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Towards Financial Stability: An Analysis of the Nexus between International Capital Flows, Financial System Stability, and the Effectiveness of Macroprudential Policy Interventions

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Towards Financial Stability: An Analysis of the Nexus between International Capital Flows, Financial System Stability, and the Effectiveness of Macroprudential Policy Interventions

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Abstract

The ever-changing economic conditions and assessment of the importance of capital flows on the financial system emphasize the necessity to address their implications for financial stability. With all the benefits associated with capital flows, such as technological transfer and industrial upgrade, capital flows influence an economy's economic conditions from various aspects, among many, financial stability. The study employs 2-step Arellano-Bond GMM estimation techniques to shed a light on the linkage between disaggregated gross capital flows and country-level financial stability over the 2000-2020 period for 115 emerging and advanced economies. The study finds an economically feasible and statistically significant relationship between capital flows and financial stability. The relationship is particularly clear in the post-crisis periods and for lending flows. Given the increased popularity of macroprudential policies as efficient tools to deter financial instability concerns, the study identifies the applicability and efficiency of these policies to mitigate the financial stability risks linked to gross capital flows. While macroprudential policy measures provide evidence of mitigating power throughout the thesis, the most of evidence derives from policy instruments targeting financial institutions. Alternative estimations and robustness checks performed to show the validity of the estimations.

Keywords: financial stability, gross capital flows, macroprudential policies, FDIs, portfolio flows, bank lending

1. Introduction

International capital flows are part of financial developments and have supported economic growth. The ever-changing level and structure of financial flows among economies urges policymakers to delve deeper into the implications of capital flows. The understanding of financial flows between developing and advanced economies has changed over time, particularly before and after the financial crisis. Before the surge of the Global Financial Crisis (hereafter GFC), financial liberalization led to capital flows that were perceived as economic growth facilitators. Indeed, several authors (Rodríguez-Clare, 1996; Henry, 2007; Kaminsky, 2005) have stressed such a role. A more cautious approach has arisen in the aftermath of the GFC. Thus, over time the views on international capital flows evolved and in the recent literature, particularly after the GFC, there is an emphasised shift and mixed evidence on the relationship between capital flows and financial stability. With all the general benefits perceived from capital flows, such as the openness of an economy and technological and industrial upgrade, capital flows possess a risk of financial contagion, currency fluctuations and financial instability. This was already anticipated before the large waves of the financial flows (Reisen & Soto, 2002). After the GFC, for example, Caballero (2014) demonstrated that the surges in international capital inflows do increase the likelihood of banking crises. Mirzaei et al. (2020) study revealed that most of the adverse influence on bank-stability is derived from cross-border bank lending.

The literature can be divided into 3 major groups, where one group finds a positive relationship between capital flows and financial stability (Ebire et al., 2021; Kaminsky & Schmukler (2008). The second group (Baum et al., 2017; Cork, 2018) finds mixed evidence on the relationship, particularly for newly industrialized economies. Yet, there is a third group of authors, who delve deeper into the country and bank-level stability as opposed to only country-level financial stability to shed further light on how the impact of capital flows is heterogenous among economies and how some of these economies witness a negative impact (Mirzaei et al., 2021; Engel, 2016). Notably, the heterogeneity among economies is rather attributed to the country-level institutional quality which can be expressed by the effective activation and implementation of macroprudential policies (hereafter MaPP).

Macroprudential (hereafter MaP) policies (e.g., Countercyclical capital buffer, Loan-to-Value ratio, etc) are preventive policy measures activated by the monetary authorities to address *"key externalities and market failures associated with activities of financial intermediaries"*

(Cerutti et al., 2017). Thus, the inconclusiveness of the literature findings motivates us to expand current methodological approaches to answer the question of how the relationship between capital flows and financial stability evolved by incorporating more economies, longer periods, and an alternative policy index into our estimations. The choice of gross capital flows contrary to net flows or inflows is intended to better capture the literature shortcoming. According to the World Bank, gross capital flows might be larger and more volatile compared to net flows and the literature gap should be addressed accordingly (Schumkler & Didier, 2013).

Furthermore, the disaggregation of gross capital flows into subcategories is necessary to better capture the risks and benefits associated with them (Obiechina, 2010). As specified in the IMF Balance of Payments Manual (6th ed.,) for the Balance of Payments statistics, the financial account consists of 3 main categories, indicating *FDIs (Foreign Direct Investments), Portfolio investments* and *Other investments (also referred as Lending)*. The FDIs include all transactions involving direct investors and direct investment enterprises such as joint ventures, M&A transactions, etc. Portfolio investments consist of equity and debt security transactions and refer to stocks, bonds, mutual funds and so on. Some of the key distinctions between portfolio investments and FDIs are the duration, degree of control, riskiness, and objectives. Other investments, on the other hand, reflect short- and long-term trade credits, thus including cross-border bank lending. The extra component of the financial account is reserve assets that will be excluded from the analysis. Such assets are held by the central banks in a foreign currency to finance payment imbalances.

Numerous studies, including Elchengreen et al. (2018), Ebire et al. (2021) and Baum et al. (2017) have reported conflicting findings when it comes to the disaggregated-level impact of capital flows on different economic indicators. With the evolving evidence, FDIs are believed to offer more stability compared to fickle portfolio flows. Yet, more nuanced evidence may argue that FDIs from emerging economies are more volatile. I conduct an empirical study on these conflicting findings to draw a nexus between respective types of gross capital flows (as opposed to net capital flows) and financial stability.

The current literature highlights how the implementation of MaPP may have a mitigating impact on financial stability concerns arising from the increased capital flows, yet the heterogeneous impact of different MaPP on reducing the financial stability risks from capital

flows is not thoroughly documented. Bermpei et al. (2018) and Gaganis et al. (2020) document the difference between *Financial Institution-Targeted Instruments (FITI)* such as capital and liquidity regulations, limits on certain exposures and *Borrower-Targeted Instruments (BTI)* such as loan-to-value and debt-to-income caps. Such distinction can facilitate the analysis of the effectiveness of the different types of macroprudential policies and provide additional insights to policymakers in selecting appropriate measures (the dataset referring to the MaPP covers 17 measures).

The following research contributes to the existing empirical findings by constructing an updated and extended data frame (including 115 economies for the 2000-2020 period) to explore the relationship established between respective types of gross capital flows (FDI, Portfolio, Lending) and country-level financial stability. I measure the sensitivity of financial stability upon surges in gross capital flows (inward and outward). The general results indicate a statistically significant (mainly negative) relationship between capital flows and respective capital flows.

Moreover, while contributing to the current policy debate on the role of macroprudential policies, I identify the applicability and efficiency of these policies to mitigate the risks linked to gross capital flows. Previous extensive research on the effectiveness of macroprudential policies has been implemented. Nevertheless, the focus was mainly on systemic risks (Apergis et al., 2021), household credit and household prices (Alam et al., 2019), and credit growth (Cerruti et al., 2015) with limited regional considerations such as OECD countries or developing economies. The empirical research by Mirzaei et al. (2020) to navigate the relationship between capital flows and financial stability is notable, even though it is confined to the time through 2014 and exclusively examines developing countries with a focus on a single accumulated macroprudential policy measure constructed by Cerutti et al. (2017). Considering this literature shortcoming, I disaggregate the MaPP into FITI (Financial Institution-Targeted Instruments) and BTI (Borrower-Targeted Instruments) to capture the disaggregated mitigating role of the policy measures. Indeed, I find that macroprudential policy activation, particularly FITIs, tends to mitigate the negative consequences associated with capital flows.

Therefore, the primary focus of the research is the analysis of county-level financial stability considering the gross capital flows in advanced and developing economies and the mitigating

impact of macroprudential policies. The findings highlight the increased importance and effectiveness of MaPP measures after the GFC as the gross flows witnessed higher volatility and increased the concerns for financial stability.

The paper is structured as follows. Section **2** examines the existing literature by identifying the research gaps and developing a research hypothesis accordingly. Section **3** explains the methodological approach and the data construction to answer the research question. The main findings and results are presented in Section **4**. Based on the results obtained from employed models, conclusions are drawn in Section **5**.

2. Literature Review and Hypothesis Development

This literature review section develops an overview of the current research stance on international capital flows, financial stability, and macroprudential policies. The identification of key studies and research gaps facilitates the development of the research hypothesis and the selection of appropriate econometric tools to derive a statistical inference. The section will identify major topics and debates in the literature by first addressing theoretical viewpoints and then reviewing relevant empirical findings.

2.1. Theoretical Review

There is continuous interest in the relationship between capital flows and different economic indicators. The literature has so far identified the driving factors of capital flows on different macroeconomic conditions, including credit cycles and bank credit risk. With more evidence on volatile capital flows and the urge to have a resilient financial system, the previous research has led to several crucial conclusions.

Capital flows, described as a "non-trivial" ideological content carrying economic phenomenon (De Gregorio, 2012), are expected to influence countries' economic conditions from various aspects, among many, financial stability. Such impacts are accompanied by several trade-offs, including, but not limited to, the trade-off between higher growth, knowledge transfer and loosened credit constraints at the expense of volatile growth (Igan et al., 2020). Capital flows consist of inward and outward flows which are believed to react heterogeneously towards economic conditions and vice versa. While capital inflows are associated with credit availability and decreased borrowing costs, capital outflows offer risk diversification, currency hedging, balance of payment position improvement.

