Master's Programme in Economic Growth, Population and Development (Development Track)

Macroprudential Policy Activity and Financial Inclusion

Cross-country analysis of macroprudential tool use

by

Marinó Örn Ólafsson

molafsson96@gmail.com

ma7851ol-s@student.lu.se

Research suggests that multiple trade-offs and synergies characterise the relationship between financial inclusion and financial stability. For example, expanding access to financial services can lead to a more stable banking system but also excessive credit growth and decreased stability. The outcome is determined by policy and management and depends on institutional factors and other country characteristics. Recently, macroprudential policy (MaPP) has become the tool of choice for managing systemic risk. Other research has found that some MaPP tools lead to less uptake of formal financial services, while others are inherently exclusionary. This thesis argues that MaPP tools counteract financial inclusion goals in the short term. I propose a relationship in which commitments to inclusion increase the perceived costs of MaPP. Thus, risk build-up associated with tighter MaPP and financial inclusion would correlate negatively. This relationship entails that in the event of risks materialising, country financial sector ability to absorb shocks is lower as inclusion decreases. To study this, I analyse cross-country data on MaPP usage and financial inclusion, first to determine whether tool usage differs by inclusion quartile and second whether financial soundness indicators predict differing levels of macroprudential activity by quartile. There is little research on the determinants of MaPP usage. Therefore, this study presents a novel and exploratory approach. The findings indicate that policy activity and inclusion are positively correlated. However, results on the determinants of policy tightening are inconclusive. Therefore, the thesis concludes with the observation that further research on what determines policy activity is needed to narrow the knowledge gap between MaPP effectiveness and usage.

Acknowledgements

First and foremost, I would like to thank my supervisor Seán Kenny for his help and support on the project. Second, I thank Nanna Hermannsdóttir for the sacrifices she has made this semester in devoting her time to taking care of my ten-month-old research assistant, our daughter Móeiður Gyða. Third, I thank my classmates for making my time at Lund University even more enjoyable and for strengthening the prosperous environment in which we have all grown during our time here.

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1 Introduction

Financial inclusion has become a significant development policy goal since the turn of the century. Research into the effects of financial inclusion led to significant data-gathering efforts, and it became a goal of global organisations such as the World Bank and the UN (World Bank, 2008). These factors, especially data availability, laid the foundations for the rapidly growing research body on financial inclusion.

There exists no universal definition of financial inclusion. However, there is not much debate around the definition either, as organisations and researchers divide the issue into specific areas of interest. The World Bank (2022) defines financial inclusion as "individuals and businesses hav[ing] access to useful and affordable financial products and services that meet their needs – transactions, payments, savings, credit and insurance – delivered in a responsible and sustainable way." The broad scope of this definition shows both why researchers tend to divide inclusion into simpler terms and aggregates before conducting research and how all-encompassing financial inclusion is in society. This thesis primarily concerns financial inclusion as measured by access to credit.

Similarly, financial stability has garnered increased attention after the Global Financial Crisis (GFC). Again, there is no universally accepted definition of financial stability. Generally, financial stability refers to a state in which the functioning of financial systems is secure and resilient to stress while minimising disruptions to the real economy stemming from macroeconomic shocks and financial imbalances (Schinasi, 2004; World Bank, 2015). The 2019 Global Financial Development Report emphasises the importance of financial stability in maintaining confidence in the financial and economic systems. Its importance is most severely felt in its absence as bank runs, hyperinflation, financial crises, etc., occur (World Bank, 2019). Thus, a level of financial stability is necessary not only for achieving sustainable economic development but also in developed countries where the real economy and financial sector are more tightly linked.

Financial inclusion and financial stability are inherently intertwined. As highlighted by Khan (2011), financial inclusion can increase efficiency in the financial system and provide more stability in bank deposit base funding. Additionally, inclusion can improve the transmission of monetary policy and supervision potential to identify illegal activities. All these possible positive outcomes can coincide as the financial resiliency of both households and small businesses increases and innovation is promoted, he argues. However, he also points out that financial inclusion is not guaranteed to do any of that if improperly managed. The subprime mortgage crisis highlights the risks of extending credit irresponsibly and without due diligence. Similarly, rapidly expanding access also poses risks to institutions in their internal risk management, and outsourcing of activities may also lead to increased systemic risks. Finally,

innovation within the financial sector can negatively affect monetary policy transmission in unexpected ways[1] (Khan, 2011).

While they are not a direct determinant of financial stability in an economy, macroprudential policy (MaPP) has emerged as the main policy of central banks and regulators worldwide to achieve financial stability. The following three elements can adequately summarise macroprudential policy:

> *(i)   Its objective: to limit systemic risk – the risk of widespread disruptions to the provision of financial services that have serious negative consequences for the economy at large.*
>
> *(ii)   Its scope: the focus is on the financial system as a whole (including the interactions between the financial and real sectors) as opposed to individual components (that take the rest of the system as given).*
>
> *(iii)   Its instruments and associated governance: it uses primarily prudential tools calibrated to target the sources of systemic risk. Any non-prudential tools that are part of the framework need to clearly target systemic risk.* (IMF-FSB-BIS, 2011, p.4)

Macroprudential toolkits primarily include capital buffers, credit growth caps, borrowing restrictions, leverage restrictions and capital flow measures directed at all or most financial institutions within a jurisdiction to limit systemic risks. They, therefore, form part of the governance system and management that Khan (2011) states are essential to attaining financial inclusion sustainably. Concurrently, they are not more than a means to financial stability. As these tools are generally geared towards reducing risk and risky lending, some may be detrimental to financial inclusion, most obviously borrower-based measures. Hence, their effects on the financial inclusion process may affect a country's ability to achieve inclusion while maintaining a stable financial system.

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[1] This is not an exhaustive list of linkages.

1.1 Research Problem and Aim

As the widespread use of macroprudential policy tools is a relatively recent development, most research effort has been devoted to the efficiency and how these tools affect relevant macroeconomic or financial sector target variables. This bias towards effectiveness research has created a gap between what we know about usage and what we know about effectiveness. Some research has explored differences in tool usage. However, to the best of my knowledge, this thesis represents the first study to focus on financial inclusion and macroprudential policies in this context and, thus, is exploratory. It, therefore, aims to fill a small part of the gap mentioned above.

Macroprudential policy demands that policymakers weigh the potential costs of policy action against the threat posed by a build-up of systemic risk in the financial system. This thesis explores a hypothesis that adverse policy effects on financial inclusion considerably raise the perceived costs of actions in low-inclusion countries. Such a relationship would lead to a positive correlation between the use of macroprudential policy and financial inclusion. As macroprudential policy should be data-driven but is not rule-based, common predictors of macroprudential action should emerge as time goes by. Therefore, the earlier proposed relationship would also lead to policy actions being negatively associated with higher risks as measured by such determinants. Should such a relationship exist, regulators require greater threats to financial stability before taking policy action as financial inclusion decreases.

To this end, the study seeks to answer two questions:

- *Is there a difference in usage of macroprudential policy tools by country inclusion level?*
- *Can differences in macroprudential tool usage be explained by differences in the determinants of tool usage?*

The thesis is limited to the period 2010-2020, as the start of that period coincides with more significant tool usage and the dawn of the modern macroprudential framework. The analysis includes the 122 countries for which the macroprudential and financial inclusion data are available.

