[48] The Eviews software was used to derive both PSVAR and country SVAR results.

[49] For the purposes of this paper, the target variable associates a change in money supply with the Monetarist theory, a change in interest rate differentials to be related to Keynesian policy and the I-Theory of Money will be addressed by deposits.

$\bar{B}_i(L)\Delta\bar{z}_{it} = \bar{\epsilon}_{it}$ as the composite and common shocks respectively. For a panel VAR with 3 variables per member, a total of 3 $\left[\frac{1}{2}(3^2 - 3)\right]$ non-redundant restrictions were required for both the common and composite responses.

The relationship between structural and reduced form representations can be summarised by Δz_{it}=$F_i(L)\mu_{\ it} = A_i(L)\epsilon_{it}$, where $\mu_{\ it}$denotes the common autoregressive reduced form VAR and $F_i(L)$ is the inverse of the $R(L) = I - \sum_{j=1}^{P} R_j L^j$. The structural reduced form VARs for each member, i, is estimated by OLS using a suitable information criteria to select the lag truncation and the common autoregressive reduced form is denoted similarly.

Once the composite structural shocks (ϵ_{it}) and the common structural shocks ($\bar{\epsilon}_{it}$) have been estimated, idiosyncratic shocks are then recovered for $\tilde{\epsilon}_{it}$, and the respective loading matrices, Λ_i, for each member of the panel. The responses to the idiosyncratic and common shocks are then represented as responses to similarly sized shocks to allow for comparability. Using these estimates, the member-specific impulse responses to the common and idiosyncratic shocks can computed. Thereafter, the mean common, composite and idiosyncratic response over time can be evaluated relative to the corresponding quantiles of the impulse responses.

A. Summary of PSVAR stability tests for Transmission theories

Stationarity and cointegration tests were conducted to ensure the stability of the PSVAR model. The Pedroni Residual Cointegration test indicated that the univariate rank for the Monetarist and the I-Theory models did not indicate the presence of cointegration at a 5 per cent level. Results based on the Keynesian model indicated that the null hypothesis of no cointegration was rejected. However, the Kao residual cointegration test, which is also Engle-Granger based, confirmed the hypothesis of no cointegration at a 5 per cent level. The unrestricted VAR confirmed that there were no unit roots and the optimal lag lengths were 3, 2 and 5 for the Monetarist, Keynesian and I-Theory structural models, respectively.

Summary of Model Inverse Roots of AR Characteristic Polynomial

Monetarist Theory		**Keynesian Theory**		**I-Theory of Money**	
Root	Modulus	Root	Modulus	Root	Modulus
0.972914	0.972914	0.966026	0.966026	0.971100	0.971100
0.911941	0.911941	0.924824	0.924824	0.925154	0.925154
0.820516	0.820516	0.588915	0.588915	0.787179 - 0.086321i	0.791897
0.524299	0.524299	-0.336307	0.336307	0.787179 + 0.086321i	0.791897
-0.125600 -0.479538i	0.495714	0.267450	0.267450	0.562421 - 0.352322i	0.663663
-0.125600 +0.479538i	0.495714	0.019218	0.019218	0.562421 + 0.352322i	0.663663
0.007041 -0.373333i	0.373399			-0.231982 - 0.612543i	0.654999
0.007041 + 0.373333i	0.373399			-0.231982 + 0.612543i	0.654999
-0.211077	0.211077			0.276783 - 0.570808i	0.634374
				0.276783 + 0.570808i	0.634374

No root lies outside the unit circle. VAR satisfies the stability condition.

Summary Lag Order Selection Criteria

Lag	Monetarist Theory			Keynesian Theory			I-Theory of Money		
	AIC	**SC**	**HQ**	**AIC**	**SC**	**HQ**	**AIC**	**SC**	**HQ**
0	-1.2038	-1.1792	-1.1942	-1.3776	-1.3531	-1.3680	-2.8034	-2.7789	-2.7938
1	-6.4159	-6.3177	-6.3774	-6.1283	-6.0302	-6.0899	-10.410	-10.312	-10.371
2	-6.4951	-6.323*	-6.4278	-6.2786	-6.1068*	**-6.2113 ***	-10.553	-10.381*	-10.486
3	-6.5437	-6.2983	**-6.448***	-6.2994	-6.0540	-6.2033	-10.603	-10.358	-10.507
4	-6.5176	-6.1989	-6.3926	-6.2777	-5.9587	-6.1527	-10.584	-10.265	-10.459
5	-6.561*	-6.1683	-6.4072	-6.3252*	-5.9325	-6.1714	-10.662	-10.269	**-10.508***
6	-6.5417	-6.0754	-6.3590	-6.3117	-5.8454	-6.1291	-10.644	-10.178	-10.462

