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The Predictors of Foreign Exchange and Interest Rate Derivatives Turnover in Emerging and Advanced Market Economies

Ivan Kudakov

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Description

Kudakov Ivan

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Abstract

Foreign exchange (FX) and interest rate (IR) derivatives are pivotal tools of risk management, crucial to the stability of the global financial system. In advanced market economies (AMEs), which have developed financial systems and accessible capital markets, the turnover and variety of derivatives are significantly higher than in less financially sophisticated and more restricted emerging market economies (EMEs). To provide insights into the dynamics impacting derivatives usage, the factors potentially affecting the turnover in AMEs and EMEs were studied. Upon competing literature review, external liabilities, trade openness, government spending, and market capitalisation of domestic companies were chosen as variables to be studied as potentially affecting the turnover of the instruments.

With the objectives to investigate whether there is an association between the aforementioned independent variables and FX and IR derivatives turnover in AMEs and EMEs, and if so, is this association positive or negative, Seemingly Unrelated Regression (SUR) and Ordinary Least Squares (OLS) models with Newey-West HAC adjustments were run. The studied period spans from 2001 to 2022, the data were obtained from sources such as the Bank for International Settlements, the International Monetary Fund, the World Bank, etc.

The results showed a strong and positive relationship between both instruments and external liabilities across both economies. Trade openness and government spending have been determined to be strongly associated with some of the instruments' turnover in both EMEs and AMEs, however the association was found to be negative. Market capitalisation did not have strong association with the derivatives turnover, recording only moderate relationship with FX derivatives turnover in AMEs and IR derivatives turnover in EMEs.

The findings contributed to a better understanding of how financial environment and dynamics impact derivatives markets, providing insights for policymakers and financial institutions looking to enhance market efficiency and risk mitigation strategies.

Keywords/tags (subjects)

Foreign Exchange Derivatives, Interest Rate Derivatives, Emerging Market Economies, Advanced Market Economies, External Liabilities, Government Spending, Trade Openness, Total Market Capitalisation of Domestic Companies, Seemingly Unrelated Regression, Newey-West HAC

Miscellaneous (Confidential information)

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1 Introduction

This chapter provides research background, presenting the focal idea of the thesis. The chapter also includes research questions and research structure.

1.1 Research background

Foreign exchange (forex/FX) and interest rate (IR) derivatives play an important role in global finance, providing tools for risk management and market speculation (Corporate Finance Institute, n.d.; International Monetary Fund, n.d.; Maunsell, 2023). These financial instruments are widely used across various sectors by market participants including multinational corporations, financial institutions, central banks, investors, and speculators. They are essential for managing fluctuations associated with interest and exchange rates, which impact a significant portion of the global financial system (Hull, 2022). Trading of these instruments is commonplace around the world, including both highly developed advanced market economies (AMEs) and less developed emerging market economies (EMEs) (Green Templeton College, n.d.; Upper & Valli, 2016).

Nevertheless, interest rate and foreign exchange derivatives markets in AMEs and EMEs have different dynamics and trading volumes. AMEs, featuring highly developed financial systems, accessible capital markets, and fostering regulatory environments possess significantly more developed derivatives markets resulting in notably higher turnover of the derivative instruments referencing their currencies than less developed EMEs (Upper & Valli, 2016) that often have challenges such as currency restrictions, capital flow limitations, and less sophisticated financial infrastructure. According to Upper & Valli (2016), the median daily turnover of currency and interest rate derivatives expressed in EMEs currencies is about 5% of their GDP, whereas for AMEs the figure is around 20%, such a significant gap underscores the lower capacity of EMEs to hedge their risks.

The aim of this research is to examine the factors influencing turnover of FX and IR derivatives in both AMEs and EMEs currencies and explore how exactly these factors impact the turnover of these instruments. Identifying these determinants can provide insights into the mechanisms influencing derivatives usage, which in turn might support further development of derivatives markets in both types of economies, enhancing market efficiency and risk management.

1.2 Research questions

The study is guided by the following questions:

1. What are the key determinants affecting the turnover of interest rate and foreign exchange derivatives referencing EMEs and AMEs currencies?

2. How do these determinants affect the turnover of foreign exchange and interest rate derivatives in EMEs and AMEs currencies?

1.3 Structure of the thesis

The thesis is organised into five chapters. The introduction presents the research background, and the research questions, highlights possible applications of the findings and outlines the structure of the study. The literature review focuses on existing research on financial derivatives, theoretical concepts relevant to the research and factors potentially influencing the turnover of the FX and IR derivatives in AMEs and EMEs. The methodology chapter provides the research design, and outlines chosen variables, data collection approaches and statistical techniques utilised. In the results chapter, the outcomes of the performed analyses are presented, including descriptive statistics and results of the regression analyses. Finally, the discussion chapter contains the results interpretations, research conclusions, and limitations of the study.

2 Literature review

In this chapter, the concepts and terms relevant to the study are defined, and previously published literature on the topic of IR and FX derivatives markets in emerging and advanced market economies are studied. The main purpose of the performed literature review is to define the factors influencing the development of FX and IR derivatives in these economies.

According to Rowley and Slack (2004), a literature review aims to organise key ideas and materials within a field in order to facilitate the research and make it more efficient. Literature review also critically evaluates quality and relevance of the existing studies, identifies gaps in the literature, highlights patterns, and suggests areas that require further investigation. This procedure provides a solid foundation for the research and plays a crucial role in formulating hypotheses (Boote & Beile, 2005).

2.1 Financial derivatives

Financial derivatives are financial instruments that are tied to and derive their value from underlying assets, which may be a bond, stock, commodity, currency, interest rate, market index, etc. (Hull, 2012). Essentially, they are contracts between two parties and their value is based on the movement in the price of an underlying asset. Their key feature, that makes them popular nowadays, is that they enable a party to trade off particular financial risks associated with interest rates, exchange rate fluctuations, equity, commodity prices, etc. with those market agents who are willing to take such risks (International Monetary Fund, n.d.).

The research focuses on financial instruments whose underlying assets are either interest rates (interest rate derivatives) or currencies (foreign exchange derivatives). A foreign exchange (forex/FX) derivative is a financial instrument whose value depends on the exchange rate between

two or more currencies. These instruments are primarily used to hedge against foreign exchange risk or to perform currency speculation. Multinational market participants use such instruments to cushion potential risks related to cash flows in foreign currencies (Kallianiotis, 2013). Similarly, an interest rate (IR) derivative is a financial instrument where an underlying asset is the right to pay or receive a notional amount of money at a specified interest rate. These derivatives are particularly popular among market agents with customised cash flow needs or specific views on interest rate movements (Ranjan et al., 2013).

Derivatives are categorised into two main categories: over-the-counter (OTC) derivatives and exchange-traded derivatives (ETD). OTC derivatives are contracts that are privately negotiated directly between two parties, tailored to specific needs and traded directly over-the-counter, meaning they are not carried out on a centralised exchange platform (European Commission, 2012). Although this flexibility enables customised agreements, due to their non-exchange-traded nature and unlike ETDs, OTC contracts present counterparty risks and lack transparency (Miguel & Singh, 2008). Exchange-traded derivatives, on the other hand, are standardised contracts that are traded on organised exchanges with terms and conditions predefined by an exchange. These contracts are more liquid, transparent and subject to regulatory oversight, thus mitigating the counterparty risk (Orient Futures, 2023). The OTC contracts frequently include substantial volumes and account for a significantly larger share of the total derivatives market (European Commission, 2012).

Additionally, derivatives are classified into several main types. The primary types of financial derivatives are:

- Forwards: customised contracts between two parties to purchase or sell an asset at a predetermined price at a specified future date. They are over-the-counter (OTC) instruments,

which means that they are not traded on exchanges, instead they are traded directly between parties (Jewitt, 2015).

- Futures: standardised contracts traded on exchanges to buy or sell an asset at a predetermined price at a specified time in the future. Although they are organised much like forwards, unlike them, futures are standardised contracts and traded on organised exchanges (Hull, 2012).
- Options: contracts that give a holder the right, but not an obligation, to buy or sell an asset at a specified strike price before or at the expiration date. Options are categorised into call options (right to buy) and put options (right to sell) (Jewitt, 2015). These instruments are traded over-the-counter (OTC) and on exchanges (Hull, 2012).
- Swaps: OTC contracts that allow two parties to exchange cash flows or other financial instruments. The most common types are interest rate swaps and currency swaps (Jewitt, 2015).

2.2 The link between interest and currency rate movements

It is fundamental to highlight that there is a link between the underlying assets of the studied instruments - interest rates and currency rates. One of the most widely known theories that explains this link is called the interest rate parity (IRP). Usually, when investors face a choice between two countries, one offering a higher interest rate and the other a lower one, ceteris paribus, they tend to invest in the country with the higher interest rate because it promises better yields. At the same time, they seek to borrow from the country with the lower interest rate to minimise borrowing costs. However, IRP theory suggests that this seemingly profitable strategy is cancelled out by adjustments in the exchange rate. The currency of the country with the higher interest rate is expected to depreciate, while the currency of the country with the lower interest rate is expected to

appreciate. This change in exchange rates eliminates the potential yields from the interest rate difference (Teall, 2013).

Nevertheless, IRP is a theoretical model, and real-world conditions often contradict its assumptions. Melvin and Norrbin (2013) note that deviations from IRP occur frequently, particularly during extraordinary events. Levich (2013), for example, highlights significant deviations from IRP during the global financial crisis. Furthermore, while interest rates undoubtedly play a crucial role in monetary policy, significantly impacting many economic variables, including foreign exchange rates (Maity, 2017), their relationship with the latter is complex (Mahajan & Wagner, 1999) and there is no clear, straightforward link between these two variables. As Hnatkovska et al. (2008) emphasise "the relationship between changes in interest rates and the level of the exchange rate is inherently non-monotonic" (p.35).

Despite the variability and lack of straightforwardness in the relationship between interest rates and foreign exchange rates, it is essential for this study to acknowledge the existence of this link as movements in interest and currency rates can increase the demand for derivatives. Furthermore, as these variables are related and their fluctuations may influence each other, they, in turn, may also impact the turnover of both FX and IR derivatives. Noting this possibility may enhance the quantitative analysis and help to choose the fitting analysis models.