The empirical strategy used to answer the two questions differs substantially. The first one can be answered by a relatively simple analysis of usage data. The second one relies on the use of regression analysis. I propose a model intended to analyse how financial soundness indicators are associated with varying levels of macroprudential activity by country inclusion level. This is a novel approach as very little research has been done on the determinants of macroprudential policy activity. Therefore, instead of studying the impact of macroprudential policy on its target variables, as the effectiveness literature tends to, this thesis explores the effects of changes in said target variables on policy use.

1.2   Outline of the Thesis

This thesis is structured as follows. Section 2 provides a brief background on the usage of macroprudential tools, followed by an overview of the literature on its effectiveness and usage. Research into the trade-offs and synergies between financial inclusion and financial stability is then presented, followed by a summary of key takeaways and a presentation of the hypothetical link between inclusion and macroprudential activity. Section 3 introduces the data used and its sources and discusses data availability limitations. Section 4 provides detailed information on the methodology for both parts of the analysis. Next, it explains calculations for the first research question and presents model specifications for regression analysis. Section 4 concludes with discussions on potential endogeneity bias in the regression results. Section 5 presents and discusses the results of the empirical analysis. Section 6 summarises the main findings that usage is positively correlated with financial inclusion and that the regression results are inconclusive due to endogeneity bias. The section concludes by emphasising the need for research into the determinants of macroprudential action before the topic, and other topics of this nature can be explored further.

2   Theory

The idea of macroprudential supervision dates back to the 1970s. However, its usage remained limited as authorities mainly used microprudential policy tools[2] until the 21st century, although macroprudential policy aimed at foreign exchange (FX) risks were relatively common in emerging market economies (EMEs). The GFC brought attention to the importance of addressing systemic risk in the financial system instead of addressing the stability of individual institutions through microprudential means. BIS (2018) highlights that the term's usage was minimal prior to the crisis but took off in the years following it, along with the usage of macroprudential tools.

In this recent surge of macroprudential policy activity, policymakers had little empirical evidence to base their decisions on in the GFC's wake. As Galati & Moessner (2018) state, much effort has been devoted to estimating the effectiveness of different tools and their actual ability to affect target variables of relevance to financial stability. They study much of the available findings and conclude that there is considerable evidence that borrower-based macroprudential tools affect house prices and housing credit growth. They find mixed evidence for the effectiveness of other tools. Forbes (2021) has a more optimistic view, reviewing the effectiveness literature and concluding that financial-institution-based tools and capital flow management tools suffer from leakages and spillovers that only undermine their effectiveness.

Further, macroprudential tools, in general, have been found effective in achieving their short-term goals and show promising signs of promoting long-term financial stability (See also Araujo, Patnam, Popescu, Valencia & Yao, 2020; Ma, 2020). Despite these advancements in knowledge on macroprudential tools, research has not yet moved beyond effects on intermediate goals such as credit growth. Thus, a complete picture of tool effectiveness and overall risk reduction in the financial system is not available yet. Therefore, cost-benefit

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[2] Microprudential policy tools are meant to target risks within individual financial institutions and are still common today. The management of systemic risk differentiates macroprudential and microprudential policy as the former is applied more generally.

analyses are not attainable, although promising attempts have begun to surface (e.g. Brandao, Gelos, Narita & Nier, 2020).

The effects of financial development and other country characteristics form an important strand of the effectiveness literature. Agénor, Gambacorta, Kharroubi & Pereira da Silva (2018) found that financial openness diminishes the output growth effects of macroprudential policies while financial development is associated with lesser improvements to financial resiliency due to MaPP. These effects are presumably due to the increased presence of unregulated agents in highly developed financial systems. This leads to domestic leakages and international spillovers of macroprudential regulation (for more on leakages, spillovers and policy coordination, see Agénor, Kharroubi, Gambacorta, Lombardo & Pereira da Silva, 2017; Agénor, Jackson & Pereira da Silva, 2022; Agénor & Pereira da Silva, 2018). Understanding of macroprudential policy effectiveness is expected to improve in the wake of the Covid-19 pandemic. This is due to the past two years being the first period of financial and economic stress with widespread active use of macroprudential policy. Unfortunately, little research along those lines has been published yet.

Other research has shown that the frequency of tool adjustment and the exact tools used differ between economies by country characteristics. Alam, Alter, Eiseman, Gelos, Kang, Narita, Nier & Wang's (2019) paper unveiling the IMF's comprehensive iMaPP database on macroprudential tools shows this clearly. The authors find that advanced economies (AEs) use macroprudential tools more often than emerging markets and developing economies and employ different tools. However, the authors offer no explanations for why that is the case. Indeed, the determining factors of macroprudential tool usage and the composition of policy tools used by different countries have not been adequately studied yet. While effectiveness may play a part in determining a country's propensity to implement macroprudential regulation, a trade-off between financial stability and inclusion might also. Thus, a considerable gap exists between what we know about effectiveness and what we know about usage. This thesis aims to contribute to that gap. Therefore, most of the literature review from here on out focuses on the literature covering the intersection between financial inclusion and financial stability and, more specifically, macroprudential policy.

2.1   Previous Research

There are straightforward channels through which financial inclusion affects financial stability. The most obvious connection is the capital deepening effect of increased inclusion through account ownership and deposits. Research by Han & Melecky (2013) showed that banks' deposit funding bases become more resilient in times of financial stress as access to bank deposits grows due to the decreased likelihood of bank runs, which mitigates liquidity risks. Another more abstract channel is through the effectiveness of the monetary and macroprudential policy. As the uptake of formal financial services increases, one can expect that the economic activity affected by the interest rate channel and the tools used by macroprudential authorities also increases. Therefore, financial inclusion enables a more

dynamic and effective response to economic development, improving financial stability. (El Said, Emara & Pearkman, 2020).

On the empirical front, much research has focused on the impact of financial development, of which inclusion is part, on various economic outcomes but not the specific inclusion-stability linkages. Financial development has thus been shown to be strongly associated with higher economic growth, reduced income inequality, and poverty alleviation (World Bank, 2001; Law & Singh, 2014; Madsen & Ang, 2016). Research on the inclusion-stability linkage highlights good regulation and supervision as requirements to synergise inclusion and stability (Cull, Demirgüc-Kunt & Lyman, 2012). GPFI (2012) highlights how financial inclusion and stability goals can, in some cases, be mutually reinforcing. However, they further state that lacking exploration of these linkages leads to the unnecessary framing of financial stability and inclusion as a trade-off in the economic and financial development process.

Mehrotra & Yetman (2015) argue that financial inclusion attained through rapid credit growth or expansions of unregulated parts of the financial system can threaten financial stability. Cihák, Mare & Melecky (2016) undertook a deep dive into the synergies and trade-offs between financial inclusion and stability. They found that trade-offs between the two mainly depend on country characteristics such as financial openness, education level, tax rates and more. Therefore, low- and middle-income countries face considerable challenges in managing the interaction between goals of inclusion and stability. The authors propose that deepening credit information systems is a beneficial mitigation policy against trade-offs due to its effect in eliminating oligopolistic markets, decreasing the cost of finance, and encouraging the use of formal financial services. They find that financial inclusion can promote stability outside of economic crises when synergies form. However, greater financial inclusion can itself contribute to increased financial risk, especially in the case of excessive borrowing by individuals. These findings highlight the importance of dismantling silos in public policymaking, as mitigation efforts become unlikely if government agencies tasked with promoting inclusion and stability do not cooperate and communicate effectively. Sahay, Cihák, N'Diaye, Barajas, Mitra, Kyobe, Mooi & Yousefi (2015) similarly find, through cross-country data analysis, that credit expansion without sufficient supervision leads to increased financial risks. They also find that this trade-off primarily presents itself through increased access to credit instead of other avenues of financial inclusion. It must be noted that the literature cited here arguing for inclusion being a risk to stability relies on the assumption that inclusion increases with all else remaining equal. Thus, finding decreased stability due to inclusion is not surprising. Regardless of financial inclusion, rapid credit growth, expansions to unregulated financial activity, and lack of regulation and supervision will increase financial instability. A more apparent separation is needed when discussing the trade-offs between inclusion and stability on the one hand and the institutional quality and social capabilities needed to accommodate the economic effects of higher financial inclusion on the other. Cihák, Mare & Melecky (2016) take a different approach in using covariate analysis of the interactions dependent on country characteristics and types of inclusion. They find that a trade-off relationship seems to present itself more often, but synergies are just as likely to appear given the right mix of policies and institutions.