Note: Following Ventzislav and Kilian (2005), the Hannan-Quinn (HQ) Criterion was used to select the lag orders for the impulse response functions over the Akaike information criterion (AIC) or the Schwarz Criterion (SC). The HQ criterion minimises the mean-squared error of the implied pointwise impulse response estimates normalised relative to their MSE based on knowing the true lag order. This is particularly the case for for quarterly data.

Summary Panel Cointegration tests

Note: * denotes rejection of the null of no cointegration at the 5 per cent significance level

	Pedroni residual cointegration test							Kao residual cointegration test		
	Alternative hypothesis: common AR coefficients (within-dimension)				**Alternative hypothesis: individual AR coefficients (between-dimension)**					
	Statistic	*Prob.*	*Wtd. Statistic*	*Prob.*		*Statistic*	*Prob.*		*t-stat*	*Prob.*
Model: Monetarist Theory										
Panel v-Statistic	3.33263	0.0004*	1.25807	0.1042	**Group rho-Statistic**	-3.41531	0.000*	**ADF**	0.1379	0.4452
Panel rho-Statistic	-12.6594	0.0000*	-2.3608	0.0091*	**Group PP-Statistic**	-2.85606	0.002*			
Panel PP-Statistic	-8.37039	0.0000*	-2.2280	0.0129*	**Group ADF-Statistic**	-2.20684	0.012*			
Panel ADF-Statistic	-8.34271	0.0000*	-1.8679	0.0309*						
Model: Keynesian Transmission										
Panel v-Statistic	-0.67887	0.7514	-0.6821	0.7524	**Group rho-Statistic**	-8. 22748	0.000*	**ADF**	1.0982	0.1361
Panel rho-Statistic	-23.6928	0.0000*	-19.518	0.000*	**Group PP-Statistic**	-6.41729	0.000*			
Panel PP-Statistic	-15.4112	0.0000*	-13.763	0.0000*	**Group ADF-Statistic**	-5.7722	0.000*			
Panel ADF-Statistic	-15.2504	0.0000*	-14.242	0.0000*						
Model: I-Theory of Money										
Panel v-Statistic	0.38512	0.3501	-1.7618	0.9610	**Group rho-Statistic**	1.84948	0.9678	**ADF**	0.6174	0.2043
Panel rho-Statistic	-1.16696	0.1216	1.49032	0.9319	**Group PP-Statistic**	-0.40575	0.3425			
Panel PP-Statistic	-10.5253	0.0000*	1.34205	0.9102	**Group ADF-Statistic**	-1.5121	0.0653			
Panel ADF-Statistic	-14.4366	0.0000*	0.85778	0.8045						

