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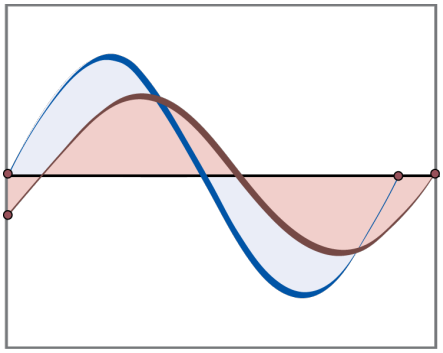

WP 03/2021 August 2021

Analysis of the Trinidad & Tobago Mutual Fund Industry Using a Time Varying Parameter Vector Autoregression (TVP-VAR) Methodology

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Abstract

The mutual fund industry in Trinidad and Tobago has developed into an important investment vehicle, and an essential part of the local financial and economic landscape, holding approximately $52.8 billion in assets under management at the end of 2019. Given that the industry exhibits interconnectedness with potential systemic risks, this study aims to evaluate the industry's reaction to movements in key macroeconomic and financial market variables using a Time-Varying-Parameter Vector Autoregression Model (TVP-VAR). For the data period studied, December 2000 to December 2019, the empirical results reveal that the impact of macroeconomic and financial variables depends on the fund-type. Moreover, large and sudden negative changes in financial and macroeconomic variables have a greater impact on fixed NAV funds than floating rate funds. The findings support regulatory actions taken after the global financial crisis to require funds to move to floating NAV and implement swing pricing

JEL Classification Numbers: C32, E44, and G10.

Keywords: Financial Markets & Macroeconomy, Mutual Funds, Capital Markets, Markov Chain Monte Carlo and Time-Varying Parameter Vector Autoregression.

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1.0 Introduction

Mutual funds[1] are financial investment vehicles that enable investors to pool funds for management by investment professionals. The industry often includes money market funds, equity funds, income or bond funds, hybrid funds, and other types of annuity and pension funds. The Trinidad and Tobago mutual fund industry formally commenced in 1981 with the establishment of the Trinidad and Tobago Unit Trust Corporation (UTC) through an Act of Parliament. The conception of the UTC allowed citizens to combine resources for capital market investing. Given the benefits of economies of scale, risk diversification, and liquidity provisions, the domestic industry has developed into a major source of households' savings, growing exponentially following financial market liberalisation in the early 1990s. Since formation, the industry has evolved from a single fund provider with around $500.0 million in funds under management at the end of the 1980s, to 15 registered[2] providers offering 68 funds, with a total of $52.8 billion in total funds under management[3] at the end of 2019. Data collected by the Central Bank of Trinidad and Tobago (CBTT)[4] from four fund providers, which accounts for just under 90.0 per cent or $47.1 billion in total funds under management, indicates that the industry is dominated by funds with a fixed net asset value (NAV) structure (over 80.0 per cent).

The growth, size, and structure of the mutual fund industry make it an essential part of the local financial and economic landscape, and activities within the industry can significantly impact local economic activity. During the 2008 global financial crisis (GFC), a major Money Market fund in the United States (US) "broke the buck"[5] triggering massive and widespread redemptions from Money Market funds. The crisis exposed the vulnerability of fixed NAV mutual funds and imposed considerable systemic risks to financial systems due to associated spillovers arising from interdependencies among institutions. Within the domestic industry, interconnectedness and contagion risks could be extensive since many fund sponsors and providers are part of the commercial banking and insurance sector. Despite these exposures, domestic fixed NAV funds remained relatively unscathed during the financial crisis. Instead, floating NAV funds experienced large declines due to falling asset prices, resulting in substantial redemptions from floating NAV funds and increased sales to fixed NAV funds as investors sought the protection of their principal investment. Consequently, fixed NAV funds have continued to grow in size, further increasing potential systemic risks. According to the International Monetary Funds (IMF) Financial System Stability Assessment (FSSA) (2020), "the (TT) market is dominated by constant (fixed) NAV funds, the regulation of which is insufficient to capture the risks they pose, both to the investors and to the financial groups that issue them" (IMF 2020).

The objective of this study is to evaluate the macroeconomic and financial market conditions that can adversely impact the domestic mutual fund industry. More specifically, how these conditions impact fixed versus floating NAV fund structures. The findings of the study would be useful to relevant authorities and stakeholders on the key drivers, risk, and vulnerabilities within the industry, from a macro-prudential perspective. The study undertakes an empirical assessment to determine potential macroeconomic and financial conditions that could pose risks to the various fund types. The assessment utilises the time-varying parameter vector autoregression (TVP-VAR) methodology, using Bayesian techniques to estimate models'

[1] Mutual funds in this study refers to Collective Investment Vehicles (CIV) and Collective Investment Schemes (CIS).

[2] Mutual funds are required by law to be registered with the Trinidad and Tobago Securities and Exchange Commission (TTSEC). This provisional figure is based on official regulatory data from the TTSEC as at December 2019 (TTSEC 2019)

[3] Funds under management represents the total value of all assets held and managed by asset managers.

[4] Data collected by the CBTT represents funds from the four largest fund providers.

[5] 'Breaking the buck' occurs when the fixed/constant NAV of Money Market funds falls below US$1.00, resulting in liabilities exceeding assets and signalling economic distress.

parameters. This approach can capture nonlinearities in the data, allowing for a much richer analysis and understanding of the structural dynamics of the relationships between macro and financial variables, and the various fund types.

The rest of this paper is structured as follows. Section 2 discusses relevant literature on the mutual fund industry, with an emphasis on studies that focused on NAV structure and macroeconomic impacts. Additionally, the literature review will also discuss relevant investment theories that can impact mutual fund portfolios. Section 3 provides some stylised facts on the size and structure of local mutual fund industry, providing details on areas of systemic significance. Section 4 will discuss the innovative Bayes TVP-VAR methodology, followed by a discussion of the results in Section 5. The final section concludes with possible policy recommendations that could be adopted to limit potential systemic risks.

2.0 Literature Review

2.1 Mutual Funds

Mutual funds are financial market products that pool funds from many savers and invests in a group of securities such as stocks, bonds, and other instruments. A major benefit of mutual funds is that it provides small or individual investors with access to diversified and professionally managed portfolios of securities while being affordable. Nazir and Nawaz (2010) explain that in developing economies, the role of mutual funds becomes more crucial since prospective investors are limited in investment knowledge, information, and facilities, and do not have the risk appetite to invest in the capital markets effectively. Furthermore, In Barbados, Lowe (2012) advances that, mutual funds allow individuals to access investment opportunities in diversified portfolios with minimal initial investment, on an island with a limited capital market.

Mutual funds allow the mobilisation of savings, and the channelling of these resources into investments, while minimising risks through diversification, economies of scale, and liquidity provisions. Investors acquire an ownership interest in the funds' assets and share in the profit, losses, and expenses. Additionally, while mutual funds do not generally guarantee returns, they do guarantee the right to sell ownership interest at current market value (Fisch and Roiter 2011). However, this liquidity characteristic of mutual funds can place investors at risk for potential runs following negative economic and financial announcements. Divanoglu and Bagci (2018) explain that investors can be swayed by past experiences and psychological factors, which can trigger unstable herding behaviour. This effect was evident during the financial crisis, following the Lehman default in 2008, which resulted in run-like behaviour, among large-scale institutional investors, from Money Market funds (Schmidt et al 2016).

An important characteristic of a mutual fund is the net asset value (NAV). The NAV represents a fund's market value per unit, calculated by dividing a fund's assets under management (AUM) by the total number of units outstanding. However, based on the characteristics established by the fund, the NAV can be either floating or fixed. According to the TTSEC (2020), the value of a unit for floating NAV funds changes based on the performance of the pool of securities. However, for fixed NAV funds, the value remains constant and is the responsibility of the fund manager to maintain the unit value. As a result, floating NAV funds often invest in securities with a higher risk profile such as equities, while fixed NAV funds are largely comprised of low-risk investments such as Treasuries. However, despite the investment risk structures, fixed NAV funds can pose potentially destabilising risks.

US Money Market funds were considered to be as secure as a bank account (Brewster and Chung 2008). However, the instability of these funds was realised during the 2008 global financial crisis when exposure to declines in the creditworthiness of troubled assets resulted in the funds "breaking the buck[6]". This triggered widespread withdrawals and runs from Money Market funds and other funds, leading the US Government to adopt emergency intervention measures to maintain stability in the short-term credit markets (Fisch and Roiter 2011). Furthermore, the Money Market industry came under increased pressure for regulatory change, with the most controversial reform proposal eliminating the fixed NAV feature of Money Market funds.

[6] While the NAV of Money Market funds are often fixed, 'breaking the buck' occurs when the calculated NAV falls below one dollar, resulting in investors losing principal value on their investments, and increasing the likelihood of the fund falling into liquidity and solvency distress.

Money Market funds are often considered similar to bank deposits due to the guarantee of a fixed unit value. As such, the demand for these funds as a source of short-term capital has been an important driver in the growth of the global Money Market industry. The use of these funds in short-term cash management offered favourable features such as price preservation, liquidity, diversification, and administrative simplicity. However, due to the lack of deposit-like regulatory frameworks and deposit insurance, these funds introduce numerous systemic vulnerabilities. According to Fisch and Roiter (2011), when a Money Market fund 'breaks-the-buck' this creates a risk of losses for investors, a risk of a run[7] on other Money Market funds, and a consequent risk that short-term credit will be exhausted. Furthermore, these systemic susceptibilities are the primary rationale for a change in policy and regulation in Money Market funds.

According to Witmer (2012), fixed NAV funds can often hold illiquid assets or have an outdated unit price, which can result in share redemptions different from the correct market price. This could negatively affect remaining shareholders, increasing the financial fragility of the fund. Considering the controversial reform proposal of eliminating the fixed NAV feature, Witmer (2012) employed a regression model to examine fund outflows for constant and variable NAV Money Market funds and determined that the variable NAV structure is less susceptible to run-like behaviour while constant NAV funds often experience more frequent episodes of sustained outflows. However, fixed NAV funds are also less frequently liquidated following a period of heavy redemptions. Nevertheless, Witmer (2012) extends that an implicit guarantee for fixed NAV mutual funds is a potential channel for contagion between the banking sector (fund sponsors) and mutual funds.

Conversely, Gordon and Gandia (2014) employed a cross sectional regression technique to examine European stable and accumulating NAV Money Market funds. They determined that the stable NAV distinction explained none of the variation in the run rate, likely due to the funds' sponsor capacity to support the fund against loss. Additionally, according to the Centre for Capital Markets Competitiveness (2013), a policy change to convert fixed NAV Money Market funds to floating NAV will result in numerous compliance burdens. Such obstacles could arise by introducing operational complexity through process changes; significant upfront costs, increased operational costs; and higher opportunity costs related to higher financing costs and lower returns. These burdens would also be prevalent in other fixed to floating fund types.

Evaluating the performance of a mutual fund often starts with an analysis of portfolio selection. Harry Markowitz (1952) developed a portfolio optimisation model known as the mean-variance model, foundational to Modern Portfolio Theory (MPT) which maximises expected return for a given risk level. Alternatively, numerous other measures are used to determine the performance and development of a mutual fund industry. Nazir and Nawaz (2010) examine mutual fund growth in Pakistan using a fixed effect and random effect model and conclude that assets turnover and expense ratio positively impact the growth of mutual funds, while management fees and risk adjusted returns are negatively associated. Agarwal and Pradhan (2018 and 2019) hypothesise that in response to changing conditions, true skill in fund management in India goes beyond portfolio management. They evaluate this by employing the traditional CAPM and the Fama–French–Carhart (FFC)-factors-based models, and found evidence of selectivity in stock picking and timing skills by Indian fund managers even after controlling for changing macroeconomic conditions.

Considering that macroeconomic conditions can significantly impact capital markets, then it is expected that these systematic factors will have a bearing on the mutual fund industry (Coffie 2019). Ang and Hogan (2018) declare that six macroeconomic factors - economic growth; real rates; inflation; credit; emerging markets; and liquidity, explains more than 90 per cent of returns across asset classes. They clarify that growth-sensitive assets rely on economic expansions to generate returns, interest rate sensitive assets can perform well when interest rates are rising, and inflation-sensitive assets fall in value during rising inflation conditions. Additionally, emerging market exposure risks could arise from less developed and less stable markets, and higher premiums can be earned from holding fewer liquid assets.

Using simple regression analyses, Shukla (2011) evaluated the inter-relationship between macroeconomic variables and the Indian mutual fund industry. The study found that money supply and interest rates were important in influencing Gilt, Liquid and Money Market Funds, while money supply, 10-year government securities and foreign inflows were important in influencing balanced growth funds. In Kenya, Kariuki (2014) employed a regression technique and concluded that money supply, interest rate, inflation and GDP positively influence Equity funds while the exchange rate negatively impacts these

[7] Since investors generally regard Money Market funds as safe vehicles that satisfy on-demand withdrawals, they tend to attract highly risk-averse investors who are particularly prone to flight when they perceive the possibility of a loss (IOSCO 2012).

funds. Similarly, Lemantile (2017) found a positive relationship between interest rates and mutual funds, and a negative relationship between exchange rates and inflation rates on mutual fund performance in Kenya. Furthermore, Gusni and Hamdani (2018) investigated the performance of Equity funds using the risk-adjusted measure proposed by Treynor[8] (1965), and found that stock selection skill and inflation influenced Equity fund performances in Indonesia.

Conversely, Coffie (2019) engaged a short-run Autoregressive Distributed Lag (ARDL) model and concluded that interest rates, inflation rates, money supply and real GDP were insignificant determinants of variations in mutual fund unit prices in Ghana, while exchange rates were found to be significant determinants. Coffie (2019) suggested that the insignificant result was due to inefficiency in pricing in risks from interest rate, inflation and money supply variations within the mutual fund industry in Ghana. However, a regression analysis by Asad and Siddiqui (2019) determined that in Pakistan the macroeconomic factors, GDP and interest rates, have a negative relationship with fund returns, likely due to fund returns being mostly dependent on micro-factors and fund manager market expectations in Pakistan. Alternatively, Aramonte, Scotti and Zer (2017) studied the sensitivity of mutual funds' liquidity profile to macroeconomic surprises using a Fixed Effects Panel Regression and determined that following negative macroeconomic surprises, liquidity sensitivity increases for less liquid funds, suggesting that during high stress periods, deteriorating liquidity profiles can amplify vulnerabilities, resulting in a run on the fund.

2.2 Portfolio Investment Theories

The following sub-sections describes the theoretical underpinnings on the impact of macroeconomic factors, and associated financial market factors, on different asset classes and mutual funds. Summary tables (**Table 2 and 3**) of the theoretical responses of mutual funds - funds under management and funds' net-sales position – can be found at the end of this section.

2.2.1 Economic Growth

Economic expansion creates demand for financial services, increases investment by firms, boosts return, and encourages stock market investment through the channelling of excess savings. Economic growth is therefore a crucial determinant of stock market development (El Wassal 2013). The Calderon-Rossell (1991) structural model suggests that economic growth and stock market liquidity are the main determinants of stock market development. Therefore, higher economic growth will have a positive impact on Equity funds.

Economic growth typically leads to increased firm revenues and profits, improving the ability to service debt. This reduces the risk of a default and lessens the risk premium on debt. Given the inverse relationship between bond prices and yields, lower risk premiums, and therefore lower bond yields, would place upward pressures on bond prices as investors actively seek out investment opportunities. An increase in bond prices would, therefore, increase the value of Assets Under Management (AUM) for mutual funds that hold bond assets.

The connection between economic growth and bond yields can also be determined through the yield curve. Diebold and Rudebusch (2013) explain that short-term rates are set by the Central Bank according to macroeconomic stabilisation goals, while long-term rates are determined mainly by expectations of future short-term rates. Given this relationship, the slope of the yield curve could be used to forecast future macroeconomic conditions (Dhanessar 2017), where an upward sloping curve is indicative of economic expansion and higher inflation in the future. The monetary authority may then seek to temper these risks by increasing the key policy rate, thereby increasing short-term rates and reducing longer-term rates.

On the other hand, if economic growth results in inflationary pressures, the upward pressure on wages, increased competition for labour, and diminished excess capacity can erode profit margins. Furthermore, rising inflation increases the vulnerability of economic slippage, which would increase credit risks and inflate bond yields. Consequently, higher bond yields will push down bond prices, thereby decreasing the AUM value for mutual funds.

[8] The Treynor Measure is a type of risk adjusted measure that compares funds' returns to a specific measure of risk (Treynor 1965).

Furthermore, economic growth theories indicate a correlation between savings and economic growth. The Life-Cycle Hypothesis (LCH) (Modigliani and Brumberg 1954) suggests that agents seek to smooth consumption throughout their lifetime, by borrowing when income is low, and saving when income is high. The theory supports the idea that during periods of economic expansion, economic agents' savings rate would also increase. Considering that investors often use mutual funds as a savings tool, an increase in economic output, should result in an expansion of sales to mutual funds.

2.2.2 Inflation

Inflation is a measure of macroeconomic stability. However, the direction of influence on the equity markets can be mixed. Inflation can either erode equity gains, or equities can hedge against inflation during periods of economic expansion. Conventional theory holds that equities should provide a hedge against inflation as equities represent a claim on the dividend stream of real assets (Attie and Roache 2009). However, Grande et al (2014) theorise that financial markets interpret inflation differently depending on the stance and credibility of monetary policy. If the monetary authority is strongly committed to price stability, even small surges in inflation expectations could trigger monetary tightening. This strong commitment is the basis of the 'Proxy Hypothesis' (Fama 1981) which infers that given the positive relationship between stock prices and economic growth, as high inflation reduces economic activity, there should be a negative relationship between inflation and stock prices. Given these differing views, the impact of inflation on Equity funds could be mixed and dependent on monetary policy.

On the other hand, there is a strong association between bond prices, short-term interest rates, and inflation. According to the Fisher hypothesis (Fisher 1930), the real interest rate is equal to the nominal interest rate less expected inflation. Therefore, the real interest rate on fixed nominal coupon bonds with principal repayments should be negatively related to expected inflation over the term of the bond (Attie and Roache 2009). The relationship suggests that rising inflation reduces the purchasing power of the interest (coupons) paid on bonds. The yields on outstanding bonds will not be able to keep up with the rising cost of inflation and the reduced purchasing power of coupon payments therefore depresses bond prices. Subsequently, the monetary authority may attempt to limit the rising inflation by increasing the key policy rate. Monetary tightening will have a positive impact on nominal interest rates, causing bond yields to increase to compensate for the rising cost of inflation. However, rising inflation and nominal interest rates negatively influence bond prices. For mutual funds that invest heavily in bond assets, interest rate risks from rising inflation, and therefore lower bond prices, will have a negative impact on bond valuations, thereby causing a fall in the value of AUM.

On the other hand, inflation appears to have a puzzling impact on economic agents' savings. Juster and Wachtel (1972) mention that unanticipated inflation generates an increased variance in expected real income that has asymmetrical effects on savings behaviour. An increase in inflation above anticipated will therefore adversely affect consumer confidence, likely leading to a higher savings rate. Conversely, Heer and Suessmuth (2006) mention that higher inflation increases the opportunity cost of money and the reduced purchasing power would result in an increase in consumption costs and therefore reduced savings. Given these dynamics, the effect of inflation on mutual fund net sales (net savings) could be mixed.

Table 1: Summary of Theoretical Responses – The Impact of Macroeconomic and Financial Variables on the Funds Under Management (FUM) of the Major Fund Types

Macroeconomic and Financial Market Variables	Response of Funds Under Management (FUM)		
	Income Funds	Money Market Funds	Equity Funds
GDP	↑ Lower yields supporting economic growth resulting in higher asset prices supporting FUM	↑ Lower yields supporting economic growth resulting in higher asset prices supporting FUM; or higher ST yields supporting FUM	↑ Economic growth and firm expansions supporting FUM growth
Inflation	↓ High inflation and nominal rates resulting in lower bond prices and lower FUM	↓ High inflation and nominal rates resulting in lower bond prices and lower FUM	↑ or ↓ Equities as a hedge against inflation; or inflation erodes equity gains
Short-Term Treasury Rates	↑ or ↓ Higher yields on new LT assets supporting FUM; or negative valuation change due to lower bond prices	↑ Due to shorter durations and less interest rate risk, higher ST yields can be beneficial to MMFs	NA
Long-Term Treasury Rates	↑ or ↓ Higher yields on new LT assets supporting FUM; or negative valuation change due to lower bond prices	NA	NA
Stock Indices	NA	NA	↑ Higher stock prices, higher Equity FUM

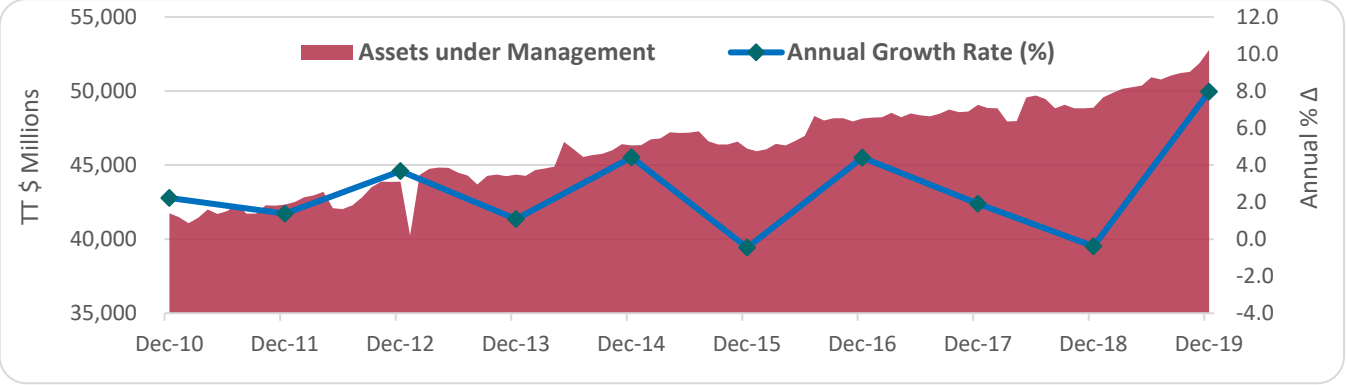
Table 2: Summary of Theoretical Responses – The Impact of Macroeconomic and Financial Variables on the Net-Sales Positions of the Major Fund Types

Macroeconomic and Financial Market Variables	Response of Funds Net-Sales Positions		
	Income Funds	Money Market Funds	Equity Funds
GDP	↑ Higher savings rate	↑ Higher savings rate	↑ Higher savings rate
Inflation	↑ or ↓ Reduced consumer confidence and higher savings; or reduced purchasing power and reduced savings	↑ or ↓ Reduced consumer confidence and higher savings; or reduced purchasing power and reduced savings	↑ or ↓ Reduced consumer confidence and higher savings; or reduced purchasing power and reduced savings
Short-Term Treasury Rates	↑ Higher savings	↑ Higher savings	NA
Long-Term Treasury Rates	↑ Higher savings	NA	NA
Stock Indices	NA	NA	↑ Higher investment savings

3.0 Stylised Facts

The domestic mutual fund industry formally commenced in 1981 with the establishment of the Trinidad and Tobago Unit Trust Corporation (UTC) through an Act of Parliament[9] (TTSEC 2007). The UTC's objective was to allow citizens to access economies of scale by pooling resources for investment, further developing the domestic money and capital market. The UTC operated as a sole supplier of Collective Investment Vehicles (CIVs) until market liberalisation in 1994. Following liberalisation, several other financial institutions registered and offered CIVs, enabling this investment vehicle to emerge as the preferred form of national investment. Over the last decade the industry developed notably, despite a fall in the number of issuers and funds. Available data from the TTSEC suggests that at the start of 2010, there were 18 registered issuers offering 82 funds, however, by the end of 2019 the industry had 15 issuers providing 68 funds. Notwithstanding this decline, over December 2010 to December 2019, the industry's total assets under management (AUM) expanded by 26.4 per cent, from $41.7 billion, to $52.8 billion (**Chart 1**), with an average annual growth rate of roughly 2.6 per cent.