The literature suggests that there is not much of a direct trade-off between financial inclusion and financial stability. Instead, it highlights the importance of good regulation and supervision, institutional quality, and many factors associated with economic and financial development in

determining the right policy mix for each country on its long-term path to inclusive and stable financial systems. As stated by Hannig & Jansen (2010, Abstract): "The potential costs of financial inclusion are compensated for by important dynamic benefits that enhance financial stability over time through a deeper and more diversified financial system."

Much empirical research is ongoing into the direct relationship between inclusion and macroprudential policy. It is likely that other factors matter when considering macroprudential policy actions specifically instead of financial stability in general. Capital tool usage that raises the cost of credit can be viewed as detrimental to financial inclusion. Further, borrower-based measures have the intended and direct consequence of excluding certain parts of the population from accessing credit. However, a stronger, more resilient, and trustworthy financial system that emerges from systematic and effective macroprudential tool usage may encourage the uptake of formal financial services. Furthermore, possible leakages of the effects of macroprudential policy from the formal to the informal sector are understudied.

As Edge & Lian (2020) highlighted, governance and adequate supervision remain essential factors. They find that countries with stronger Financial Stability Committees are more likely to set countercyclical capital buffers[3] (CCyBs) than other countries and are more likely to counteract systemic risk by using the CCyB effectively. These findings echo those of the IMF, FSB and BIS (2016) that institutional foundations, relevant mandates, good governance and clear policy goals are essential to the effective use of the provided tools.

Therefore, it is interesting to note that most countries with lower levels of financial inclusion are also the least developed and commonly found to lack good governance practices. Thus, a large informal sector thrives in the absence of financial inclusion. Even when formal financial institutions are available and accessible, underdeveloped credit markets often contain both formal and informal finance actors (Madestam, 2014; Ghate, 1992). Therefore, the dynamics between macroprudential regulation, which only directly affects formal financial agents, and the informal financial system are essential in the stability/inclusion puzzle.

As minimal data is available on informal finance, important questions are still to be settled, and the literature remains patchy and inconclusive (Levine, Lotti, Batini & Kim, 2010). Direct

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[3] Countercyclical capital buffers are a macroprudential tool which imposes higher capital requirements on financial institutions during good times as risks increase. The intention is that these buffers can subsequently be released when risks materialize, freeing up the funds gathered in times of relative prosperity for immediate usage. Therefore, the buffer is intended to force capital build-up in a way that is countercyclical to the financial cycle at a given point in time.

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research into the effects of macroprudential regulation on the informal finance sector relies heavily on shadow banking and tends to focus less on emerging and least developed countries. Gebauer & Mazelis (2020) found that tighter capital requirements lead to increased shadow bank lending in the Euro area. Similarly, Claessens, Cornelli, Gambacorta, Manaresi & Shiina (2021) found that tightening MaPP can increase non-bank financial intermediary activity and vice-versa. There is little to suggest that similar trends are not found outside developed countries, given greater observing capabilities. There are, however, promising signs as Bengui & Bianchi (2018) show that the welfare effects of macroprudential policies remain positive despite shadow banking, regulatory arbitrage and circumvention. Hassine & Rebei (2019) similarly conclude that informality reduces macroprudential policy effectiveness. They further show that cooperative monetary and financial stability policy can mitigate these effects. Therefore, the outreach of macroprudential policy and its effectiveness may be frustrated by the informal credit sector, but it does not render the policies useless.

Deléchat, Kiyasseh, MacDonald & Xu (2020; 2021) contribute significantly to the literature on the effects of macroprudential policies on the financial inclusion process. Using multinomial logistic regressions controlling for various individual and country characteristics, they show that supply-side macroprudential policies are negatively associated with formal financial access. The same is not found for demand-side policies. Notably, the effects are only present within the borrowing channel of financial inclusion (i.e., inclusion as measured by credit) but not in the savings channel. This is presumably because macroprudential policies do not target savings, and understandably so, as financial deepening and the broadening of bank deposit bases can hardly decrease financial stability. Therefore, policies targeting financial institutions in emerging and developing countries are associated with higher resort to informal finance. Further, they find that this resort to informal access is dependent on financial development. Perhaps due to the increased availability of sophisticated informal financial institutions that come with financial development, more minor leakages are found from formal to informal finance in countries with low financial development. These are found in countries with high financial development. However, they find that in countries with low financial development, macroprudential policies cause leakages from informal finance to having no access to financial services. Lastly, they urge central bankers and bank regulators to consider these negative spillovers on financial inclusion prior to implementing a new policy.

Deléchat et al. (2020) investigate whether macroprudential policy's strictness also matters. Their results are consistent with those that do not account for strictness but confirm that the policy's actual strictness matters, not just its existence. However, it must be noted that the count of policy actions used in their study is not a direct measure of policy strictness. As such, those results may be unreliable.

There are a few key takeaways from this literature review. First, research on macroprudential policy tools has primarily focused on their effectiveness. Results indicate that they perform differently given different financial and economic development contexts. Second, there is some consensus that many perceive a trade-off between financial stability and financial inclusion, while the evidence remains mixed. In the case of macroprudential policy to ensure financial stability, the trade-offs with inclusion become pretty clear. This is especially evident in Deléchat et al.'s (2021) findings. Third, there has been very little research into the determinants of macroprudential policy. The specific intersection of financial inclusion and macroprudential

policy covered in this theory remains unexplored to the author's knowledge. The closest related body of literature likely is research into predictors of bank distress (e.g. Demirgüç-Kunt & Detragiache, 1998). However, that is only tangentially related to the topic at hand through the way such predictors factor into macroprudential policy decisions.

2.2   Theoretical Approach

The discussion presented here highlights the trade-offs between financial development and financial stability, focusing on the channels affected by macroprudential policy. These empirically tested relationships between the two should theoretically have implications for the usage of macroprudential policy viewed through the lens of financial inclusion. In this thesis, financial development is assumed to be a policy goal of national authorities worldwide. With that in mind, policymakers may be deterred from tightening macroprudential policy due to its perceived adverse effects on financial inclusion and deepening if they consider negative spillovers, as Deléchat et al. (2021) recommend. Should this be the case, the perceived cost of the macroprudential policy would rise relatively more in low-inclusion countries than in others.