2.3 Emerging and advanced market economies

The study differentiates between derivatives trading in advanced market economies and emerging market economies. Advanced market economies, also known as developed market economies, are the most developed financial and economic systems. These economies are defined by high income

levels, easily accessible capital markets, effective financial institutions, and ease of capital movement. Therefore, to be classified as an AME, in addition to high-income status a country must also demonstrate openness to foreign ownership and overall market efficiency (Nielsen, 2012).

By comparison, EMEs are less developed economies, with more volatile financial markets (De Santis & İmrohoroğlu, 1997), and generally more restrictive policies regarding capital flows and foreign ownership (Barua, 2018). Still, It is crucial to note that there is no universally accepted definition for EMEs (Arizala & Yang, n.d., as cited in Duttagupta & Pazarbasioglu, 2021). Different organisations, including the International Monetary Fund (IMF), J.P. Morgan, Morgan Stanley Capital International (MSCI), and Bloomberg, have their own sets of criteria for classifying markets. The most frequently used criteria include levels of economic development, market accessibility to foreign investors, trade openness, GDP size, equity market size, and income levels (Duttagupta & Pazarbasioglu, 2021; MSCI, 2014). Because of these slightly varying criteria, some economies may be categorised differently by various entities. A prime example is South Korea, which is considered a developed market by the IMF but is still classified as an emerging market by MSCI due to the trading restrictions present in the country (Mari, 2023).

Despite the limitations and problems faced by EMEs, their role in the world economy is still very significant. In 2023, EMEs accounted for about 42% of the world's total GDP (World Economic Outlook, n.d.). In 2022, they constituted around 41% of global trade in goods (International Monetary Fund, 2023; WTO Stats, n.d.). In 2023, the three largest EMEs in terms of GDP were China, the second largest economy in the world, India, the fifth largest, and Brazil, the ninth largest (World Bank, n.d.-a).

2.4 Trading volumes in emerging and advanced market economies

Considering their size, volatility and significant involvement in global trade it is reasonable to assume that EMEs would actively utilise financial derivatives as hedging tools. Especially, forex and interest rate derivatives are likely to be used, as FX derivatives can protect against currency-related risks (Howton & Perfect, 1998), and interest rate derivatives can help in reducing risks caused by volatile interest rates, which is a common characteristic of EMEs (Neftci & Santos, 2003).

However, despite the assumption that EMEs would actively engage in financial derivatives trading to hedge risks, the reality is different. In 2016, financial derivatives referencing EMEs currencies or interest rates accounted for only 10% of total global turnover (Upper & Valli, 2016). According to Mihaljek and Packer (2010), the average daily turnover of derivatives in 33 EMEs, for which data was available, was just $1.2 trillion in April 2010—representing 6.2% of those economies' GDP. In contrast, advanced economies had a turnover of $13.8 trillion, or 36% of GDP.

An analysis of the year 2022 figures reveals a significant dominance of AMEs in both interest rate and foreign exchange derivatives trading. Currencies such as US dollar, euro, yen, and pound sterling led by a wide margin (Bank for International Settlements, n.d.-a; Bank for International Settlements, n.d.-b). Figure 1 illustrates data for forex derivatives trading, where among the top ten most-referenced currencies, the only EME currency was Chinese renminbi. Notably, the daily turnover of forex instruments tied to the renminbi, despite China being the world's second-largest economy with a GDP of $17,848.54 billion USD in 2022, was comparable to the volumes of the currencies of much smaller economies, like Australia (12th largest, GDP of $1,724.924 billion), Canada (9th largest, GDP of $2,161.483 billion), and Switzerland (20th largest, GDP of $818.643 billion) (International Monetary Fund, 2024).

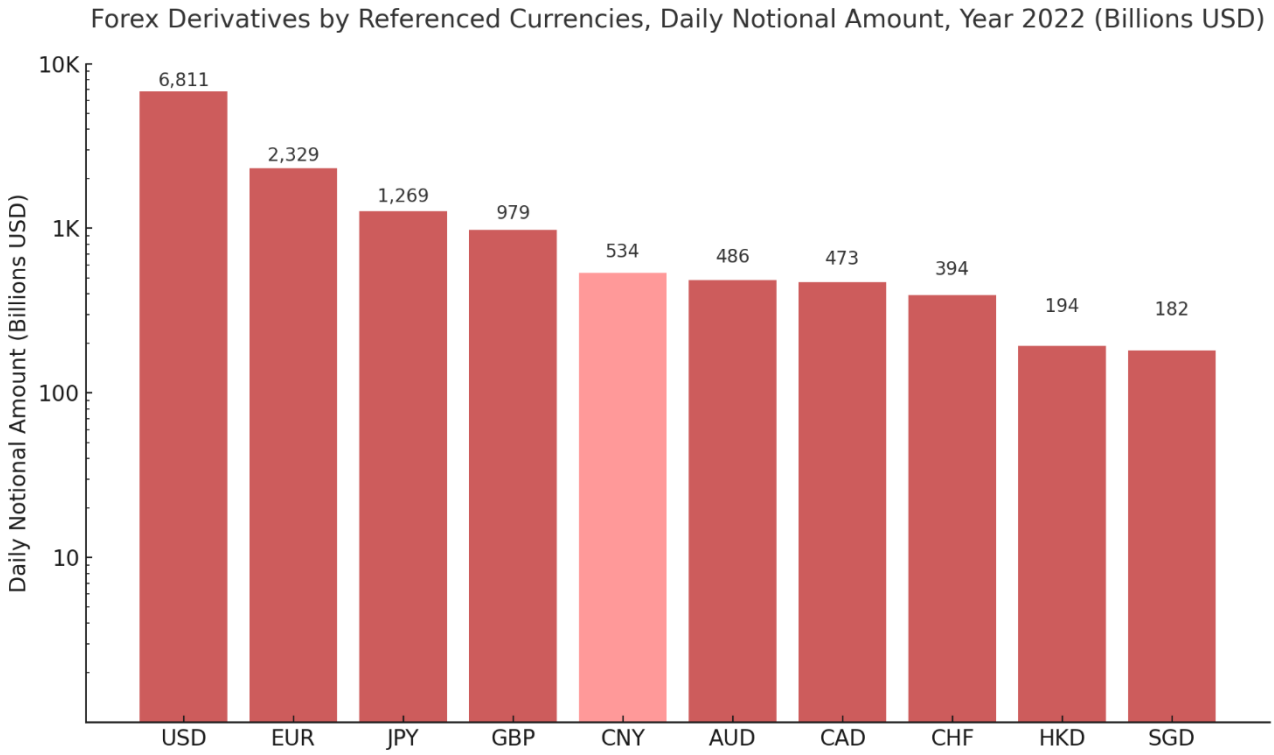

Figure 1. FX derivatives by referenced currencies (Bank for International Settlements, n.d.-a; Bank for International Settlements, n.d.-b)

This reveals an interesting dynamic, in spite of China's immense economic size and its role as the world's largest exporter (Seong, 2024), the daily turnover of forex instruments tied to the renminbi is similar to the ones linked to currencies of countries like Australia and Canada, which are neither global financial centres nor issuers of reserve currencies (Upper & Valli, 2016). According to Upper and Valli (2016), lower turnover in instruments referencing EMEs currencies indicates that these economies are much less enabled to effectively hedge their risks.

A similar trend is observed in the interest rate derivatives market, as depicted in Figure 2. AMEs currencies, especially US dollar and euro, hold a dominant position. Among the top ten currencies in this market, three come from EMEs, namely Brazilian real, Chinese renminbi, and Korean won. However, the turnovers of instruments referencing these currencies are far lower than those tied

to AME currencies such as US dollar, Euro, British pound, Australian dollar, Japanese yen, and Canadian dollar. This further emphasises that AMEs currencies continue to dominate the market, demonstrating the significant gap between AMEs and EMEs in the use of financial derivatives.

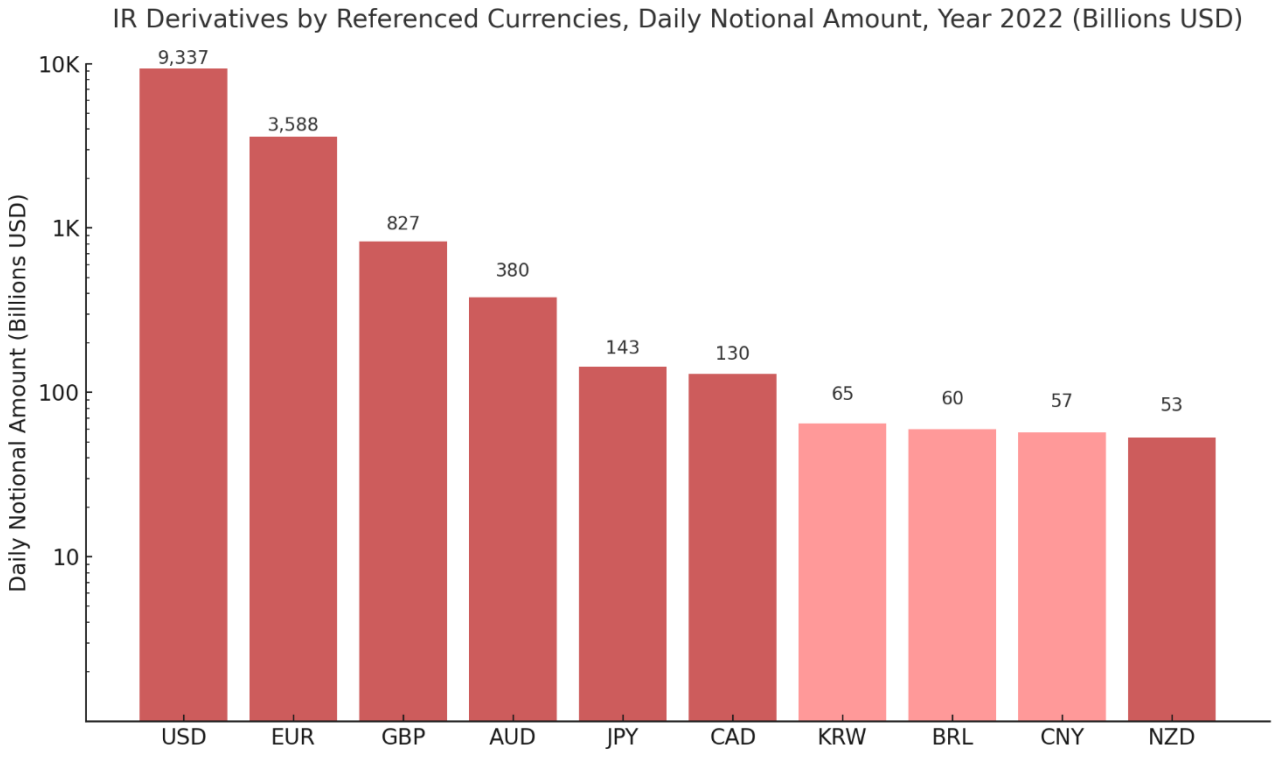

Figure 2. IR derivatives by referenced currencies (Bank for International Settlements, n.d.-a; Bank for International Settlements, n.d.-c).