Several transmission channels reflect an interplay between financial markets and banking sector that influence the financial stability. One vastly studied mechanism is "Overlending" or Excessive lending (Caballero, 2014). Surges in capital *inflows* increase the capital available, which increases the funds intermediated via financial sector, potential leading to unsustainable credit booms (Hoggarth et al., 2016) and potential currency mismatches (Khalil et al., 2022). With such conditions, the increased information asymmetry in the domestic market might lead to moral hazard and negatively impact the stability of the financial sector (Gavin & Hausmann, 1996). Additionally, due to the real exchange rate appreciation, credit availability and higher net worth of domestic agents, the domestic demand might boost (Bruno & Shin, 2015), resulting in a relative increase in non-tradeable goods and asset prices and a spiral effect. Hence, a sudden stop or a reversal of capital flows can occur, exacerbating the liquidity concerns.

The opposite phenomenon occurs with increased levels of capital *outflows*. As the interest rate increases, the domestic borrowers get underfinanced by the financial market leading to overall credit squeeze, drop in asset values, worsened balance sheets and thus instability (Ebire et al., 2021; Cordero & Montecino, 2010). This is accompanied by currency depreciation, domestic competitiveness loss and increased foreign debt burden. As a result, short-term loses will occur through the financial channels and long term loses through the trade channels (Rodrik & Velasco,1999).

However, openness to capital flows can as well be associated with stability-related benefits, particularly if driven by sound economic conditions rather than push factors (López & Stracca, 2021). As the share of capital inflows and particularly bank flows increase, the domestic financial market becomes more diversified and less volatile upon the shocks derived from local conditions. With an increased risk sharing and openness, the liquidity and pricing efficiency in an economy can amplify (de la Torre et al., 2007). Additionally, the FDIs can potentially boost corporate governance practices, domestic competitiveness, and innovation upgrade, resulting in industrial and technological spillover effects.

With an identification of both negative and positive transmission channels affecting financial system stability, it is reasonable to conclude that the magnitude and direction of these impacts might be conditioned upon additional factors. While negative implications for financial stability might arise rather immediately, the positive implications, particularly those

deriving from Portfolio flows, might be realized over time (López & Stracca, 2021). This impact is heavily influenced by an economy's institutional quality. It is theoretically underpinned that financial liberalization and surges in capital flows shall be accompanied by a sufficiently developed financial systems where respective institutions and the policies are equipped with the tools and fundamentals tackling financial instability concerns from misallocations (OECD, 2012; Irma (2015); Guichard, 2017). Therefore, the impact on stability linked to the capital flow booms is heterogenous and conditioned upon the institutional quality. In the scope of this study, institutional setting can be somewhat captured by macroprudential policy activations following the studies on such linkage by Apergis et al. (2021) and Beirne et al. (2017).

Depending on a research question, the choice of a gross flows contrary to net flow might lead to a better indicator of volatility. Bank of England studies have shown that the abrupt boom before the GFC and the sharp decrease after the GFC in capital flows was rather captured in gross flows, whereas the variations in net flows did not contain significant signalling from policy making perspective (Hoggarth et al., 2016). Therefore, the thesis choice of gross capital flows within the context of financial stability is supported by 2 arguments. Firstly, contrary to net capital flows which are rather associated with exchange rate fluctuations, gross capital flows are more linked to financial stability due to the high procyclicality, magnitude and more comprehensive perspective they provide to policymakers. Besides, gross flows are growing at a higher rate and their volatility has increased over time, indicating the increased co-movement between capital inflows and outflows, especially in advanced economies (Davis et al., 2019). Secondly, as previously highlighted, the World Bank has continuously (particularly after the GFC) urged to analyse the behavioural patterns of gross flows. With the increased volatility and pro-cyclicality in gross flows, such behaviour can lead to collapse, especially during banking and debt crisis as considerable reallocations between domestic and international investors can influence the financial system volatilities (Broner et al., 2013; World Bank, 2013).

Unsal (2013) argues that traditional economic and monetary policies lack the instruments to stop capital flows from destabilizing the financial system. Contrary to micro-prudential policies that focus on boosting bank-level stability, the macro-prudential viewpoint strives to stabilize the financial system as a whole. Therefore, the gap between macroeconomic policies

and the conventional micro-prudential regulations of financial institutions is minimized by implementing macro-prudential policies.

In an attempt to quantify the connection between macroprudential policies and capital flows in CESEE (Central, Eastern and South-eastern Europe) countries, Eller et al. (2021) identify the transmission channels (direct and indirect) thanks to an extensive literature research. The first and relatively straightforward channel is the "direct cross-border dimensions" of macroprudential policies that enable foreign currency lending and foreign currency positions. Secondly, several MaPP measures are aimed at deterring excessive lending (e.g., through Loan-to-Value Ratio (LTV), Debt Service-to-Income ratio (DSTI) or Capital Requirements that curb the credit available). With the activation of such tools, the demand for cross-border bank lending is reduced. Besides, an increase of measures targeting liquidity ratios can ensure the ability of the banking system to withstand outflow surges. Lastly, the cyclical approach of MaPP measures, such as countercyclical capital buffers, that increase the requirements on the ratio between regulatory capital and risk-weighted assets, restrict excessive and aggressive lending activates by the financial institutions. This fosters the resilience of the financial system by reducing sensitivity of the output coming from global contagion, particularly in emerging economies.

2.2. Empirical Review and Hypothesis Development

The nexus between capital flows and stability has been explored by employing various economic models, such as the regime-switching factor-augmented vector autoregression (FAVAR) framework (Eller et al., 2021), seemingly uncorrelated regression (SUR) model (Baum et al., 2017), inverse propensity-score weighted (IPW) estimator (Alam et al., 2019), etc.

Moving to the highlights of empirical implications, Mirzaei et al. (2020), address the literature gap by discussing how 84 emerging economies were impacted by different types of international capital inflows between 2000 and 2014, before and after the financial crisis. Using data on individual bank-level financial stability, the analysis employs a 2-step GMM estimation to quantify the volatility of the financial system and further categorise *Other investments* into *bank-lending* and *non-bank lending*. The results provided mixed evidence on the impact, whereby total capital inflows boost the bank-level financial stability, namely bank-level z-score and NPL in the pre-crisis period. However, such a relationship is mainly attributed to cross-border bank lending. Meanwhile, when analysing the aforementioned relationship in

the post-crisis period (2010-2014), this relationship turns negative, resulting in Other flows, particularly bank lending, having negative and statistically significant effects. Furthermore, the authors measure the mitigating role of macroprudential policies activated by the respective monetary authorities.

The authors use data constructed by Cerutti et al. (2017) which creates a MaPP policy instrument, whereby policy instruments are coded for the period they were actually in place, thus reflecting both the tightening and loosening of the MaPP. However, the dataset is limited to the year 2014 and does not capture the intensity of policy measures. Moreover, Mirzaei et al. (2020) only use the sum of total macroprudential instruments activated in a country, whereas my research differentiates between FITI and BTI as well as creates a separate policy measure that only reflects tightening actions. In line with the previous literature (Cerutti et al., 2017; Eller et al., 2021; Beirne et al., 2017), the authors concluded that macroprudential instruments were successful in reducing the adverse effects of international capital inflows on individual bank-level stability. Additionally, robustness checks were carried out by measures of alternative bank-level stability indicators and country-level institutional measurements and were in line with the baseline results, despite the existence of second-order autocorrelation in the GMM estimation when including the institutional quality indicator. This, however, was anticipated due to the relatively high multicollinearity between the chosen independent variables when controlling for institutional quality.

Therefore, by using the Mirzaei et al. (2020) methodology, I hypothesize that Total gross capital flows have a negative impact on country-level financial stability. The research tests if these effects are apparent in different types of gross capital flows. I expect heterogeneity among the types of capital flows and thus hypothesize it. The existing literature is inconclusive in the direction of respective capital flow, particularly after the financial system distortions in 2008. When using a panel regression study with annual fluctuations, Igan et al. (2020) revealed that such a relationship occurred due to debt rather than equity inflows. However, the long-run effect test they implemented revealed that equity inflows were the ones more associated with growth. Moreover, the previous literature findings are largely focused on capital inflows or net inflows, hence, different results might be observed when I shift the focus to gross flows.

Baum et al. (2017) findings show a meaningful relationship between the financial stability indicators and gross capital flows. They use proxies for financial stability and attempt to explore the relationship between disaggregated components of gross capital flows and emerging country-level financial stability by employing SUR estimators which respectively enable the estimated country relationship to vary. It is apparent that the gross FDI flows are the ones most related to the stability-indicating variables. Therefore, the impact of financial stability indicator volatility differs by the type of capital flow considered. For example, while inward FDI flow affects positively the volatility of deposits, outward FDI is rather tended towards increasing the volatility of NPL and liquid assets. The magnitude of volatility is a function of country characteristics as well. Hence, I will define a separate set of country-specific variables (GDP growth, inflation) to increase the explanatory power of the selected model and make it comparable to the previous empirical studies. I expect Total flows and Lending to record a negative relationship with financial stability they directly incorporate cross-border bank lending in their calculation. The impact of Portfolio and FDI is somewhat unclear given that I incorporate both inflows and outflows into the model. Such experiment will shed a further light on the current and previous empirical implications.