Chart 1: TTSEC – Collective Investment Vehicles – Assets under Management (AUM)



Source: Trinidad and Tobago Securities and Exchange Commission (TTSEC).

Despite net redemptions during 2016 and 2017, the growth of the industry was generally supported by steady net sales over the period. Official TTSEC data indicates that over the ten-years ending December 2019, sales to the industry averaged roughly $17.8 billion per year while redemptions averaged $16.8 billion, resulting in an average annual net sales position of just under $1.0 billion (**Chart 2**). In terms of the most recent period, during 2019, the CIV industry observed just under 13.0 per cent increase in sales to $19.3 billion, while redemptions increased by 5.8 per cent to $17.3 billion. This activity resulted in a 193.7 per cent jump in net sales to just over $1.9 billion, which was likely due to elevated excess liquidity levels during 2019.

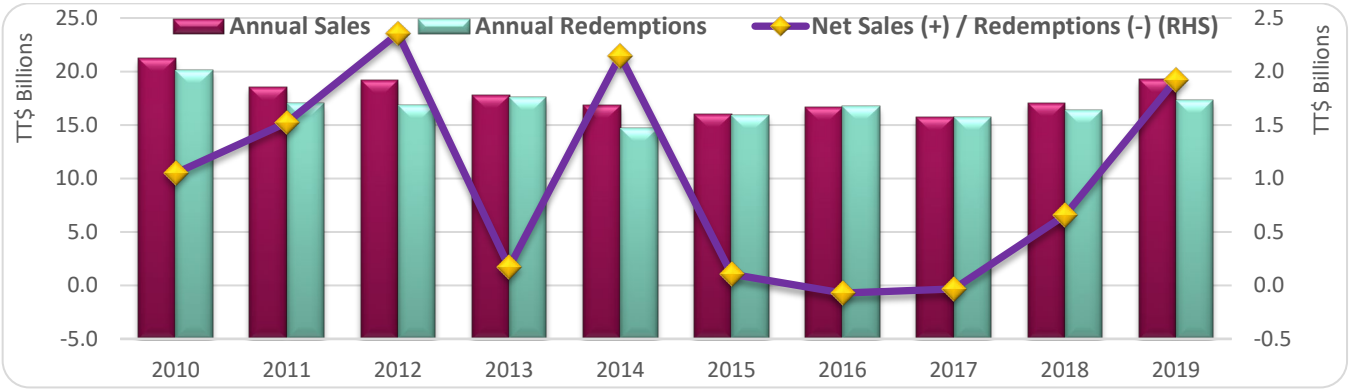
The data analysed in this study was sourced from the CBTT[10,11]. As at the end of December 2019, this dataset accounted for 89.3 per cent of the industry's total AUM. During the pre-financial crisis era and into the early stages of the GFC, from Q1:2001 to Q3:2009, aggregate funds under management (FUM) grew to $40.8 billion from just under $7.0 billion, averaging roughly 20.1 per cent growth per year. However, during Q4:2009, aggregate FUM plummeted by 12.9 per cent to $35.5 billion, a loss of almost $5.3 billion. Following this period, growth moderated to around 2.9 per cent per year, ending 2019 at just over $47.1 billion (**Chart 3**). On the other hand, the oil price shock of 2014 had a less pronounced effect on aggregate FUM resulting in a 1.4 per cent decline to $41.4 billion at the end of 2015.

[9] The Unit Trust of Trinidad and Tobago Act 1981

[10] Aggregate funds under management refer to mutual fund information collected by the Central Bank of Trinidad and Tobago, including funds managed by the Trinidad and Tobago Unit Trust Corporation (UTC), Royal Bank Trinidad and Tobago (RBTT), Republic Bank Limited (RBL) and First Citizens Bank Limited (FCB).

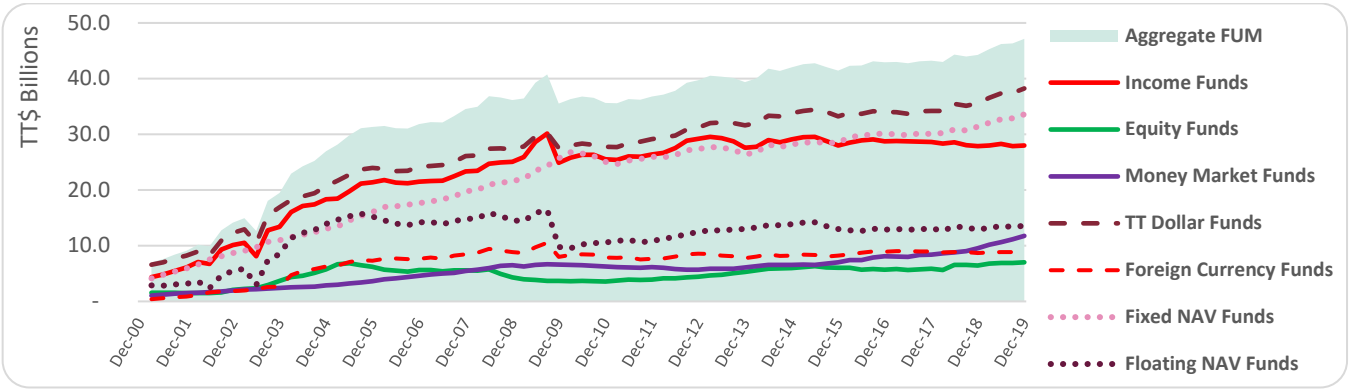
[11] All values in this study are presented in TT dollars.

Chart 2: TTSEC – Collective Investment Vehicles – Sales & Redemptions



Source: Trinidad and Tobago Securities and Exchange Commission (TTSEC).

Chart 3: Mutual Fund Industry by: Fund Type, Currency, and NAV Structure



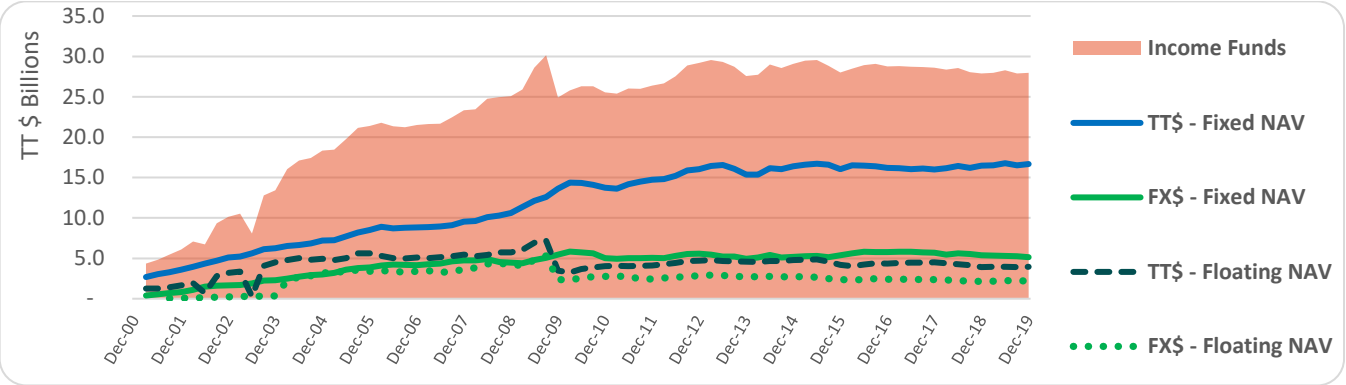
Source: Central Bank of Trinidad and Tobago (CBTT).

The mutual fund industry is dominated mainly by Income funds, representing 60.0 per cent of aggregate FUM, or just under $30.0 billion at the end of 2019. As a result, aggregate FUM closely followed the trend of Income funds, especially during the pre-financial crisis era. On the other hand, Equity funds which represents roughly 15 per cent of aggregate FUM, around $7.0 billion, have generally exhibited more volatility, especially during the GFC. Additionally, at the end of 2019 Money Market funds accounted for around 25.0 per cent of aggregate FUM, or $11.8 billion, and have generally displayed an upward trend over the period, with more pronounced growth over the recent years. Excluded from this analysis are funds classified as 'Other'[12] which represented roughly 0.8 per cent of aggregate FUM at the end of 2019. The domestic mutual fund industry primarily consists of TT dollar funds, representing 81.1 per cent of aggregate FUM or $38.2 billion, while foreign currency funds represent just 18.9 per cent at the end of 2019. Additionally, the industry is dominated by fixed NAV funds (71.2 per cent or $33.6 billion), while floating NAV funds accounted for 28.8 per cent or $13.6 billion at the end of 2019.

At the end of 2019, Income funds primarily consisted of TT dollar funds (73.7 per cent or $20.6 billion), while 78.0 per cent ($21.8 billion) were fixed NAV and 22.0 per cent ($6.1 billion) were floating NAV. The largest component, TT dollar – fixed NAV Income funds, observed strong growth (around 18.7 per cent per year) pre-financial crisis, however, growth declined to roughly 2.1 per cent per year following the financial crisis period. Foreign currency – fixed NAV Income funds, observed a similar pre-financial crisis trend, growing by roughly 29.3 per cent per year. However, following this period, these funds observed an average annual decline of 0.4 per cent, likely due to the consistent net redemptions over the period (**Chart 4**). It is also worthwhile noting that fixed NAV Income funds generally weathered the effects of the financial crisis, likely due to the associated principal guarantee.

[12] The analysis excludes funds classified as 'Other', which represents high yield and retirement funds.

Chart 4: Mutual Fund Industry: Income Funds



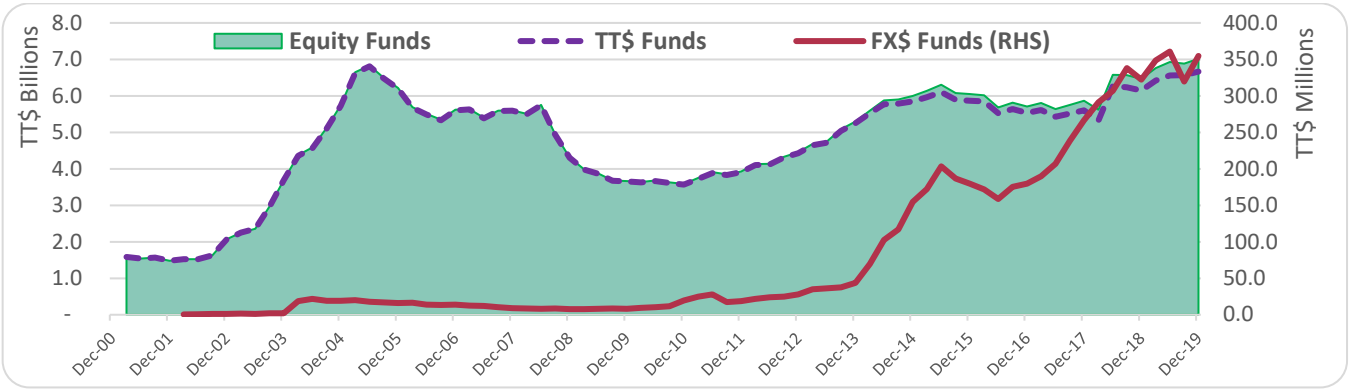
Source: Central Bank of Trinidad and Tobago (CBTT).

On the other hand, TT dollar – floating NAV Income funds exhibited a very volatile trend over the review period. Pre-financial crisis, these funds recorded an annual average growth rate of 23.2 per cent. However, in Q4:2009, a 51.7 per cent decline occurred, eroding $3.7 billion in FUM, primarily due to net redemptions. Following this period, the fund type observed an average growth rate of 1.7 per cent per year. A similar trend was observed for foreign currency – floating NAV Income funds which grew exponentially from $41.0 million in 2001 to a peak of $5.3 billion in Q3:2009. During Q4:2009, external crisis conditions resulted in the fund type losing $2.9 billion in FUM, a 55.5 per cent decline, mostly due to substantial net redemptions during the quarter. Subsequently, the fund type did not observe any notable recovery as growth averaged -0.2 per cent per year. However, following the 2014 oil price shock, aggregate Income funds under management experienced a 3.8 per cent decline during 2015, largely driven by a 12.3 per cent decline in floating NAV Income funds.

Owing to the asset risk characteristics, domestic Equity funds have a floating NAV structure. TT dollar Equity funds represented 94.9 per cent or $6.7 billion of aggregate Equity funds at the end of 2019. During 2001 to 2005, TT dollar Equity funds grew by an average of 35.1 per cent per year, largely on account of a notable expansion in the domestic stock market - supported by low interest rates, robust economic conditions, high energy prices, and domestic energy sector diversification. However, during the second half of 2005 the stock market experienced a major shock when a regulatory requirement forced pension funds to reduce their holdings of Equity assets to within statutory limits, inducing major sell-offs by insurance companies. This shock, in addition to the perception that the stock market was becoming overheated, led to a substantial fall in stock market capitalisation. As a result, TT dollar Equity funds experienced a period of decline, averaging -10.1 per cent per year over the next five years. Subsequently, accommodative monetary policies supported recovery, resulting in TT dollar Equity funds growing by an average of 7.4 per cent per year over the next nine years ending 2019 (**Chart 5**). Conversely, foreign currency Equity funds were relatively small pre-financial crisis. However, post-GFC, these funds experienced considerable growth, moving from $8.3 million at the end of 2009 to $354.9 million at the end of 2019. However, following the 2014 oil price shock, the annual growth rate of Equity funds fell to 0.8 per cent in 2015 and -5.6 per cent in 2016, from an annual average of 15.2 per cent over 2012 to 2014.

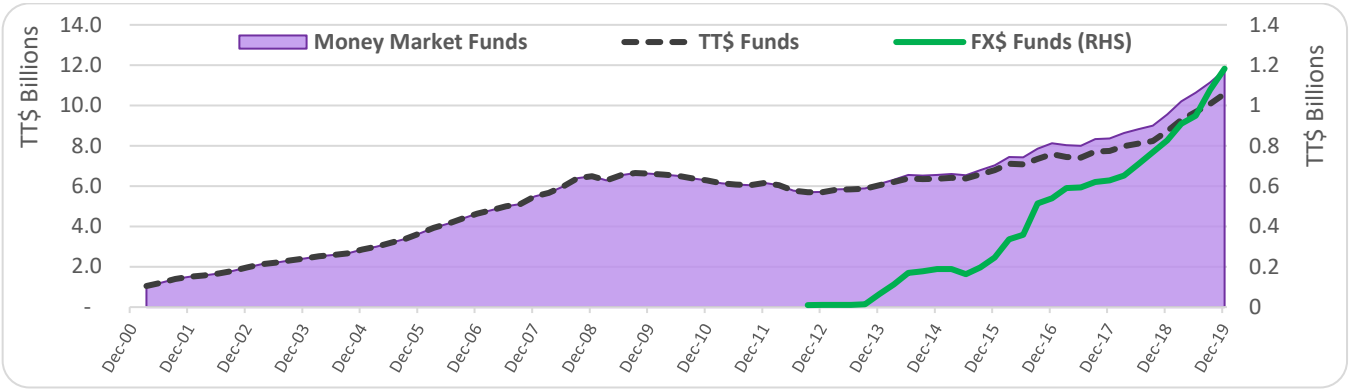
Due to a safer risk structure and guaranteed principals, domestic Money Market funds are fixed NAV. At the end of 2019, TT dollar Money Market funds accounted for 89.9 per cent, or $10.6 billion, while foreign currency funds represent 10.1 per cent or $1.2 billion. During 2001 to 2009, Money Market funds experienced robust growth, averaging 23.2 per cent per year, on account of strong domestic economic conditions (**Chart 6**). However, over the next three years ending 2012, substantial net redemptions resulted in the fund type declining at an average of 4.9 per cent per year. During this period, depressed economic conditions resulted in the CBTT pursuing an accommodative position, while elevated excess liquidity levels kept short-term interest rates low. Over the next seven years ending 2019, TT dollar Money Market funds regained momentum, averaging 9.4 per cent growth per year. During this period, the fund type observed large net sales, especially over 2018 and 2019. Furthermore, available data for foreign currency Money Market funds shows that these funds experienced substantial growth, from $10.5 million FUM at the end of 2012 to $1.2 billion at the end of 2019.

Chart 5: Mutual Fund Industry: Equity Funds



Source: Central Bank of Trinidad and Tobago (CBTT).

Chart 6: Mutual Fund Industry: Money Market Funds

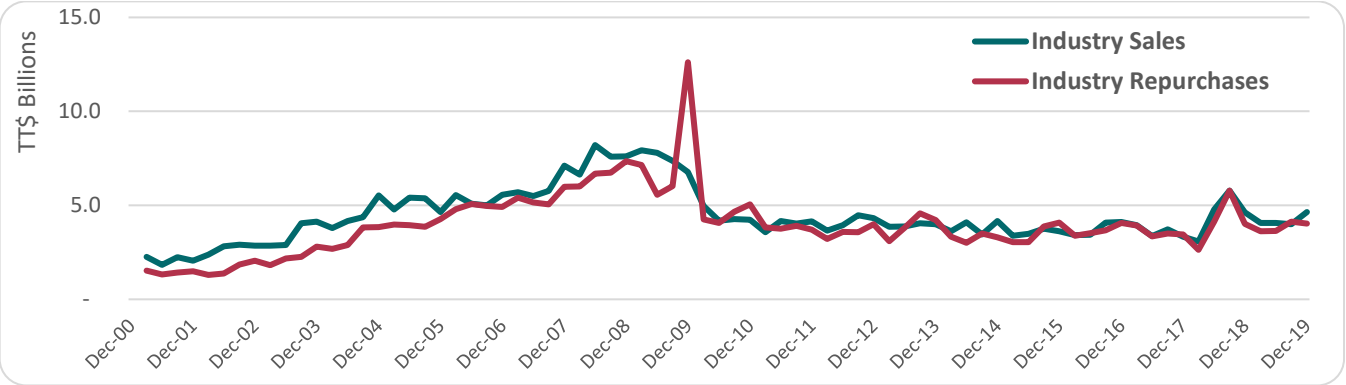


Source: Central Bank of Trinidad and Tobago (CBTT).

Prior to the financial crisis, total industry sales and repurchases exhibited a steady growth trend. Over the period, sales were recorded at an average of $4.4 billion per quarter, peaking at $8.2 billion in the second quarter of 2008. Repurchases depicted a similar trend, averaging $3.5 billion per quarter. Consequently, net sales averaged $892.5 million per quarter, supporting industry growth. From mid-2008 to mid-2010, sales declined substantially from over $8.0 billion to $4.3 billion. However, redemptions remained elevated, averaging $6.7 billion per quarter, before peaking at $12.6 billion at the end of 2009. This peak in repurchases was primarily driven by $11.1 billion in redemptions from Income funds, resulting in the industry experiencing an overall net redemption of $5.8 billion in that quarter. Following this period and over the next decade, sales adopted a new normal with growth, averaging $3.9 billion per quarter while repurchases averaged $3.8 billion per quarter (**Chart 7**).

Income funds have historically monopolised the composition of aggregate sales and repurchases. From Q1:2001 to Q3:2018, Income fund sales and repurchases accounted for an average of 76.0 per cent and 77.1 per cent of the industry total, respectively. However, over Q4:2018 to Q4:2019, Income fund sales declined to an average of 53.0 per cent while repurchases fell to 62.8 per cent. On the other hand, over the same two periods Money Market fund sales increased from an average of 17.9 per cent to 40.1 per cent, while repurchases increased from an average of 17.5 per cent to 30.5 per cent. This transition is likely due to investors seeking principal guarantees in fixed NAV funds, and reduced risks as offered by Money Market funds. Sales and repurchases to Equity funds however, has been consistently low, averaging 5.9 per cent and 5.1 per cent of the industry totals, respectively over the review period.

Chart 7: Mutual Fund Industry: Sales & Repurchases



Source: Central Bank of Trinidad and Tobago (CBTT).