2.5 Derivatives market structures in emerging and advanced economies

While the difference in the daily turnover of foreign exchange and interest rate derivatives highlights the gap between AMEs and EMEs, this imparity extends beyond turnover figures. The structure and composition of derivatives markets in these two groups of economies demonstrate distinctive characteristics.

Derivatives trading in EMEs is primarily concentrated on FX contracts, with FX instruments accounting for the vast majority of turnover. According to Upper and Valli (2016), by 2016, FX contracts made up 75–90% of the total derivatives turnover in most EMEs. Similarly, Mihaljek and Packer (2010) emphasise the predominant role of FX instruments in EMEs derivatives trading.

It is important to note, however, that FX instruments remain vital in AMEs as well. Upper and Valli (2016) highlight that FX turnover in AMEs still exceeds the one of interest rate derivatives, however, AMEs trade a wider variety of instruments, including interest rate and equity derivatives, to a larger extent. This reflects the more developed bond and money markets in advanced economies, together with their comparatively lower concern about exchange rate fluctuations than in their counterparts (Mihaljek & Packer, 2010).

Another key difference between AMEs and EMEs is the complexity of the contracts traded. As Upper and Valli (2016) note, derivatives markets in EMEs are not only smaller in size but also feature less sophisticated contracts. Instruments such as cross-currency swaps, FX options, interest rate swaps, and interest rate options account for a smaller portion of total turnover in EMEs compared to AMEs.

Additionally, due to currency convertibility controls and capital restrictions that often exist in emerging markets (Doukas & Zhang, 2013), non-deliverable contracts are common in some of the largest EMEs derivatives markets. Upper and Valli (2016) highlight that in Brazil, for example, three-quarters of FX forwards and swaps for Brazilian real are non-deliverable. Similar trends are observed in contracts for Korean won (two-thirds non-deliverable), New Taiwan dollar (56%), and Indian rupee (47%).

Non-deliverable contracts are derivative instruments that allow investors and companies to interact with markets having restrictions on their domestic currencies' trade (McCauley & Shu, 2016; UBS AG, 2019). The key feature of such contracts is that they are settled in one currency, a widely traded one such as US dollar or euro. This feature makes non-deliverable contracts especially useful in markets where currency convertibility is limited or where foreign exchange regulations prevent the free movement of capital (Schmittmann & Teng, 2020). The widespread usage of non-deliverable contracts highlights the challenges presented by these restrictions, which prevent the development of contracts settled in both local and foreign currencies (Upper & Valli, 2016).

One of the most common forms of such contracts are non-deliverable forwards (NDFs) which function by settling the difference between a pre-agreed exchange rate and the actual spot rate at the maturity date. The settlement involves a single payment made in a non-restricted currency from one counterparty to the other, representing the profit or loss. NDFs enable hedging and speculative activities on a currency without the need to physically deliver that currency (McCauley & Shu, 2016). This flexibility allows market agents to avoid restrictions on the local market (onshore) and the need to transfer the local currency offshore. Such a feature of NDFs makes them a critical tool for managing restricted or controlled foreign exchange environments.

Due to the aforementioned restrictions, foreign exchange and interest rate derivatives referencing EMEs currencies are usually traded outside their domestic markets (offshore), typically in major global financial centres such as New York, London, Hong Kong, and Singapore. Notably, offshore trading tends to align with similar time zones, for example, Latin American currencies are mostly traded in New York, while Central and Eastern European currencies are dealt with in London, and Asian currencies are frequently traded in Hong Kong and Singapore (Upper & Valli, 2016).

2.6 Growth of IR and FX derivatives

Interest rate and foreign exchange derivatives in EMEs, though generally less developed than those in AMEs are experiencing rapid growth. Upper and Valli (2016) observed that, when measured in local currencies, the turnover of IR and FX instruments in EMEs increased by 25% between 2013 and 2016. Similarly, Mihaljek and Packer (2010) found that the FX and IR derivatives turnover in EMEs currencies has been increasing at a faster rate than in AMEs currencies. While Upper and Valli (2016) reported that the average daily turnover of FX and IR derivatives in EMEs was approximately 5% of GDP in 2016, far behind the 20% seen in AMEs, it is noteworthy that EMEs have seen a 300% increase in daily turnover during the first decade of the 21st century, even despite the 2008–2009 financial crisis. In comparison, turnover in AMEs grew by 250% over the same period (Mihaljek & Packer, 2010).

By 2016, the largest and most rapidly growing derivatives market among EMEs was China. Turnover of Chinese renminbi (RMB) denominated contracts grew by 55% between 2013 and 2016 (Upper & Valli, 2016). Such a remarkable growth rate is closely tied to China's FX liberalisation strategy, which played an important role in fostering the expansion of RMB derivatives markets. As a part of China's efforts to internationalise RMB, new financial instruments, including NDFs, were first introduced in offshore markets, primarily in Hong Kong SAR and Singapore, beginning in the mid-1990s. By 2016, offshore trading accounted for 73% of OTC RMB derivatives turnover (Ehlers et al., 2016).

In addition, Ehlers et al. (2016) opine that policy reforms, such as allowing the use of RMB for cross-border trade settlement and the growth of the investment channels scheme, have significantly promoted international demand for RMB-denominated instruments. RMB offshore trading has expanded beyond Asia and experienced notable growth in the United States, where its share

in offshore turnover increased from 7% to 12% between 2013 and 2016. Despite these advancements, there remains a gap between the pace of development of RMB FX and IR derivatives, the latter have not yet matched the growth seen in the FX market, largely due to the limited depth of the onshore interest rate derivatives market (Ehlers et al., 2016).

Although it was mentioned that sophisticated financial instruments, such as cross-currency swaps, FX options, interest rate swaps, and interest rate options, generally account for a lower share of total derivatives turnover in emerging markets compared to advanced economies. There are signs that these contracts are becoming more common in certain EMEs. For instance, relatively liquid cross-currency swap markets have developed in Mexico and South Africa. It is also worth noting that in the interest rate segment, several emerging countries have established active over-the-counter (OTC) markets for options (Upper & Valli, 2016).

Ehlers and Eren (2016) observe that despite that the OTC interest rate derivatives market remains dominated by contracts involving AMEs currencies, turnover in instruments denominated in EMEs currencies has been steadily growing. In April 2016, the notional turnover of these contracts accounted for 4.6% of the global market, up from 4.4% in April 2013. However, growth across EMEs currencies was uneven, for example, significant growth happened in OTC interest rate contracts denominated in Mexican peso between 2013 and 2016. In contrast, the notional turnover of interest rate contracts denominated in Chinese renminbi declined, even as renminbi FX trading increased during the same period (Upper & Valli, 2016). Furthermore, average daily turnover fell for OTC interest rate derivatives denominated in Brazilian reals and Indian rupees, while it increased for other currencies such as Hungarian forint, Chilean peso, and Colombian peso (Ehlers & Eren, 2016).

2.7 Drivers of derivatives turnover disparity

Upper & Valli (2016) suggest that the significant disparity in turnover is attributed to the lack of market participants in EMEs willing to take the opposite side of derivative contracts. In volatile emerging markets, many investors seek to hedge against potential depreciation in a local currency, but it is less clear who would take the opposite position, protecting against currency appreciation. These could be domestic holders of foreign assets, or foreign market agents issuing debt in local currency. However, due to capital controls and underdeveloped nature of many EME markets, such participants are far less common there. For derivative markets to operate effectively and at scale, both sides of the contract must be sufficiently represented, the condition that is often missing in many EMEs.

A relevant example highlighting the importance of such counterparties is the Chilean domestic derivatives market. During the 2008 global financial crisis, Chile experienced less financial stress compared to other EMEs, this resilience is partly explained by the size and functionality of its derivatives market (Avalos & Moreno, 2013). In the years leading up to the crisis, the Chilean derivatives market experienced significant growth, largely driven by the hedging needs of private pension funds, known as *Administradoras de Fondos de Pensiones* (AFPs). AFPs, which held substantial investments in foreign markets and were required to limit their exposure to foreign currency risk, which, in turn, led them to consistently hedge against exchange rate fluctuations by taking short forward positions in foreign currency. Moreover, AFPs often hedged a larger portion of their portfolios than was required by the regulations.

By the third quarter of 2008, the net short forward positions held by AFPs were large enough to act as the main counterpart to the long forward positions of banks and the non-financial sector,

both of which had significant foreign exchange exposures. This dynamic created a liquid and sizable derivatives market in Chile that was sustained by the constant need of AFPs to hedge their foreign asset portfolios. Furthermore, natural resident counterparties in the FX derivatives market, such as banks and the non-financial sector, contributed to maintaining market liquidity and stability during periods of financial turmoil (Avalos & Moreno, 2013).

The Chile's example leads us to one of the factors that may influence the derivatives turnover, the level of integration into foreign markets. Chile's AFPs have been substantially investing in the foreign assets while its resident banks and non-financial sector were receiving money flows from abroad. Such integration increased the need for derivatives, although in case of Chile mostly FX ones (Avalos & Moreno, 2013).

There are several works that determine that such proxies of a country's level of integration into the global economy as trade openness, capital account openness, gross trade, foreign assets and liabilities influence the turnover of derivatives. As a part of the BIS Quarterly Review in December 2010, Mihaljek and Packer (2010) conducted an analysis of 30 EMEs and determined that gross trade, foreign assets and liabilities are strongly associated with the turnover of the FX derivatives, in researchers' sample 10% higher gross trade flows are associated with 8.8% higher daily turnover of FX derivatives and 10% higher holdings of external assets and liabilities are associated with 10.4% higher turnover of FX derivatives.