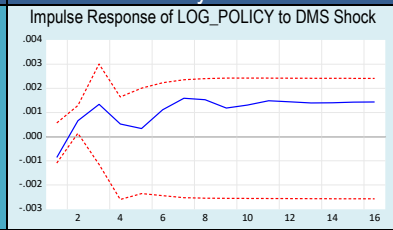
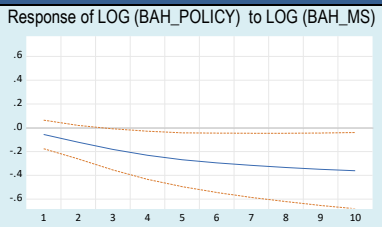
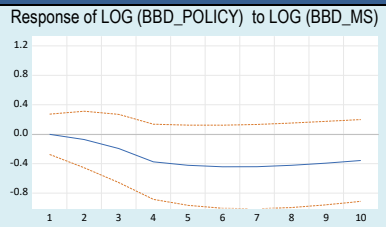
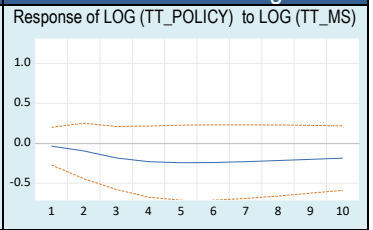
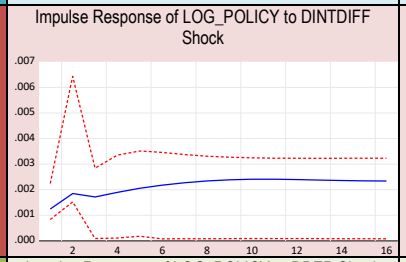
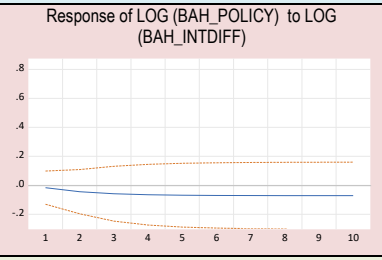
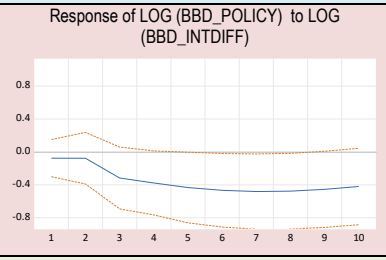
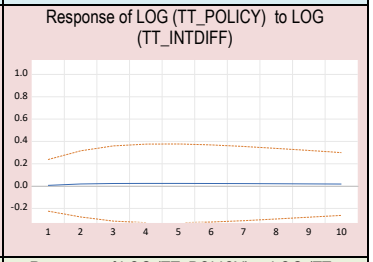
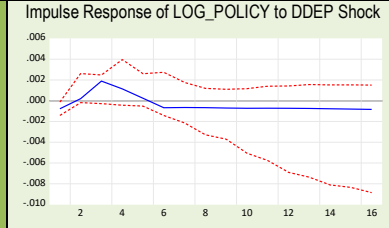
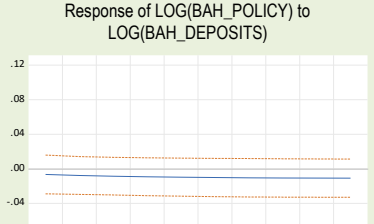
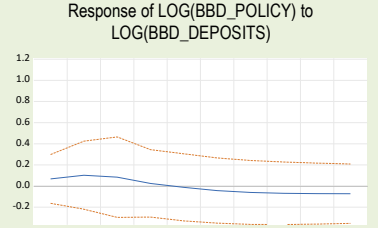
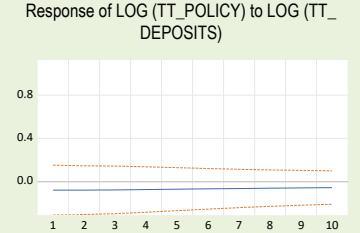
B. Summary of Country SVAR Data and Adequacy Checks

Country (Data Range)	Variables	Number of Observations	AR Roots	VAR Lag Order Selection Criteria	Cointegration Test
THE BAHAMAS (1992-2016)	Money Supply	99	No root lies outside the unit circle. VAR satisfies the stability condition.	1	Trace test indicates no cointegration at the 0.05 level
	Interest Rate Differential	99		1	Trace test indicates no cointegration at the 0.05 level
	Deposits	99		2	Trace test indicates no cointegration at the 0.05 level
BARBADOS (1992-2019)	Money Supply	72		3	Trace test indicates no cointegration at the 0.05 level
	Interest Rate Differential	112		5	Trace test indicates no cointegration at the 0.05 level
	Deposits	72		5	Trace test indicates 1 cointegrating eqn(s) at the 0.05 level*
TRINIDAD AND TOBAGO (2002-2019)	Money Supply	71		1	Trace test indicates no cointegration at the 0.05 level
	Interest Rate Differential	71		1	Trace test indicates no cointegration at the 0.05 level
	Deposits	71		1	Trace test indicates 2 cointegrating eqn(s) at the 0.05 level*

Source: Authors' estimation.
Note: The presence of cointegrating equations require an SVECM. The SVECM is achieved by structural restrictions on the long-run impulse response matrix of the SVAR, *F*.