Macroprudential policy decisions are not strictly rule-based, but valid data and analysis should always drive them. The setting of macroprudential policy inherently involves assessing the potential costs of regulations versus the risks at a given point in time (IMF-FSB-BIS, 2016). Therefore, some indicators should emerge that can predict the tightening of macroprudential policy because they are used by different national authorities to inform policy decisions. Thus, it is possible that the adverse effects on inclusion contribute to an overall estimate that the costs outweigh the risks. If this happens systematically, it leads to greater avoidance of macroprudential policy action in low inclusion countries. Therefore, inclusion becomes positively correlated with the usage of macroprudential policy. Hesitant policymaking in countries with lower financial inclusion then leads to greater threats to the financial system being needed before policy tools are tightened compared to other countries. If this is the case, a pattern of more relative change in the indicators used to inform policy decisions in countries lacking financial inclusion before macroprudential policy is tightened will emerge.

3 Data

The datasets used in this thesis are assembled from secondary sources. These sources are published by the World Bank and the IMF and are commonly used both in development economics and in the specific niches of financial inclusion and macroprudential policy. The analysis aims to address two different questions, and as such, the same data will be manipulated in different ways to achieve that goal. This chapter only informs the reader of the data used and its reliability and relevance to the topic. The following methods chapter contains more detailed information on how the data was compiled into two separate datasets to empirically analyse whether macroprudential regulation differs by inclusion level and then explore whether macroprudential policy authorities react similarly to financial stability threats in different contexts of financial inclusion.

3.1 Macroprudential policy data

The data on macroprudential tool usage comes from the IMF's iMaPP database. This database was created by Alam et al. (2019) by combining five pre-existing databases on macroprudential instrument use with the IMF's Macroprudential Policy Survey. It contains dummy indicators for the tightening and loosening of seventeen different tools, subcategories for several of them and a numerical value for LTV ratios.

By combining these different datasets in a standardised manner, Alam et al. (2019) covered 134 countries from 1990 to 2016. AEs make up 36 of these, while there are 98 emerging market and developing economies (EMDEs) included. Therefore, the data should cover macroprudential instrument use at all levels of financial inclusion. The database has since been expanded annually by IMF staff using the newest available data from the IMF's Macroprudential Survey and now covers the period from 1990 to 2020. (IMF, n.d.). The databases used in constructing the iMaPP database are based on surveys, national sources and information from national authorities. All policy actions were cross-checked with national sources and official documents from the IMF, BIS or FSB. Therefore, some data available in the integrated databases may have been erased in the iMaPP database due to language barriers or lack of official documentation of the instruments being used at a given time. What remains in the iMaPP database is a very reliable account of macroprudential tool usage. However, it may be missing a small number of policy adjustment instances and does not include reliable data on the first usage in some cases, most notably for tools related to foreign exchange and capital flows, as it only goes back to 1990. I do not expect this to impact the results severely as globalisation has demanded less of these restrictions due to increased trade. Furthermore, the adjustment frequency of each specific tool will be analysed, which should indicate whether these tools are still frequently applied.

The iMaPP database does not provide the means to analyse the intensity of macroprudential policy cross-country. The dummy-type indicators only indicate whether a policy has been tightened, loosened, or not changed. Therefore, an instrument may be recalibrated often, but in small increments, or seldom, but with more significant changes. Such differences in usage between countries are not discernible in the database. This relates to a larger problem in studying macroprudential tool usage: the policies demand calibration according to the local situation, and there is no one-size-fits-all policy mix. It is tough to compare different policy tools and their effects in one analysis using the intensity of regulation. Each tool's details and specific workings are usually up to national regulators, making intensity hard to standardise. Some authors have creatively solved these problems using clever econometric techniques, micro-level data, and natural experiments, but they do not come without disadvantages (Forbes, 2021). Therefore, the frequency of use limits the study but remains the standard way of cross-country macroprudential policy comparison.

3.2   Financial inclusion data

The data used to measure financial inclusion is the most comprehensive set of indicators available on demand-side financial access worldwide. The World Bank's Global Findex database consists of survey answers from 150.000 respondents in 140 countries. There have been three rounds of the survey, the first in 2011, the second in 2014 and the most recent published data in 2017 (Demirgüc-Kunt, Klapper, Singer, Ansar & Hess, 2018).

The survey questionnaire aims to gather data on how adults worldwide save, borrow, make payments and manage risk. Thus, it includes questions on financial account holding, means of transferring money, ability to come up with emergency funds, reasons for possible financial exclusion, etc. This is tallied into representative categories by age, gender, income, and more based on individual responses and each country's demographic makeup. The sample is randomly selected by household to be representative of each nation. The specific individual within a household that answers the questionnaire is then randomly selected by interviewers. Therefore, the data should represent the country's overall status of financial inclusion. The standardised manner in which the interviews are conducted should ensure the data's validity for cross-country comparisons.

Due to the multidimensional nature of financial inclusion, the database does not provide a single straightforward measure of financial inclusion. Indicators must be hand-picked from the survey to act as proxies for financial inclusion overall or the type of financial inclusion relevant to the study at hand each time. Indices may, of course, be constructed to achieve some general idea of the overall status of financial inclusion. Since 2014, the survey has included more data on the use of financial services, as disparities between access and usage became clear (Demirgüc-Kunt et al., 2018). Here lies the main advantage of the demand-side nature of the Global Findex survey. Other databases, such as the IMF's Financial Access Survey, are supply-side and based on reported administrative data from relevant authorities, therefore not examining the globally unbanked in detail but instead providing proxies for and derived indicators of financial exclusion. Therefore, these indicators may show general trends and are highly reliable but lack

the representativity of Global Findex responses, making them harder to use for cross-country comparisons due to heterogeneity in financial system structure and governance.

The indicator used to measure financial inclusion in this thesis will be the proportion of people aged 15 and over who report having borrowed money from a financial institution or used a credit card in the past 12 months. This indicator was chosen as the relevant measure of financial inclusion due to its direct relation to credit growth and, by extension, financial stability. The Global Findex database defines the term financial institution as all types of financial institutions that offer deposit, checking, and savings account while simultaneously falling under prudential regulation by a government body. Therefore, only formal financial institutions are included, ranging from post offices and microfinance institutions to multinational banks (Demirgüc-Kunt et al., 2018). Further, the findings by Deléchat et al. (2021) that macroprudential regulation causes leakages away from formal financial institutions when looking at borrowing but not at saving support this choice of indicator. The proportion of the population aged over 15 who has an account at a financial institution will also be used to test this choice of indicator and reconfirm Deléchat et al.'s (2021) findings on the borrowing and saving channels.

Using Global Findex data for time series analysis poses problems due to its triennial nature. This thesis will base its inclusion level specification on each country's most recent available data. Therefore, inclusion levels are acquired by sorting countries into quartiles based on the most recent available data for each country. This removes the dynamic of countries moving between quartiles in the different waves of the Findex study. However, this does not often happen in the 2014-2017 waves of the survey, with only 19 countries of 136 moving between levels. Table 3.1 below shows the countries that have moved between inclusion levels in the database. For a complete list of countries by inclusion level, see Appendix A.