In the recent analysis by Pasricha & Nier, (2020), the IMF emphasizes how country-level institutional characteristics can be a determining factor and how an economy can exploit these benefits. More specifically, the role of inflow CFM (Capital flow management measures) and MPM (Macroprudential measures) is apparent in mitigating the destabilizing impact of capital flows. The effectiveness of these policies can be highlighted in the surges in exchange mismatches, increased credit, and leverage ratios, etc. As a result, in the analysis, I add a unique list of control variables that reflects the macroprudential policies taken by the respective monetary authorities. To motivate the emphasis on the activation of macroprudential policies, I follow 3 different studies by Aysan et al. (2014, 2015 & 2017) on macroprudential measures implemented by the Turkish Central Bank in the post-financial crisis period which managed to mitigate the negative impact deriving from excessive capital inflows. Therefore, I hypothesize that the activation of macroprudential policies will have a mitigating impact on economies where certain relationship between gross capital flows and financial stability is recorded.

The research follows Apergis et al. (2021) to capture the impact of different types of macroprudential policies and divides the MaPP variables, as previously discussed, into 2

subcategories (i) *Financial Institution-Targeted Instruments (FITI);* MaPP measures including limits on foreign currency lending, limits on growth or the volume of aggregate credit, taxes and levies, loan restrictions, countercyclical capital buffer, etc., (ii) *Borrower-Targeted Instruments (BTI);* MaPP measures, namely debt-service-to-income ratio and the loan-to-income ratio (DSTI), and loan-to-value (LTV) ratio. The authors simultaneously document the heterogeneity of disaggregated MaPP instruments on reducing bank systematic risk. Hence, I hypothesize that the mitigating impact of MaPP will be heterogenous depending on the activation of BTI and FITI. I anticipate that the relatively large share of mitigating role from macroprudential policies will be attributed to FITI measures. First and foremost, lender-targeted instruments have witnessed the most tightening and loosening episodes over the last 20 years, thus offering more variation. Secondly, FITI policies are aimed at boosting the financial system's capacity to absorb shocks and ensure that there is enough buffer for lenders to absorb the losses. International capital flows can arise risks associated with currency and maturity mismatches and these types of risks are tackled by lender-based policies, such as limits on foreign currencies and measures taken to mitigate risks from global and domestic systemically important financial institutions (SIFIs). Lastly, emerging economies consist of the majority of our dataset and have been rather implementing FITI policies, whereas advanced economies tend to be towards the use of BTIs. Therefore, a key element that differentiates my research from the previous literature, including Mirazei et al. (2020), is underlined in the construction of an alternative database reflecting the activation of macroprudential policies.

Considering the discussed literature, the research question of the thesis is how the relationship between disaggregated (FDI, portfolio, lending) gross capital flows and country-level financial stability has evolved by considering developing and advanced economies and recent data over the years 2000-2020. The research seeks to find out how the institutional quality expressed by the activation of MaP policies can facilitate the neutralization of potential adverse effects deriving from capital flows and if the impact of MaP policy is heterogenous upon the type of policy implemented. The following will serve as the key hypothesis:

Hypothesis 1: International capital flows negatively affect the country's financial stability, and the impact varies by the nature of capital flows.

Hypothesis 2: The potential negative consequences brought on by these capital flows are mitigated by the activation of macroprudential policies.

Hypothesis 2a: The magnitude of the mitigating role of Macroprudential policies varies by the activation of FITIs and BTIs, with FITIs standing as the major transmission channel.

To further ensure the reliability of the main findings that support the hypothesis proposed, additional robustness checks and alternative analyses will be conducted. More specifically, alternative measures of country-level financial stability, as well as differentiation of MaPP indicators related specifically to tightening actions, will be incorporated into the model. Moreover, the initial dataset will be split into 2 subperiods to reveal the relationship under investigation in pre-crisis and post-crisis periods. Lastly, fixed effect estimation is employed for the baseline specifications to facilitate comparability with 2-step GMM estimation.

3. Methodology and Data

3.1. Methodological Approaches

To examine the proposed hypothesis, the thesis develops a baseline regression specification. To answer the first research question "Do gross capital flows determine country-level financial stability and if so, is the impact heterogeneous upon the type of flow?", I study financial stability as a function of *(i) gross capital flows,* and *(ii) country-specific* characteristics.

Considering the previous research, the country-level Z-score is used as financial stability proxy. The Z-score reflects insolvency as discussed by Beck et al. (2013), which captures the probability of default of a country's banking system. The higher is the Z-score of an economy's banking system, the further away it is from the insolvency line. Moreover, for robustness, 2 other financial stability proxies are introduced: Capital Adequacy Ratio, reflecting the ratio between regulatory capital and risk-weighted assets, and Non-performing loans (NPL), reflecting the ratio of bank Non-Performing Loans to Gross Loans (%). Basel Committee considers such indicators to be among the primary indications of bank stability (Mirzaei et al., 2020; Ebire et al., 2021 and BIS, 2022) exhibiting credit risk and the system's ability to absorb potential losses respectively.

The empirical model which establishes the relationship between country-level financial stability and gross capital flows controlling for the country-level characteristics and macroprudential policy activations is as follows:

$$\boldsymbol{FS_{ct}} = \beta \times FS_{ct-1} + \delta \times \boldsymbol{FLOW}_{ct} + \rho \times MaPP_{ct} + \pi \times \boldsymbol{FLOW_{ct}} \times \boldsymbol{MaPP_{ct}} + \gamma \times X_{ct} + \varepsilon_{ct} \qquad Eq.(1)$$

Where *c* refers to country and *t* refers to year. FS_{ct} indicates the country-level financial stability, $FLOW_{ct}$ refers to respective gross capital flows. I further divide the capital flows into FDI, Portfolio and Lending models to clearly distinguish the heterogenous volatility of the system from different types of capital flows. The variable of interest is gross capital flows and its coefficient; δ. A negative coefficient will indicate that a higher flow of capital into and out of an economy increases the risk of financial instability. To have a more robust model and high explanatory power, I build a country-specific vector, X_{ct}, to control for the financial stability relationship with GDP growth and inflation. The inclusion of such controls derives from the consistent and parallel development of business cycles and financial stability (Al-Khazali et al., 2017).

To address the research question on the effectiveness of macroprudential policies, I interact a proxy calculated for macroprudential policy to the variable of interest, namely respective capital flows in the selected economies, expressed as $FLOW_{ct} \times MaPP_{ct}$. While the variable $MaPP_{ct}$ reflects the individual impact of macroprudential policy activations, the interaction term captures how aggregated (MaPP Total) and disaggregated (FITIs and BTIs) macroprudential measures imposed have a mitigating impact given the relationship between financial stability and capital flows.

The model may suffer from endogeneity issues due to potential reverse causality and multicollinearity concerns. Although capital flows might have a detrimental effect on financial stability, economies with a higher stability level may attract more capital flows which will cause the reverse causality. The same reasoning applies to multicollinearity: country controls and capital flows may be correlated.

Thus, I employ a two-step GMM estimator to prevent any endogeneity concerns following Apergis et al. (2021), Mirzaei et al. (2021), and Cerutti et al. (2017) among others. The two-step GMM was first popularized by Arellano & Bond (1991) and is particularly preferred for

datasets with large N and small T. To avoid simultaneity issues, following Al-Khazal et al. (2017), I use lags of both explanatory and lagged dependent variables as instruments.

Furthermore, for the robustness of the baseline results, I extend the lag lengths of instruments and report the results in the **Appendices**. The inclusion of the lagged dependent variable is typical for the difference GMM of the dynamic panel data analysis. To identify the fitness of the selected instruments, I conduct overidentifying restrictions test (the Sargan test). A failure to reject the joint null hypothesis of the instruments being valid (p-value being 0.05) will indicate that the selected instruments are reliable. In the such specification, the absence of second-order autocorrelation is needed. Nevertheless, first-order autocorrelation is expected due to the lagged term (Kivet et al., 2017). To implement a comprehensive analysis, I will as well employ Fixed Effect estimation, which, due to the endogeneity in the dataset, might result in biased results. However, when compared to the 2-step GMM, such results might lead to relevant conclusions. This will be represented in Section **4**, where I employ Fixed-effect estimation on Z-score and Capital Adequacy. The Fixed effects model has disadvantages in terms of endogeneity but strengths in that it does not require all GMM assumptions and strong instruments, among other things. Endogeneity might be less relevant than previously assumed if the FE estimate does not differ significantly in coefficient magnitudes, direction, and significance.