4.0 Data and Methodology

The following methodology is used to examine the total funds under management and net sales[13] position of the three major fund types: Money Market, Income and Equity. The paper uses quarterly data from December 2000 to December 2019. For each fund type the data is disaggregated into NAV type and currency where applicable. In order to evaluate the macroeconomic and financial market conditions that can impact the industry, the mutual fund variables are estimated against the Quarterly Index of Real Economic Activity (QEA), and headline inflation as the macroeconomic variables. Depending on the fund type, the financial market variables employed are: the short-term 3-month US and TT Treasury rate; the long-term 10-year US and TT Treasury rate; and the US S&P 500 and TT CPI stock market indices.

4.1 Establishing Time Variance

The paper follows the approach outlined in Nakajima (2011), where a typical vector-autoregression (VAR) is restated as a state-space model (SSM)[14] representation, identifying its time varying (TV) components as well as allowing for stochastic volatility in the error term. This method enables us to capture dynamic changes in the structure of the time series, providing policy makers with a robust understanding of the risks involved in the domestic mutual fund industry. Allowing for stochastic volatility complicates estimation, however, the Bayesian computation methodology Markov Chain Monte Carlo (MCMC) is utilised to infer the true model. The basic algorithm can be explained via a univariate example as follows, but this is extended in reality to the multivariate case.

The typical regression model can be expressed as:

$$Y_t = x'_t\beta + z'_t\alpha_t + \varepsilon_t, \qquad \varepsilon_t \rightarrow N(0, \sigma^2), \quad t = 1, \ldots, n \qquad (1)$$

Where α_t is a vector of time varying coefficients expressed in the following form:

$$\alpha_{t+1} = \alpha_t + u_t, \qquad u_t \rightarrow N(0, \Sigma), \quad t = 0, \ldots, n-1 \qquad (2)$$

Stochastic volatility in the errors (σ^2_t) takes the form:

$$\sigma^2_t = \Upsilon \exp(h_t), \quad h_{t+1} = \varphi h_t + \eta_t, \qquad \eta_t \rightarrow N(0, \sigma^2_\eta), \quad t = 0, \ldots, n-1 \qquad (3)$$

[13] Net sales represent the difference between total sales to the fund and total redemptions or withdrawals from the fund over the period.

[14] State-space models use state variables to describe a system by a set of first-order differential or difference equations, rather than by one or more n^{th}-order differential or difference equations. The state-space model structure is a good choice for quick estimation because it requires you to specify only one input, the model order, n. (MathWorks, nd.)
https://www.mathworks.com/help/ident/ug/what-are-state-space-models.html

In this example, y_t is a response scalar (vector in the multivariate case) and x_t and z_t are (k x 1) and (p x 1) vectors of covariates. β is a (k x 1) vector of constant coefficients and α_t is a (p x 1) vector of time-varying coefficients, with h_t representing stochastic volatility. It is assumed that $\alpha_0 = 0$, $u_0 \rightarrow N(0, \Sigma_0)$, $\Upsilon > 0$ and $h_0 = 0$. In the equation, the effects of x_t on y_t are time invariant while the effects of z_t on y_t are as assumed to be time varying. The vector z_t acts on y_t via α_t, whose time variation is characterised by the first order random walk process given by Equation (2). This is done to account for possible nonlinearities like structural breaks or unit roots. While this may risk overfitting, for example in comparison to a less accommodative AR(1) restriction on time variation, free movement of α_t under the random walk assumption allows less restricted estimation of the TV coefficients. The regression's Gaussian disturbance term ε_t follows the time-varying variance σ^2_t. In this case the log volatility $h_t = \log \sigma^2_t/\Upsilon$ is assumed to follow an AR(1) process, i.e., $|\varphi| < 1$ in Equation 3.

The SSM is formed with the elements of y_t as the measurement equation, α_t and h_t as state variables, and its TV errors result in it being a nonlinear SSM. To solve the TVP regression via the SSM, the MCMC method is thus utilised. The MCMC method repeatedly samples a Markov chain whose stationary distribution is the Bayesian posterior distribution of the true parameter.

4.2 Moving from Bayes Theorem to MCMC

To demonstrate, Bayes Theorem is obtained as follows:

$$\pi(\theta \mid y) = f(y \mid \theta)\, \pi(\theta) / \int f(y \mid \theta)\, \pi(\theta) d\theta \qquad (4)$$

In this example, π(θ) is the prior density specified for an unknown set or vector of parameters, θ. The term $f(y \mid \theta)$ is the likelihood function for the data $y = \{y_1, \ldots, y_n\}$. The posterior distribution is thus $\pi(\theta \mid y)$. The prior information concerning θ 'updates' when data, y, is observed. The integral in the denominator is known as the marginal distribution or normalising constant. The iteratively increasing complexity of this integral justifies the MCMC approach of sampling from the posterior, often without even necessitating the computation of the normalising constant. The MCMC recursively samples the conditional posterior where the most recent values of the conditional parameters are used in the simulation.

The two components of the MCMC are Monte Carlo estimation and Markov Chains (Simonov 2013). Monte Carlo estimation can be summarised for a given integral $\{\int g\theta f(y \mid \theta)\, \pi(\theta) d\theta\}$, the fact that the prior, π(θ), is a known density can be leveraged. Once sampling from π(θ) is possible, an m number of draws $\theta_1, \ldots, \theta_m$ can be generated to compute:

$$1/m \sum_{i=1}^{m} g(\theta_i)\, f(y \mid \theta_i) \qquad (5)$$

Given the Law of Large Numbers (LLN), this converges to the expectation of the original integral, $\{\int g\theta f(y \mid \theta)\, \pi(\theta) d\theta\}$. The posterior distribution can be similarly sampled:

$$1/m \sum_{i=1}^{m} g(\theta_i) \rightarrow^{a.s.} \{(\int g\theta f(y \mid \theta)\, \pi(\theta) d\theta) / (\int (y \mid \theta)\, \pi(\theta) d\theta)\} \qquad (6)$$ [15]

While the simulation will, by construction, converge with the true distribution an $m \rightarrow \infty$, the rate of convergence is essentially limited to $1/\sqrt{m}$. It can also still be subject to large errors even when m is large (Lapyere, 2007). Treating θ as a random variable allows us to utilise the ergodic properties of Markov Chains in order to achieve convergence. The Markov property is described as follows:

$$P(\theta_{n+1} = y \mid \theta_1, \ldots, \theta_n) = P(\theta_{n+1} = y \mid \theta_n) \qquad (7)$$

That is, the value of θ at θ_{n+1} depends only on its value at θ_n. The set of θ where the Chain takes values is its state space. Ergodicity in the Markov Chain is required for it to converge to the posterior distribution, i.e., it must have the same statistical behaviour over the entire state space. The first necessary condition for this characteristic is that the distribution of θ_{n+1} given θ_n must be independent of n, i.e., the chain must be stationary. Additionally, it must reach all areas of the state space, i.e., the probability of getting from any state to another should exceed zero, so there is no subset of states where the algorithm gets trapped. If the chain is ergodic, it satisfies $1/N \sum_{i=1}^{n} y_i \rightarrow^{as} E(Y)$.

[15] The term 'a.s.' refers to asymptotic motion.

Thus in this example the prior $\pi(\theta)$ is a stationary distribution of a Markov Chain from which $\pi(\theta \mid \theta_i, y)$ will be drawn. The algorithm initialises with some starting point θ_0, then θ_1 is drawn as $\theta_1 \mid \theta_0 \sim \pi(\theta \mid \theta_0, y)$, and θ_2 is drawn as $\theta_2 \mid \theta_1 \sim \pi(\theta \mid \theta_1, y)$, repeating m times until the sample $\theta_0, \ldots, \theta_m$ is drawn. Long run averages of the draws from the Markov Chain converge to the appropriate integral for the posterior distribution $\pi(\theta \mid y)$.

What this means is that at its simplest, MCMC operates as follows. The researcher understands that the posterior distribution exists and can be defined by a parameter, θ. The researcher has a pre-evidence (prior) belief about the maximum likelihood value of this distribution and initialises the MCMC procedure by providing this value as a proposed starting point, θ_0. The first iteration of the MCMC begins with a different subsequent parameter value, θ_1, being proposed. This next guess implies a particular likelihood function and sets up a hypothesis test (which can be flexible) as to whether the proposed parameter value will be rejected or accepted by the data. If the proposal θ_1 passes the hypothesis test, the implication is that this proposal is superior to the previous proposal for the data, in that it is likely closer to the parameter value of the true posterior.

The Markovian characteristic of the MCMC is that if θ_1 passes the hypothesis test, it now forms the point against which a subsequent proposal, θ_2, will be examined. Each iterative sample is used as a stepping stone to generate the next random sample. A property of this chain is that, while each new sample depends on the previous one, subsequent new samples do not depend on any samples before the previous one, demonstrating the Markov Property (Brown 2018). However, if the current proposal is rejected, the previous proposal is retained. The Monte Carlo characteristic of the MCMC algorithm is that this sampling process repeats over $\theta_0, \ldots, \theta_m$ until the true parameter θ is realised. The advantage of combining the two characteristics into the MCMC algorithm, is that while Monte Carlo is ergodic in the long run, the Markovian characteristic decreases the likelihood that the algorithm settles at a local rather than the global optimum. Several criteria by which the algorithm terminates exist, but they are not discussed here.

Two popular MCMC estimation procedures are the Metropolis-Hastings method and the Gibbs Sampler. This paper utilises the latter and is explained as follows:

Consider the vector of unknown parameters $\theta = (\theta_1, \ldots, \theta_p)$. An arbitrary starting point is chosen $\theta_0 = (\theta^0_1, \ldots, \theta^0_p)$, implying i =0. Then, given $\theta_i = (\theta^i_1, \ldots, \theta^i_p)$,

a) generate θ^{i+1}_1 from the conditional posterior $\pi(\theta^{i+1}_1 \mid \theta^i_2, \ldots, \theta^i_p)$

b) generate θ^{i+1}_2 from the conditional posterior $\pi(\theta^{i+1}_2 \mid \theta^{i+1}_1, \theta^i_3, \ldots, \theta^i_p)$

c) generate θ^{i+1}_3 from the conditional posterior $\pi(\theta^{i+1}_3 \mid \theta^{i+1}_1, \theta^{i+1}_2, \theta^i_4, \ldots, \theta^i_p)$

d) generate $\theta^{i+1}_4, \ldots, \theta^{i+1}_p$ similarly, then set i = i+1, and repeat the process until convergence.

By invoking the ergodicity of Markov Chains, these repeated draws form the basis of inference.

4.3 The TVP VAR

A basic structural VAR defined as

$$Ay_t = F_1 y_{t-1} + \ldots + F_s y_{t-s} + u_t,\ t = s+1, \ldots, n \qquad (8)$$

Where y is a kx1 vector of observables and A, F1, …, Fs are kxk matrices of coefficients. The term ut is a kx1 disturbance i.e., structural shock and ut ~ N (0, ΣΣ), where Σ is a kxk diagonal matrix with σ1, …, σk on the diagonal elements. A is restricted to being lower triangular, and the model can be expressed in the reduced form as

$$Y_t = B_1 y_{t-1} + \ldots + B_s y_{t-s} + A\Sigma\varepsilon_t,\ \varepsilon_t \sim N(0, I_k) \qquad (9)$$

Where Bi = A-1Fi for I = 1, …, s. Tensoring the rows of Bi's into a k2s x 1 vector, β, and defining Xt = Ik ⊗ (y't-1, …, y't-s)[16], allows the reduced form VAR to be written as

$Y_t = X_t\beta + A^{-1}\Sigma\varepsilon_t$ (10)

This representation is still time invariant, but can be stated as the TVP-VAR simply as

$Y_t = X_t\beta + A^{-1}\Sigma\varepsilon_t,\ t = s+1, \ldots, n$ (11)

In this representation, the coefficients β_t and the parameters A_t and Σ_t are all time varying. In this estimation, the matrix A_t is considered to be lower triangular, mainly for simplicity and this is not the only form of restriction that can be imposed. Additionally, the parameters are considered to follow a random walk process in order to capture the unrestricted dynamic characteristics of the parameters. The variance-covariance structure of Σ is diagonal[17] in β_t, A_t and h_t. It should be reiterated at this juncture that the variable h_t accounts for stochastic volatility. While the presence of stochastic volatility results in a nonlinear and non-random model, accounting for it most often allows the parameters to more closely reflect the true model (Cogley and Sargent, 2005). In any case, MCMC can treat the inconvenience of non-normality in TVP-VAR models as some identifiable 'integration' of normal state spaces and conduct draws from this formulation (Koop and Korobilis, 2010). The notion of parsimonious models is relaxed in employing TVP-VARs, complexity increasing with the number of variables as well as the notion of time variance. Both practically and conceptually, priors facilitate 'shrinkage' of the parameters toward their fundamental levels. For the covariance structure, priors for Σ_β, Σ_a and Σ_h will be applied. The initial states of these TV parameters require a separate prior however, and owing to their random walk nature, multiple approaches can be used[18].

Estimating the model would rely on the Gibbs sampling approach outlined above. Let $y = \{y_t\}^{t=1}_n$, and $w = (\Sigma_\beta, \Sigma_a, \Sigma_h)$ with a prior density π(w). From the data y, we draw samples from the posterior distribution π (β, a, h, w │y) by the following algorithm:

1) Initialise β, a, h, w,
2) Sample β│a, h, Σβ, y,
3) Sample Σβ│β
4) Sample a│β, h, Σa, y,
5) Sample Σa│a,
6) Sample h│β, a, Σh, y,
7) Sample Σh│h
8) Go to (2) and repeat until convergence.

For the actual model estimation, the MCMC is conducted for 10000 iterations after a burn- in period of 1000 iterations. The priors for Σ_β, Σ_a and Σ_h are inverse Wishart priors, given that a Gibbs sampler is utilised for posterior inference (Koop and Korobilis, 2010). Concerning the priors for these parameters, a tighter prior is used for Σ_β while diffuse priors are utilised for Σ_a and Σ_h. The priors for the initial states are fairly flat. The details of the procedure can be found in Nakajima (2011).

[16] ⊗ is the Kronecker product

[17] The tensor of A_t, stacks its lower triangular elements into a vector a_t, and h_t is the log volatility, $\log\sigma^2_{jt}$

[18] Noted as i) a normal distribution based on the mean and variance on a pre-sample constant parameter VAR, and ii) a flat prior for the initial states reflecting a view of no apriori information (Nakajima, 2011).

The results of the study are based on an estimated unrestricted model, in that no structural sequence is imposed. In this way the relationships of interest are extracted in a pairwise fashion. The results are displayed as topographical impulse response functions (IRF)[19] that relate the cross-section of the forecasted responses of the dependent variable following a shock of a size relative to the average level of stochastic volatility over the reference period. Essentially, one impulse-response function is computed for each period, and the cross-section represents all such responses computed over the reference period. This allows the researcher to observe how the dynamic relationship between impulse and response changes over time, and make inferences about what drives the structural dynamics of this relationship. Other research (e.g., Mumtaz, Zabczyk, and Ellis 2011) sometimes employs smoothing techniques in representing the IRFs, but this sacrifices the rich dynamics offered for inference by the TVP-VAR technique. In this manuscript, the entire cross-section of impulse-responses is analysed. Summary results tables (**Tables 3 and 4**) can be found at the end of the results section. The data extend quarterly from December 2000 to December 2019, and is expressed in annualised growth rates.

5.0 Results

5.1 Income Funds – Aggregate

Income funds make up the largest portion of total aggregate FUM. The analysis suggests that a positive shock to economic activity (**q**), given by the Quarterly Index of Real Economic Activity (QEA), results in a notable increase in Income FUM (**inc_fum**) over most of the review period (**Figure 1**). However, the positive and consistent reaction is likely due to two different dynamics. The first being the pre-GFC period where robust economic growth was accompanied by elevated interest rates, supporting strong Income fund returns. The second post-GFC relationship would have seen monetary policy accommodation supporting economic recovery. During this period, lower interest rates inflated bond prices resulting in a positive valuation impact on Income funds. On the other hand, no notable change is observed in the IRFs during the GFC period, nor the period corresponding with the 2014 oil price shock, suggesting that aggregate Income funds were relatively resilient to these structural shocks.

The positive shock to the QEA also results in an initial negative response in net-sales (**inc_net**), followed by a mixed trend over the remainder of the time series. The initial dip in net-sales could be attributed to increased expenditure reducing the savings rate. However, the mixed trend in the following periods is likely due to two dynamics working in opposite directions: an increase in savings during improving economic conditions, in addition to lower interest rates reducing savings. Overall, the net impact suggests that low interest rates can have negative effect on savings, however, sustained improvements in economic conditions can overcome this effect and stimulate increased net-sales to Income funds. Additionally, the period prior to the GFC exhibited volatile positive spikes in net-sales followed by a substantial decline and net-redemptions in the period coinciding with the onset of the GFC. This reversal was likely due to domestic investors withdrawing funds to limit any exposure to declining asset values or any potential run on Income funds. On the other hand, the 2014 oil price shock did not reveal any notable change in net sales to Income funds as investors likely held firm given the expectation of safety in fixed NAV funds.

A shock to headline inflation (**i**) has a mixed response over the time varying results (**Figure 2**). Prior to and during the onset of the GFC, higher inflation results in a positive and volatile response by Income FUM, contrary to the theoretical response. The initial pre-GFC behaviour of Income FUM to inflation is likely due to the infrequent issuances of primary bonds in the domestic market, resulting in demand for these assets outstripping supply and maintaining elevated bond prices. The reaction then tapers off into a minimal impact over the next few periods, however, a notable decline in Income FUM is observed during the 2014 oil price shock, corresponding with inflationary pressures and an uptick in Treasury rates. Higher inflation also results in an overall negative impact in net-sales to Income funds, though, a few instances of positive responses are observed. This suggests that inflation initially induces savings due to reduced consumer confidence, however, as inflation continues to erode economic agents purchasing power, net-sales to Income funds declines.

[19] The topographical impulse response functions (Figures 1 to 23) displayed in the Results section are based on the authors' computations via MATLAB programming and statistical analysis software.

Figure 1: Impact of Economic Activity (q) on Income Funds - FUM and Net Sales

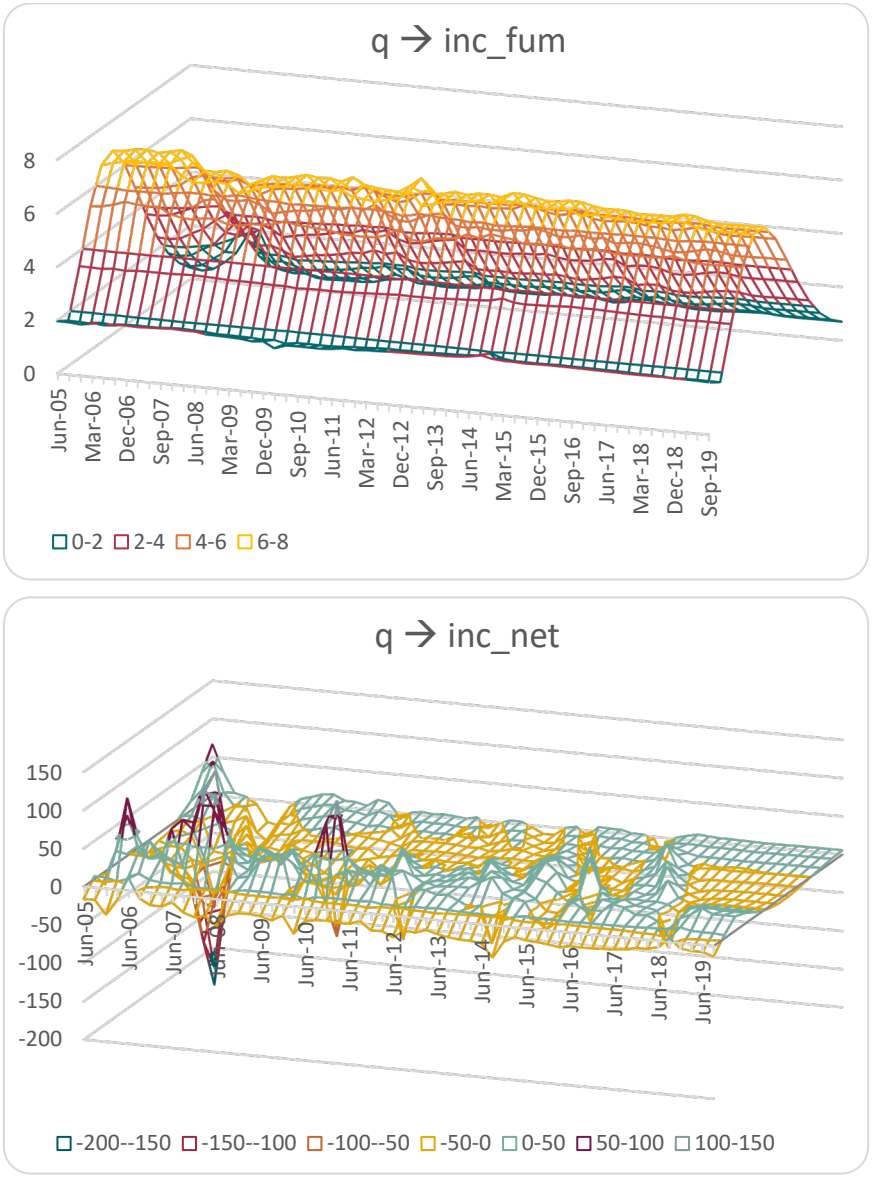
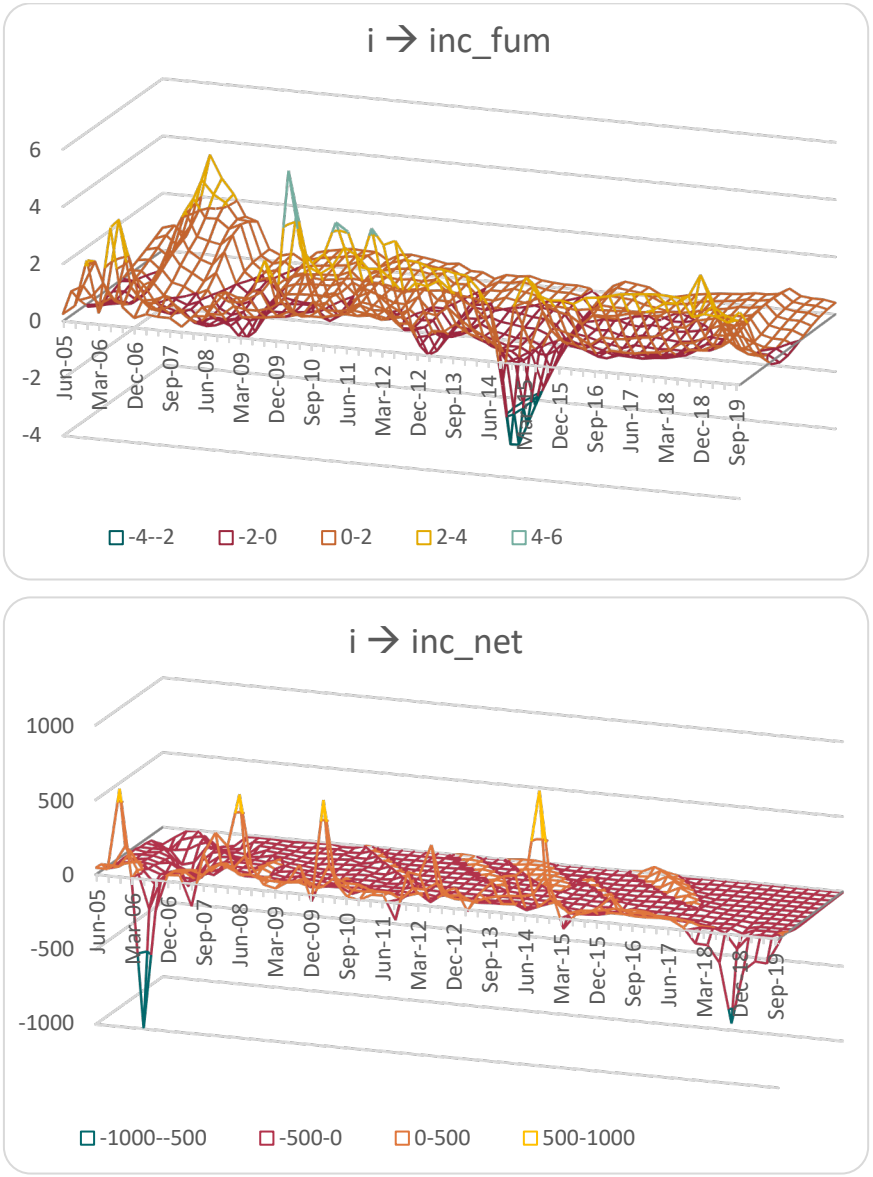