External liabilities represent all financial obligations a country owes to foreign entities, including debt such as bank loans, government bonds, and other financial commitments made by residents to non-residents (Milesi-Ferretti, 2024). Generally, it is supposed that larger external liabilities introduce more financial risks such as exposure to fluctuations in foreign exchange rates, interest

rates, and commodity prices. As a result, the need to manage these risks arises, creating demand for derivatives which can help hedge against such potential financial uncertainties (Upper & Valli, 2016).

On the other hand, external assets also reflect a country's level of integration. External assets are financial claims on foreign entities such as foreign direct investments and portfolio equity investments (Milesi-Ferretti, 2024). However, they do not necessarily create the same demand for derivatives as external liabilities because external assets often serve as a natural hedge, cancelling off financial exposures without the need for derivatives (Upper & Valli, 2016; Australian Bureau of Statistics, 2016). For instance, if a company holds assets that generate income in the same currency as its liabilities, the risk is offset naturally without using financial instruments.

In addition to the research of Mihaljek and Packer (2010), in the BIS Quarterly Review of December 2016, Upper and Valli (2016) conducted a similar study on 24 EMEs and 10 AMEs using bivariate and multivariate regression techniques. They found that larger external liabilities are significantly linked to higher turnover in both FX derivatives and total derivatives (including both FX and interest rate derivatives). Additionally, they identified capital account openness, along with other variables such as bond market size and per capita GDP as strong predictors of the development of the derivatives market.

Continuing with the variables reflecting the level of integration into the global market, it is noteworthy to highlight the variable of trade openness. Trade openness is defined as the ratio of an economy's sum of exports and imports to its gross domestic product (GDP) and serves as a measure of its engagement in international trade (Steiner, 2016). A high level of trade openness reflects

strong integration into the global economy, as it indicates that a significant portion of the country's economic activity is linked to cross-border transactions. Such integration is usually related to an increase in demands for financial derivatives, as companies and investors try to hedge against currency, interest rate, and commodity price risks (Upper & Valli, 2016).

Firms use forex derivatives to lock in exchange rates and hedge against unfavourable movements of these. Moreover, as international trade grows, so often does external financing in foreign currencies (Bayar & Sasmaz, 2020). Companies may borrow or lend in foreign markets, which exposes them to interest rate fluctuations in those markets. Thus, interest rate instruments provide a mechanism to hedge against such risks, helping firms stabilise their financing costs (Franke et al., 2019). Therefore, high trade openness might not only be linked to greater use of FX derivatives but also to the adoption of interest rate instruments as firms hedge their exposure to global capital markets and cross-border lending.

On the other hand, Vo et al. (2020) investigated the relationship between trading of FX and IR exchange-traded derivatives (ETDs) and several macroeconomic variables for a sample of 17 countries, encompassing both EMEs and AMEs. After utilising advanced econometric methods such as Panel Vector Autoregression, Impulse Response, and Variance Decomposition, their findings confirmed that trade openness has a significant impact on the derivatives markets. However, the results also indicate that sometimes trade openness may be negatively associated with derivatives trading. The researchers note that it is particularly common in short term, the negative impact possibly arises due to the shocks related to increased participation in global trade. The shocks raise the competition and bring new technologies, altering the cost of goods and services and making the business environment less predictable. Therefore, companies become more uncertain

about their future operations, which, in turn, slows down growth of financial sector, including derivatives markets.

In addition, Kim et al. (2009) state that although there is a common opinion among researchers that trade openness positively influences the financial sector activities, the exact effect is not clear and may vary. The researchers note that trade openness is both boosting long-term financial development by fostering international competition and increasing risk exposure that might lead to more frequent financial crises therefore having a negative impact on financial development in short term. Ultimately, the researchers note that despite this ambiguity trade openness definitely contributes to financial development, including financial markets, however, it is not always clear whether this impact is positive or negative.

Additionally, Upper and Valli (2016) emphasised the role of financial development itself as a critical factor in developing a functional derivatives market. They used the size of a country's domestic bond market as a proxy for financial development, finding a positive association between the size of the bond market and the turnover of interest rate derivatives and total derivatives (FX and IR). Their study showed that a 1% increase in the ratio of bonds outstanding to GDP is, on average, associated with an increase in the ratio of derivatives turnover to GDP by 0.3%. This underlines the importance of a well-developed financial system in fostering the growth of a derivatives market (Upper & Valli, 2016).

Government spending is another aspect of financial development that has a significant association with derivatives markets (Vo et al. 2020). Government spending is an expenditure on essential public services like infrastructure, healthcare, and education (Ortiz-Ospina & Roser, 2024). However, the direction of the influence of government spending on derivatives markets is unclear. On

one hand, government expenditure can promote financial development by funding essential infrastructure and services, which in turn support economic growth, and market stability and affect the quality of financial markets and structure of the financial system (Aman et al., 2023; Levine 1997).

On the other hand, some scholars express scepticism regarding the benefits of government spending, pointing out that there are clear negative consequent effects of excessive financing of these expenditures. For example, abundant government spending may create disincentives to economic growth and financial development due to the link between increased government spending and more centralised decision making, which in turn affects markets negatively in a way of diminishing profit motive and competition, aspects that are vitally necessary to the development of a market economy (Diamond, 1990).

In addition, Barra et al. (2019) state that the quality and efficiency of government spending are as important as its quantity. They further emphasise that, in addition to government spending, the institutional environment is important for economic development as it creates incentives for an efficient economic system. The researchers also state that public spending tends to be more efficient in fostering economic development in countries with more accountable governments such as democracies. However, researchers caution that government spending does not necessarily lead to efficient outcomes. Lamartina and Zaghini (2008) add that government spending can grow without actual benefit due to problems such as inefficiency and corruption.

Moving forward, as it was previously mentioned, researchers studying the factors influencing FX and IR derivatives turnover often place significant emphasis on the size of bond and equity markets. Upper and Valli (2016) highlight the size of the domestic bond market as a relevant variable reasoning that investors, particularly those holding bonds, may want to hedge interest rate risks

via IR derivatives. Another point is that foreign investors can use FX contracts to protect themselves against currency risks related to their bond holdings. Upper and Valli also use bond market size as a proxy for financial market development, noting that a larger bond market tends to indicate a more developed and liquid financial environment. Additionally, Mihaljek and Packer (2010) highlight the role of bond and equity market size in driving FX derivatives market growth. Their findings show that a 10% increase in bonds outstanding from the government and nonfinancial corporate sectors is associated with an 8.3% rise in daily FX derivatives turnover. Similarly, a 10% growth in equity market turnover correlates with a 3% increase in FX derivatives turnover.

In addition to bond and equity market size, another related variable worth considering is the total market capitalisation of domestic companies. Although no specific studies were found that have examined the relationship between this variable and forex and interest rate derivatives turnover, market capitalisation is still regarded as a proxy of the overall depth, size, and level of development of a country's financial markets by some researchers (Ogbeide et al., 2022; Pokharel, 2020). As demonstrated by Zhongming et al. (2018), capital markets are crucial to the development of an economy. Total market capitalisation reflects the combined value of all publicly traded companies. Larger market capitalisations generally suggest more developed and sophisticated financial systems, where market agents have better access to advanced financial instruments, including derivatives, to manage risks related to interest rates and currency fluctuations.

Given the similarities between market capitalisation and equity market size, as well as their roles in financial development, it is reasonable to hypothesise that a larger market cap could contribute to increased derivatives activity.

2.8 Research hypotheses

Based on the literature review, the following hypotheses and sub-hypotheses were formulated for Emerging Market Economies (EMEs) and Advanced Market Economies (AMEs)**.** The sub-hypotheses were created to differentiate the interest rate (IR) and foreign exchange (FX) derivatives markets.

Advanced Market Economies (AMEs):

H_1 (AMEs): External liabilities positively influence the turnover of foreign exchange and interest rate derivatives in AMEs.

> *$H_{1.1}$ (AMEs - FX): External liabilities positively influence the turnover of foreign exchange derivatives in AMEs.*
>
> *$H_{1.2}$ (AMEs - IR): External liabilities positively influence the turnover of interest rate derivatives in AMEs.*

H_2 (AMEs): Trade openness positively influences the turnover of foreign exchange and interest rate derivatives in AMEs.

> *$H_{2.1}$ (AMEs -FX): Trade openness positively influences the turnover of foreign exchange derivatives in AMEs.*
>
> *$H_{2.2}$ (AMEs - IR): Trade openness positively influences the turnover of interest rate derivatives in AMEs.*

H_3 (AMEs): Trade openness negatively influences the turnover of foreign exchange and interest rate derivatives in AMEs.

> *$H_{3.1}$ (AMEs - FX): Trade openness negatively influences the turnover of foreign exchange derivatives in AMEs.*
>
> *$H_{3.2}$ (AMEs - IR): Trade openness negatively influences the turnover of interest rate derivatives in AMEs.*

H_4 (AMEs): Government spending positively influences the turnover of foreign exchange and interest rate derivatives in AMEs.

> *$H_{4.1}$ (AMEs - FX): Government spending positively influences the turnover of foreign exchange derivatives in AMEs.*
>
> *$H_{4.2}$ (AMEs - IR): Government spending positively influences the turnover of interest rate derivatives in AMEs.*

H_5 (AMEs): Government spending negatively influences the turnover of foreign exchange and interest rate derivatives in AMEs.

> *$H_{5.1}$ (AMEs - FX): Government spending negatively influences the turnover of foreign exchange derivatives in AMEs.*
>
> *$H_{5.2}$ (AMEs - IR): Government spending negatively influences the turnover of interest rate derivatives in AMEs.*

H_6 (AMEs): Total market capitalisation of domestic companies positively influences the turnover of foreign exchange and interest rate derivatives in AMEs.

> *$H_{6.1}$ (AMEs - FX): Total market capitalisation of domestic companies positively influences the turnover of foreign exchange derivatives in AMEs.*
>
> *$H_{6.2}$ (AMEs - IR): Total market capitalisation of domestic companies positively influences the turnover of interest rate derivatives in AMEs.*

Emerging Market Economies (EMEs):

H_7 (EMEs): External liabilities positively influence the turnover of foreign exchange and interest rate derivatives in EMEs.

> *$H_{7.1}$ (EMEs - FX): External liabilities positively influence the turnover of foreign exchange derivatives in EMEs.*
>
> *$H_{7.2}$ (EMEs - IR): External liabilities positively influence the turnover of interest rate derivatives in EMEs.*

H_8 (EMEs): Trade openness positively influences the turnover of foreign exchange and interest rate derivatives in EMEs.