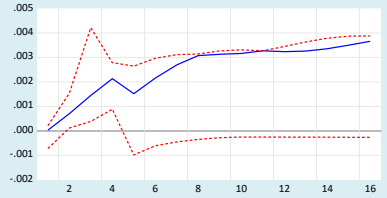
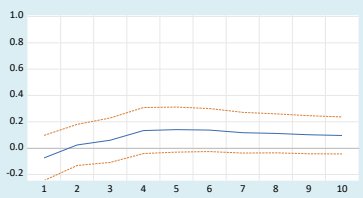
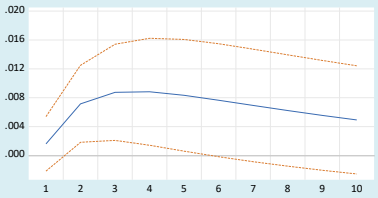
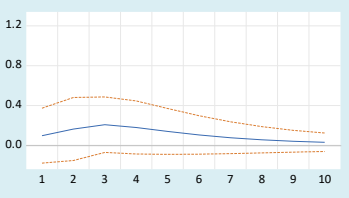
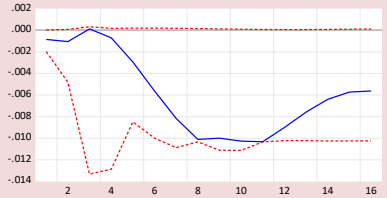
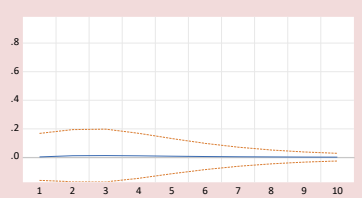
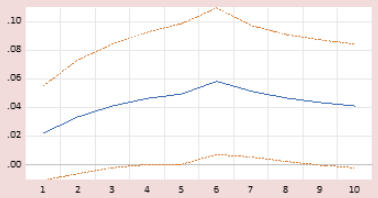
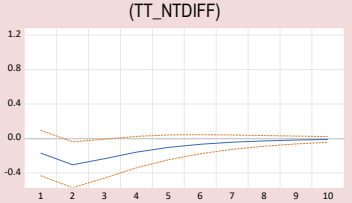
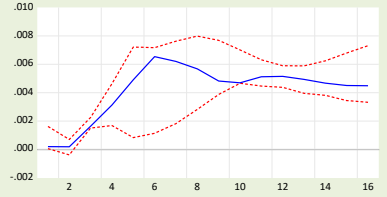
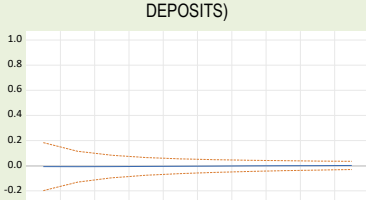
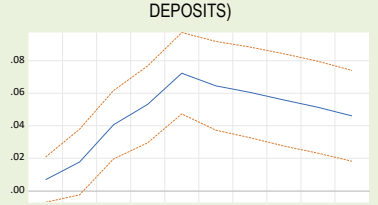
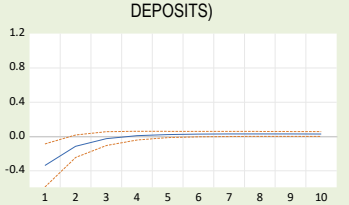
C. Regional SVAR Monetary Policy and Credit Impulse Response Functions

Regional Response of Monetary Policy compared to Idiosyncratic responses

Scenario	PSVAR Idiosyncratic shock	The Bahamas	Barbados	Trinidad and Tobago
Monetarist Money Supply				
Keynesian Interest Rate Differential				
I-Theory of Money Deposits				

Source: Authors' estimates.

Regional Response of Credit compared to Idiosyncratic responses

Scenario	PSVAR Idiosyncratic shock	The Bahamas	Barbados	Trinidad and Tobago
Monetarist Money Supply	Impulse Response of LOG_PSC to DMS Shock 	Response of LOG (BAH_ PSC) to LOG (BAH_MS) 	Response of LOG (BBD_ PSC) to LOG (BBD_MS) 	Response of LOG (TT_ PSC) to LOG (TT_MS) 
Keynesian Interest Rate Differential	Impulse Response of LOG_ PSC to DINTDIFF Shock 	Response of LOG (BAH_ PSC) to LOG (BAH_NTDIFF) 	Response of LOG (BBD_ PSC) to LOG (BBD_NTDIFF) 	Response of LOG (TT_ PSC) to LOG (TT_NTDIFF) 
I-Theory of Money Deposits	Impulse Response of LOG_ PSC to DDEP Shock 	Response of LOG (BAH_ PSC) to LOG (BAH_ DEPOSITS) 	Response of LOG (BBD_ PSC) to LOG (BBD_ DEPOSITS) 	Response of LOG (TT_ PSC) to LOG (TT_ DEPOSITS) 

Source: Authors' estimates.