Figure 2: Impact of Headline Inflation on Income Funds - FUM and Net Sales



Income FUM initially responds negatively to the short-term 3-month TT Treasury rate (**t3m**), which then turns positive a few periods ahead (**Figure 3**). Overall, the initial negative impact is attributed to falling bond prices due to higher short-term rates. However, Income FUM quickly corrects to a positive response in the medium to long-term following the shock, likely the result of portfolio rebalancing[20]. The peak response during the earlier period is similarly due to the limited supply of primary bond issuances in the domestic market, resulting in demand outweighing supply and inflating these asset prices. This suggests that the limited availability of short-term Treasury and bond assets in the domestic market could limit the ability of Income funds to manage interest rate risks. The response of net-sales to Income funds is somewhat mixed over the time-varying series. Initially, there is a notable negative impact, coinciding with the period around the financial crisis. Following this, the reaction is slightly negative suggesting that the higher Treasury rates could be associated with higher inflation, reducing purchasing power and the level of savings. Some positive responses are observed in later periods, likely due to an increase in the savings rate corresponding to higher short-term interest rates.

In terms of the effect of a shock to longer-term bond assets, the TT 10-year Treasury rate (**t10y**) appears to have an overall positive impact on Income FUM, with a notable large jump prior to the GFC (**Figure 4**). This suggests that domestic Income funds can benefit from higher yields on new long-term assets while defending against interest rate risks. On the other hand, the reaction also mirrors the issues in the domestic bond market where demand for these assets surpasses supply, keeping bond prices elevated. Despite no discernible impact during the 2014 oil price collapse, following this structural shock, the positive response of Income funds to the TT 10-year Treasury rate is notably smaller. The response of net-sales to Income funds following a shock to the TT 10-year rate is somewhat mixed. During the initial time-varying periods and the GFC, an increase in the long-term rate appears to have a substantial negative impact on net-sales, however, during the post-financial crisis period, the impact is marginally negative with periods of positive net-sales. The results indicate that the financial crisis period reduced incentives to save or invest in these funds, however, in the later periods, the effect was less pronounced.

[20] According to Zilbering et al (2015), portfolio rebalancing refers to the goal of minimising risk relative to a target asset allocation in an effort to recapture a portfolio's risk-and-return characteristics. Over time, asset classes produce different returns that alters a portfolio's allocation. Portfolios are often rebalanced during these periods. Furthermore, fund managers must also comply with investment classes and currency restrictions, limiting options related to portfolio rebalancing. However, in most cases, portfolio rebalancing is a strategic and planned undertaking and often achieves targets.

Figure 3: Impact of TT 3-Month Treasury Rate on Income Funds - FUM and Net Sales

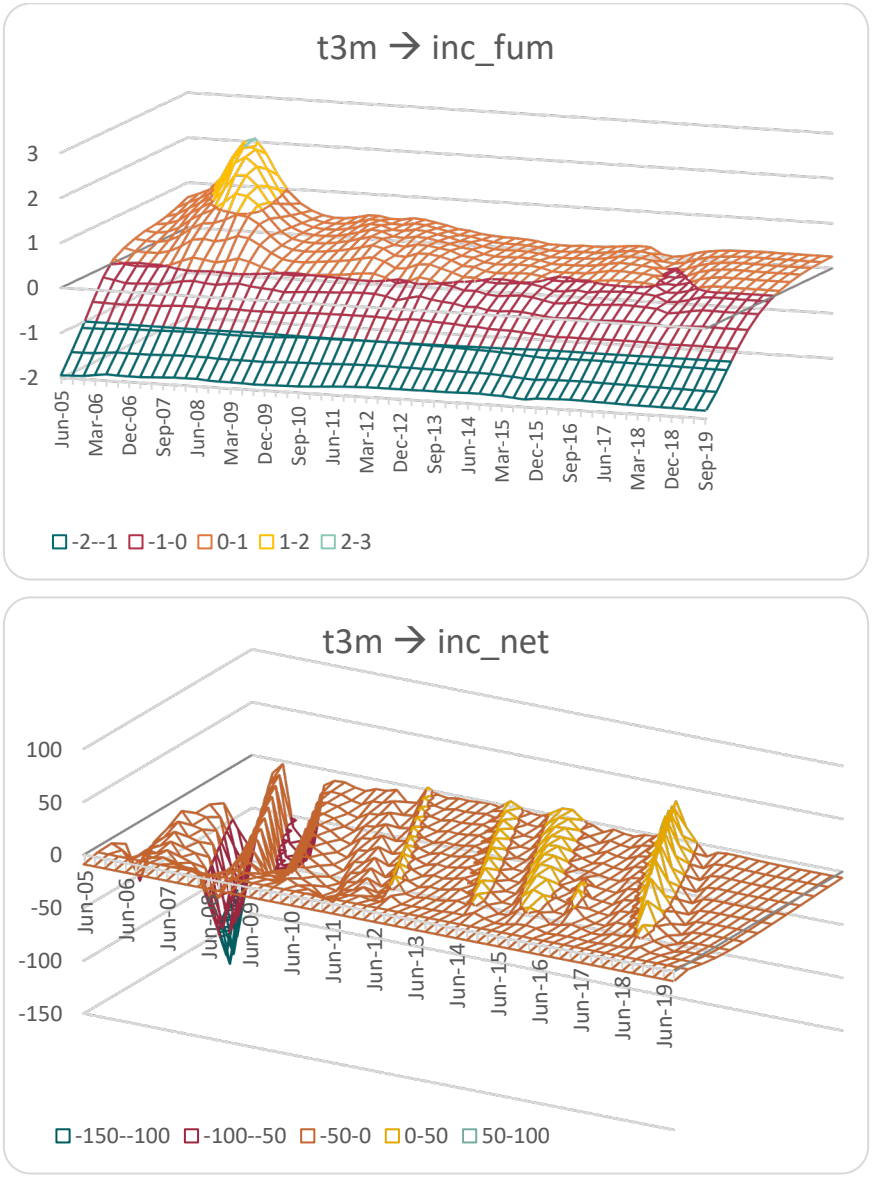
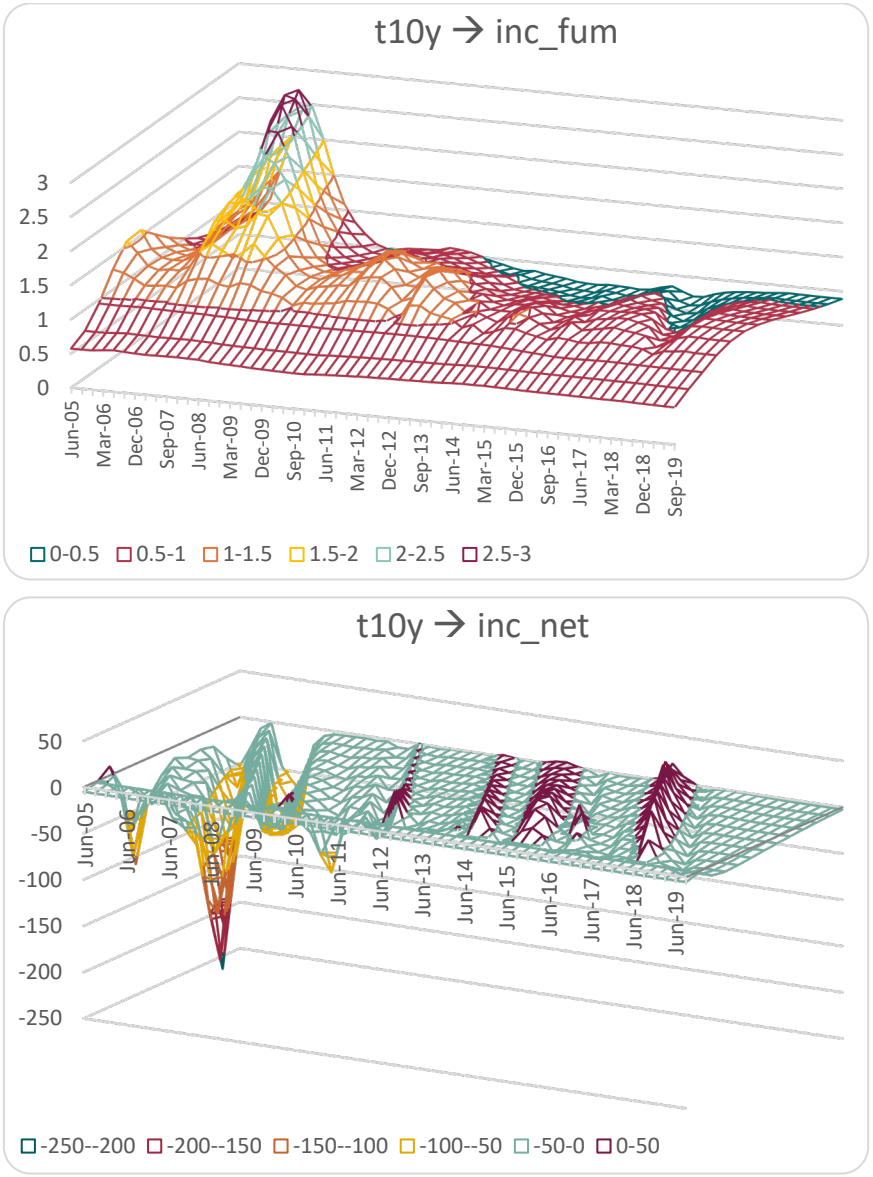


Figure 4: Impact of TT 10-Year Treasury Rate on Income Funds - FUM and Net Sales



5.1.1 Income Funds – Fixed NAV, TT Dollar

Similar to the impact on aggregate Income funds, a positive shock to QEA results in a notable increase in TT dollar fixed NAV Income FUM (**inc_fum_tt_fix**) over the period (**Figure 5)**. The results also did not display any negative response to the GFC or the 2014 oil price shock, suggesting that the fixed NAV structure of these funds were resilient to the financial market volatility during this time. Additionally, a positive to shock to QEA results in a general short-term increase in net-sales. The findings suggest an overall preference for the safety of fixed NAV funds. A shock to domestic headline inflation displays a general negative impact on TT dollar fixed NAV Income FUM, especially prior to and during the GFC periods (**Figure 6)**. This is attributable to higher inflation and nominal rates resulting in lower bond prices and reducing the value of FUM. The negative effect of a shock to inflation is also observed in substantial net-redemptions to these funds, likely due to inflation reducing both spending power and savings, in addition to inflation eroding the limited returns generally associated with fixed NAV funds.

A positive shock to the TT 3-month Treasury rate impacts TT dollar fixed NAV Income FUM in a complex manner. Initially, there is a marginal decline in FUM, followed by a quick reversion into positive before dipping back into negative territory where it remains (**Figure 7)**. The initial decline is likely due to higher Treasury yields resulting in a negative valuation effect and a net-withdrawal effect, followed by a portfolio rebalancing effort to recover asset valuations. However, the longer term negative FUM effect suggests that these fixed NAV funds not able to fully recover asset valuations following any type of monetary policy tightening. On the other hand, a shock to the TT 10-year Treasury rate results in an overall negative impact on TT dollar fixed NAV Income FUM and an initial notable increase in the net-sales position (**Figure 8)**. The negative impact on FUM would be due to negative asset valuation changes caused by the higher long-term rate, emphasising heightened interest rate risks. However, the increase in net-sales is likely caused by an increase in savings as a result of a higher interest rates. Additionally, the GFC and 2014 oil price shock produced no distinct changes to the IRFs, suggesting that these funds were relatively resilient to these structural shocks.

The impact on TT dollar fixed NAV Income funds from a shock to US short-term and long-term Treasury rates differs from that shown by domestic Treasuries. Prior to and during the GFC, a positive shock to the US 3-month (**u3m**) and 10-year (**u10y**) Treasury rates resulted in an initially positive impact on TT dollar fixed NAV Income FUM (**Figure 9 and 10)**. However, the initial time-varying impact turned negative over the latter periods. This dynamic is likely due to TT dollar Income funds initially benefitting from higher US interest rates, supporting higher fund returns. However, the negative reaction in the latter periods is likely due to a negative valuation effect on US dollar assets. Considering that post GFC, interest rate in advanced economies would have remained relatively accommodative or neutral, then any increase in interest rates would have resulted in falling bond values. The effect is apparent during the 2013 US taper tantrum[21] which resulted in a surge in Treasury yields and subsequent dive in bond prices. Furthermore, the positive shock to US Treasuries appears to have an initially large positive short-term impact on net-sales to TT dollar fixed NAV Income funds, suggesting that as US interest rates increase, investors switch to TT dollar funds in order to hedge any valuation risks associated with US dollar Income funds. Investors may also be more inclined to seek the safety of fixed NAV funds during periods of increasing interest rate risks.

[21] The 2013 taper tantrum refers to the surge in US Treasury yields following an announcement from the Federal Reserve (Fed) of a future tapering of its quantitative easing policy which was instituted during the GFC. Quantitative easing supported bond prices through its ongoing purchases by the Fed. The premature assumption of tapering therefore resulted in investors quickly selling bond assets causing prices to be depressed.

Figure 5: Impact of Economic Activity on TT Dollar, Fixed NAV Income Funds - FUM and Net Sales

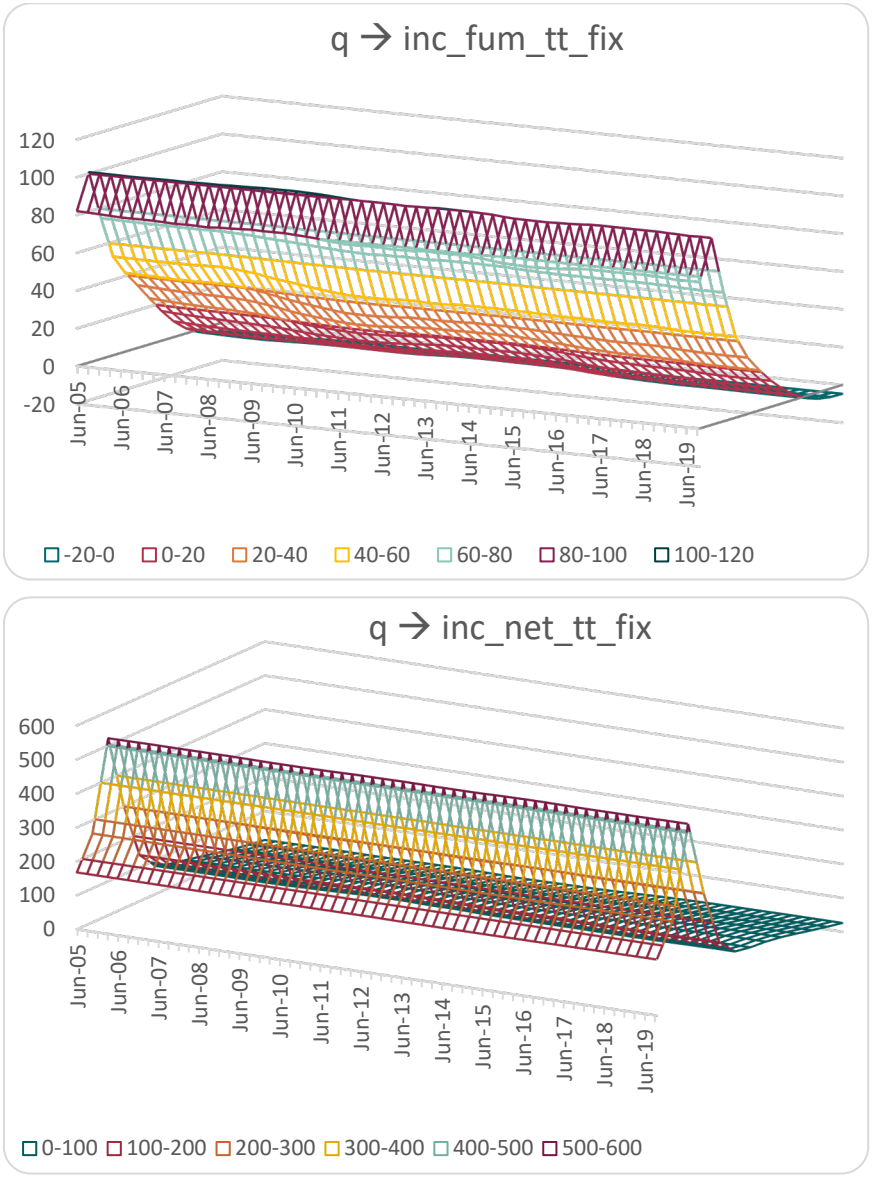


Figure 6: Impact of Headline Inflation on TT Dollar, Fixed NAV Income Funds - FUM and Net Sales

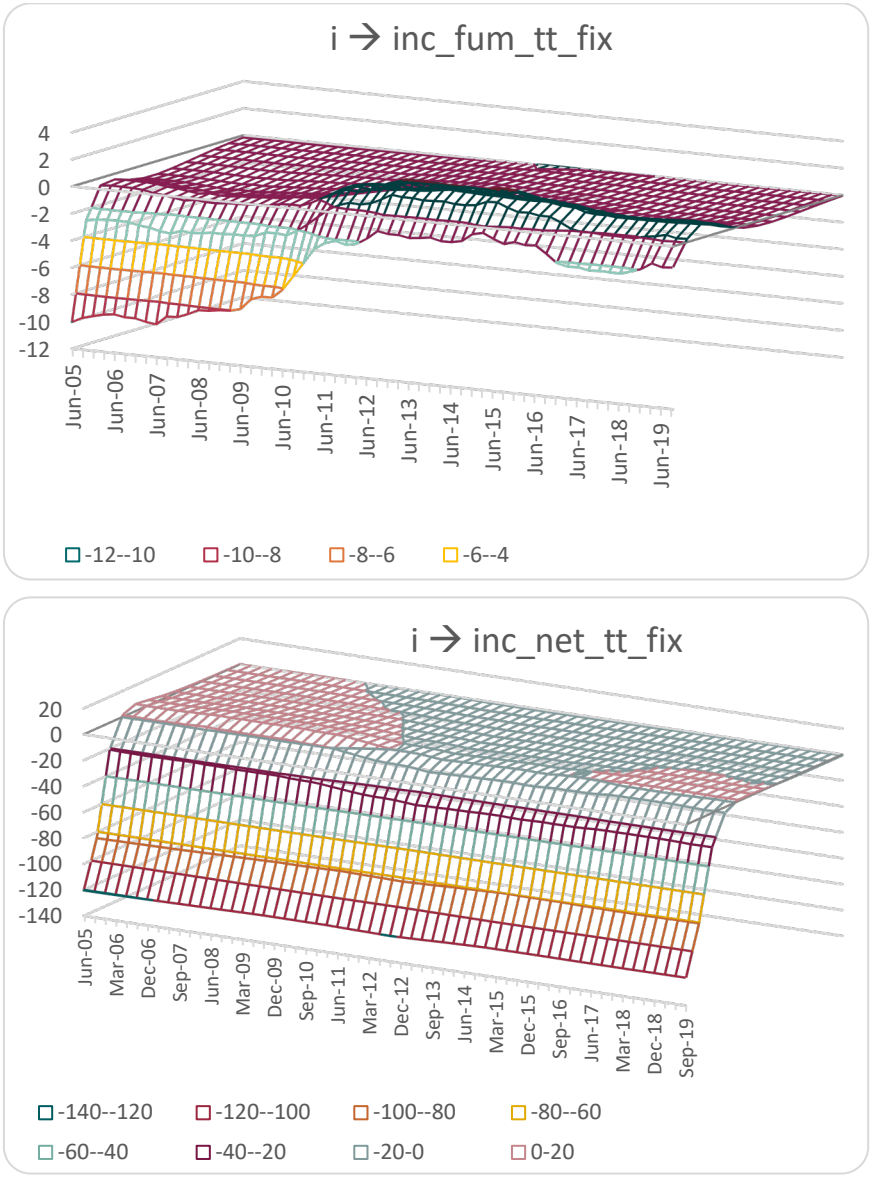


Figure 7: Impact of TT 3-Month Treasury Rate on TT Dollar, Fixed NAV Income Funds - FUM and Net Sales