$H_{8.1}$ (EMEs -FX): Trade openness positively influences the turnover of foreign exchange derivatives in EMEs.

$H_{8.2}$ (EMEs - IR): Trade openness positively influences the turnover of interest rate derivatives in EMEs.

H_9 (EMEs): Trade openness negatively influences the turnover of foreign exchange and interest rate derivatives in EMEs.

$H_{9.1}$ (EMEs - FX): Trade openness negatively influences the turnover of foreign exchange derivatives in EMEs.

$H_{9.2}$ (EMEs - IR): Trade openness negatively influences the turnover of interest rate derivatives in EMEs.

H_{10} (EMEs): Government spending positively influences the turnover of foreign exchange and interest rate derivatives in EMEs.

$H_{10.1}$ (EMEs - FX): Government spending positively influences the turnover of foreign exchange derivatives in EMEs.

$H_{10.2}$ (EMEs - IR): Government spending positively influences the turnover of interest rate derivatives in EMEs.

H_{11} (EMEs): Government spending negatively influences the turnover of foreign exchange and interest rate derivatives in EMEs.

$H_{11.1}$ (EMEs - FX): Government spending negatively influences the turnover of foreign exchange derivatives in EMEs.

$H_{11.2}$ (EMEs - IR): Government spending negatively influences the turnover of interest rate derivatives in EMEs.

H_{12} (EMEs): Total market capitalisation of domestic companies positively influences the turnover of foreign exchange and interest rate derivatives in EMEs.

$H_{12.1}$ (EMEs - FX): Total market capitalisation of domestic companies positively influences the turnover of foreign exchange derivatives in EMEs.

$H_{12.2}$ (EMEs - IR): Total market capitalisation of domestic companies positively influences the turnover of interest rate derivatives in EMEs.

3 Methodology

This chapter presents the methodology of the study, including data description, data sources, selected variables, data collection approach and analytical techniques utilised. The data collection and data preparation procedures were conducted utilising Microsoft Excel, and the econometric tests and models were run using the RStudio integrated development environment.

3.1 Data description

The sample contains 18 economies, 10 AMEs and 8 EMEs. The economies were classified according to Morgan Stanley Capital International (MSCI), one of the leading benchmark index providers in the world, particularly focusing on EMEs and AMEs (MSCI, n.d.). The MSCI classification framework is based on the assessment of three dimensions: economic development, size and liquidity of equity markets, and market accessibility for foreign investors. All dimensions must be met for a country to become an AME (MSCI, 2014). Additionally, the Euro Area is classified as an advanced market economy as the majority of its member countries are high-income, well-developed economies with efficient institutional frameworks (i.e. AMEs) (International Monetary Fund, 2023). Table 1 provides the list of AMEs and EMEs chosen for this study.

Table 1. Studied economies

Advanced Market Economies	**Emerging Market Economies**
Australia	Brazil

Canada	China
Euro Area	Hungary
Hong Kong	India
Japan	Korea
New Zealand	Mexico
Norway	Poland
Switzerland	South Africa
United Kingdom	
United States	

Two separate datasets were created, the first contains data for the AMEs comprising a total of 195 observations, the second – data for the EMEs with a total of 155 observations. The studied period spans 22 years, from 2001 to 2022, although for some economies several years are missing due to the unavailability of data. In addition, since the OTC derivatives turnover is provided only triennially, the linear extrapolation method was used to calculate figures for the intermediate years.

All variables were standardised as percentages of each country's GDP for the purpose of consistency across datasets. Furthermore, the variables were transformed into natural logarithm form, a common econometric technique that serves two purposes: linearisation of relationships and reducing data skewness (Benoit et al., 2011, Çetinkaya-Rundel & Hardin, 2021).

3.2 Data collection

The data for this study were collected from various websites and databases, trading volumes for forex and interest rate derivatives were sourced from the Bank for International Settlements (BIS) (Bank for International Settlements, n.d.-a; Bank for International Settlements, n.d.-b; Bank for In-

ternational Settlements, n.d.-c). Data for external liabilities were obtained from the dataset created by Gian Maria Milesi-Ferretti, a senior fellow at the Hutchins Centre on Fiscal and Monetary Policy (Milesi-Ferretti, 2022). Data for government spending to GDP were sourced from the International Monetary Fund dataset (International Monetary Fund, 2022) and particularly for Euro Area from the Trading Economics website (Trading Economics, 2023). In addition, data for trade openness, market capitalisation of domestic companies and GDP were collected from the World Bank datasets (World Bank, n.d.-a; World Bank, n.d.-b; World Bank, n.d.-c). The data were either initially in the format of a ratio to GDP (government spending, trade openness) or set against each country's GDP to standardise the measures (derivatives' turnovers, external liabilities, market capitalisation of domestic companies).

3.3 Variables description

Table 2 provides a summary of the studied variables. The chosen independent variables are trade openness, public spending, external liabilities, and total market capitalisation of domestic companies. The dependent variables of the study are IR and FX derivatives turnover.

Table 2. Study variables

Dependent Variables	**Label**	**Definition**
Foreign exchange derivatives turnover	FX	Total annual turnover of foreign exchange derivatives as a percentage of GDP
Interest rate derivatives turnover	IR	Total annual turnover of interest rate derivatives as a percentage of GDP
Independent Variables		
External liabilities	Ex.L.	Total amount of external liabilities as a percentage of GDP

Market capitalisation of domestic companies	Mkt.Cap.	Total market value of publicly traded domestic companies as a percentage of GDP
Government spending	Gov.S.	Total government expenditure as a percentage of GDP
Trade openness	Tr.Op.	Total trade (export + import) as a percentage of GDP

Some variables that were defined by other researchers to be associated with FX and IR derivatives markets turnover such as external assets, bond and equity market sizes were not included in this study. External assets were not included because their impact on derivatives market development is not as evident, primarily due to their role in fostering natural hedging, which is an alternative to derivatives. To avoid any potential misinterpretation that could arise from including external assets, which may not directly drive the use of derivatives, this study focuses solely on external liabilities, where the demand for derivatives is more clear.

As was mentioned in the literature review chapter, when studying derivatives market activity, to assess financial depth of an economy sizes of equity and bond market are primarily used. However, obtaining consistent and comprehensive data on these markets across the countries involved in this research was challenging. In contrast, data on the total market capitalisation of domestic companies were more available, making it a suitable substitution. Given the influence of financial market development on the use of financial derivatives, the study employs total market capitalisation as a proxy variable for the former. This measure enables the researcher to assess the role of market size and development in driving derivatives turnover, while addressing the practical limitation related to obtaining bond and equity market data.

3.4 Data analysis

For data analysis, the Seemingly Unrelated Regression (SUR) model and Newey-West estimator method were selected, using multivariate linear regressions (MLR). SUR model was estimated with the Generalised Least Squares (GLS) technique, while the Newey-West estimator was incorporated into Ordinary Least Squares (OLS) regressions. In addition, Variance Inflation Factor (VIF) tests were used to check for multicollinearity.

Beginning from the fundamental aspects of the conducted regression, multiple linear regression (MLR) was chosen to incorporate all independent variables of interest. MLR enables the examination of the relationship between multiple independent variables and a single dependent variable, and captures collective impact of various factors. This technique is particularly valuable in exploring complex economic relationships, where multiple influences may be at play (Çetinkaya-Rundel & Hardin, 2021). The Ordinary Least Squares (OLS) method was selected for its simplicity, straightforwardness and wide recognition in the field of econometrics. OLS estimates the parameters of the regression model by minimising the sum of the squared residuals, ensuring that the model fits the data in the best possible way (Çetinkaya-Rundel & Hardin, 2021). The OLS regression models that were supplemented by the Newey-West component for the robustness check are expressed as follows:

$$ln(FX_{AMEs}) = \beta_0 + \beta_1 ln(Ex.L_{AMEs}) + \beta_2 ln(Tr.Op._{AMEs}) + \beta_3 ln(Gov.S_{AMEs}) + \beta_4 ln(MCap_{AMEs}) + \epsilon$$

$$ln(IR_{AMEs}) = \beta_0 + \beta_1 ln(Ex.L_{AMEs}) + \beta_2 ln(Tr.Op._{AMEs}) + \beta_3 ln(Gov.S_{AMEs}) + \beta_4 ln(MCap_{AMEs}) + \epsilon$$

$$ln(FX_{EMEs}) = \beta_0 + \beta_1 \ln(Ex.L_{EMEs}) + \beta_2 \ln(Tr.Op._{EMEs}) + \beta_3 \ln(Gov.S_{EMEs}) + \beta_4 \ln(MCap_{EMEs}) + \epsilon$$

$$ln(IR_{EMEs}) = \beta_0 + \beta_1 \ln(Ex.L_{EMEs}) + \beta_2 \ln(Tr.Op._{EMEs}) + \beta_3 \ln(Gov.S_{EMEs}) + \beta_4 \ln(MCap_{EMEs}) + \epsilon$$

Where $ln(FX_{AMEs}), ln(IR_{AMEs}), ln(FX_{EMEs}), ln(IR_{EMEs})$ are natural logarithms of studied dependent variables, $ln(Ex.L_{AMEs}), ln(Tr.Op._{AMEs}), ln(Gov.S_{AMEs}), ln(MCap_{AMEs}),$ $ln(Ex.L_{EMEs})$, $ln(Tr.Op._{EMEs})$, $ln(Gov.S_{EMEs})$, $ln(MCap_{EMEs})$ are natural logarithms of independent variables employed in the study. β_0 is an intercept term, $\{\beta_1, \dots, \beta_4\}$ are regression coefficients of the independent variables and ϵ is an error term.

The main analysis model, the SUR model allows the estimation of several equations simultaneously, unlike regular regression models that estimates only one at a time. The SUR regression accounts for potential correlation in the residuals between the studied equations, therefore covering the shared influence of the models. This leads to more accurate estimations compared to running each equation separately (Baltagi, 2003). This feature of SUR is especially useful for this study due to the nature of the dependent variables, the turnovers of financial instruments whose underlying assets, foreign exchange and interest rates, have a well-known association highlighted in the literature review part. Given this connection, it may be assumed that the dynamics of the turnover of FX and IR derivatives are interrelated. To acknowledge this potential interrelation, the SUR statistical technique is utilised.