3.2. Data Description and Descriptive Statistics

To conduct the analysis, I merge different datasets and conduct data manipulation according to the needs of the analysis of model specification. The datasets subject to manipulation are filtered by years and paired by country (iso3c) and represented in **Table 1:** Variable definitions, sources, and descriptive statistics. The data on international capital flows derives from *IMF's Balance of Payments Statistics* from 2000-2020. The gross capital flows are then calculated as a percentage of current GDP. I then disaggregate gross capital flows into FDIs, Portfolio investments and Other investments to capture the disaggregated impact on financial stability. *World Bank's Global Financial Development Database (GFDD)***,** an extensive database for 108 financial systems characteristics (both for financial institutions and financial markets) of 241 economies is the main reference for collecting financial stability proxies. I select country-level Z-score, Bank Nonperforming Loans to gross loans (%), and Capital adequacy ratio on a yearly basis.

Table 1: *Variable definitions, sources, and descriptive statistics*[1]

Variables	Definition	Source	Mean	St. Dev.
Bank Financial Stability				
Z-score	Z-score compares the buffer of a country's commercial banking system (capitalization and returns) with the volatility of those returns (IMF).	World Bank- GFDD	15.60	8.84
NPL	Bank Non-Performing Loans to Gross Loans (%).	"	6.17	6.86
Capital Adequacy	Bank regulatory capital to risk-weighted assets (%).	"	16.53	4.62
Gross Capital Flows				
Total Flows	Total gross capital flows, % of GDP.	IMF-IFS	37.52	210.16
FDI	Gross Foreign Direct Investments, % of GDP.	"	15.71	112.16
Portfolio	Gross Portfolio Investments, % of GDP.	"	12.40	83.23
Lending	Gross Other Investments, % of GDP.	"	9.41	60.58
Macroprudential Policy				
MaPP (Total)	The yearly MaPP variable (policy change indicator) resulted from summing up monthly macroprudential policy activation (both tightening and loosening) across a year and dividing by 12 to account for potential lag effects.	IMF- iMaPP and own calculations	0.053	0.15
Lender	MaPP(Total) variable only for FITI (Financial Institutions-Targeted Instruments)	"	0.05	0.14
Borrower	MaPP(Total) variable only for BTI (Borrower-Targeted Instruments)	"	0.01	0.04
MaPP_T (Tightening)	MaPP variable considering only the activation of Tightening actions	"	0.09	0.14
Lender_T	MaPP variable considering only the activation of Tightening actions for FITI.	"	0.08	0.12
Borrower_T	MaPP variable considering only the activation of Tightening actions for BTI.	"	0.01	0.04
Controls				
Economic Growth	GDP growth (annual %)	World Bank- WDI	3.26	4.19
Inflation	GDP price deflator	"	5.14	8.68
Observations	2048 for Z-score, 1726 for Capital Adequacy and 1702 for NPL			

[1] Variables reflecting Gross Capital Flows and Controls are represented in percentages, whereas for the model implementations respective values are divided by 100 to facilitate comparability and the interpretation of coefficients.

IMF's survey on *Integrated Macroprudential Policy Database (iMaPP)* is a detailed and extensive dataset that provides "*(1) dummy-type indicators of tightening and loosening actions of various macroprudential policy instruments, (2) a unique numerical indicator of regulatory limits on the loan-to-value ratio, and (3) a description of each policy action*" (Alam et al., 2019). The dataset groups countries into 3 categories according to data sources and availability and contains information relevant to analysis for 135 countries. Based on the approach employed by Alam et al. (2019), I create a yearly MaPP variable (policy change indicator) by accumulating monthly macroprudential policy activation (both tightening and loosening) over 12 months (within a year) and dividing by 12 to capture potential lagged effects. Additionally, to understand the role of the impact of MaPP based on solely tightening actions, I create another policy indicator of tightening for selected macroprudential instruments which take 1 if tightened and 0 otherwise in the examining year. To address the research question of which type of policy action has a more significant impact, I divide the policy indicator into lender-targeted (FITI) and borrower-targeted (BTI) policy variables. To account for country-specific macroeconomic conditions, I build the country-characteristic vector on inflation and annual GDP growth based on the World Bank's World Development Indicators (WDI), a detailed 6-dimensional dataset for 208 countries.

After careful and extensive manipulation of the datasets, I built a dataset (unbalanced panel) including 115 (80 were classified as EMDE, while 35 were classified as Advanced) countries from the years 2000-2020. Though most of the datasets discussed cover data for the majority of the world economies, the iMaPP dataset is still limited in scope and is the dataset that limits the ultimate number of observations. The summary statistics, description of country-level financial stability, capital flow, macroeconomic and MaPP variables and respective sources are represented in **Table 1:** Variable definitions, sources, and descriptive statistics. Overall, 2048 observations for 21 years are retained for the main results.

The number of observations for Capital Adequacy and NPL is fewer (1726 and 1702 respectively). It is worth noting that NPL has political nature to some extent due to potential preferential lending, and political connections. The politicization of the NPL problem is further explored by several authors, including Shih (2004), Braun & Koddenbrock (2022), and Infante & Piazza (2014). Therefore, potential inconsistencies in the model output with NPL considerations might occur. Furthermore, the average value of Lender-targeted instruments is larger than the average value of Borrower-targeted instruments, consistent with the

statement of more MaPP activations associated with FITI measurements referred to in Section 2. The FITI has 942 observations with values different than 0, while BTI has only 243 as such. FDI is responsible for the biggest proportion of Total flows, followed by Portfolio and Lending flows.

4. Discussions and Results

In this section, I employ $Eq.(1)$ to answer the main research questions by making an inference about the relationship between country-level financial stability indicators and respective forms of gross capital flows. The main tables show results obtained by a 2-step GMM estimation, along with the p-values for the Sargan test of overidentification as well as for AR (1) and AR (2) tests. In all the tables, the respective p-values for the Sargan test and AR (2) are above the critical value of 0.05, failing to reject the null hypothesis of over-identifying restrictions and no secondary-order autocorrelation.

4.1. Do current empirical observations record linkage between Flows, Stability, and Macroprudential Policy Interventions?

The interaction term between respective capital flows and Total MaPP indicator represents the potential mitigating impact deriving from the activation of macroprudential policies at a country level. **Table 2** reports the main findings, reflecting the hypothesized relationship between gross capital flows and financial stability. According to the 2-step GMM estimation results, there is economically meaningful and statistically significant relationship between the variables of interest in the panel. The inference deriving from GMM estimation, despite the substantial analogies and parallels with Fixed-effect estimations in terms of coefficient signs and direction (subject to further discussion), proposes that Total, FDI and Lending flows negatively impact country-level financial stability. In contrast, Portfolio flows are expected to have a stabilizing effect. Hence, such a relationship varies depending on the nature of specific capital flows, backing the hypothesis underlined in Section 2.

Overall, the 2-step GMM estimation records a positive and statistically significant coefficient (at the 1% significant level) for the lagged dependent variable, indicating path-dependency. In econometric terms, the coefficient for Total flows (Model 1) implies that, ceteris paribus, a 10-percentage point increase in a country's Total capital flows is associated with a roughly 2

Table 2: *Gross Capital Flows, Financial Stability, and the Activation of Macroprudential Policies over the Period 2000-2020: Baseline Results*

	Dependent variable is Z- score			
	Total	FDI	Portfolio	Lending
	Model 1	Model 2	Model 3	Model 4
Lag Dep.	0.455***	0.447***	0.424***	0.415***
	(0.068)	(0.065)	(0.085)	(0.063)
Capital Flow	-0.190***	-0.322***	0.108***	-0.557***
	(0.025)	(0.083)	(0.037)	(0.120)
Inflation	2.285	1.214	1.969	2.508
	(1.732)	(1.890)	(2.030)	(1.710)
Growth	9.611***	9.005**	9.867***	8.599
	(3.090)	(4.516)	(3.769)	(5.245)
MaPP (Total)	0.2	0.479	0.375	0.333
	(0.418)	(0.453)	(0.458)	(0.408)
Flow*MaPP	1.737***	1.505***	3.834***	2.515*
	(0.152)	(0.299)	(0.422)	(1.445)
Sargan Test	1.00	1.00	1.00	1.00
AB AR(1)-(p-value)	0.00	0.00	0.00	0.00
AB AR(2)-(p-value)	0.79	0.79	0.66	0.72
Observations	1765	1765	1765	1765
Countries	115	115	115	115

The table reports results obtained from $Eq.(1)$ determined by 2-step GMM estimation. The dependent variable, reflecting country-level financial stability, is Z-score. Refer to **Table 1** for detailed description of the variables. Robust standard errors are reported in parenthesis. *, **, *** indicate significance at the 10%, 5% and 1% levels respectively. The null hypothesis for the Sargan Test of over-identification is not rejected. The null hypothesis for the Arellano-Bond test for the AR(2) is not rejected.

points decrease in financial stability proxy, which is statistically significant at the 1% level. FDIs and Lending investments (Model 2 and Model 4), despite the same sign and significance level as Total flows, record a higher magnitude in terms of their influence on the Z-score, whereby a 10-percentage point increase is associated with an approximately 3- and 6-point decrease in the country-level financial stability indicator, respectively. Among the capital flow variables, coefficient for Lending exhibits the largest negative impact on stability due to the financial

system volatility deriving from cross-border bank lending and deposits reflected in the other flow. Such flows possess direct risks for the economies' financial system as they might impose foreign currency, credit, or liquidity concerns and more. Portfolio flows (Model 3), on the other hand, with a statistically significant coefficient, tend to have a stabilizing impact the Z-score, demonstrating a quantitatively meaningful relationship with financial stability. Despite the Z-score evolving over time, it is not an elastic variable and is partially determined by its previous values, thus a larger percentage change in capital flows is not expected to have a larger marginal impact on the z-score.