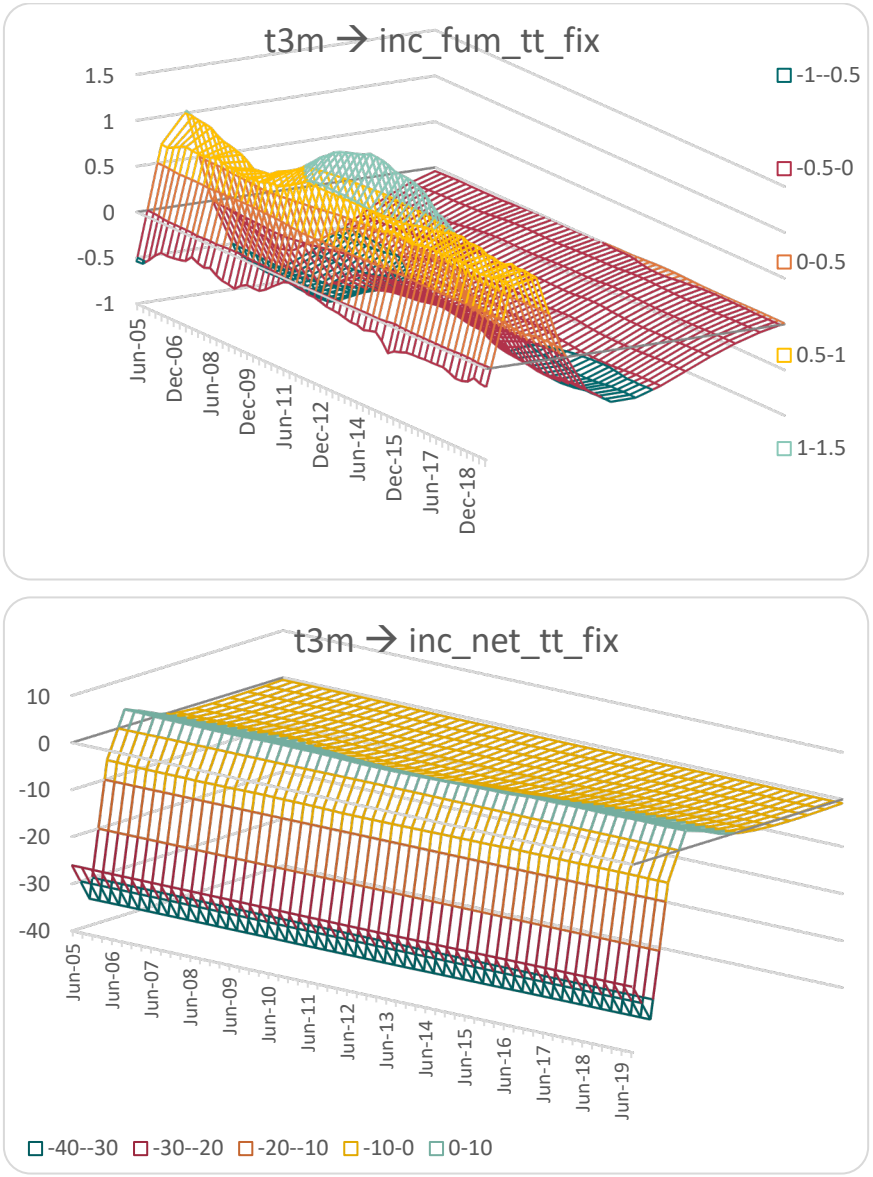


Figure 8: Impact of TT 10-Year Treasury Rate on TT Dollar, Fixed NAV Income Funds - FUM and Net Sales

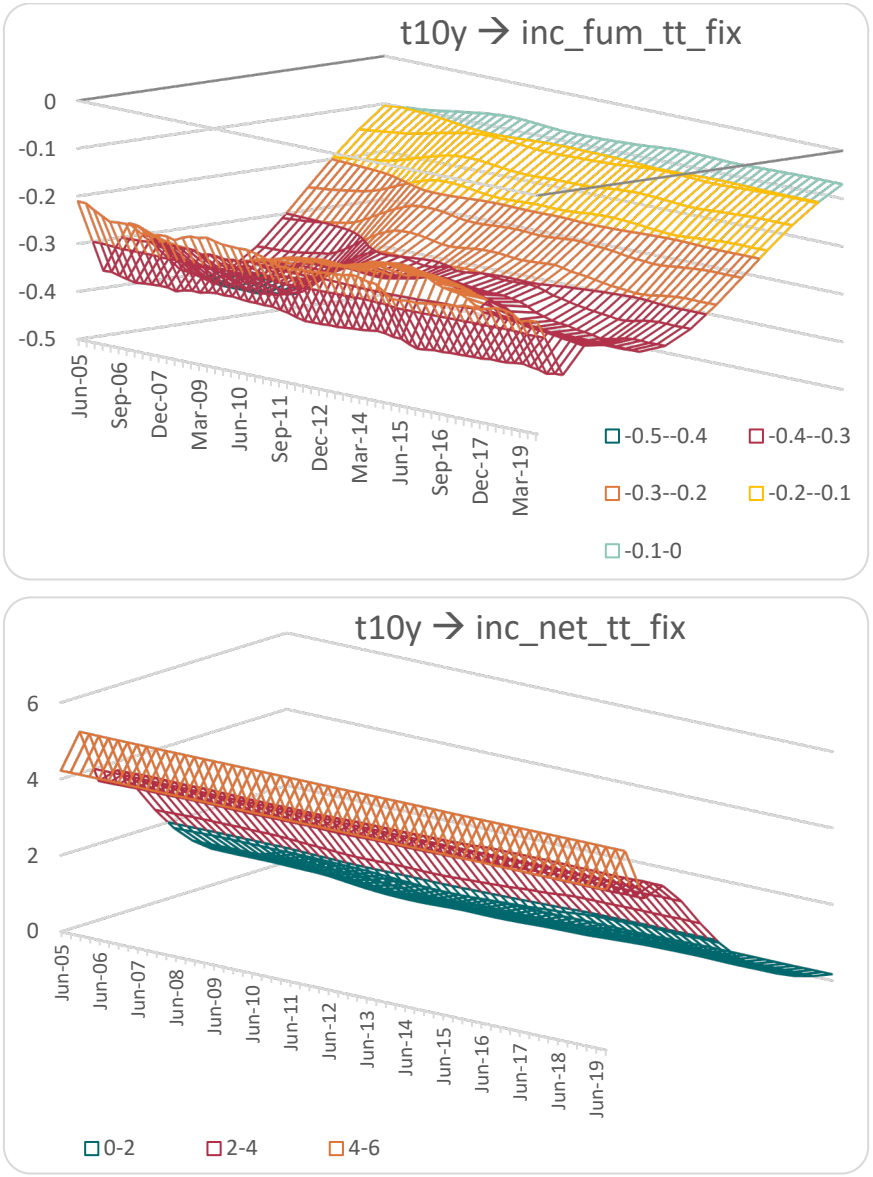


Figure 9: Impact of US 3-Month Treasury Rate on TT Dollar, Fixed NAV Income Funds - FUM and Net Sales

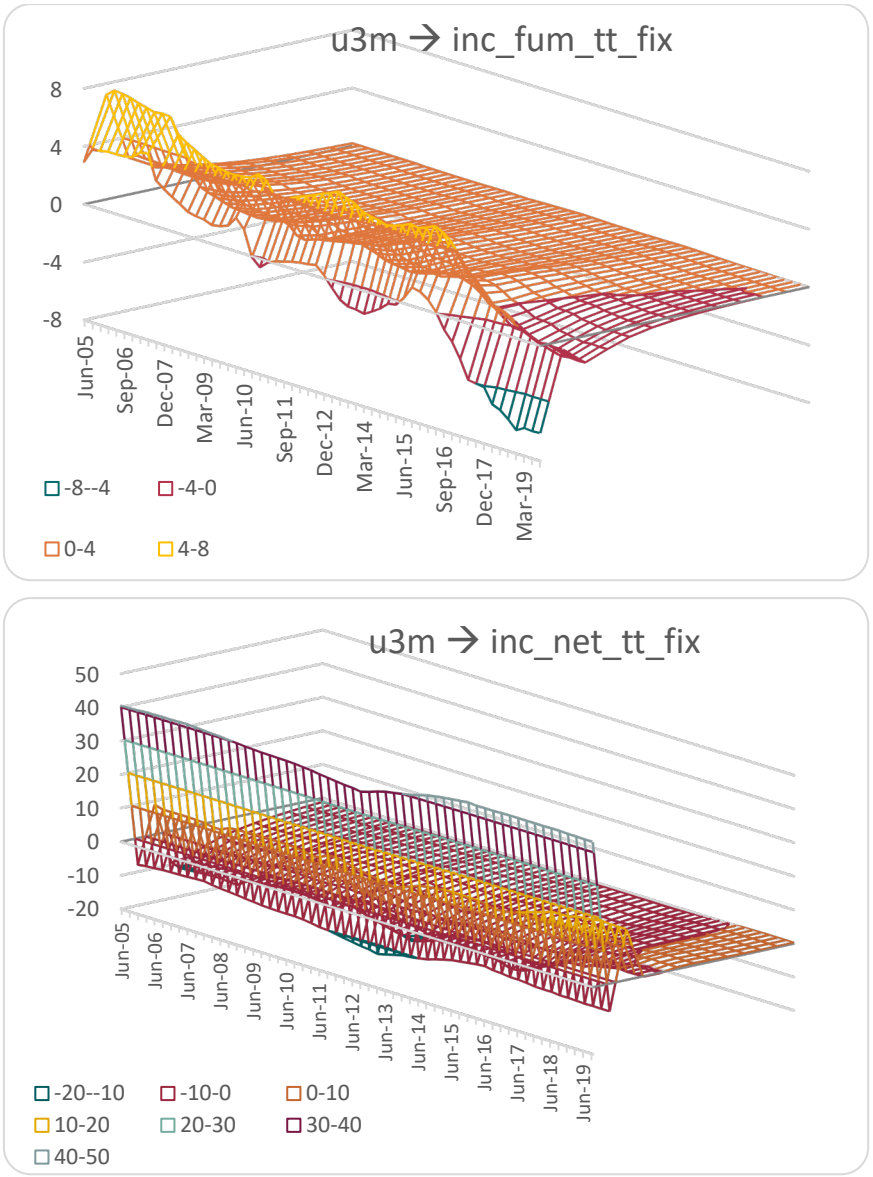
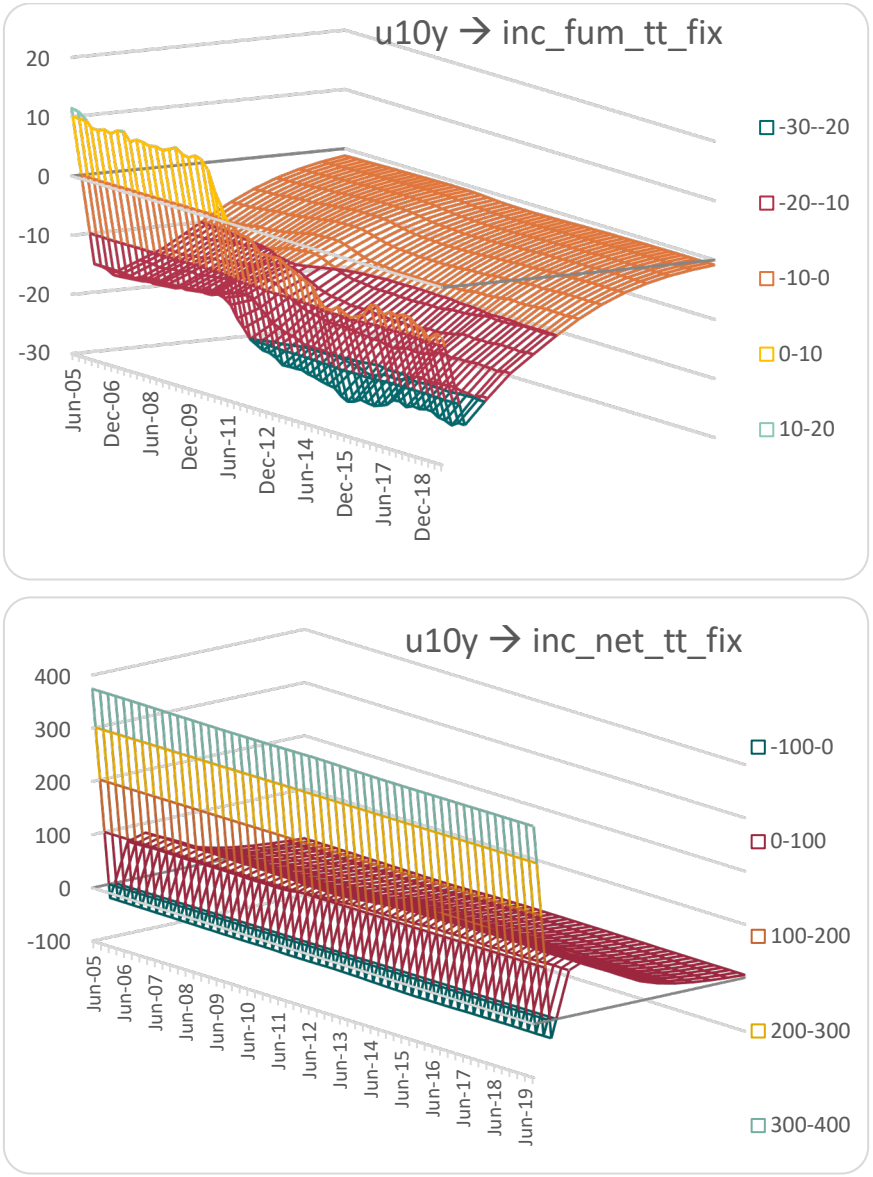


Figure 10: Impact of US 10-Year Treasury Rate on TT Dollar, Fixed NAV Income Funds - FUM and Net Sales



5.1.2 Income Funds – Fixed NAV, Foreign Currency

Similar to the impact on total Income funds, a positive shock to QEA results in a notable increase in foreign currency fixed NAV Income FUM (**inc_fum_tt_fix**) over most of the review period (**Figure 11**). This positive effect is likely a result of robust economic growth in the pre-GFC period and monetary policy accommodation in the post-GFC period. On the other hand, a shock to domestic headline inflation has a mixed response as foreign currency fixed NAV Income FUM initially experiences a large decline during the pre-GFC period, likely due to higher nominal interest rates eroding bond values and higher inflation reducing spending power and savings. However, this negative impact tempers over the more recent post-GFC periods as the reaction is less substantial.

A positive shock to the TT 3-month Treasury rate exhibits a very mixed result over the review period (**Figure 12**). Before 2009, the impact was generally negative, likely due to a negative valuation impact stemming from higher short-term rates. However, between 2009 to 2017 the impact was volatile, with positive and negative responses by foreign currency fixed NAV Income FUM. This post-GFC period would have been impacted by monetary policy accommodation and the 2014 oil price shock. Conversely, a shock to the TT 10-year Treasury rate results in an initial negative impact on foreign currency fixed NAV Income FUM, which then turns positive in the long-term. Likely due to an initial negative valuation impact, followed by successful portfolio rebalancing and a recovery in FUM. The impact on foreign currency fixed NAV Income FUM from a shock to the US 3-month and 10-year Treasury rates both depict an initial increase during the earlier pre-GFC periods, while the latter periods exhibit a negative impact (**Figure 13**). This suggests that during the earlier periods, especially prior to the GFC, increasing interest rates in the US supported an increase in FUM, however, post financial crisis, these funds would have been negatively impacted by valuation changes following an increase in the respective Treasury rates.

Figure 11: Impact of Economic Activity and Headline Inflation on Foreign Currency, Fixed NAV Income Funds

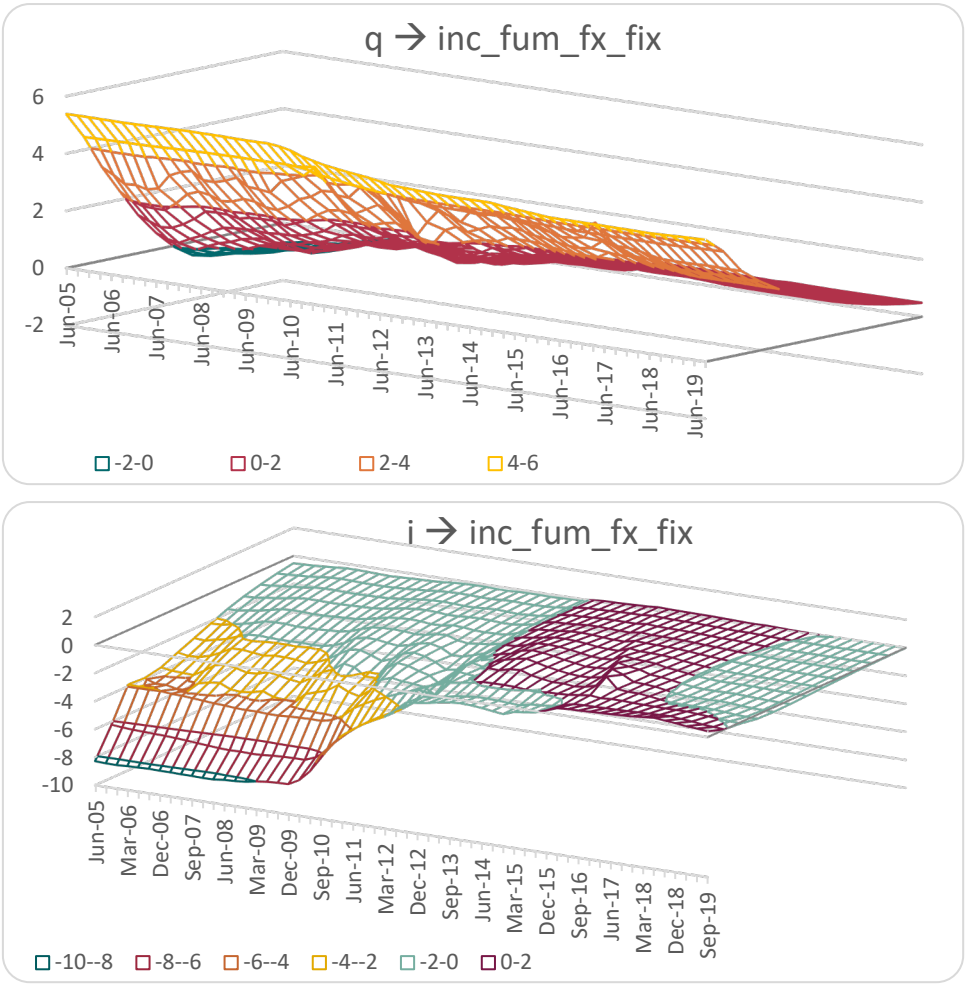


Figure 12: Impact of TT 3-Month and 10-Year Treasury Rates on Foreign Currency, Fixed NAV Income Funds