Table 3.1: Countries that move between inclusion quartiles, 2014 vs. 2017

Azerbaijan (-1)	Bosnia & H. (-1)	Botswana (-1)	Colombia (-1)	Georgia (+1)
Greece (-1)	Croatia (-1)	Haiti (+1)	Kazakhstan (+1)	Kyrgyzstan (-1)
Latvia (-1)	North Macedonia (-1)	Nepal (+1)	Philippines (-1)	El Salvador (-1)
Slovenia (+1)	Tajikistan (+1)	Turkey (+1)	Vietnam (+1)	

3.3 Financial stability data

The latter part of the empirical analysis requires a measure of financial stability. There is no precise measure of overall financial stability for much the same reasons as there are none for financial inclusion. As a multidimensional and opaquely defined concept, not much is gained from a single indicator of financial stability, and indexes will always be limited in scope. This thesis employs data from the IMF's Financial Soundness Indicators database (IMF, 2019) as proxies for financial stability. The database is intended to monitor financial system soundness worldwide by assembling indicators of capital adequacy, asset quality, profitability, liquidity, and market risk sensitivity. Relevant national authorities report the data for these indicators. The data relies on primary reporting from financial institutions in each country before national authorities submit the original data to the IMF. In most countries, this means that several

agencies must cooperate. Therefore, complete reliability cannot be guaranteed as definitions and calculations along with differences in methodology and reporting standards can vary between countries. However, the IMF does supply a detailed compilation guide that should ensure that the indicators are, for the most part, identically reported (IMF, 2019).

The Financial Soundness Indicators (FSIs) used in this thesis are Tier 1 capital to risk-weighted assets (RWA), total regulatory capital to risk-weighted assets, bank return on equity (ROE) and non-performing loans to total gross loans. Both capital ratios are based in the Basel Capital Accord and are widely used to assess bank capital adequacy. Non-performing loans provide clues on the build-up of credit risks, while return on equity may hint towards the materialisation of previously assumed or unexpected risk (IMF, 2019). I argue that the indicators function as a proxy for financial stability and might be determinants of macroprudential policy[4] due to their usage in supporting decisions to adjust or implement macroprudential tools (IMF, 2019). Data collection for the IMF's Financial Soundness Indicator database remains too limited to test other variables, such as real-estate prices. However, data collection improvements in future, other datasets or innovative means of assessing such variables cross-country could solve that problem.

The last indicator used to proxy financial stability in assessing determinants is the country average bank Z-score. This indicator is acquired from the Global Financial Development Database (Cihák, Demirgüc-Kunt, Feyen & Levine, 2012). While this indicator is not entirely reliable as it is based on accounting measures from individual institutions biasing its estimates upwards, average Z-score trends over time may help identify systemic risk build-up. The Z-score differs from other chosen indicators in that it is not commonly used to reason for macroprudential tool adjustment. Thus, it may not be a good predictor of policy use. However, given the intended purpose of the indicator to measure the probability of insolvency of banks and assuming it generally does a good job of that, it should provide information on the stability of the financial system.

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[4] Some macroprudential tools are structural. This means that they are not adjusted according to the financial cycle (neither pro- nor countercyclically). Only cyclical tool adjustment can be expected to reliably follow trends set by these kinds of determinants. Addressing structural tools requires more detailed data on how each national regulatory authority treats applies each individual tool.

3.4   Summary statistics and other data

Table 3.2 below presents summary descriptive statistics for all variables used in regressions in this thesis. The variables that have not been explicitly covered in this chapter but are present in this thesis are control variables in the various regressions and are generally self-explanatory or commonly used. Information on all data sources is shown in Appendix A. Although the financial soundness indicators are somewhat volatile, the dataset as a whole consists of relatively stable variables. This volatility is to be expected, but the minimum and maximum values for return on equity and both capital ratios suggest there may be some outliers. Outliers will be removed in robustness checks performed to confirm results.

Table 3.2: Summary Descriptive Statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
No. of MaPP tightenings	1,047	1.516	1.853	0	13
No. of capital buffer tightenings	1,047	0.559	0.942	0	7
Real GDP per capita (log)	1,047	9.059	1.314	5.657	11.595
High inflation	1,047	0.0917	0.289	0	1
Inflation targeting	1,014	0.322	0.468	0	1
Credit to GDP (%)	1,019	64.451	44.740	5.443	258.430
Tier 1 capital ratio	1,047	15.892	4.735	-2.623	39.451
Regulatory capital ratio	1,047	18.071	4.460	-1.670	39.451
Bank Z-score	1,047	14.553	9.631	-1.84	59.78
Non-performing loans ratio	1,024	6.311	6.964	0.146	54.823
Bank return on equity	980	13.855	48.097	-121.865	1379.972
Inclusion quartile (borrowing)	982	2.635	1.070	1	4
Inclusion quartile (account)	982	2.671	1.032	1	4
Financial Development Index	949	40.803	24.008	7.914	98.261

4   Methods

4.1   Analysing adjustment frequency by inclusion level

The first part of the empirical analysis in this thesis aims to establish whether there is a difference in macroprudential policy usage by country inclusion level. Countries are divided into quartiles by inclusion as measured by access to credit. The number of macroprudential policy actions per year indicates each country's activity. That number is attained by summing up all policy adjustments as indicated by the IMF's iMaPP database and dividing by period length (eleven years) to get a yearly average for each country. Country-level averages are then transformed into group-level averages for each inclusion level.

To achieve a level of standardisation in the macroprudential policy tools available to each country, only the period from 2010 to 2020 is included. Before then, macroprudential policy tools were primarily aimed at limiting capital flows related to foreign exchange. Much of the activity was contained in countries with significant vulnerabilities due to export focus or currency regime related considerations. After the GFC, macroprudential policy became more uniform and general while being based mainly on the goals and considerations of the Basel III regulatory reforms of increased management of systemic risk in the financial system.

Further analysis of the policy mix employed by countries at different inclusion levels is done by looking at the average number of policy actions for each instrument included in the iMaPP database. This should uncover whether the tools employed differ based on inclusion level, as Alam et al. (2019) found true when comparing AEs and EMDEs.

To address whether the strictness of policy differs by inclusion level, I use the database's information on average loan-to-value (LTV)[5] ratios. By analysing first how usage of the tool

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[5] Loan-to-value ratios are a macroprudential tool stipulating the maximum credit financial institutions can lend borrowers as a percentage of the underlying asset's value. It is most commonly used to limit mortgage credit growth but may also be implemented more specifically or generally targeted and targeting other sources of credit growth.

has evolved between 2010 and 2020 and then whether country inclusion level is correlated with strictness, an indication of whether frequency and strictness are correlated can be found. As this analysis is limited to the LTV ratio, this analysis provides only a single clue but an important one given the complications of cross-country comparison of macroprudential policy tools (see Forbes, 2021).

4.2 Analysing FSIs as triggers of policy tightening

After analysing the differing application of macroprudential policy by inclusion level, the focus shifts toward exploring the theoretical relationship introduced in Chapter 2. That means investigating whether macroprudential policymakers in low inclusion countries need greater financial instability to present themselves before applying regulation due to their commitment to financial inclusion. Thus, I aim to clarify whether indicators that are intuitively linked to financial stability determine macroprudential action differently within different country inclusion contexts.

Establishing causality within such a broad framework is challenging. This thesis represents a novel approach to macroprudential policy research as it is the first to differentiate macroprudential policy regimes by responses to changing indicators of financial soundness. Typically, research is focused on the ability of macroprudential policy to affect the indicators instead of using them as predictors for the policy adjustments in the first place.

This part of the analysis will be conducted via regression analysis using the statistical software STATA 17. Specifically, I estimate the following linear model for country-year panel data using the fixed effects estimator:

$$MaPP_{i,t} = \beta_1 + \beta_2 X_{i,t} + \beta_3 FS_{i,t} + \alpha_i + \epsilon_{i,t},$$

where i is country and t is time (in years). The dependent variable $MaPP_{i,t}$ refers to the total count of macroprudential policy tools, as defined by Alam et al. (2019), tightened in country i in year t. X is the set of explanatory variables that consists of the countries' macroeconomic, monetary, and financial characteristics. Using the Financial Development index developed by Svirydzenka (2016) to control for financial development is possible. However, due to its strong correlation with GDP, other explanatory variables were chosen that do not entail a high risk of multicollinearity.