The descriptive statistics revealed a lower standard deviation for Z-score, thus the coefficients obtained explain less of the variance for the dependent variable. Because of the heterogeneity of disaggregated capital flows, Total flows have relatively lower coefficients for overall impact analysis, confirming the necessity for disaggregation outlined in Section **2**. Additionally, in terms of the country-level controls, GDP annual growth tends to boost financial stability, consistent with previous literature.

The last 4 interaction terms between *Flow and MaPP* variables consider how respective capital flows determine the direction of financial stability proxy upon considering the activation of macroprudential policies. Overall, the coefficients based on solely MaPP policy index record statistically insignificant effects, whereas the interaction suggests that the negative impact on Z-score transmitted particularly through Lending could translate into positive effects upon the activation of policies, thus supporting the hypothesis of macroprudential policies having mitigating role. The mitigating role will vary upon the magnitude of the policy proxy. In economic terms, the Model 1 implies that, at the mean value of policy activation index (0.089), 1 percentage point increase in flows will only be associated with roughly -0.03 points decrease in Z-score. At the 3rd quartile value of 0.16 for the MaPP, the 1 percentage point increase in flow will result in 0.08 points increase in stability proxy. These indicate that the mitigating impact is conditioned upon the number of policy reactions recorded over a year across the MaPP measures explored.

If an economy records sound level of stability and economic fundamentals, the policy measures might not matter. Yet, in case of a large crisis or a shock the system would respond differently if the measures were applied. Once there is a flow of capital, the banking sector reacts to it depending on the activation of MaPP. This could explain the statistically

insignificant effects deriving from the MaPP individually. To support the argument, one could refer to Okada (2012) who found that while financial openness and institutional quality do not have a significant impact on foreign capital flows, the interaction term does. Moreover, as suggested by Apergis et al. (2021), the impact of capital flows on stability is highly conditioned upon the institutional fundamentals that could be somewhat reflected by the activation of macroprudential policies.

Such a mitigating role of MaPP is prevalent in the interaction with Portfolio and Lending flows, which suggests that the stronger the impact of transmission through flows, the more efficient policy activation is in terms of magnitude. Policy measures are more effective in tackling the negative consequences associated with other flows (especially as the value of policy index increases) as it includes cross-border lending, and the impact is rather direct. Although the baseline specification already indicated a positive relationship between portfolio flows and stability indicators, activation of MaPP can facilitate the transmission of these positive implications more efficiently and at a relatively higher rate. These results are consistent with previous literature findings and the hypothesis on mitigating the role of MaPP policies this paper suggested. For example, (López & Stracca, 2021) and Kaminsky (2008) illustrate that the potential negative consequences from capital flows will be negated due economic fundamentals and institutional quality. Mirzaei et al. (2020) findings illustrate that MaPP may offset the detrimental impact of capital inflows transmitted through portfolio and lending flows.

Several empirical implications are derived from the thesis results when comparing with previous findings. On one hand, the mainstream economic arguments tend to favour FDIs due to relatively negligible stability concerns, whereas Portfolio and cross-border Lending are recognized for their destabilizing role. Mirzaei et al. (2020) findings for post-crisis period indicate the adverse influence of Total and Lending inflows on Z-score and NPLs, whereas the pre-crisis period was prominent in terms of capital inflows influencing positively the stability. Contrary to this, Hamdi & Jlassi (2014) and Kaminsky (2008) findings reveal no consequence on banking crisis from financial liberalization, yet the Total and FDI liabilities can increase the likelihood of an economy witnessing banking crisis.

On the other hand, Ebire et al. (2021), Baum et al. (2017) and Pruski& Szpunar (2008) findings differ from the mainstream results. According to Ebire et al. (2021), capital flows (Inward and

Outward FDI, Outward Portfolio and Other flows) in EMDE are significant and positive predictors of country-level financial stability for 2005-2017 period. The authors illustrate that Outward Portfolio flows can boost the financial system of an economy, whereas Other flows and Portfolio inflows have destabilizing effect. Pruski& Szpunar (2008) mention that although Portfolio and Lending can have destabilizing role, the accompanying macroeconomic conditions can alter the course of such investments. These can explain why the aggregated (gross) impact of Portfolio model can boost the financial stability, particularly upon the activation of MaPP according to my research. The findings of Baum et al. (2017) reflect that FDI inflows are supposed to decrease system volatilities, whereas FDI outflows can have the largest negative impact on stability, even more than Lending Outflows. Besides, the impact from inflows is less clear and heterogenous among economies.

According to the thesis findings, Gross Total, FDI and Lending flows destabilize the financial system, whereas the impact of Portfolio investments varies depending to the model specifications (either positive or no impact at all). Such results are somewhat in the borderline of the research and are twofold. I find that the destabilizing role from Total and Lending flows is preserved, whereas the positive implications associated with FDI inflows can be negated by a surge in FDI outflows and change the course of their impact. Therefore, the aggregation of capital flows in my research provides meaningful implications for policymaking and emphasizes the need that the variations in system volatilities can be further explained by gross flows as opposed to net flows.

To conclude, policymakers' attempts at macroprudential policy activation were successful in negating the adverse effects that gross capital flows (aggregated and disaggregated) recorded on country-level financial stability. Furthermore, I extend the lag of instruments from 3 to the maximum lag length possible for robustness purposes and report the results in **Table 7** and **Table 8** of the **Appendi**. The results obtained are consistent with the baseline specification in terms of directions and magnitudes, particularly when it reveals the relationship between financial stability and Total and Lending flows. Moreover, with more lag length, more mitigating power is attributed to the interaction with the policy activation index.

4.2. Do such patterns differ after the Global Financial Crisis?

Moving forward, to get a more detailed perspective on the relationship between capital flows and stabilizing MaPP, one shall effectively address the period covered in the analysis. The results so far referred to the 2000-2020 period, which could be divided into 2 subgroups: The pre-crisis and post-crisis period. In the pre-crisis period, namely 2000-2008, the importance of macroprudential policies was not anchored to an extent to cope with large extended economic shocks. It was believed that monetary policy measures were equipped with necessary transmission channels to prevent financial system vulnerabilities (implicit financial stability). Thus, many economies, including those categorised as advanced, somewhat lacked the necessary prudential mechanism and did not fully address the pressing urge of prioritizing financial stability as a key policy objective. Economic openness and financial liberalization were rather associated with positive economic outcomes. On this matter, Darvas et al. (2016) concludes that the policymakers, instead of supervision of the financial system, directed efforts towards individual-firm level supervision. Over time, the joint efforts of a global community with the contribution of the IMF have led to large-scale reforms, including Basel III implementation which resulted in more resilient global financial stability implications (IMF, 2018).

Panel A of **Table 3** represents the pre-crisis relationship between respective capital flows and financial stability upon the activation of MaP policies whereby the dependent variable is country-level Z-score. As I split the dataset into 2 subgroups, substantial loss of observations (covering only 8 years and 108 economies) occurs. Nevertheless, the lagged value of the dependent variable for all the models is statistically significant at a 1% level, thus confirming the path dependency and the necessity to incorporate the lagged value of dependent variable as an instrument. Given the data used, no significant relationship is found between capital flows and stability indicators. These results are aligned with the findings of Hamdi & Jlassi (2014) and Kaminsky (2008) discussed previously. I find no evidence of MaPP activation influencing the relationship between capital flows and stability because (i) gross respective capital flows did not have a crucially negative impact on country's financial stability, thus there was no shock to observe by policy activation, (ii) MaPP measures were not fully

Table 3: *Gross Capital Flows, Financial Stability, and the Activation of Macroprudential Policies in pre- and post-crisis periods*

	Dependent variable is Z-score				Dependent variable is Z-score			
	Panel A: Pre-crisis period (2000-2008)				**Panel B:** Post-crisis period (2010-2020)			
	Total Model 1	FDI Model 2	Portfolio Model 3	Lending Model 4	Total Model 5	FDI Model 6	Portfolio Model 7	Lending Model 8
Lag Dep.	0.459***	0.418***	0.448***	0.458***	0.429***	0.402**	0.423***	0.317***
	(0.069)	(0.071)	(0.073)	(0.079)	(0.137)	(0.184)	(0.140)	(0.121)
Capital Flows	-0.013	0.618	0.142	-0.081	0.230***	0.304***	0.060	-1.231***
	(0.165)	(0.957)	(0.116)	(0.267)	(0.052)	(0.117)	(0.059)	(0.376)
Inflation	0.512	0.942	2.684	2.362	2.595	1.783	1.812	2.619
	(4.082)	(3.098)	(2.838)	(4.030)	(1.826)	(1.858)	(1.683)	(1.789)
Growth	2.58	8.448	6.062	3.156	8.931*	10.171**	8.872**	8.120*
	(10.960)	(9.863)	(8.238)	(10.374)	(4.717)	(4.343)	(4.338)	(4.617)
MaPP (Total)	-0.935	-0.345	0.384	-0.494	0.065	0.371	0.292	0.432
	(1.504)	(1.152)	(1.125)	(1.201)	(0.354)	(0.360)	(0.392)	(0.363)
Flow*MaPP	5.797	9.756	1.99	7.296	1.482***	1.207***	2.598***	1.822*
	(8.764)	(16.218)	(22.110)	(13.825)	(0.163)	(0.264)	(0.578)	(0.982)
Sargan Test	0.24	0.31	0.45	0.33	1.00	0.98	0.98	0.98
AB AR(1)-(p-value)	0.02	0.02	0.02	0.02	0.00	0.01	0.00	0.01
AB AR(2)-(p-value)	0.17	0.16	0.16	0.17	0.55	0.89	0.60	0.71
Observations	697	697	697	697	906	906	906	906
Countries	108	108	108	108	112	112	112	112