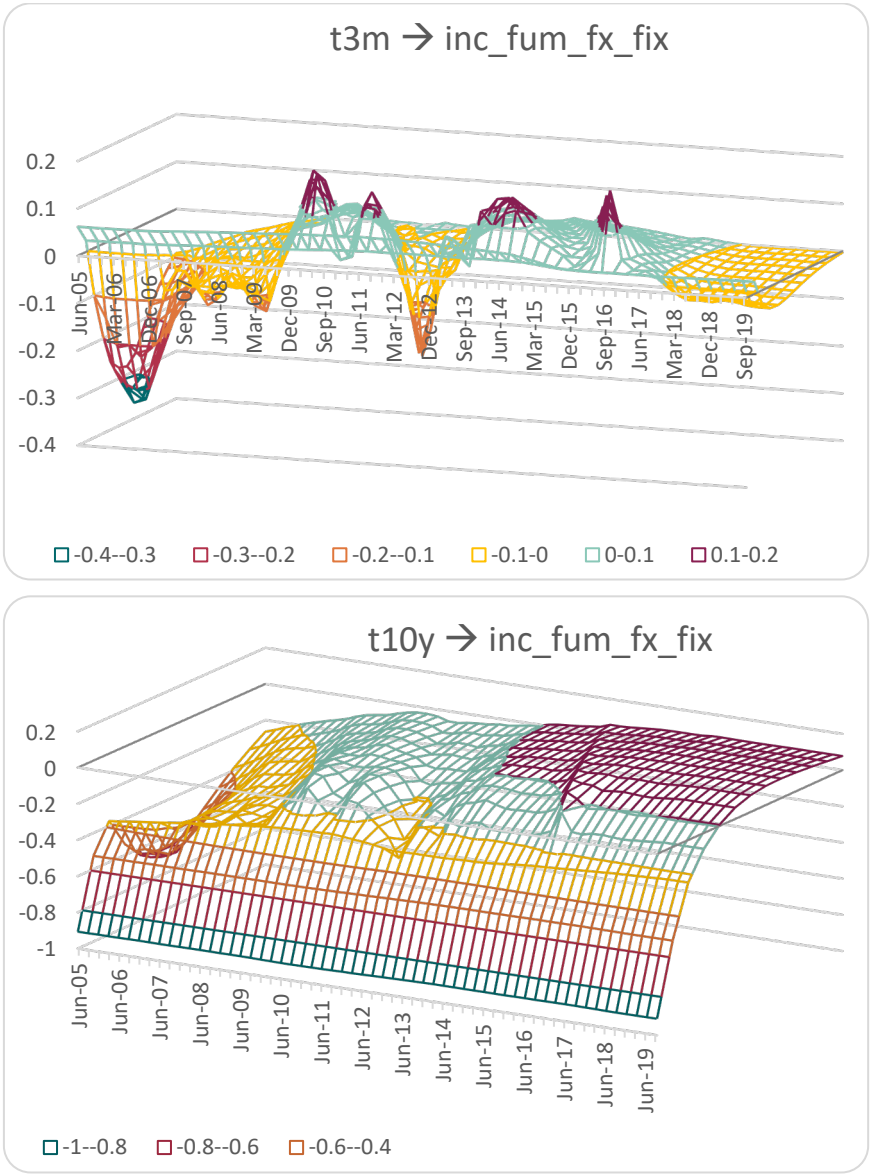
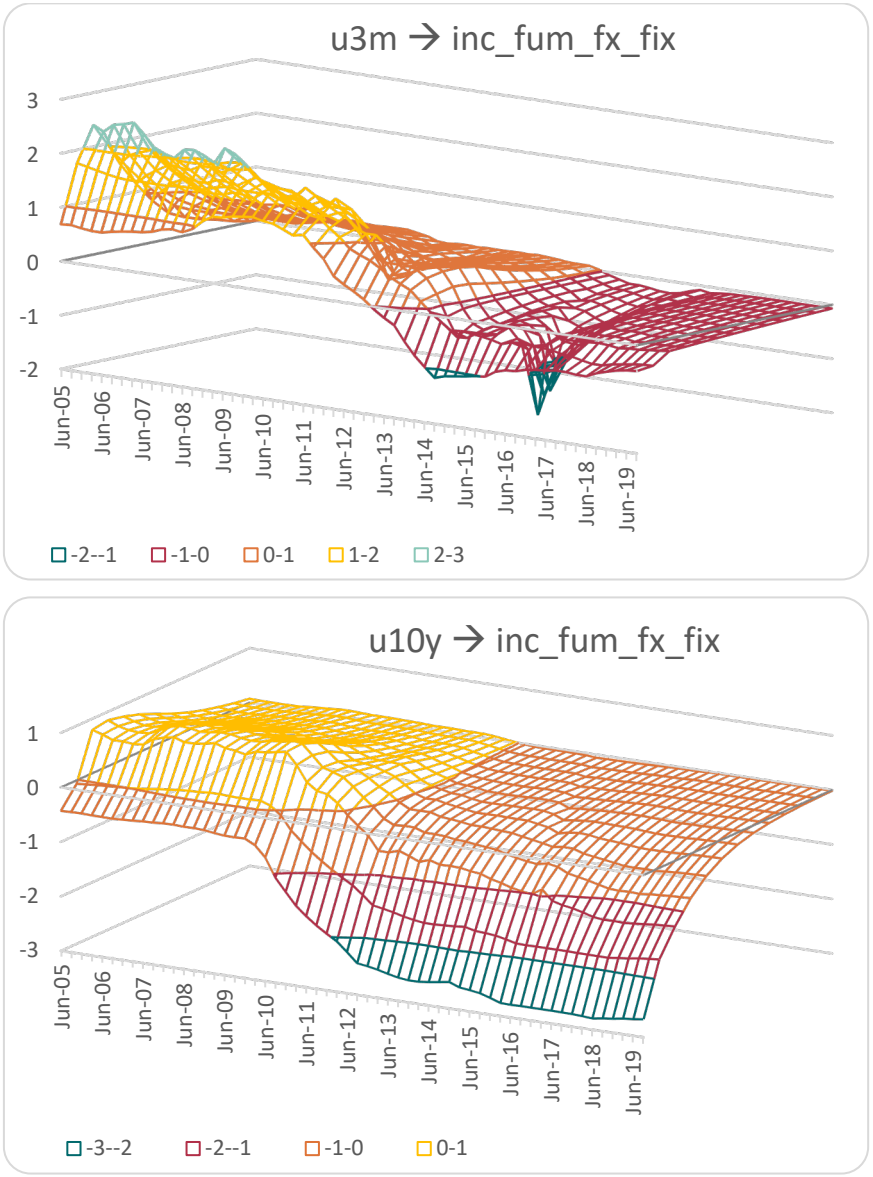


Figure 13: Impact of US 3-Month and 10-Year Treasury Rates on Foreign Currency, Fixed NAV Income Funds



5.1.3 Income Funds – Floating NAV, TT Dollar

In response to a positive shock in economic output, TT dollar floating NAV Income FUM[22] (**inc_fum_tt_flt**) initially reacts negatively before subsiding in the long-run (**Figure 14**). Considering that these funds pass on NAV volatility risks to the investors, the negative reaction to the QEA index is likely due to increasing interest rates during periods of economic growth, which would negatively impact the valuation on bond assets held in these portfolios. Furthermore, following the positive shock to the QEA index, net-sales (**inc_net_tt_flt**) initially reacts negatively which quickly turns to a positive jump, confirming the theory of a higher savings and investment rate during periods of economic growth. However, the impact on net-sales returns to negative in the long-run.

Apart from some initial jumps during the financial crisis periods, a shock to headline inflation generally results in a declining trend for TT dollar floating NAV Income funds (**Figure 15)**, confirming that higher inflation and nominal rates results in lower bond prices, negatively affecting floating NAV funds. Additionally, a shock to inflation initially results in a fall in net-sales to these funds, suggesting a short period of reduced savings. However, this quickly reverts into a large jump in net-sales indicating that investors become increasingly concerned about economic stability resulting in a preference to increase investment savings.

Shocks to the 3-month and 10-year domestic Treasury rates both resulted in an initial decline in TT dollar floating NAV Income FUM, however, the response from the shock to the 3-month rate remained relatively negative, while that of the 10-year rate turned into a positive impact on the FUM (**Figure 16 and 17)**. This confirms that floating NAV Income funds are initially impacted by negative valuation changes from higher Treasury rates. However, the longer-run positive impact from a shock to the 10-year rate suggests that portfolio managers are successfully rebalancing portfolios and managing interest rate risks. Shocks to the short- and long-term Treasury rates also triggers initial net-redemptions, which then turns into some instances of net-sales. This result somewhat follows that of inflation, where higher rates are likely accompanied by rising inflation, initially resulting in reduced spending power and lower savings. However, as the shock continues, investments to these funds occasionally recover, spurred by economic stability concerns.

[22] Floating NAV Income funds makes up roughly 22.0 per cent of all Income funds. Of this, 64.1 per cent are TT dollar floating NAV Income funds.

Figure 14: Impact of Economic Activity on TT Dollar, Floating NAV Income Funds - FUM and Net Sales

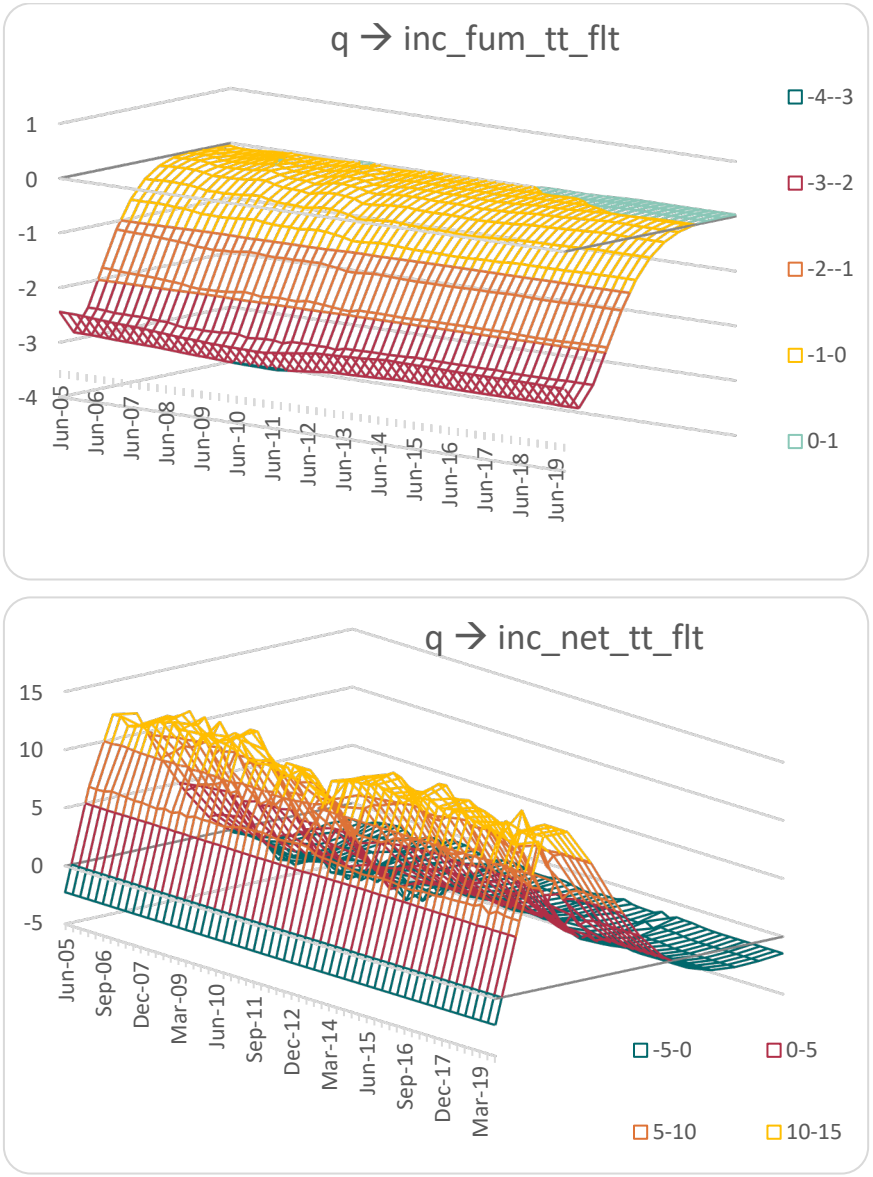


Figure 15: Impact of Headline Inflation on TT Dollar, Floating NAV Income Funds - FUM and Net Sales

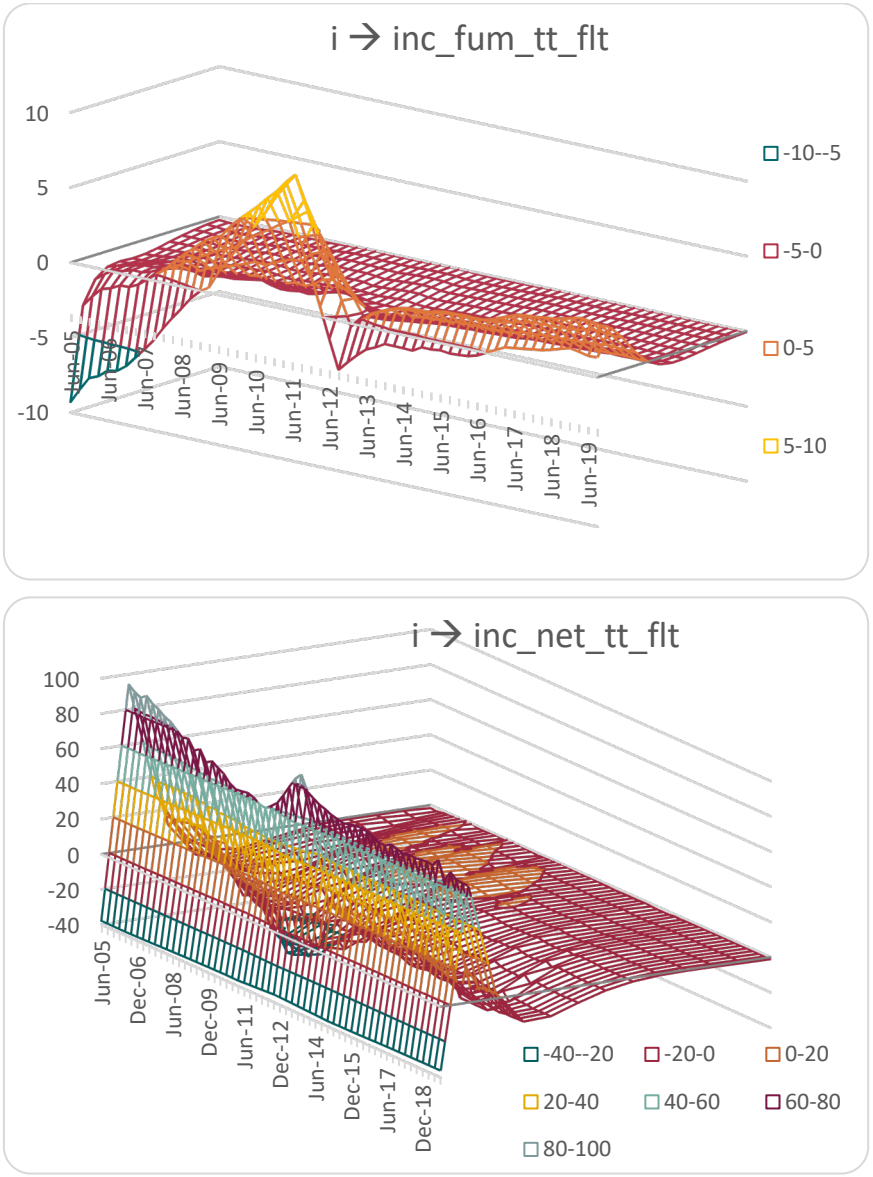


Figure 16: Impact of TT 3-Month Treasury Rate on TT Dollar, Floating NAV Income Funds - FUM and Net Sales

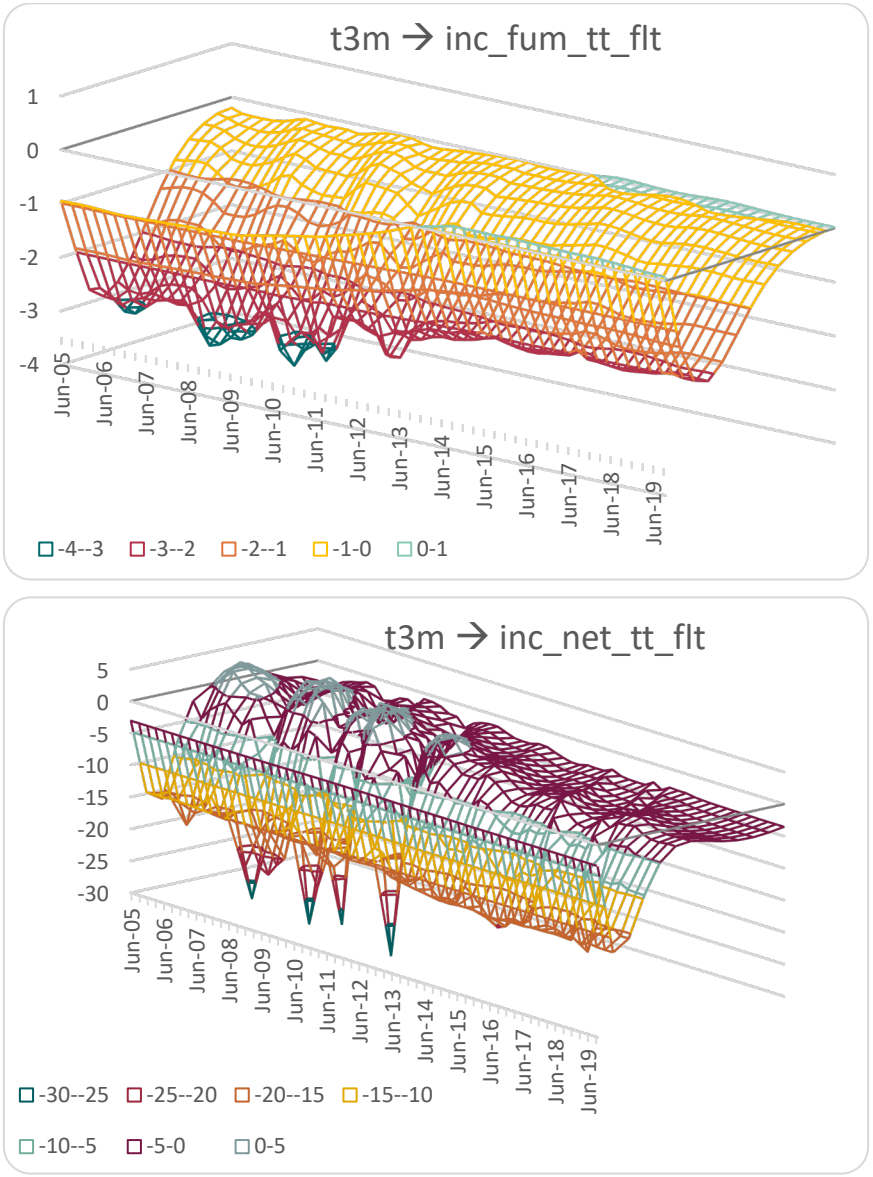
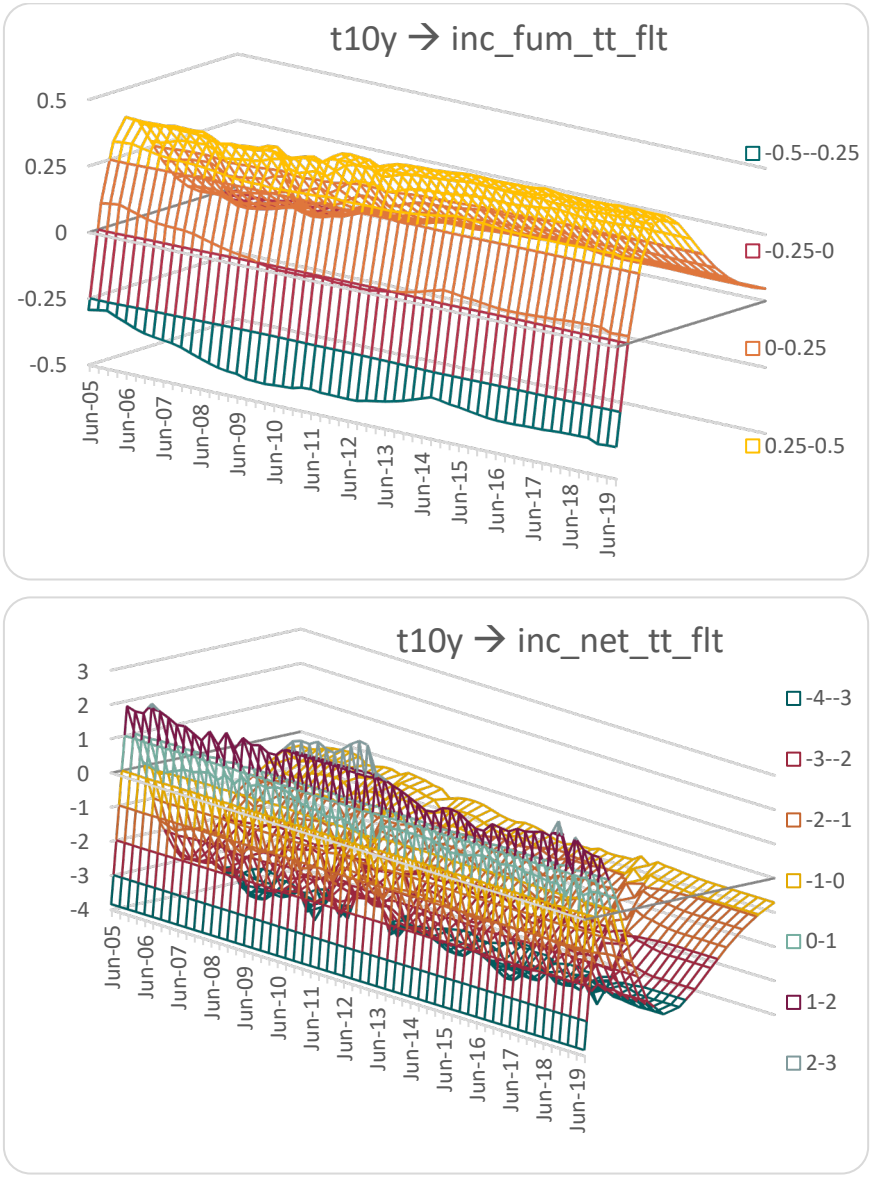


Figure 17: Impact of TT 10-Year Treasury Rate on TT Dollar, Floating NAV Income Funds - FUM and Net Sales



5.2 Money Market Funds - Aggregate

Money Market funds (MMF), which accounts for around 25.0 per cent of the industry, has been growing substantially, mainly due to the relative safety supported by the fixed NAV structure and guaranteed principal investment. A positive shock to the Quarterly Index of Real Economic Activity (QEA) results in a notable positive reaction of MMF FUM (**Figure 18**), suggesting that these funds are supported by positive valuation changes during monetary accommodation, and increasing interest rates during robust economic growth. Despite the increase in FUM, net-sales to MMFs unexpectedly reacts negatively to an increase in economic activity. Given the relative safety of fixed NAV funds, Money Market funds generally provides a small fixed return to investors. As such, during periods of rising interest rates, investors are likely to search for higher yielding investments and greater returns from Income and Equity funds, inducing net-redemptions from MMFs. Furthermore, during the GFC and 2014 oil price shock, substantial declines in net-sales is observed, suggesting that during these periods' investors were bearish, or pessimistic, about the state of the underlying economy.

A positive shock to inflation however results in a decline in MMF FUM, likely due to higher inflation and nominal rates depressing bond prices (**Figure 19**). Additionally, the inflation shock initially results in a short-lived positive impact on MMF net sales which turns negative over the next few periods. This reaction of net-sales is likely due to inflation initially inducing savings due to reduced consumer confidence, followed by a fall in purchasing power generating a fall in savings.

The results of the analysis suggest that Money Market funds react differently to domestic and US 3-month Treasury rates. A positive shock to the US 3-month Treasury rate initially results in a positive response by MMF FUM, even during the GFC (**Figure 20**). During this period, domestic MMF were likely able to manage portfolios and benefit from periods of changing interest rates. However, the response then declines substantially during 2013, coinciding with the US taper tantrum which resulted in a surge in US Treasury yields, triggering a negative valuation effect on these funds. Following this period, MMF FUM generally responded negatively, suggesting that these funds were not able to effectively hedge against rising US Treasury rates. A shock to the US 3-month Treasury rates generally resulted in a mixed net-sales reaction. Prior to the GFC, net-sales reacted generally positive, however, substantial negative volatility was observed during the 2010 to 2012 period, suggesting that the volatility in the US Treasury market following the GFC was still causing turbulence in domestic MMFs.