The independent variable *FS* refers to the indicator used to measure financial stability. As outlined in the data chapter, these variables are Tier 1 capital to risk-weighted assets, regulatory capital to risk-weighted assets, non-performing loans to total gross loans, bank return on equity and bank Z-scores. Separate regressions are run for each of these indicators to avoid multicollinearity.

4.2.1 Explanatory variables

As outlined in the literature review, the efficiency of macroprudential policy is heavily affected by country characteristics. There is little to suggest that such effects are limited to efficiency. Thus I expect that they extend themselves to the frequency of usage too. The propensity of countries to use macroprudential policy may be partly driven by differences in the efficiency of different tools in affecting the development of target variables. This study attempts to identify trends and correlations while fully acknowledging that causality has not been established. Therefore, in all likelihood, the results do not represent a causal relationship.

To control for the effects of economic development, I use the log of real GDP per capita. This is generally accepted as a good proxy for economic development. Further country-level controls are meant to control the financial sector's development. The first is domestic credit to GDP to account for financial depth. This choice of explanatory variable follows that of Deléchat et al. (2021). This must not be confused with the credit-to-GDP gap (the 'Basel gap'), a frequently used indicator in determining trigger points for the countercyclical capital buffer. That variable is a widely documented predictor of financial distress, although its usefulness in policymaking is debated (Alessandri, Bologna & Galardo, 2021; Behn, Detken, Peltonen & Schudel, 2013). Comparing the overall level of credit to GDP differs from comparing the deviation of credit to GDP from its long-term HP filter trend (the gap). One accounts for increasing systemic risk, while the overall indicator contains little information on trends while conveying valuable information on financial depth, which is vital to financial development.

I control for financial development by using a dummy variable which indicates if a country has an inflation-targeting monetary policy regime. Such regimes are typically associated with higher financial development (Délechat et al., 2021). This control has the benefit of identifying countries with robust institutional arrangements but lower levels of financial depth and economic development.

As macroeconomic turmoil is likely to affect macroprudential policy usage, a dummy variable for high inflation is used as a control. The cut-off point for high inflation is set at the 90th percentile of observed annual CPI inflation in the sample, 8,01%. The country fixed effects included are assumed to capture other time-invariant country-specific factors. This small set of country-level controls could undoubtedly be expanded. However, explanatory variables must be carefully picked to avoid multicollinearity and distorting the currently obscure channels through which financial stability indicators may predict macroprudential policy usage.

4.2.2 Potential endogeneity

This model specification lends itself to two potential sources of endogeneity due to simultaneity. These will be discussed here in order of severity, starting with the more severe one.

Capital adequacy ratios (CARs), i.e., Tier 1 capital and regulatory capital to risk-weighted assets, can be directly affected by four macroprudential tools that make up the dependent variable. These are the countercyclical capital buffer, capital conservation buffers, measures

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taken to mitigate risks in systemically important financial institutions and other capital buffers. These buffers together form the combined buffer requirement. Thus, a tightening of one of these tools may lead to increases in the capital adequacy ratios. Finding an appropriate instrument that can intuitively be argued to causally affect the CARs while fulfilling the exclusion restriction and having no confounding effect on the dependent variable was unsuccessful. Thus, the endogeneity cannot be eliminated using IV regressions.

It is difficult to assess how much of an impact this has on the results. To eliminate some endogeneity, robustness checks will be performed using capital buffer usage as a control variable while they have been removed from the dependent variable. This should absorb some of the effects capital buffers have on CARs at the cost of adding a confused control variable.

The other potential source of endogeneity is that the data is aggregated yearly. This eliminates the potential to observe the build-up of financial system risk in the periods before tightening. Therefore, the yearly average for financial soundness indicators includes the immediate effects that the policy tools had. Ideally, one would like to observe how the underlying indicators of financial stability developed in the preceding quarters to policy tightening. Due to the scarce availability of quarterly data in low-inclusion countries, a quarterly analysis could not be carried out while still including them. Thus, the analysis suffers from not being strictly contemporaneous and lacks meaningful analysis of lead-lag effects in the policymaking process. This does not lead to the results being unusable but does increase the risk of identifying faulty correlations and limits the potential detail of any analysis, meaning that the actual determinants of macroprudential policy go unnoticed. A similar strategy to the ones used by Alam et al. (2019) to measure the effectiveness of macroprudential policy could conceivably alleviate some of the reverse causality fears. The model would have to be respecified to do almost the exact opposite while having different but similar controls. The propensity-score based approach they also use to reduce the impact of observations likely to be affected by reverse causality would be ideal. As this thesis represents the first exploratory work on the topic, it is sensible to apply a simplified methodology as I intend to. However, exploring the possibilities highlighted here and other ways to address the problem is appropriate for later research.

5   Results and Discussion

5.1   Frequency of MaPP adjustments

A large majority of countries have used macroprudential tools at some point. However, their usage is not uniform throughout the world (Alam et al., 2019). Figure 5.1 shows the average number of macroprudential tools used per year by countries at different levels of financial inclusion[6]. There is a significant increase at each level of financial inclusion as the first quartile countries average 1,04 policy actions per year, followed by second and third quartile countries with 1,85 and 2,08 actions, respectively. Countries with the highest levels of financial inclusion sit comfortably at the top with an average of 2,50 macroprudential policy actions per year.
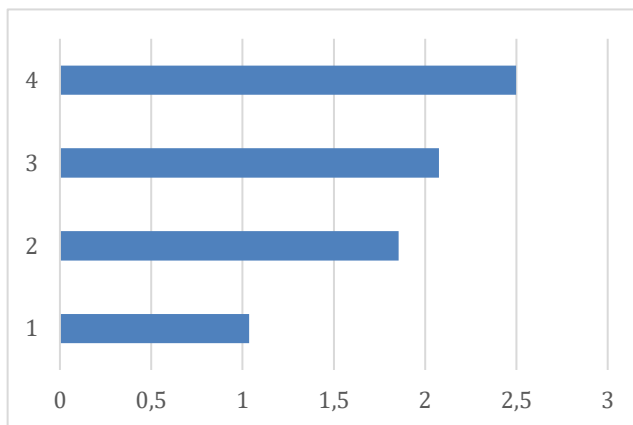

Figure 5.1: Adjustment Frequency per year (2010-2020 average) vs Inclusion Level (Author's Calculation, see Appendix A for a summary of data sources)

Figure 5.2 shows how the average number of macroprudential policy actions has increased across all inclusion levels from 2010 to 2020. The large differences in Figure 5.1 are thus primarily driven by recent developments. The year 2020 represents a considerable outlier in the data as the COVID-19 pandemic led to the release of various capital buffers in many countries while tightening and loosening actions were also taken to manage credit risk and asset price

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[6] Figure 5.1 is based on the borrowing indicator for financial inclusion. This statement is also true if having an account is used to measure financial inclusion, see Appendix B for an analogous figure to the one presented here using that measure to separate countries by inclusion level.