The table reports results obtained from $Eq.(1)$ determined by 2-step GMM estimation. The dependent variable, reflecting country-level financial stability, is Z-score. Refer to **Table 1** for detailed description of the variables. Robust standard errors are reported in parenthesis. *, **, *** indicate significance at the 10%, 5% and 1% levels respectively. The null hypothesis for the Sargan Test of over-identification is not rejected. The null hypothesis for the Arellano-Bond test for the AR(2) is not rejected.

established as a policy priority and their role was subject to further investigation after the GFC.

In a contrasting situation, moving to Panel B, where the relationship under investigation is considered for the post-crisis period, the patterns change. In terms of sign and direction, the model estimates are consistent with the initial findings reported in **Table 2**. Only after the GFC, Total flows started to be associated with a negative Z-score, whereas Portfolio flows did

not reveal any positive and meaningful influence on stability. Lending flows witnessed an increase in the negative magnitude and started to explain more of the variation in the stability proxy. After 2010, a 10-percentage point increase in cross-border lending accounted for a 12-point decrease in country-level Z-score. Additionally, similar pattern was recorded in FDI flows with a relatively smaller magnitude increase. All these coefficients are statistically significant at the 1% level. The reason behind the patterns of Portfolio flows in a model with shorter period could be explained by the findings of López & Stracca (2021). The authors mention that while negative consequences of capital flows are rather immediate, the long-term positive implications, particularly from Portfolio flows, are only materialized in a long-term.

Therefore, the relationship explored in **Table 2** is rather attributed to the surge of GFC and the system volatilities it brought. Contrary to the pre-crisis period, where MaPP measures were activated less and had small marginal impact, the post-crisis MaPP activation by respective authorities lead to substantial alleviation of financial system stability deriving from capital flows. All the coefficients for the interaction between Flows and MaPP are positive and statistically significant at the 1% level. Notably, the interaction term with Portfolio flows follows the same pattern. This implies that even though the individual Portfolio variable is insignificant after the crisis, when the policy is activated, Portfolio flows can positively affect stability and such relationship is conditional. Therefore, with the increased concerns on financial stability implications and continuous reforms in the banking sector regulation, the activation of macroprudential policies was complemented by a decrease in financial system volatilizes deriving from respective gross capital flows. Such findings support the initial outcomes on potential mitigating implications of MaPP and the need for policymakers to emphasize the importance of such measures to tackle systemic risks as the effectiveness of policy measures after the GFC has improved substantially.

4.3. Do we observe heterogenous impact from the disaggregated Macroprudential Policies?

These results arise the question of what are the main drivers of such mitigating impact of macroprudential policies, and can we disaggregate the policy indeed to an extend to obtain meaningful results? These questions will formulate grounds for the next empirical aspect of the study by exploring if the magnitude of the mitigating role of MaP policies varies by the

FITIs and BTIs. A 2-step GMM is employed whereby the MaPP index is divided into subgroups (i) lender-targeted policy activations, (ii) borrower-targeted policy activations, which thereafter are interacted with respective capital flows. The obtained results, pinned down in **Table 4**, support the hypothesis that the magnitude of the mitigating role of MaP policies varies by the FITIs and BTIs. The descriptive statistics as well as the reasoning behind dividing policies into FITIs and BTIs in Section **2** predicted that most impact will be transmitted through FITIs.

Table 4: *Disaggregation of Macroprudential Policies into Lender- and Borrower-Targeted instruments for the period 2000-2020*

	Dependent variable is Z-score			
	Total	FDI	Portfolio	Lending
	Model 1	Model 2	Model 3	Model 4
Lag Dep.	0.462***	0.452***	0.427***	0.404***
	(0.070)	(0.082)	(0.082)	(0.062)
Capital Flows	-0.188***	-0.290***	0.052	-0.477***
	(0.024)	(0.066)	(0.038)	(0.133)
Controls	✔	✔	✔	✔
MaPP (Lender)	0.312	0.492	0.497	0.428
	(0.458)	(0.471)	(0.490)	(0.414)
MaPP Disaggregation				
Flow Lender*	1.747***	1.325***	3.982***	2.115*
	(0.15)	(0.25)	(0.42)	(1.11)
Flow Borrower*	0.506	6.437	-3.853	6.437
	(2.010)	(4.486)	(3.943)	(8.515)
Sargan Test	1.00	1.00	1.00	1.00
AB AR(1)-(p-value)	0.00	0.00	0.00	0.00
AB AR(2)-(p-value)	0.79	0.79	0.66	0.7
Observations	1765	1765	1765	1765
Countries	115	115	115	115

The table reports results obtained from $Eq.(1)$ determined by 2-step GMM estimation. The dependent variable, reflecting country-level financial stability, is Z-score. Refer to **Table 1** for detailed description of the variables. Robust standard errors are reported in parenthesis. *, **, *** indicate significance at the 10%, 5% and 1% levels respectively. The null hypothesis for the Sargan Test of over-identification is not rejected. The null hypothesis for the Arellano-Bond test for the AR(2) is not rejected. Although Borrower variable is added to the baseline regression individually, its coefficients are reported in the same column for compactness.

The magnitudes of statistically significant coefficients for lender-targeted instruments do not vary substantially from the baseline specification in **Table 2**, suggesting that the transmission channel of policy activation was more efficient via measures specifically targeting the lender. As opposed to FITIs, the interaction with Borrower variable suggests that borrower-targeted instruments incorporated in the dataset do not offer any significant linkage in terms of their mitigating potential. Therefore, such findings are consistent with the hypothesis that the mitigating role of MaPPs for financial stability implications derived from cross-border flows shall be attributed to FITIs.

Such implications for heterogeneity among policy measures used for empirical analysis can be attributed to several factors, including, but not limited to, the following: (i) the vast majority of macroprudential policies in the considered timeframe consisted of FITIs and the occurrence of such policy activations were roughly 4 times more likely as opposed to BTIs, (ii) BTIs incorporate LTV and DSTI policy measures which are rather aimed at reducing the credit available to borrowers, thus preventing excessive credit growth and balancing the debt obligation and income ratio for borrowers, (iii) meanwhile, the range of policy measures covered by FITIs are relatively large in amount (15 measures compared to the 2 for FTIs) and such measures limit credit availability from a lender's perspective thus mitigating lending procyclicality.

The discussed results are aligned with prior studies covering effectiveness of MaPP. The scope of disaggregated policies is somewhat determined by the country development level and the risk being addressed. Findings of Cerutti et al. (2017), Mirzaei et al. (2020), Apergis et al. (2020) and Aysan et al. (2015) demonstrate that BITIs are more common and effective tools in advanced economies, whereas FITIs are more prevalent and successful in EMDE. Since my dataset primarily refers to EMDE, this could explain why I find larger impact deriving from FITIs. Besides, BTIs are more common in negating the effects on household credit growth and real estate market shocks, whereas this research studies the insolvency risk and the stability of the banking sector. This could explain why in their discussion on macroprudential policy effectiveness on stability, Mirzaei et al. (2020) and Aysan et al. (2015) identify statistically significant stabilizing effects derived from foreign currency-associated measures which are categorized as FITI.

I further investigate if the main findings on the MaPP are robust to an alternative policy indicator that only considers the tightening episodes recorded through the given timeframe.

Table 9 in **Appendices** includes 2 interaction terms, *Flow*MaPP* and *Flow*Lender* for only tightening actions recorded over the past 21 years. The estimation impact of the aggregated policy measure while interacting with respective capital flows is consistent with the findings revealed in **Table 2** (in terms of signs, directions, and statistical significance), suggesting that tightening actions by policymakers can indeed negate the adverse effects of gross capital flows. One notable difference arises for the interaction between Lending and FITI measures (Model 4), whereby the mitigating role derives solely from tightened FITI measures. The sole incorporation of tightening measures into the policy index reflects regulatory bodies' ambition to impose stricter rules toward market players and boost stability and design resilience. Hence, the results with alternative policy index indicates once more that such mitigating consequences are largely derived from FITIs for all types of gross capital flows, thereby supporting the findings revealed in **Table 4.**

4.4. Are alternative estimations robust to the main findings?

The main findings of the thesis are derived from employing a 2-step GMM estimation to tackle the endogeneity of datasets used for such analysis. However, an alternative estimation to observe some insights could be implemented by fixed effect estimations. Despite the existing endogenous variables, FE estimation can provide us with some inference of the anticipated results and directions of variables, enabling comparison among different methods for such datasets. As suggested by Cerutti et al. (2017), the FE estimation for a model specification with such data will most likely lead to biased results.