In comparison, a positive shock to the TT 3-month Treasury rate initially results in a negative impact on MMF FUM, which then tapers off over the next few periods (**Figure 21**). This result could be due to two possible circumstances. Firstly, negative valuation changes following an increase in Treasury yields. Although MMFs generally have reduced interest rate risk due to the short-term nature of assets and lower portfolio durations, the limited availability of short-term Treasury assets or bonds in the domestic market may not support the ability of MMFs to hedge against interest rate risks. This effect is somewhat confirmed in the response of MMF net-sales to an increase in TT short-term Treasury rates. Although an increase in short-term rates should stimulate savings, in this case, the negative valuation impact results in a noticeable initial decline in net-sales before tapering off over the next few periods. Secondly, the negative reaction of MMF FUM could be due to a corresponding increase in the short-term US Treasury rate. Since CBTT's monetary actions considers the TT:US interest rate differential, an increase in US rates could result in an increase in the domestic rate to curb capital outflows, negatively affecting Treasury asset prices. Acknowledging that MMFs are all fixed NAV, this negative response of MMFs to an increase in TT short-term rates could be a major concern if domestic Treasury rates begin to increase substantially.

Figure 18: Impact of Economic Activity on Money Market Funds - FUM and Net Sales

Figure 19: Impact of Headline Inflation on Money Market Funds - FUM and Net Sales

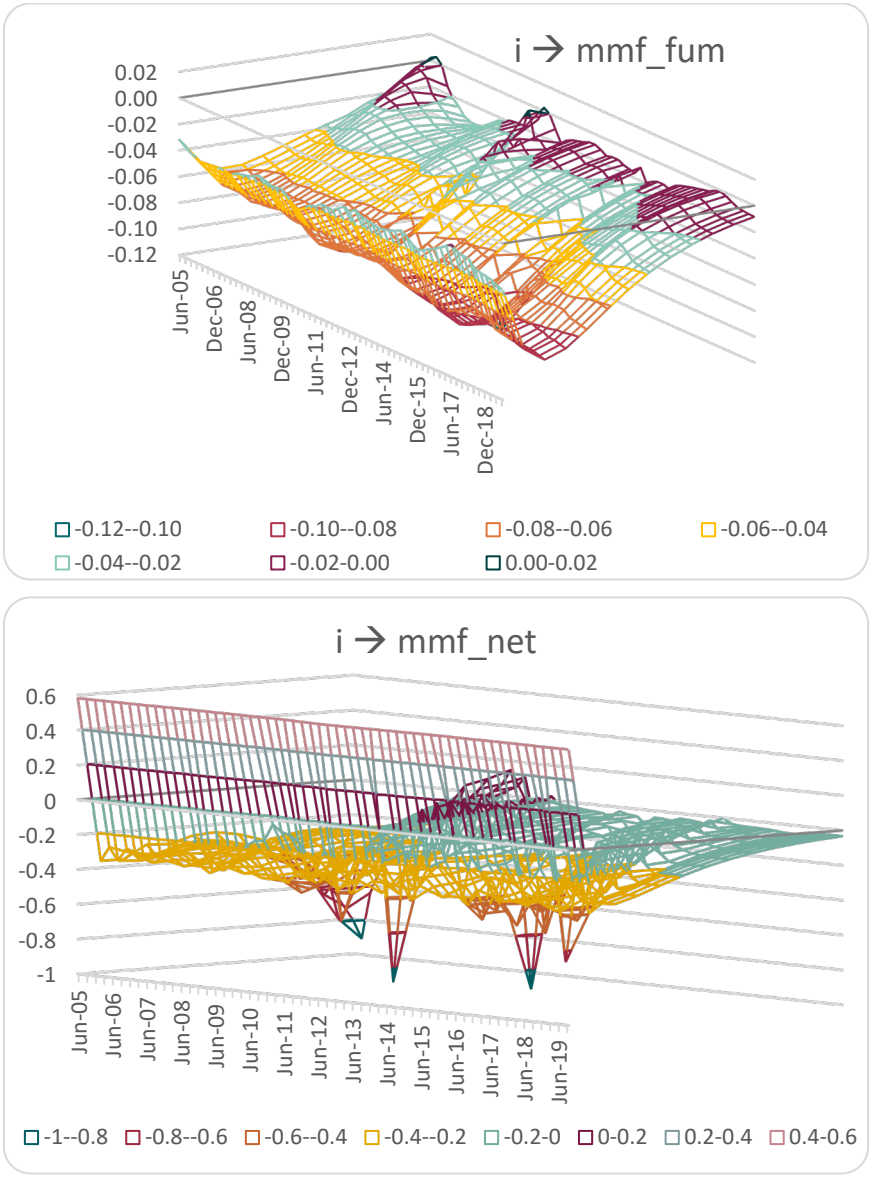


Figure 20: Impact of US 3-Month Treasury Rate on Money Market Funds - FUM and Net Sales

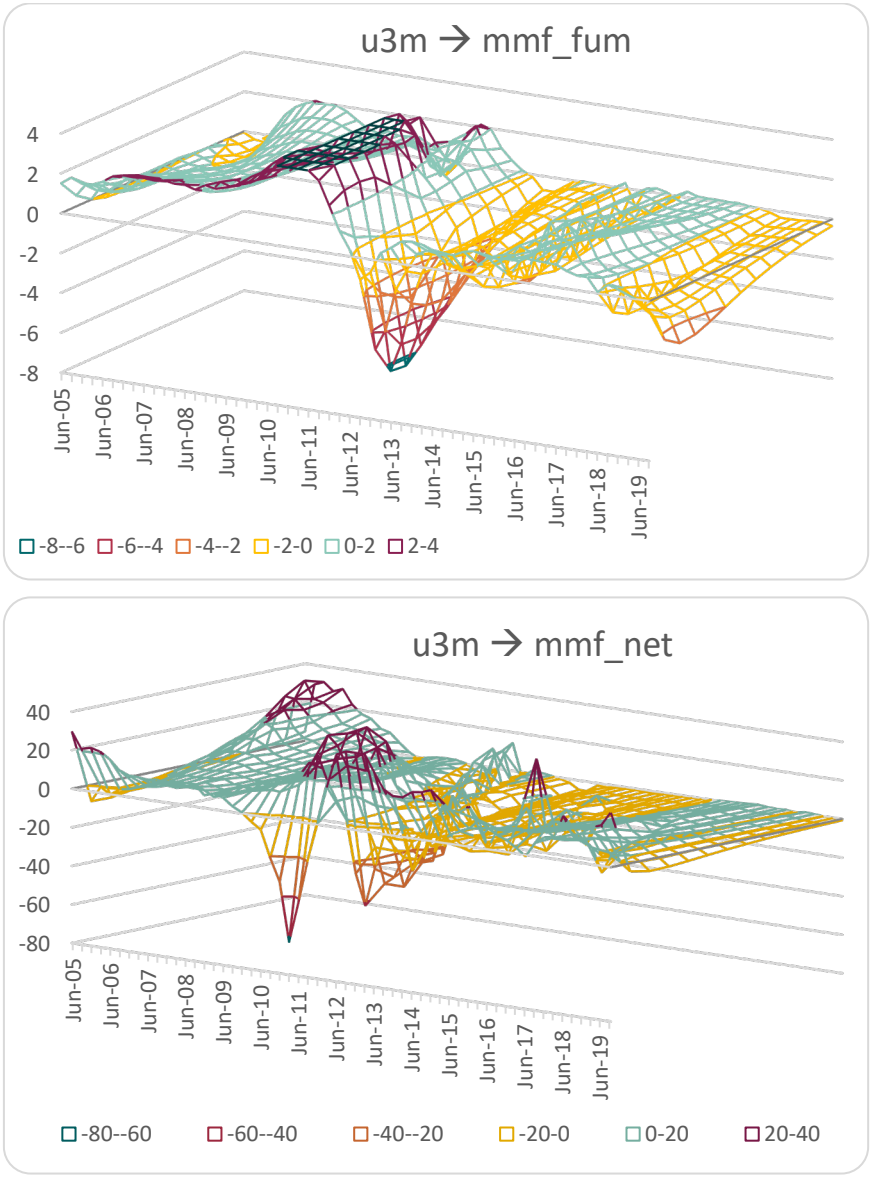
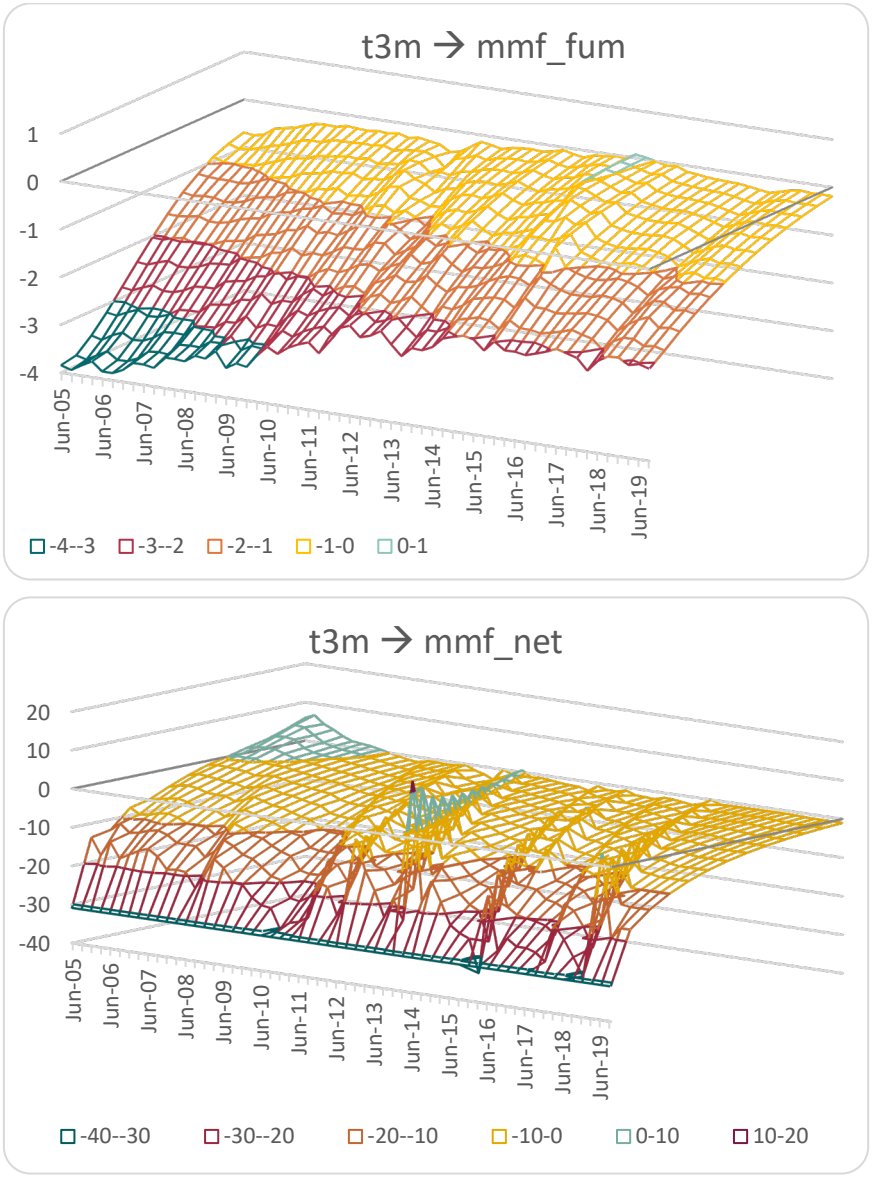


Figure 21: Impact of TT 3-Month Treasury Rate on Money Market Funds - FUM and Net Sales

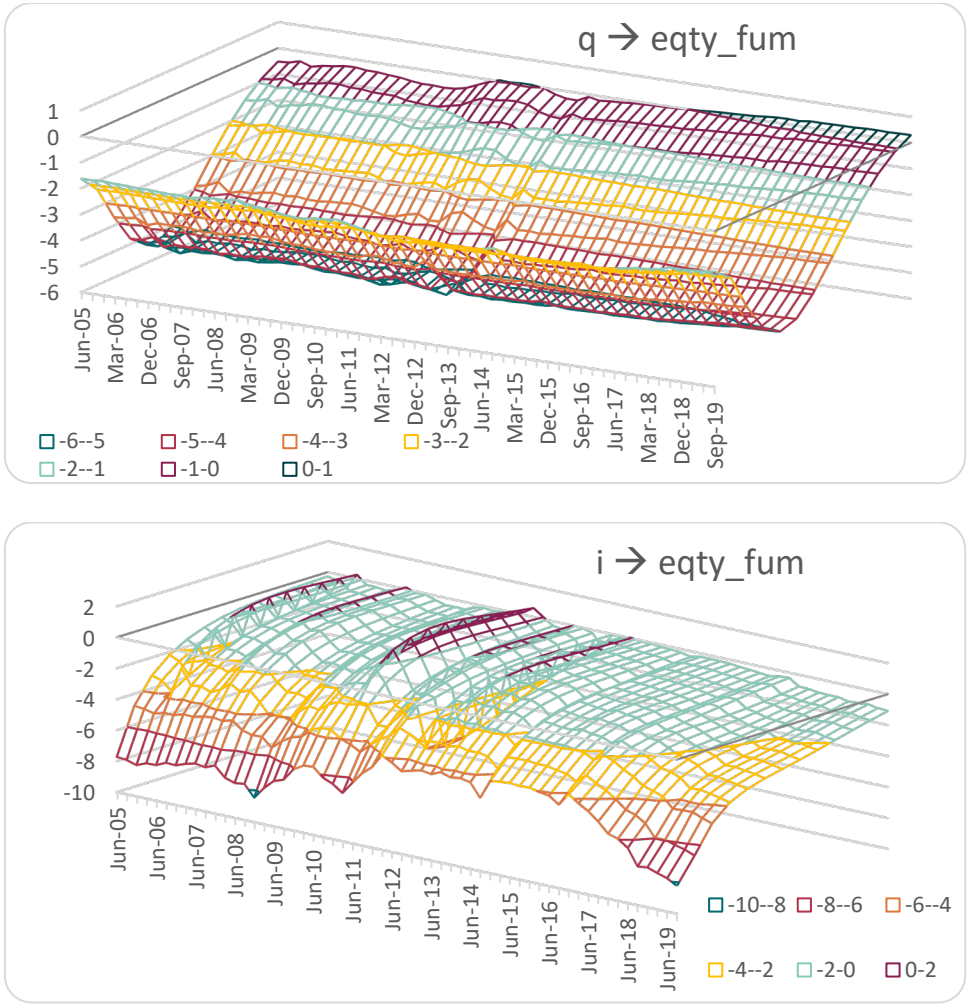


5.3 Equity Funds - Aggregate

Equity funds in the domestic mutual fund industry are all floating NAV due to the inherent risk characteristics associated with these assets. A positive shock to the Quarterly Index of Real Economic Activity (QEA) uncharacteristically results in a negative response by Equity FUM (**Figure 22**). Similarly, positive shock to headline inflation results in a notable decline in Equity FUM. These results are likely linked through the relationship between economic growth and inflation. In a study examining the determinants of stock market development in Trinidad and Tobago, Dhanessar (2018)[23] found that inflation has a unidirectional negative impact on stock market capitalisation, suggesting that inflation erodes equity gains in the domestic market. Considering that GDP and inflation are often correlated, this result confirms the findings by Dhanessar (2018) and McCarthy et al (1990)[24] who determined that accounting for real economic activity did not remove the negative relation between stock market returns and inflation. As a result, the negative reaction of Equity FUM to a positive shock in the QEA is likely a reaction to inflation eroding equity gains.

In alignment to the theoretical response, a positive shock to the US S&P 500 stock index results in a notable initial increase in Equity FUM which tapers off over the next few quarters (**Figure 23**). While a positive shock to the major domestic stock index results in an initial positive response by Equity FUM, which then marginally dips into negative territory.

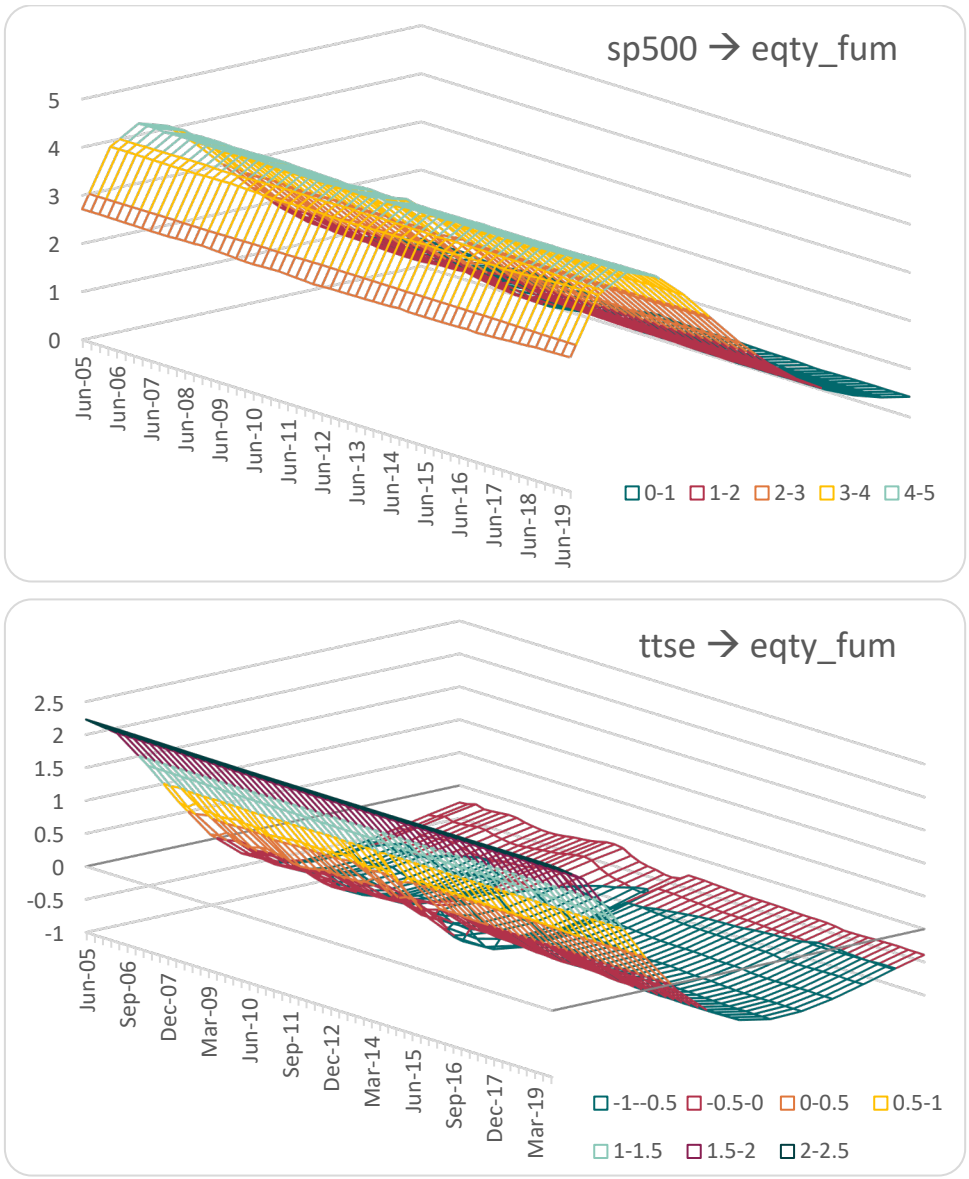
Figure 22: Impact of Economic Activity and Headline Inflation on Aggregate Equity Funds



[23] The Determinants of Stock Market Development in Trinidad and Tobago (Dhanessar 2018, unpublished).

[24] McCarthy, Joseph, Mohammad Najand, and Bruce Seifert. (1990). "Empirical Tests of the Proxy Hypothesis." The Financial Review 25, no. 2: 251-263.