fluctuations. A general upward trend can be seen at all inclusion levels for the whole period, but the trend is more substantial as financial inclusion increases. This may be due to higher levels of financial development leading to more complex financial systems, more rapid adoption of the post-crisis macroprudential framework, or a higher level of cooperation and reciprocation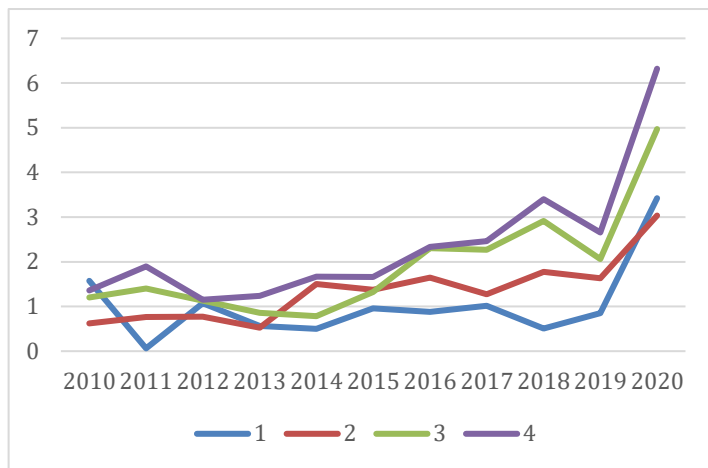 of macroprudential policies in advanced economies. Another possible explanation is that policymakers in low-inclusion countries are hesitant towards macroprudential policy tightening

Figure 5.2: Adjustment Frequency per year by Inclusion Level, 2010-2020 (Author's Calculations, see Appendix A for a summary of data sources).

due to possible trade-offs with financial development through the adverse effects policy actions may have on financial deepening and inclusion. The truth likely lies nestled somewhere within all those potential reasons. I have shown that macroprudential policy activity is correlated with financial inclusion. What is unknown is whether this results from financial systems requiring less macroprudential supervision in financially underdeveloped countries or due to the other factors that may lead to increased risk of financial instability in the long run.

Figure 5.3 shows the frequency of policy changes per year for each tool included in the iMaPP database. Interestingly, the policy mix does not differ substantially between inclusion levels. This contradicts the findings of Alam et al. (2019) that AEs and EMDEs apply different sets of tools. They suggest that the two types of economies face different challenges: high LTV usage due to housing sector vulnerabilities in AEs and high FX-related tool usage in EMDEs due to capital flow vulnerabilities. Either these vulnerabilities have evened out globally, or usage of the tools has become more uniform as the learning-by-doing process following the GFC led to more knowledge on the outcomes of macroprudential policy tool usage. I suspect the latter is a more likely reason for the trends not carrying over from Alam et al.'s (2019) analysis of data on usage up to 2016.
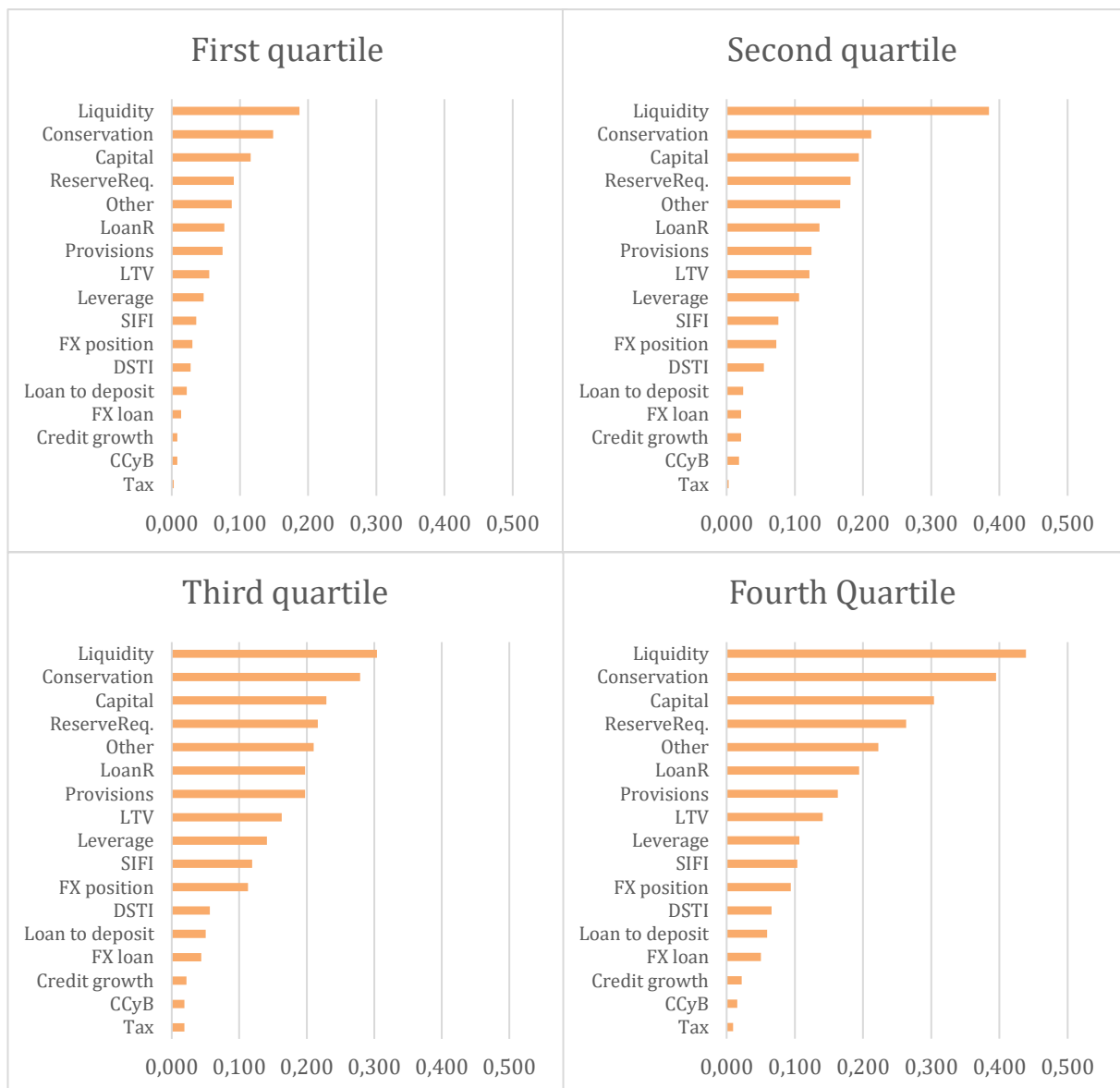
Figure 5.3: Adjustment Frequency per year (2010-2020 Average) by Policy Tool and Inclusion Level, 2010-2020 (Author's Calculations, see Appendix A for a summary of data sources)