Table 5 includes 2 panels: Panel A, where the dependent variable is the Z-score, and Panel B, where the dependent variable is the Capital adequacy Ratio (alternative variable for financial stability). Both panels report rather similar results in terms of variable directions. Panel A, in line with GMM estimations and the hypotheses proposed by the study, indicates that Total,

FDIs and Other Investments impact negatively country-level financial stability. However, no direct impact between Portfolio flows and financial stability is recorded.

FE estimation would predict a direct and statistically significant relationship between some of the selected variables, such as GDP growth (positive coefficient sign). Although the suggested coefficient signs are reasonable, we cannot draw an inference about causality based on simultaneously moving and multicollinear data (e.g., a higher GDP growth might signal about county's robust trading activity and move foreign funds (capital) to a country, and a higher amount of foreign capital flows into a given country might facilitate the use of such means to finance trade). Furthermore, FE estimation suggests that both the MaPP variable individually and the interaction term are statistically significant and positive and can observe the adverse consequences of respective capital flows, thus supporting the initial findings on mitigating the role of macroprudential policies.

It is worth noting that despite employing fixed-effects estimation, the model does not manage to effectively capture the year-fixed effects, since the variation for the selected variables, particularly for Z-score, within the chosen timeframes is relatively small and rather time-invariant. Such scenario is as well reflected when the lagged values of dependent variables tend to partially determine the future values of respective variables. In terms of coefficient magnitudes, FE predicts relatively higher magnitudes for the lagged dependent variables and rather similar magnitudes for capital flows and MaPP. For example, in 2-step GMM, there is a 0.45 to 1 point rise ratio on average between the previous and current Z-score values, whereas, in the FE estimate, the change ratio reaches 0.62.

Panel B of **Table 5** subsequently reports the results when the dependent variable is the Capital Adequacy ratio. Similar results to those of FE and GMM estimation for the Z-score are recorded. However, only the interaction terms for Total and FDI models suggest any mitigating role deriving from policy introduction. Interestingly, GDP growth had negative implications for the capital adequacy ratio. Such relationship can happen when an expansion of economic growth results in "aggressive" lending and increase the proportion of risk-weighted assets. Nevertheless, the overall significance levels, signs, and directions of coefficients both in Panel A and Panel B are consistent with **Table 2** outcomes. To conclude, Fixed-effect estimation does a good job of providing a meaningful inference about the relationship investigated, whereas the GMM provides more robust magnitudes for the

coefficients as it deals with potential endogeneity and simultaneity bias. Cerutti et al., 2017 similarly employs FE estimation and represents conclusions results that are similar in terms of directions and significance to those of 2-step GMM estimation results. Therefore, the concerns of endogeneity were less relevant.

***Table 5**: Baseline specification results obtained by employing Fixed-effect Estimation*

	Dependent variable is Z-score				Dependent variable is Capital Adequacy			
	Panel A				**Panel B**			
	Total Model 1	FDI Model 2	Portfolio Model 3	Lending Model 4	Total Model 5	FDI Model 6	Portfolio Model 7	Lending Model 8
Lag Dep.	0.632***	0.638***	0.621***	0.630***	0.750***	0.753***	0.753***	0.749***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Capital Flows	0.140***	-0.178**	0.169	0.721***	0.104***	-0.159**	-0.047	0.551***
	(0.05)	(0.08)	(0.12)	(0.15)	(0.04)	(0.07)	(0.10)	(0.13)
Inflation	-0.348	-0.397	-0.331	-0.25	-0.661	-0.688	-0.687	-0.527
	(0.95)	(0.96)	(0.95)	(0.95)	(0.96)	(0.96)	(0.96)	(0.96)
Growth	4.727***	4.633***	4.432***	5.297***	9.280***	9.446***	9.459***	8.725***
	(1.53)	(1.53)	(1.52)	(1.53)	(1.51)	(1.50)	(1.51)	(1.51)
MaPP (Total)	0.978**	1.323***	1.098***	1.039***	0.907***	1.048***	1.048***	1.027***
	(0.39)	(0.38)	(0.39)	(0.40)	(0.34)	(0.33)	(0.34)	(0.34)
Flow*MaPP	1.693***	1.096**	3.314***	3.294**	0.777***	1.045**	0.767	0.149
	(0.34)	(0.51)	(0.64)	(1.29)	(0.28)	(0.42)	(0.53)	(1.07)
Country Fixed effects	✔	✔	✔	✔	✔	✔	✔	✔
Countries	114	114	114	114	101	101	101	101
Observations	1,902	1,902	1,902	1,902	1,604	1,604	1,604	1,604
R^2	0.452	0.446	0.454	0.454	0.597	0.596	0.594	0.599
Adjusted R^2	0.416	0.409	0.417	0.417	0.568	0.567	0.566	0.571

The table reports results obtained from $Eq.(1)$ determined by Fixed-effect estimation. The dependent variable, reflecting country-level financial stability, is captured by Z-score in Panel A and Capital Adequacy in Panel B. Refer to **Table 1** for detailed description of the variables. Robust standard errors are reported in parenthesis. *, **, *** indicate significance at the 10%, 5% and 1% levels respectively. Because not all variables are accessible for the alternative stability indicators for all country-year pairs, the number of observations vary across model specifications.

In **Table 6**, additional robustness analysis is conducted with alternative stability indicators, namely Capital Adequacy (Panel A) and NPL (Panel B), by employing 2-step GMM. The incorporation of these variables limits the sample size to 102 countries. Similar to the FE

estimation in **Table 5**, Panel A suggests negative and statistically significant relationship between capital flows (Total, FDI, Lending) and stability. In contrary to the FE estimation that attributes relatively higher magnitudes to the independent variable, the GMM records more robust coefficients. The individual effect of macroprudential policies disappears, yet the interaction with respective capital flows highlights once more the effectiveness of MaPP measures or Capital Adequacy. Economically speaking, if a MaPP activation is recorded in an

Table 6: *Robustness: Gross Capital Flows, Financial Stability, and the Activation of Macroprudential Policies for alternative proxies of financial stability*

	Dependent variable is Capital Adequacy				Dependent variable is NPL			
	Panel A				**Panel B**			
	Total Model 1	FDI Model 2	Portfolio Model 3	Lending Model 4	Total Model 5	FDI Model 6	Portfolio Model 7	Lending Model 8
Lag Dep.	0.527***	0.494***	0.526***	0.515***	0.679***	0.678***	0.712***	0.691***
	(0.118)	(0.126)	(0.110)	(0.097)	(0.061)	(0.052)	(0.058)	(0.067)
Capital Flows	-0.078***	-0.105*	-0.007	-0.419***	0.100	0.437	-0.004	0.0002
	(0.028)	(0.058)	(0.021)	(0.091)	(0.071)	(0.393)	(0.035)	(0.182)
Inflation	2.406	1.924	2.625	1.896	-1.971	-2.152	-2.659	-2.237
	(2.460)	(1.874)	(1.824)	(1.895)	(2.407)	(2.346)	(2.379)	(2.486)
Growth	-0.265	-0.592	-2.084	-1.679	20.126**	19.693**	19.010**	19.644**
	(4.146)	(4.496)	(4.265)	(4.483)	(9.036)	(8.571)	(7.668)	(8.043)
MaPP (Total)	0.173	0.2	0.271	0.142	-0.172	-0.215	-0.281	-0.04
	(0.370)	(0.375)	(0.382)	(0.347)	(0.674)	(0.662)	(0.541)	(0.589)
Flow*MaPP	0.653***	0.547*	0.990***	1.385**	-0.429*	-0.993	-0.860*	-2.26
	(0.127)	(0.283)	(0.316)	(0.696)	(0.227)	(0.741)	(0.494)	(1.530)
Sargan Test	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AB AR(1)-(p-value)	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.03
AB AR(2)-(p-value)	0.70	0.68	0.68	0.70	0.10	0.10	0.09	0.10
Observations	1491	1491	1491	1491	1450	1450	1450	1450
Countries	102	102	102	102	102	102	102	102

The table reports results obtained from $Eq.(1)$ determined by 2-step GMM estimation. The dependent variable, reflecting country-level financial stability, is captured by Capital Adequacy Ratio and NPL. Refer to **Table 1** for detailed description of the variables. Robust standard errors are reported in parenthesis. *, **, *** indicate significance at the 10%, 5% and 1% levels respectively. The null hypothesis for the Sargan Test of over-identification is not rejected. The null hypothesis for the Arellano-Bond test for the AR (2) is not rejected.

economy and the policy index is in its maximum of 1.08, 1 percentage point increase in Lending flows will increase Capital Adequacy ratio by roughly 1 percentage point.

On the other hand, the capital flow variables in Panel B do not suggest any statistically significant linkage with NPL. Annual GDP growth tend to be the decisive factor determining the direction of the variable. As such, the political nature of NPLs is described in Section **3**. My analysis is limited to country-level implications, whereas the inclusion of bank-level information could alter the relationship under investigation (e.g., using Bankscope data). Moreover, the variation is NPL records higher path-dependency and is largely explained by its previous values.