Figure 23: Impact of the S&P500 Index and the TTSE CPI on Aggregate Equity Funds



5.4 Summary Results Tables

Table 3: Summary Results – The Impact of Macroeconomic and Financial Variables on the Funds Under Management (FUM) of the Major Fund Types

Macroeconomic and Financial Market Variables	Response of Funds Under Management (FUM)		
	Income Funds	Money Market Funds	Equity Funds
GDP	⊕ ***Aggregate & Fixed NAV:*** general increase ↑ ⊗ ***Floating NAV***: overall decline ↓	⊕ ***Aggregate:*** general increase ↑ in FUM	⊗ **Aggregate**: general decline ↓ observed over review period
Inflation	∅ **Aggregate**: mixed, negligibly positive ↑ impact post-GFC; notable decline ↓ during 2014 oil price shock ∅ ***Fixed NAV:*** negative ↓ pre-GFC; marginally negative ↓ with periods of slightly positive ↑ responses post-GFC ∅ ***Floating NAV:*** pre-GFC decline ↓ leading to a post-GFC spike ↑; followed by mixed ↑↓ responses	⊕ **Aggregate**: general decline ↓ observed	∅ **Aggregate**: general decline ↓ observed over review period
Short-Term Treasury Rates [TT & US]	⊕ ***Aggregate:*** [TT] initial decline ↓ followed by an increase ↑ ⊕ ***Fixed NAV:*** [TT] initial decline ↓ followed by an increase↑; [US] pre-GFC increase ↑ and post-GFC decline ↓ ⊕ ***Floating NAV:*** [TT] overall decline ↓ in FUM	⊗ **Aggregate**: [TT] general ↓ decline in FUM; [US] pre-GFC increase ↑, followed by a mixed ↑↓ post-GFC reaction	NA
Long-Term Treasury Rates [TT & US]	⊕ ***Aggregate:*** [TT] general increase ↑ in FUM; smaller positive effect post 2014 oil price shock ⊕ ***Fixed NAV:*** [TT] TT dollar funds experience a decline ↓ while foreign currency funds observed an initial decline ↓ with some recovery ↑ in the latter periods; [US] pre-GFC increase ↑ and post-GFC decline ↓ ⊕ ***Floating NAV:*** [TT] initial small decline ↓ followed by a quick recovery ↑	NA	NA
Stock Indices [SP500 & TTSE]	NA	NA	⊕ **Aggregate**: [SP500 & TTSE] general increase ↑ in FUM

⊕ Indicates empirical result aligns with a theoretical response

∅ Indicates empirical result is partially or periodically different from theoretical responses

⊗ Indicates empirical result is different from theoretical responses

Table 4: Summary Results – The Impact of Macroeconomic and Financial Variables on the Net-Sales Positions of the Major Fund Types

Macroeconomic and Financial Market Variables	Response of Funds Net-Sales Positions	
	Income Funds	Money Market Funds
GDP	∅ **Aggregate**: general initial decline ↓ followed by a mixed ↑↓ trend. However, pre-GFC spike ↑ and large decline ↓ during GFC ⊕ ***Fixed NAV:*** general increase ↑ ∅ ***Floating NAV:*** initial decline ↓ trailed by a positive spike ↑ before returning to a long-term decline ↓	⊗ **Aggregate**: generally negative ↓ with notable plunges ↓ during the GFC and 2014 oil price shock
Inflation	⊕ **Aggregate**: large decline ↓ observed pre-GFC, overall decline ↓ ⊕ ***Fixed NAV:*** large initial decline ↑, marginally mixed ↑↓ in medium- to long-term post-shock ⊕ ***Floating NAV:*** initial decline ↓ trailed by a positive spike ↑ before returning to a medium-term decline ↓	⊕ **Aggregate**: initial increase ↑, followed by a negative response ↓ shortly afterwards
Short-Term Treasury Rates [TT & US]	⊗ **Aggregate**: overall mixed: general pre-GFC decline ↓ inclusive of prominent plunge ↓ pre-GFC; post-GFC generally negative ↓ with some medium- to long-term increases ↑ ⊗ ***Fixed NAV:*** large initial decline ↓ and long-term marginal decline ↓ ⊗ ***Floating NAV:*** general decline ↓ with some earlier periods showing marginal increases ↑	∅ **Aggregate**: [TT] initial decline ↓ which gradually weakens to a marginal decline ↓, few periods of positive net-sales and volatility during 2014 oil price shock observed [US] generally positive ↑ pre-GFC, however, generally negative ↓ volatility observed in the early years post-GFC while the latter periods exhibited mixed ↑↓ reactions
Long-Term Treasury Rates [TT & US]	⊗ **Aggregate**: overall mixed: general pre-GFC decline ↓ inclusive of prominent plunge ↓ pre-GFC; post-GFC generally negative ↓ ⊕ ***Fixed NAV:*** large initial increase ↑, generally positive ↑ ∅ ***Floating NAV:*** initial decline ↓ which quickly turns positive ↑ before returning to negative in the medium- to long-term	NA

⊕ Indicates empirical result aligns with a theoretical response

∅ Indicates empirical result is partially or periodically different from theoretical responses

⊗ Indicates empirical result is different from theoretical responses

6.0 Conclusion and Policy Recommendation

6.1 Conclusion

This study undertook an evaluation of the impact of macroeconomic and financial market conditions on the domestic mutual fund industry using an innovative TVP-VAR empirical methodology. This approach allows the study to capture structural changes in the dynamic relationships among macroeconomic variables. The findings can be used to inform policymakers and stakeholders on the key drivers, risk, and vulnerabilities within the industry.

Important conclusions can be drawn based on the results of the analysis. A positive shock to economic activity, generally results in an increase in aggregate Income funds under management. Pre-GFC, this impact would have been on account of robust economic growth and elevated interest rates supporting fund returns, while monetary policy accommodation and low interest rates provided a positive valuation impact during the post-GFC periods. Additionally, fixed NAV Income funds under management responded strongly to an increase in economic activity, while TT dollar floating NAV Income funds initially responded negatively, suggesting that the anticipation of rising interest rates could negatively impact valuations of these funds. Although the reaction of QEA on net-sales to Income funds is generally mixed, fixed NAV TT dollar Income funds displays a positive reaction, likely due to the protection of principal investment. Conversely, floating NAV funds, which transfers investment risks to unit holders, could potentially see net-redemptions during periods of financial market volatility.

Similar to aggregate Income funds, Money Market funds under management responds positively to an increase in economic activity, however, net-sales to Money Market funds responds negatively. Despite the safety of a fixed NAV structure, during periods of economic growth, investors may allocate funds to higher yielding investments as opposed to the shelter of fixed NAV Money Market funds, resulting in larger net-withdrawals from these funds. Conversely, a positive shock to economic activity unexpectedly triggered a negative response by Equity funds under management. This reaction is likely due to the correlation between inflation and GDP, examined in McCarthy et al (1990) and Dhanessar (2018), where higher real economic activity is unable to remove the effect of higher inflation eroding equity gains.

A positive shock to headline inflation generally resulted in a negative but sometimes mixed response by Income funds under management, confirming that higher inflation and higher nominal rates can have a negative valuation impact on Income funds. Furthermore, inflation generally had a negative impact on net-sales to Income funds, suggesting that inflation reduces investors' purchasing power and results in a lower savings rate. Conversely, the positive shock to headline inflation resulted in a somewhat atypical impact on TT dollar Money Market funds[25], which depicted a pre-GFC positive response, followed by a post-GFC negative response. During the Pre-GFC period, inflation was driven by strong economic conditions, which supported investment savings, exceeding any losses due to inflation. However, in the latter periods, the negative effect of inflation and higher nominal rates exceeded any potential increases due to economic growth. On the other hand, the impact of higher inflation on Equity funds was shown to be negative, confirming the theory that inflation erodes equity gains.

A positive shock to domestic Treasury rates was shown to mostly have a negative impact on Income funds, likely due to negative asset valuation changes. However, in the latter periods, TT dollar floating NAV and foreign currency fixed NAV Income funds responded positively, possibly owing to portfolio rebalancing following the changing interest rate environment. Higher domestic Treasury rates also prompted in an initial net-redemption effect from Income funds, which eventually turned positive. This suggests an increase in redemptions during the initial negative fund valuation impact, and possible higher nominal rates reducing investors savings rate. However, following effective portfolio rebalancing, the higher interest rates would incentivise an increase in savings.

Similarly, a positive shock to the short-term domestic Treasury rate exhibited a notable decline in Money Market FUM, likely due to negative valuation changes following an increase in Treasury yields. Although a short-term investment structure enables Money Market funds to reduce interest rate risks, the limited availability of short-term bond assets in the domestic market may not support the ability of domestic Money market funds to effectively hedge against interest rate risks. This negative valuation effect is also reflected in net-redemptions from Money Market funds, despite investors benefitting from relative principal investment protection.

[25] Over the period examined, TT dollar Money Market funds represented more than 90 per cent of aggregate Money Market funds.

A positive shock to US Treasury rates generally resulted in a mixed response by fixed NAV Income Funds and Money Market funds. Generally, fixed NAV Income funds responded positively pre-GFC, and negatively post-GFC. However, net-sales to these funds generally responded with an initial positive spike. The reaction suggests that prior to the GFC, these funds benefitted from increasing US Treasury rates, likely driven by increasing economic activity. However, following the GFC, economic conditions never regained sufficient momentum to overcome the negative valuation impact of rising US Treasury rates. Furthermore, the relative safety of fixed NAV Income funds would have provided an incentive for investing in these funds, confirmed by a large positive impact on net sales. Similarly, a positive shock to US short-term Treasury rates resulted in Money Market funds under management increasing pre-GFC, and declining post-GFC. Net-sales to Money Market funds also followed the same response pattern, suggesting that the volatility in the US Treasury market following the GFC was still causing turbulence in domestic MMFs.

A main characteristic of the MCMC driven TVP-VAR procedure is the ability to account for non-linearity in a way that traditional models do not. While the relationships identified and described in the topographical IRFs were stable and robust over the longer term, most variables reflected that the GFC, and at times the 2014 oil price crash, acted as the sources of reliably identifiable disturbances in the dynamic relationships between mutual fund categorisations and their associated impulses.

6.1.1 Fixed NAV Funds

Brewster and Chung (2008); Fisch and Roiter (2011); and Witmer (2012), all explain that fixed NAV funds, such as Money Market funds, operated with a structure that retail investors considered to be as secure as a bank account. However, during the global financial crisis, these funds "broke the buck" exposing investors to massive losses, runs, and exhaustion of short-term credit markets. Considering that the domestic mutual fund industry is predominantly made of fixed NAV funds (71.2 per cent[26]), then this poses numerous risks to the domestic financial system.

TT dollar, fixed NAV Income funds, which represents 59.6 per cent of total Income funds, responds positively to an increase in economic activity. However, inflation is shown to deteriorate the value of FUM while triggering net-redemptions, likely due to reduced purchasing power and therefore lower savings. The reaction of these funds to an increase in domestic Treasury rates is mixed. An increase in the short-term rate results in an increase in FUM and initial net-redemptions, while an increase in the long-term rate results in a decline in FUM and an increase in net-sales. Higher short-term Treasury rates suggests monetary policy tightening, indicative of rising inflation and the slowing down of an overheating economy, which was shown to trigger net-redemptions. On the other hand, higher long-term Treasury rates will have a negative valuation impact on FUM, while prompting economic stability concerns and increase savings. This reflects the theory by Deaton (1977) which suggests that the higher uncertainty associated with rising inflation, depresses consumer confidence and encourages savings[27]. Comparatively, over the more recent periods, an increase to the US short- and long-term Treasury rates resulted in a fall in FUM and an increase in net-sales. The higher yields would result in a negative valuation impact on FUM; however, investors would relate an increase in US yields as an investment opportunity for a higher rate of return.

Foreign currency, fixed NAV Income funds, which represents 18.4 per cent of total Income funds, responds positively to an increase in domestic economic activity. However, post-GFC these funds react negligibly to an increase in domestic inflation, suggesting that these foreign currency funds could be considered as a hedge against local inflation. Similarly, short-term TT and US Treasury rates generally has a negligible or marginal impact on fixed NAV Income FUM. Conversely, an increase to both the domestic and US 10-year rate results in a negative response in FUM, indicative of a negative valuation impact.

Domestic Money Market funds, the fastest growing segment of the mutual fund industry, is entirely made up of fixed NAV funds, accounting for roughly 25 per cent of the market. While economic activity supports growth in Money Market FUM, it also results in net-redemptions, likely caused by investors seeking higher yielding opportunities which Money Market funds often do not provide. On the other hand, the negative valuation impact from rising inflation results in a decrease in Money Market FUM, however, an initial increase in net-sales is observed. The initial increase in net-sales is possibly due to a

[26] CBTT data, as at the end of 2019.

[27] In this case, economic stability concerns arise as a result of higher long-term Treasury rates, indicative of inflationary pressures. Consequentially, Deaton (1977) explains that "inflation depresses consumer confidence, (and) the higher uncertainty is then reflected in higher savings ratios as consumers seek to protect themselves against instability".

reduction in consumer confidence stemming from high unanticipated inflation[28], and a subsequent increase in savings[29], especially to the safety of fixed NAV Money Market funds.

The portfolio of Money Market funds mainly comprises of short-term and liquid assets. Over the more recent periods, an increase in the TT and US 3-month rates resulted in a somewhat negative impact on Money Market FUM, suggesting a valuation effect. The safety and strength of TT dollar Money Market funds depends on the stability and availability of short-term, liquid assets. However, considering that the domestic financial system lacks this availability, and investing in international Treasury markets requires a steady supply of foreign currency, then these conditions can pose risks to fixed NAV Money Market funds. Furthermore, an increase in domestic short-term rate results in an increase in net-redemptions, while an increase in the US short-term rate results in a somewhat mixed net-sales effect. The increase in short-term Treasury rates often coincides with monetary policy tightening, often due to rising inflationary concerns, which can result in a fall in purchasing power and a reduction of savings. Therefore, in a scenario of rising inflationary pressures, the combined impact of rising short-term rates could result in a negative valuation impact on Money Market FUM, in addition to large net-withdrawals. These conditions, if not monitored and managed, could potentially result in a domestic 'break the buck' scenario, placing substantial pressures on the domestic financial and banking system due to the interconnectedness.

6.2 Policy Recommendations

Large and sudden adverse changes in financial and macroeconomic variables could significantly deplete the value of funds under management. In the case of floating NAV funds, these changes show up in the share/unit price, therefore transferring the losses from various shocks to the investors. Fixed NAV funds, however, are unable to adjust the fixed unit/share price following a major shock. During the GFC, there were several large runs on US Money Market funds, as redemption requests outstripped the ability of fund managers to liquidate assets, triggering knock-on effects and contagion risks through the fire sale of assets. Within the local industry, substantial interconnections exist as many fund managers are subsidiaries or affiliates of banks or insurance companies. Hence, the inability to facilitate an increase in redemptions could increase contagion risks and negatively affect the domestic banking and financial sector. Reducing the vulnerability of the mutual funds industry to large adverse shocks could go a long way to preserving financial system stability. The findings of this study can therefore be useful in guiding long-term sustainability of the domestic industry. The following outlines some specific recommendations to improve the resilience of the mutual funds industry in Trinidad and Tobago.

Within the domestic capital market, there is limited issuance of short and long-term securities, particularly government Treasuries and publicly auctioned bonds. Generally, the market demand for bonds and treasuries is often higher than the market supply. This situation could distort asset valuations and restrict efficient price discovery. Providing a larger and more frequent supply of treasuries of various maturities would contribute to improving price discovery in the domestic market. Furthermore, an increase in the supply and frequency of publicly auctioned government bonds will also enable fund managers to more effectively rebalance portfolios and minimise potential risks. Possible associated initiatives could be the establishment of a bond calendar, re-engage the bond auction system by the Government of Trinidad and Tobago, and the development of the domestic stock market to diversify the demand for financial instruments. A bond calendar and effective bond auction system can be achieved through market and legislative support enabling the bond auction process to conveniently and cost effectively, arrange and auction government bonds, thereby reducing the need for the private placements[30] of these securities. Additionally, financial institutions and regulatory agencies could streamline the regulatory hurdles to initial public offerings, providing a simpler process for corporations to list on the stock exchange. These measures

[28] Given that the study examines the effect of an empirical shock to macroeconomic variables, then this can be considered an unanticipated shock to inflation.

[29] According to Deaton (1977) unanticipated inflation has a strong positive effect on savings with a negative effect on non-durable expenditure, while anticipated inflation increases non-durable expenditure and reduces savings. However, the author further explains that inflation is rarely fully anticipated. Additionally, in another study, Howard (1978) mentions that "inflation creates a feeling of uncertainty and pessimism about the future that is hypothesised to encourage saving". The author examined personal savings behaviour in major industrial economies and determined that the marginal propensities to save out of permanent and transitory income are positive and significant, and the uncertainty and general confidence effects of inflation encourage personal saving, as predicted.

[30] Compared to public auctions which often requires numerous disclosure prerequisites in order to offer bonds under competitive bids to the wider public, a private placement provides funding through direct negotiation with a small group of financial institutions and requires minimal disclosure conditions. Additionally, privately placed bonds are often not publicly traded in an official secondary market.

would assist in further developing the domestic capital market and address any current imbalance in the growth of the various fund types within the industry.

Fixed NAV funds are often perceived to be safe, given the principal guarantee. However, this assurance places additional pressures on fund providers during macroeconomic and financial market shocks. One possible solution would be the conversion of fixed NAV funds to floating NAV. According to the IOSCO (2012), conversion to floating NAV structures reduces the specific risks associated with fixed NAV funds as it allows fluctuations in unit prices, and improves investors' understanding of the inherent risks and the differences with bank deposits. The results of the exercise suggest that fixed NAV funds responds negatively and significantly to changes in important macroeconomic and financial market variables. A positive shock to inflation and short- and long-term Treasury rates generally results in periodic deteriorations in the value of fixed NAV FUM, in addition to an increase in net-redemptions. These negative forces could trigger a potential 'break the buck' scenario and erode the perceived safety of these funds, triggering a run on mutual funds. The conversion of fixed NAV funds to floating NAV would transfer losses from price volatility to the fund investors, limiting the risk of destabilising runs. According to the IMF (2020), "while transitioning to a floating NAV structure presents legal, operational, and market-impact challenges, it is critical to rebalance the sector away from quasi deposit-taking activities into longer-term investments. Reforms should be implemented in a carefully sequenced manner".

A complete conversion of fixed to floating NAV, however, may be legislatively and fundamentally challenging, in addition to the conversion itself potentially having a high risk of triggering a run. Furthermore, the elimination of fixed NAV funds could be potentially disruptive to the short-term financing market[31]. An alternative solution would be a managed migration to a less risky structure and the implementation of stringent controls on fixed NAV funds[32]. The IMF (2020) mentions that international reforms following the GFC generally transitioned away from fixed NAV funds, except for funds with highly liquid and low-risk assets. These funds could continue to operate with fixed NAV structures, however, with built-in safeguards.

One safeguard could be the inclusion of NAV buffers, such as the accumulation of capital reserves, explicit capital commitments from fund sponsors, or short-term cash insurance to provide a potential backstop against fund losses when asset valuations deviate from the fixed NAV price. Capital and reserve buffers could increase resilience of fixed NAV funds as it reduces the markets' tendency to freeze and improves the ability of the short-term funding markets to weather periods of financial stress (IOSCO 2012). Furthermore, such buffers could mitigate incentives for runs and provide investors with additional flexibility to manage unit holdings.

Another safeguard would be the establishment of a minimum liquidity requirement and portfolio composition requirement for fixed NAV funds. A crucial source of systemic risk in mutual funds is a liquidity mismatch between fund investments and redemption conditions. As such, appropriate liquidity thresholds should be established and managed, proportionate to a funds' redemption obligations and liabilities (IOSCO 2018). Effective liquidity management would enhance fund stability and safeguard investors during stress periods, helping to reduce systemic risks. Additionally, limitations should be applied to the types of assets in which fixed NAV funds may invest. Portfolios should hold a majority of high quality, short-term assets, and low-duration fixed income instruments, with limited exposure to more risky and less liquid assets. Furthermore, concentration limits and diversification ratios should be imposed to reduce exposure risks. These safeguards, however, would be more achievable if the domestic Treasury and government bond market is further developed, offering a greater number of securities through scheduled and frequent issuing periods.

The inclusion of redemption and anti-dilution safeguards could also support funds' liquidity risk management. Regulators could establish withdrawal limits, specify controlled withdrawal periods for fixed NAV funds, or include anti-dilution levies which would mitigate liquidity risks and limit any potential dilution effect[33] by imposing a cost on the redemption of units. According to the IOSCO (2012), redemption restrictions would provide a fund sponsor with valuable time to evaluate and

[31] Elimination of fixed NAV funds could reduce Money Market fund's ability to provide short-term credit and commercial paper credit to local governments and financial institutions (IOSCO 2012).

[32] The IOSCO (2012) suggests that where a complete elimination of fixed NAV funds is seen as impracticable, various safeguards should be introduced to address outflows in the event of significant redemption pressures.

[33] The dilution effect occurs when investors' subscriptions and redemptions dilute or reduces the NAV of a fund due to the purchase and sale of underlying assets incurring a trading cost and transaction expense which is charged to the fund, therefore diluting its NAV.

react to increased withdrawal pressures. Redemption safeguards could include liquidity fees which are imposed when the volume of redemption reaches a threshold limit, or minimum balance requirements (MBR) where unitholders could redeem up to a certain percentage of their shareholdings without restriction, while the balance is held back for a specified period of time. These withdrawal options would transfer some of the liquidity cost to the redeeming shareholder, instead of transferring those costs to the remaining shareholders. Additionally, the MBR safeguard would ensure that shareholders remain somewhat exposed to the fund and lessen any incentives to engage on a run. However, a potential drawback is the loss of a liquidity benefit associated with fixed NAV Money Market funds.

Another important characteristic of the domestic mutual fund industry is the substantial interconnectedness as many fund managers are subsidiaries or affiliates of banks or insurance companies. The associated interlinkages create a "step-in risk" where "banks provide financial support to an unconsolidated entity facing stress over and above any contractual obligation" (Adcock 2017). Step-in risks could produce negative spillover effects from the shadow banking system to banks, especially where a bank or insurance company acts as the fund sponsor. Although existing provisions by the Basel Committee on Banking Supervision (BCBS), post-GFC, have helped to address step-in risk, the Committee concludes that step-in risks still exist (BCBS 2017). To further address these risks, the BCBS provided additional recommendations to fund sponsors, advising that step-in risks should be comprehensively identified and existing macroprudential tools and supervisory responses should be leverage on, in the event that the risks are large. Additionally, the inclusion of a liquidity reserve could reduce the need for a fund sponsor to step-in during stress periods. Although the domestic financial sector is transitioning into the Basel II and III regulatory frameworks, the extensive linkages in the mutual fund, banking and insurance sectors should be closely monitored and contagion risks addressed accordingly.

Given that an announcement of some of these measures could trigger large withdrawal demand, regulators and fund managers would need to impose these measures strategically, with sufficient transparency, enabling investors fully understand the reasons for these measures. Furthermore, regulators should embark on initiatives to improve the public's knowledge and understanding of the market and the associated investment risks. This would enable investors to make better informed investment decisions, in addition to reducing the perception that certain types of funds are safe or riskless investments, guaranteed by fund providers or associated entities.

Furthermore, although some of these options could eliminate a crucial liquidity and redemption benefit of Money Market funds, the overall benefit of mitigating a potential 'break the buck' scenario, and associated run and spillover risk, outweighs the loss of these benefits. Additionally, enacting these measures would require extensive legislative support and further capital market development. However, given the growing importance of the mutual funds industry in Trinidad and Tobago, these measures are critical to ensuring continued financial system strength and stability.

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