The SUR model utilised in this study for AMEs and EMEs, expressed in the matrix format to highlight the simultaneous estimation of the included models is given as:

$$\begin{bmatrix} y_{FX} \\ y_{IR} \end{bmatrix} = \begin{bmatrix} X_{FX} & 0 \\ 0 & X_{IR} \end{bmatrix} \begin{bmatrix} \beta_{FX} \\ \beta_{IR} \end{bmatrix} + \begin{bmatrix} \varepsilon_{FX} \\ \varepsilon_{IR} \end{bmatrix}$$

Where, y_{FX} and $y_{IR}$are dependent variables, $X_{FX}$and $X_{IR}$are all independent variables employed, expressed in the block diagonal matrix $\begin{bmatrix} X_{FX} & 0 \\ 0 & X_{IR} \end{bmatrix}$ to ensures that there is no interaction between the independent variables, $\beta_{FX}$and β_{IR} are coefficient vectors, a collection of regression coefficients for the respective independent variables, ε_{FX} and ε_{IR} are error terms. The error terms of the utilised SUR model are organised as given:

$$\begin{pmatrix} \varepsilon_{FX} \\ \varepsilon_{IR} \end{pmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_{FX}^2 I_T & \sigma_{FX,IR} I_T \\ \sigma_{FX,IR} I_T & \sigma_{IR}^2 I_T \end{pmatrix} \right]$$

Where $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$ is a zero meaned vector and $\begin{pmatrix} \sigma_{FX}^2 I_T & \sigma_{FX,IR} I_T \\ \sigma_{FX,IR} I_T & \sigma_{IR}^2 I_T \end{pmatrix}$ is a covariance matrix, including σ_{FX}^2 and σ_{IR}^2 which are variances of errors of respective models, $\sigma_{FX,IR}$ which is a covariance between FX and IR, and I_T is an identity matrix for a number of observations T.

SUR model is primarily estimated using the GLS technique (Universität Innsbruck, n.d.). The advantage of GLS method is that it takes into account possible violations of linear model such as autocorrelation and heteroscedasticity and reducing the effect of these violations (Gujarati & Porter, 2009; Taboga, 2021). The estimator for the SUR model is calculated using GLS the following way:

$$\hat{\beta}_{SUR} = (X' W^{-1} X)^{-1} X' W^{-1} y$$

Where X is a block diagonal matrix of the independent variables of all equations, W is a variance-covariance matrix of error terms for all equations and y is vector of dependent variables for all equations. X' denotes the transposed independent variable matrix, W^{-1} represents the inversed

variance-covariance matrix, and $(X'W^{-1}X)^{-1}$ is the inversed weighted product of independent variables matrices and the error term matrix. $X'W^{-1}y$ is a product of independent variables and the dependent variable vector weighted by the application of inversed variance-covariance matrix W.

In addition to the SUR, for the robustness check, OLS MLR regressions supplemented with Newey-West heteroskedasticity and autocorrelation consistent (HAC) estimator, along with VIF tests were run. The Newey-West estimator accounts for potential heteroscedasticity and autocorrelation in the error terms (Gujarati & Porter, 2009; Zeileis, 2004). The estimator addresses potential violations and enhances the reliability of the results.

The component is calculated as follows (Ao, 2009):

$$\widehat{\sum NW} = [\sum_{t=1}^{T} x_t x'_t]\left[\sum_{t=1}^{T} \hat{u}_t^2 x_t x'_t + \sum_{v=1}^{q}\left(1-\frac{v}{q+1}\right)\sum_{t=v+1}^{T}(x_t\hat{u}_t, T\hat{u}_{t-v}, Tx'_{t-v} + x_{t-v}\hat{u}_{t-v}, T\hat{u}_t, Tx'_t)\right][\sum_{t=1}^{T} x_t x'_t]^{-1}$$

Where T represents the total number of observations, x_t is a vector of independent variables for observation t, x'_t is a transposed vector of independent variables for the same observation, $\hat{u}_t$ are residuals of the model at observation t, q is a bandwidth parameter, maximum number of lags, and v is a lag index.

Important to note that in the Newey-West estimator the adjustment of standard errors is performed by lagging observations. In this study, the maximum number of observations to lag n is calculated by the lag selection parameter by Newey and West (1994):

$$n = \left[4\left(\frac{T}{100}\right)^{\frac{2}{9}}\right]$$

Where T is the sample size.

Finally, VIF tests were run to check for potential multicollinearity within the models. Multicollinearity is a condition where predictor variables in a regression model are highly correlated with each other, therefore inflating the standard errors, which in turn reduces the reliability of results. A VIF value greater than 10 indicates high multicollinearity between variables (Gujarati & Porter, 2009; Struck, 2024).

4 Results

The results of the conducted analyses are presented in this chapter. The first subsection presents the descriptive statistics, the second and third subsections provide the results of the SUR models for AMEs and EMEs, respectively. Finally, the fourth subsection covers the outcomes of the four OLS regressions with Newey-West HAC estimators, conducted for robustness check.

4.1 Descriptive statistics

Tables 3 and 4 provide the descriptive statistics for dependent and independent variables in AMEs and EMEs. As expected, AMEs show a significantly higher mean foreign exchange derivatives turnover at 304.41%, compared to just 77.45% in EMEs. Similarly, for interest rate derivatives turnover, AMEs have a mean of 147.80%, while EMEs report a much lower one of 20.94%.

Regarding standard deviations, AMEs show higher variability in FX turnover (171.60%) compared to EMEs (54.59%), as well as in IR turnover (127.70% versus 20.16%). This suggests a much wider differences in the level of development of these markets in AMEs relative to EMEs.

Table 3. Descriptive statistics for AMEs

Descriptive statistics for AMEs

	FX	IR	Ext.L.	Tr.Op.	Gov.S.	Mkt.Cap.
Mean	304.41	147.80	305.42	95.33	38.05	203.40
St. Deviation	171.60	127.70	278.77	100.67	8.77	310.03
Range	702.51	545.81	1170.60	422.17	41.14	1759.04
Minimum	81.15	8.71	38.12	20.45	13.93	18.18
Maximum	783.66	554.52	1208.71	442.62	55.07	1777.23
Count	195	195	195	195	195	195

Where FX – the total annual foreign exchange derivatives turnover as a percentage of GDP, IR – the total annual interest rate derivatives turnover as a percentage of GDP, Ext. L. – the amount of external liabilities as a percentage of GDP, Tr.Op. – the total annual trade as a percentage of GDP, Gov.S. – the total annual government spending as a percentage of GDP, Mkt.Cap. – the total market capitalisation of domestic listed companies as a percentage of GDP.

Examining the independent variables, external liabilities are substantially higher in AMEs, with a mean of 305.42%, compared to only 98.44% in EMEs. Trade openness also shows a difference, AMEs have a mean trade openness of 95.33%, while EMEs report a slightly lower figure of 70.01%. Additionally, standard deviations for both variables are considerably higher in AMEs, with trade openness at 100.67% and external liabilities at 278.77%, in comparison to EMEs, where trade openness is 38.55% and external liabilities are 79.22%. This suggests greater variability in both trade openness and external liabilities across advanced economies. Government spending presents smaller differences between AMEs and EMEs. The mean for AMEs is 38.05%, while for EMEs it is 33.40%, indicating that government expenditure is typically higher in AMEs. Additionally, the standard deviations between AMEs and EMEs are quite close, 8.77% and 8.68%, respectively. Market capitalisation presents a dramatic contrast between the AMEs and EMEs. The AMEs report a

mean of 203.40%, while EMEs record only 76.06%, which underscores a much higher level of market development on average in EMEs. The standard deviation for AMEs is significantly higher (310.03%) compared to EMEs (69.25%), highlighting notable disparities in market capitalisation in AMEs.

Table 4. Descriptive statistics for EMEs

Descriptive statistics for EMEs

	FX	IR	Ext.L.	Tr.Op.	Gov.S.	Mkt.Cap.
Mean	77.45	20.94	98.44	70.01	33.40	76.06
St. Deviation	54.59	20.16	79.22	38.55	10.29	69.25
Range	251.01	90.87	378.79	163.17	34.90	312.42
Minimum	5.57	0.17	33.81	22.11	16.46	10.29
Maximum	256.58	91.05	412.60	185.27	51.36	322.71
Count	155	155	155	155	155	155

Where FX – the total annual foreign exchange derivatives turnover as a percentage of GDP, IR – the total annual interest rate derivatives turnover as a percentage of GDP, Ext. L. – the amount of external liabilities as a percentage of GDP, Tr.Op. – the total annual trade as a percentage of GDP, Gov.S. – the total annual government spending as a percentage of GDP, Mkt.Cap. – the total market capitalisation of domestic listed companies as a percentage of GDP.

4.2 SUR results for AMEs

This section presents the results of the SUR regression for the AMEs. The following Table 5 demonstrates the detailed results of the regression analysis, illustrating the key figures and coefficients obtained from the models. The correlation between the residuals of the two models is 0.086, indicating a slight association between the unexplained factors in both models. Each model contains 195 observations. The adjusted R-squared values are 40.5% for the FX derivatives model and 47% for the IR derivatives model.

In the FX derivatives model, external liabilities are significantly associated with FX derivatives turnover, with a positive coefficient of 0.814. Conversely, trade openness and government spending

both have a significant negative association with the explanatory variable, with coefficients of -0.465 and -1.269, respectively. Finally, market capitalisation of domestic listed companies has a small but significant negative relationship with FX derivatives turnover, with a coefficient of -0.330.

Table 5. SUR results for AMEs

Seemingly Unrelated Regression for Advanced Market Economies

	FX	IR
Adjusted R-squared	0.405	0.470
Intercept	9.283 (p < 0.001)	1.866 (p = 0.232)
Ext.L.	0.814 (p < 0.001)	1.209 (p < 0.001)
Tr.Op.	-0.465 (p < 0.001)	-1.351 (p < 0.001)
Gov.S.	-1.269 (p < 0.001)	0.718 (p = 0.032)
Mkt.Cap.	-0.330 (p < 0.001)	-0.152 (p = 0.209)
Correlation of the residuals	0.086	
Total number of observations	195	195

Where FX – the nat.logarithm of the total annual foreign exchange derivatives turnover as a percentage of GDP, IR – the nat.logarithm of the total annual interest rate derivatives turnover as a percentage of GDP, Ext. L. – the nat.logarithm of the amount of external liabilities as a percentage of GDP, Tr.Op. – the nat.logarithm of the total annual trade as a percentage of GDP, Gov.S. – the nat.logarithm of the total annual government spending as a percentage of GDP, Mkt.Cap. – the nat.logarithm of the total market capitalisation of domestic listed companies as a percentage of GDP.