Nevertheless, the interaction term with policy activation somewhat alters such patterns. Conditioned to Total and Portfolio flows in and out of an economy (Model 5 and Model 7), macroprudential policy activations tend to stabilize the system by reducing the NPL ratio. Portfolio flows tend to behave similar way in terms of their impact on stability, whereby the flow of portfolio capital matters significantly when the policymakers intervene in the market practices.

Mirzaei et al. (2020) explore this relationship considering bank-level data (large number of observations from Bankscope) and report coefficient values for the lagged dependent variable of more than 0.8. Although in their model specification the capital inflows (particularly Total and Lending models) exhibit statistically significant impact, such linkage is again not holding the persistency as it does for the Z-score. Additionally, individual bank-level controls tend to explain more of the variation in NPLs. One shall note that the previous literature, including Mirzaei et al. (2020) and Boren (2016), rather captures the impact of capital inflows whereas my study explores the relationships derived from gross flows, which does possess different implications as elaborated in Section **2**. Based on the findings of Apergis et al. (2020) I further explain my results on NPL. Weak institutional quality is associated with increased risk from financial liberalization. Since NPL has political considerations, alarming NPL indicator might indicate already inadequate institutional quality. Thus, the activation MaPP might not be backed by adequate institutional foundations to deliver positive implications from capital flows.

Despite the meaningful implications derived from this study, the scope of the research contains some limitations. Firstly, the study generated results by conducting analysis on country-level data. The inclusion of individual bank-level data could increase the explanatory power of the model and potentially account for more of the variation of the stability. Besides, the incorporation of alternative proxies of financial stability led to fewer number of observations. Secondly, the study reflects the potential positive implications generated through the activation of macroprudential policies. However, the cost of such policy activations is subject to further investigation to capture the potential trade-offs. Lastly, the macroprudential policy variables do not reflect the intensity of the policy in place but rather the activation of the policy. Nevertheless, despite such limitations, the study provides meaningful relationship between capital flows and financial stability upon the activation of macroprudential policies.

5. Conclusions

This study (i) analyses the impact of gross international capital flows as opposed to net inflows/flows on country-level financial stability and compares the generated outcomes with previous researchers' findings, (ii) builds an extensive dataset which includes both emerging and advanced economies to explore the magnitude of policies based on a globally aggregated level and given their heterogeneous regulatory and financial frameworks, (iii) augments an extensive dataset with macroprudential policy information from 2000-2020, whereby the activation of policies are disaggregated based on the policy nature. Such experiments shed a light on the opportunities and limitations of policy actions as well as provide robust inferences based on historic data.

The estimation is conducted by employing 2-step GMM estimation to tackle potential endogeneity issues. According to the study results, Total, FDI and Lending flows destabilize the financial system, particularly after the GFC. Macroprudential policy activations mitigate these observed consequences. Most stability implications derived from such policies shall be attributed to FITIs. FITIs are the most popular tool for policy activation in the dataset explored and they refer to certain policy instruments that directly target the financial system's capacity to absorb shocks and ensure that there is enough buffer for lenders to absorb the losses. Thus, the impact of policy varies upon the intensity of occurrences of policy activations across different measures. Furthermore, only after the GFC, Total flows started to be associated with

a negative Z-score, whereas Portfolio flows did not reveal any positive and meaningful influence on stability.

Such results are aligned with previous empirics. Taken together, the incorporation and aggregation of gross capital flows in this study provides meaningful implications for policymaking and emphasizes that the variations in system volatilities can be further explained by gross flows contrary to net flows. Further research could be conducted by disaggregating respective capital flows based on classification of flows as debt or equity in the official accounts. Additionally, MaPP instruments could be disaggregated into multiple subgroups to capture the impact of each group of policy activation. The iMaPP dataset, to certain extent, as well allows for further disaggregation within the scope of an individual policy measure. Lastly, an alternative policy measure explicitly capturing the intensity of the policy in place could derive extended implications.

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Appendices

Table 7: *Gross Capital Flows, Financial Stability, and the Activation of Macroprudential Policies over the Period 2000-2020: Baseline Results for instruments with 2 lags*

	Dependent variable is Z-score			
	Total	FDI	Portfolio	Lending
	Model 1	Model 2	Model 3	Model 3
Lag Dep.	0.453***	0.441***	0.386***	0.399***
	(0.084)	(0.090)	(0.079)	(0.074)
Capital Flow	-0.199***	-0.341***	0.137**	-0.646***
	(0.028)	(0.077)	(0.055)	(0.135)
Inflation	3.344	2.516	3.07	3.662
	(2.235)	(2.214)	(2.220)	(2.370)
Growth	9.116**	8.196*	10.727**	9.036*
	(3.756)	(4.591)	(4.315)	(5.352)
MaPP (Total)	0.078	0.395	0.252	0.165
	(0.420)	(0.451)	(0.433)	(0.373)
Flow*MaPP	1.895***	1.463***	4.532***	4.035**
	(0.163)	(0.349)	(0.469)	(1.608)
Sargan Test	1.00	1.00	1.00	1.00
AB AR(1)-(p-value)	0.00	0.00	0.00	0.00
AB AR(2)-(p-value)	0.78	0.77	0.59	0.69
Observations	1765	1765	1765	1765

Countries	115	115	115	115

The table reports results obtained from $Eq.(1)$ determined by 2-step GMM estimation. The dependent variable, reflecting country-level financial stability, is Z-score. Refer to **Table 1** for detailed description of the variables. Robust standard errors are reported in parenthesis. *, **, *** indicate significance at the 10%, 5% and 1% levels respectively. The null hypothesis for the Sargan Test of over-identification is not rejected. The null hypothesis for the Arellano-Bond test for the AR(2) is not rejected.

Table 8: *Gross Capital Flows, Financial Stability, and the Activation of Macroprudential policies over the Period 2000-2020: Baseline Results for instruments with maximum lag length*

	Dependent variable is Z-score			
	Total	FDI	Portfolio	Lending
	Model 1	Model 2	Model 3	Model 4
Lag Dep.	0.565***	0.561***	0.527***	0.556***
	(0.061)	(0.074)	(0.053)	(0.053)
Capital Flow	-0.104*	-0.098	0.208**	-0.491*
	(0.053)	(0.116)	(0.097)	(0.251)
Controls	✔	✔	✔	✔
MaPP (Total)	0.035	0.105	-0.009	-0.105
	(0.658)	(0.686)	(0.648)	(0.625)
Flow*MaPP	1.474***	0.570	3.710***	4.010*
	(0.288)	(0.432)	(0.794)	(2.135)
Sargan Test	1.00	1.00	1.00	1.00
AB AR(1)-(p-value)	0.00	0.00	0.00	0.00
AB AR(2)-(p-value)	0.83	0.80	0.70	0.82
Observations	1765	1765	1765	1765
Countries	115	115	115	115

The table reports results obtained from $Eq.(1)$ determined by 2-step GMM estimation. The dependent variable, reflecting country-level financial stability, is Z-score. Refer to **Table 1** for detailed description of the variables. Robust standard errors are reported in parenthesis. *, **, *** indicate significance at the 10%, 5% and 1% levels

respectively. The null hypothesis for the Sargan Test of over-identification is not rejected. The null hypothesis for the Arellano-Bond test for the AR(2) is not rejected.

Table 9: *Impact of Macroprudential Policies for the Period 2000-2020 considering only tightening actions.*

	Dependent variable is Z-score			
	Total Model 1	FDI Model 2	Portfolio Model 3	Lending Model 4
Lag Dep.	0.430***	0.420***	0.391***	0.420***
	(0.066)	(0.061)	(0.081)	(0.064)
Capital Flows	-0.226***	-0.369***	0.014	-0.598***
	(0.039)	(0.114)	(0.044)	(0.106)
Controls	✔	✔	✔	✔
MaPP (Tightening)	-0.076	0.249	-0.04	0.134
	(0.478)	(0.481)	(0.493)	(0.424)
Interaction (Tightening)				
*Flow*MaPP*	1.727***	1.633***	4.505***	2.168
	(0.364)	(0.526)	(0.399)	(1.600)
*Flow*Lender*	1.810***	1.649***	4.538***	2.856**
	(0.333)	(0.544)	(0.392)	(1.370)
Sargan Test	1	1	1	1
AB AR(1)-(p-value)	0	0	0	0
AB AR(2)-(p-value)	0.72	0.65	0.8	0.81
Observations	1765	1765	1765	1765
Countries	115	115	115	115

The table reports results obtained from $Eq.(1)$ determined by 2-step GMM estimation. The dependent variable, reflecting country-level financial stability, is Z-score. Refer to **Table 1** for detailed description of the variables. Robust standard errors are reported in parenthesis. *, **, *** indicate significance at the 10%, 5% and 1% levels respectively. The null hypothesis for the Sargan Test of over-identification is not rejected. The null hypothesis for the Arellano-Bond test for the AR(2) is not rejected. Although Borrower variable is added to the baseline regression individually, its coefficients are reported in the same column for compactness.