Turning to the IR derivatives model, external liabilities are again strongly associated, with an even larger positive coefficient of 1.209. Trade openness similarly shows a significant negative association with IR derivatives turnover, with a larger coefficient of -1.209. In contrast with the FX model, government spending was found to be positively related to IR derivatives turnover with a significant coefficient of 0.718. Market capitalisation of listed domestic companies was found to be insignificant, with a coefficient of -0.152.

4.3 SUR results for EMEs

This section presents the results of the SUR regression for the EMEs. Table 6 below demonstrates the results of the regression, illustrates the key figures and coefficients from the models. The correlation between the residuals of the two models is 0.576, indicating a moderate positive relationship between the unexplained factors in FX and IR derivatives turnover. Each model has 155 observations. The adjusted R-squared values are 70.4% in FX model and 41.1% in IR model.

In the FX derivatives model, the most influential factor is external liabilities with a significant coefficient of 1.247 showing a strong positive association. Unlike in advanced economies, trade openness has a minor and statistically insignificant relationship with FX derivatives turnover (0.065, p = 0.610). Government spending has a small but significant negative association with FX derivatives turnover, with a coefficient of -0.351. Finally, market capitalisation of listed domestic companies is significantly associated with the dependent variable, with a positive coefficient of 0.299.

Table 6. SUR results for EMEs

Seemingly Unrelated Regression for Emerging Market Economies

	FX	IR
Adjusted R-squared	0.704	0.411
Intercept	-1.639 (p = 0.038)	1.159 (p = 0.512)
Ext.L.	1.247 (p < 0.001)	2.454 (p < 0.001)
Tr.Op.	0.065 (p = 0.610)	-1.557 (p < 0.001)
Gov.S.	-0.351 (p = 0.049)	-1.075 (p = 0.008)
Mkt.Cap.	0.299 (p < 0.001)	0.163 (p = 0.192)
Correlation of the residuals	0.576	
Total number of observations	155	155

Where FX – the nat.logarithm of the total annual foreign exchange derivatives turnover as a percentage of GDP, IR – the nat.logarithm of the total annual interest rate derivatives turnover as a percentage of GDP, Ext. L. – the nat.logarithm of the amount of external liabilities as a percentage of GDP, Tr.Op. – the nat.logarithm of the total annual trade as a percentage of GDP, Gov.S. – the nat.logarithm of the total annual government spending as

a percentage of GDP, Mkt.Cap. – the nat.logarithm of the total market capitalisation of domestic listed companies as a percentage of GDP.

Similarly, external liabilities have a significant positive connection with IR derivatives turnover with a very strong coefficient of 2.454. Trade openness and government spending, in contrast, have a significant negative link with IR derivatives turnover with coefficients of -1.557 and -1.075, respectively. Market capitalisation of listed domestic companies has a small and statistically insignificant positive relationship with IR derivatives with a coefficient of 0.163.

4.4 Robustness check

For the robustness check, the multivariate regressions with the application of the Newey-West estimator were run to ensure robust results. The following section demonstrates the results of these robust regressions and VIF ratios conducted to check for multicollinearity.

4.4.1 AMEs

The following Table 7 summarises the results of the OLS regressions with the Newey-West component for AMEs. External liabilities are positively and significantly associated with FX derivatives turnover, with a coefficient of 0.814. On the contrary, trade openness and government spending are both negatively associated with FX derivatives turnover with significant coefficients of -0.465 and -1.269, respectively. Meanwhile, market capitalisation of listed domestic companies has a small significant negative relationship with FX derivatives turnover, with a coefficient of -0.330.

Table 7. OLS regressions with HAC results for AMEs

OLS with Newey-West HAC for Advanced Market Economies		
	FX	**IR**
Intercept	9.283 ($p < 0.001$)	1.866 ($p = 0.462$)

Ext.L.	0.814 (p < 0.001)	1.209 (p < 0.001)
Tr.Op.	-0.465 (p = 0.004)	-1.351 (p < 0.001)
Gov.S.	-1.269 (p = 0.002)	0.718 (p = 0.202)
Mkt.Cap.	-0.330 (p = 0.086)	-0.152 (p = 0.413)
VIF		
Ext.L.	5.153	
Tr.Op.	4.032	
Gov.S.	3.090	
Mkt.Cap.	4.582	
Total number of observations	191	191
Number of lagged observations	4	4

Where FX – the nat.logarithm of the total annual foreign exchange derivatives turnover as a percentage of GDP, IR – the nat.logarithm of the total annual interest rate derivatives turnover as a percentage of GDP, Ext. L. – the nat.logarithm of the amount of external liabilities as a percentage of GDP, Tr.Op. – the nat.logarithm of the total annual trade as a percentage of GDP, Gov.S. – the nat.logarithm of the total annual government spending as a percentage of GDP, Mkt.Cap. – the nat.logarithm of the total market capitalisation of domestic listed companies as a percentage of GDP.

For IR derivatives turnover, external liabilities have a strong and significant positive relationship with a coefficient of 1.209. Trade openness, on the other hand, shows a significant negative association, with a coefficient of -1.351. Government spending has a positive but statistically insignificant link with IR derivatives turnover with a coefficient of 0.718. Similarly, market capitalisation of listed domestic companies has a small, negative but insignificant relationship, with a coefficient of -0.152.

The VIF values for all variables are well below the threshold of 10, indicating no serious concerns regarding multicollinearity issues in this model. The total number of observations is 191 as the result of the application of the Newey-West estimator with 4 period lags.

4.4.2 EMEs

Table 8 below provides the results of the OLS regressions with the Newey-West component for EMEs. External liabilities have a significant positive association with FX derivatives turnover, with a

coefficient of 1.247. Trade openness has a small positive, non-significant relationship with the FX derivatives turnover variable, with a coefficient of 0.065. Government Spending has a negative but non-significant relationship with FX derivatives turnover, with a coefficient of -0.351. Market capitalisation of listed domestic companies is positively associated with FX derivatives turnover, with a coefficient of 0.299.

Table 8. OLS regressions with HAC results for EMEs

OLS with Newey-West HAC for Emerging Market Economies

	FX	IR
Intercept	-1.639 (p = 0.179)	1.159 (p = 0.656)
Ext.L.	1.247 (p < 0.001)	2.454 (p < 0.001)
Tr.Op.	0.065 (p = 0.734)	-1.557 (p = 0.003)
Gov.S.	-0.351 (p = 0.142)	-1.075 (p = 0.078)
Mkt.Cap.	0.299 (p < 0.001)	0.163 (p = 0.309)
VIF		
Ext.L.	4.493	
Tr.Op.	3.741	
Gov.S.	2.693	
Mkt.Cap.	1.709	
Total number of observations	151	151
Number of lagged observations	4	4

Where FX – the nat.logarithm of the total annual foreign exchange derivatives turnover as a percentage of GDP, IR – the nat.logarithm of the total annual interest rate derivatives turnover as a percentage of GDP, Ext. L. – the nat.logarithm of the amount of external liabilities as a percentage of GDP, Tr.Op. – the nat.logarithm of the total annual trade as a percentage of GDP, Gov.S. – the nat.logarithm of the total annual government spending as a percentage of GDP, Mkt.Cap. – the nat.logarithm of the total market capitalisation of domestic listed companies as a percentage of GDP.

The external liabilities variable also has a significant and positive relationship with IR derivatives turnover, with a coefficient of 2.454. Trade openness has a significant negative link with IR derivatives turnover, with a coefficient of -1.557. Government spending has a negative significant associ-

ation with IR derivatives turnover, with a coefficient of -1.075. Market capitalisation of listed domestic companies has a small, positive but non-significant relationship with IR derivatives turnover, with a coefficient of 0.163.

Similar to the AME models the VIF values for all independent variables are well below 10, indicating that multicollinearity is not an issue. The number of observations is 151, following the application of the Newey-West estimator with 4 period lags.

5 Discussion

This chapter interprets the results of the study, summarises the hypotheses testing, discusses limitations, and provides conclusion.

5.1 Advanced market economies

This subsection focuses on the results for AMEs, provided in Table 5 and Table 7. Beginning with external liabilities, where the SUR model shows a significant positive association with both FX and IR derivatives turnover. These findings are further confirmed by the robust regressions, supplemented with the Newey-West estimator. The results indicate that the growth of external liabilities in AMEs is positively related to the growth of IR and FX derivatives turnover, possibly indicating that market participants from AMEs tend to mitigate their exposures associated with external liabilities through these instruments, in turn potentially impacting the increase of the turnover of these instruments. Therefore, these results do not reject the following hypothesis:

> *H_1 (AMEs): External liabilities positively influence the turnover of foreign exchange and interest rate derivatives in AMEs.*

Moving further, the SUR model shows a significant negative relationship between trade openness and turnover of both FX and IR derivatives. The findings are also confirmed to be robust by the Newey-West regression, suggesting that growth in trade is negatively associated with growth in FX and IR derivatives. Potentially, this may happen because foreign trade introduces new exposures and worsens market conditions, as Vo et al. (2020) and Kim et al. (2009) highlighted, foreign trade can create market risks and worsen the market environment in the short term, which, in turn, can negatively affect derivatives markets, while the positive effect is more expected to happen in the long run. As the employed regression techniques do not focus on long term, it was not possible to capture potential positive association in the long run. Another possible explanation is that as an AME becomes more involved in global trade, it may rely more on alternative hedging tools, such as external assets, leading to natural hedging activities that may reduce the need for derivatives. Concluding, based on the results the following hypothesis is supported:

> *H_3 (AMEs): Trade openness negatively influences the turnover of foreign exchange and interest rate derivatives in AMEs.*

While the following one is rejected:

> *H_2 (AMEs): Trade openness positively influences the turnover of foreign exchange and interest rate derivatives in AMEs.*

The government spending variable has a significant negative association with FX derivatives turnover and a significant positive with IR derivatives turnover, according to the SUR model. However, according to the Newey-West model government spending is not a significant predictor as its p-value (0.202) exceeds the common threshold of 0.1. The association with FX remains significant,

indicating that an increase in government spending is related to a decrease in FX market turnover. That supports the notion of Diamond (1990) that government spending is not always good for market development as it can disincentivise market participants and impact development negatively. Therefore, based on the obtained results, the following sub-hypothesis is rejected:

> *$H_{4.1}$ (AMEs - FX): Government spending positively influences the turnover of foreign exchange derivatives in AMEs.*

While the following one is supported:

> *$H_{5.1}$ (AMEs - FX): Government spending negatively influences the turnover of foreign exchange derivatives in AMEs.*

The following sub-hypotheses are rejected due to the high p-value of the results:

> *$H_{4.2}$ (AMEs - IR): Government spending positively influences the turnover of interest rate derivatives in AMEs.*

> *$H_{5.2}$ (AMEs - IR): Government spending negatively influences the turnover of interest rate derivatives in AMEs.*

As for the market capitalisation variable, the SUR model showed a small statistically significant negative relationship with FX derivatives turnover and a statistically insignificant association with IR derivatives turnover. Following robustness check models results supported the findings of the SUR model, surprisingly confirming the lack of a solid association between the recognised market

development proxy and derivatives turnover. Contrary to expectations, even a negative association emerged, suggesting that higher market capitalisation, does not necessarily drive derivatives market activity and may even present an inverse relationship. One possible explanation may be that in AMEs derivatives markets are already sufficiently developed and a further market expansion does not affect the IR derivatives market and even may have a moderate negative impact. Thus, according to the conducted analysis market capitalisation of domestic countries was not found to be a positive predictor of FX and IR derivatives turnover in AMEs. Therefore, the following hypothesis cannot be supported:

> *H_6 (AMEs): Total market capitalisation of domestic companies positively influences the turnover of foreign exchange and interest rate derivatives in AMEs.*

5.2 Emerging market economies

The following subsection discusses the results presented in Table 6 and Table 8, focusing on the predictors of the FX and IR derivatives turnover in EMEs. Similar to the results for AMEs, the SUR model reveals a strong positive relationship between external liabilities and both FX and IR derivatives turnover. These findings are further supported by the Newey-West regression, which confirms the robustness of this association. This positive link may suggest that, likewise in AMEs, EMEs market participants utilise derivatives to hedge against exposures to external liabilities. Therefore, increasing the turnover of these instruments. Consequently, the results support the following hypothesis:

> *H_7 (EMEs): External liabilities positively influence the turnover of foreign exchange and interest rate derivatives in EMEs.*

Regarding the trade openness variable, the SUR model indicates that trade openness has a significant negative impact on IR derivatives turnover, while the effect on FX derivatives turnover is not significant. The Newey-West regression confirms the robustness of this negative association for IR derivatives. This suggests that similar to the AMEs, in EMEs greater trade openness is associated with reducing of IR derivatives turnover. Therefore, the following sub-hypothesis is supported:

> *$H_{9.2}$ (EMEs - IR): Trade openness negatively influences the turnover of interest rate derivatives in EMEs.*

While the following sub-hypothesis is rejected:

> *$H_{8.2}$ (EMEs - IR): Trade openness positively influences the turnover of interest rate derivatives in EMEs.*

Moreover, due to the high p-values, the following sub-hypotheses cannot be supported:

> *$H_{8.1}$ (EMEs -FX): Trade openness positively influences the turnover of foreign exchange derivatives in EMEs.*

> *$H_{9.1}$ (EMEs - FX): Trade openness negatively influences the turnover of foreign exchange derivatives in EMEs.*

The results of the SUR model reveal a negative association between government spending and both FX and IR derivatives turnover. However, the Newey-West model only identifies the association with IR as significant. This result suggests that government spending might weaken IR deriva-

tives market development, as mentioned previously, this may happen due to the potential discouraging effect on the financial markets that government spending may create by influencing market dynamics. Based on the findings, the following sub-hypothesis is supported:

> *$H_{11.2}$ (EMEs - IR): Government spending negatively influences the turnover of interest rate derivatives in EMEs.*

While the following sub-hypothesis is rejected:

> *$H_{10.2}$ (EMEs - IR): Government spending positively influences the turnover of interest rate derivatives in EMEs.*

Additionally, due to the high p-values, the following sub-hypotheses cannot be supported:

> *$H_{10.1}$ (EMEs - FX): Government spending positively influences the turnover of foreign exchange derivatives in EMEs.*

> *$H_{11.1}$ (EMEs - FX): Government spending negatively influences the turnover of foreign exchange derivatives in EMEs.*

Market capitalisation of domestic companies has a moderate yet significant association with FX but an insignificant one with IR derivatives turnover. This is consistent across both the SUR and Newey-West models, indicating that market capitalisation is not a strong predictor of derivatives turnover in EMEs. However, its slightly positive association with FX derivatives turnover may indicate a limited positive influence of the variable on the FX derivatives market in EMEs. Thus, the following sub-hypothesis is supported:

$H_{12.1}$ (EMEs - FX): Total market capitalisation of domestic companies positively influences the turnover of foreign exchange derivatives in EMEs.

While, due to the lack of statistical confidence this sub-hypothesis cannot be supported:

$H_{12.2}$ (EMEs - IR): Total market capitalisation of domestic companies positively influences the turnover of interest rate derivatives in EMEs.

5.3 Conclusion and limitations

To conclude, the study provides an analysis of the predictors of foreign exchange (FX) and interest rate (IR) derivatives in advanced market economies (AMEs) and emerging market economies (EMEs). Upon examining such variables as external liabilities, trade openness, government spending, and market capitalisation of domestic companies, both positive and negative associations with FX and IR derivatives turnover referencing the currencies of these economies were identified. Overall, the results reveal that external liabilities are a key positive predictor of FX and IR derivatives turnover across both markets in both types of economies, indicating that as an economy's external liabilities grow, so does the demand for these derivatives.

Trade openness and government spending displayed more complex relationships with derivatives turnover in both economies. In AMEs, trade openness showed a negative relationship with both FX and IR derivatives turnover. Whereas in EMEs, trade openness had a minimal yet statistically insignificant positive effect on FX derivatives and a statistically significant negative association with IR derivatives turnover, meaning that by raising its international trade an economy may negatively affect the turnover of FX and IR derivatives referencing its currency. Government spending also proved to be negatively associated with the FX derivatives market in AMEs and the IR derivatives

market in EMEs, meaning that increased government spending may have a negative impact on FX and IR derivatives market turnover. Market capitalisation of domestic companies was a less influential predictor of FX and IR derivatives turnover, showing only a moderate negative association with FX derivatives turnover in AMEs and a moderate positive relationship with IR derivatives turnover in EMEs.

Data availability was the main limitation of the following study. The absence of annual over-the-counter derivatives data was an issue, leading to the need for extrapolating figures for intermediate years, which might affect the accuracy and representativeness of the data. The unavailability of the detailed data on equity and bond market size led to a substitute in a total market capitalisation which proved to be less associated with the markets than the former variable. The sample size in this study included 10 AMEs and 8 EMEs and was small in comparison to the studies of the Bank for International Settlements of 2010 and 2016, which had 30 EMEs and 24 EMEs and 10 AMEs, respectively. Creating a larger pool of economies would likely have led to more representative results, but the data unavailability issues led to the limited sample size.

In addition, the study does not capture country-specific characteristics such as business environment, regulatory frameworks, or economic stability when studying the associations between variables within the samples. Such limitation may have generalised the results, as the listed factors could have impact on derivatives turnover. Finally, it is crucial to note that this is an observational study, therefore the results should be interpreted as rather correlations, than causal relationships. There remains a possibility that some of the studied variables are rather confounding than predicting.

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Appendices

Appendix 1. R code

```
library(systemfit)
formula_SUR_FX <- FX ~ ExL + Trade + GovS + MCap
formula_SUR_IR <- IR ~ ExL + Trade + GovS + MCap
SUR_equations <- list(FX = formula_SUR_FX, IR = formula_SUR_IR)
SUR_AMEs <- systemfit(SUR_equations, data = AMEs_for_R, method = "SUR")
SUR_EMEs <- systemfit(SUR_equations, data = EMEs_for_R, method = "SUR")
summary(SUR_AMEs)
summary(SUR_EMEs)
coef(SUR_AMEs)
coef(SUR_EMEs)
library(sandwich)
library(lmtest)
calculate_lag <- function(T) {
n <- floor(4 * (T / 100)^(2 / 9))
return(n)
}
T_EMEs <- nrow(EMEs_for_R)
T_AMEs <- nrow(AMEs_for_R)
lag_EMEs <- calculate_lag(T_EMEs)
lag_AMEs <- calculate_lag(T_AMEs)
model_EMEs_IR <- lm(IR ~ Trade + MCap + GovS + ExL, data = EMEs_for_R)
newey_west_EMEs_IR <- coeftest(model_EMEs_IR, vcov = NeweyWest(model_EMEs_IR, lag = lag_EMEs, prewhite =
FALSE))
model_EMEs_FX <- lm(FX ~ Trade + MCap + GovS + ExL, data = EMEs_for_R)
newey_west_EMEs_FX <- coeftest(model_EMEs_FX, vcov = NeweyWest(model_EMEs_FX, lag = lag_EMEs, prewhite =
FALSE))
model_AMEs_IR <- lm(IR ~ Trade + MCap + GovS + ExL, data = AMEs_for_R)
newey_west_AMEs_IR <- coeftest(model_AMEs_IR, vcov = NeweyWest(model_AMEs_IR, lag = lag_AMEs, prewhite =
FALSE))
model_AMEs_FX <- lm(FX ~ Trade + MCap + GovS + ExL, data = AMEs_for_R)
newey_west_AMEs_FX <- coeftest(model_AMEs_FX, vcov = NeweyWest(model_AMEs_FX, lag = lag_AMEs, prewhite =
FALSE))
print("EMEs - IR Regression with Newey-West Adjustments:")
print(newey_west_EMEs_IR)
print("EMEs - FX Regression with Newey-West Adjustments:")
print(newey_west_EMEs_FX)
print("AMEs - IR Regression with Newey-West Adjustments:")
print(newey_west_AMEs_IR)
print("AMEs - FX Regression with Newey-West Adjustments:")
print(newey_west_AMEs_FX)
library(car)
print("VIFs for EMEs - IR Model:")
print(vif(model_EMEs_IR))
print("VIFs for EMEs - FX Model:")
print(vif(model_EMEs_FX))
print("VIFs for AMEs - IR Model:")
print(vif(model_AMEs_IR))
print("VIFs for AMEs - FX Model:")
print(vif(model_AMEs_FX))
```