These frequencies offer little information on whether macroprudential policy tools differ in intensity between countries. Although perhaps not very likely, it is conceivable that low-inclusion countries might calibrate their tools less often but apply larger changes each time, leading to similar results as in high inclusion countries. The iMaPP database includes data that enables the comparison of LTV limits cross-country. Comparing macroprudential policy across countries is difficult as the policies often cannot easily be translated to a single numerical value (Forbes, 2021). Alam et al. (2019) went to great lengths to standardise measures of LTV limits. Figure 5.4 shows the number of countries at each inclusion level with an active LTV limit by quarters from 2010 to 2020 (an active regulatory limit of 100% is not included). A similar trend as in the overall usage of macroprudential policy emerges, i.e., a general upward trend in usage that is stronger in high-inclusion countries.
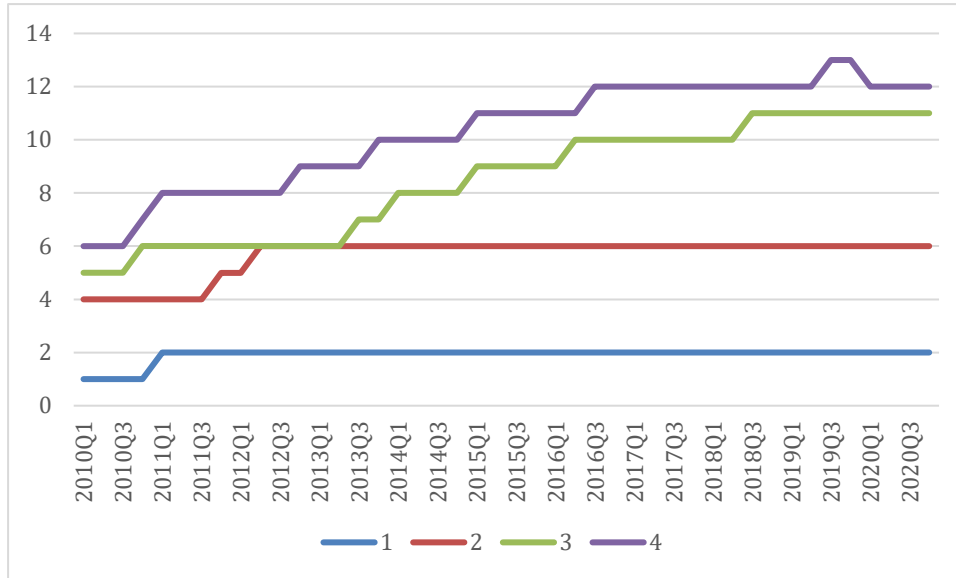
Figure 5.4 Number of Countries with Active LTV Limits over Time by Inclusion Level, 2010-2020 (Author's Calculations, See Appendix A for a summary of data sources).

Figure 5.5 examines the intensity of LTV limits by inclusion level. While the intensity of LTV limits seems to follow an inverted U-curve, one must be wary of interpreting the average limit on the first inclusion quartile as it comprises the average LTV limit of only two countries. At least in the case of LTV limits, tighter restrictions are placed in high-inclusion countries. This corresponds well to my hypothesis of macroprudential activity being affected by commitments to financial development while suggesting that what low-inclusion countries lack in frequency, they do not make up for in intensity.
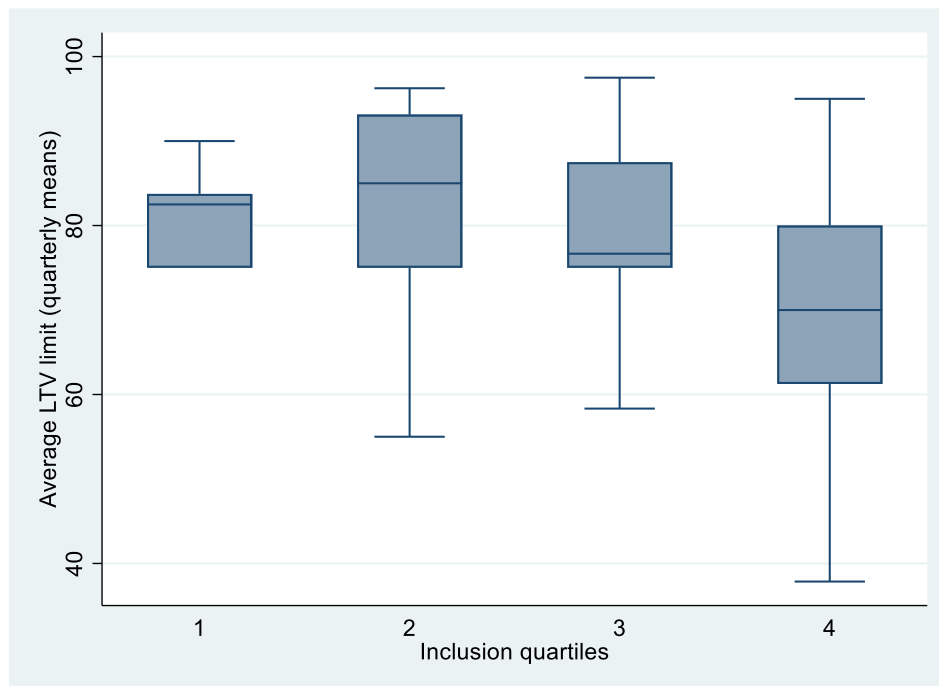

Figure 5.5: Intensity of LTV Ratio (2010-2020 Average) by Inclusion Level (Author's Calculations, see Appendix A for a summary of data sources).

5.2 FSIs as predictors of policy tightening

Having established that there is indeed a strong correlation between inclusion levels and the frequency of macroprudential policy tool usage, the second part of the empirical analysis can proceed as planned. I have proposed a theoretical relationship that the adverse effects of macroprudential tool usage on financial deepening and financial inclusion may reduce the propensity of policymakers in low-inclusion countries to react to increasing financial instability. This would, theoretically, be due to their commitment to financial development and the relative difficulties of minimising the trade-offs and achieving the correct policy mix to promote synergies between financial stability and inclusion. These synergies have been shown to exist but demand much collaboration of different government agencies and authorities, which may be outside the institutional capabilities of many low-inclusion countries(Cihák, Mare & Melecky, 2016; IMF-FSB-BIS, 2016).

A stronger correlation between indicators of financial instability and macroprudential policymaking while controlling for country-level characteristics would support my hypothesis. This theoretical link should lead to a more hesitant response to financial stability threats at lower inclusion levels. To test this, I have proposed a regression model intended to capture the determinants of macroprudential policy.

Table 5.1 shows the results of various model specifications. Note that the coefficients shown for control variables apply only for the first specification, i.e., with Tier 1 capital to risk-weighted assets measuring financial stability. They do not vary greatly depending on the financial stability indicator. Therefore, those coefficients only serve to inform the reader about the general effects of these controls. The R-squared values shown also only apply to the first specification. These values range from 0.08-0.18, indicating that the model captures only a tiny part of the variation in macroprudential tool usage within countries.

The regression results do show a stronger correlation in both significance and magnitude in the case of the two CARs. These variables are very related, with Tier 1 capital being a subset of total regulatory capital. As such, similar results are to be expected. Notably, none of the other proposed determinants of tool usage has predictive power. There are few clear trends in the magnitude of the coefficients on other indicators as inclusion increases, and statistical significance is mainly absent.

I further test whether my model specification can provide results in support of Deléchat et al.'s (2021) findings that resort to informal finance due to macroprudential policy is primarily found within the borrowing channel. Similarly, I test whether the results are consistent with findings that financial development significantly increases macroprudential policy use. These tests are only done using the Tier 1 capital ratio as other indicators for financial stability did not significantly affect usage in the original model specification, and total regulatory capital adds little nuance.

Firstly, I change the indicator used to assign inclusion levels from one that measures borrowing to a measure of account holding. Doing this removes the correlation found earlier, both in

magnitude and significance. The highest inclusion level is the only category in which the effects of the ratio are statistically different from zero.

Secondly, I use Zvirydzenka's (2016) financial development index to split the sample by country. The regression indicates that, indeed, financial development matters. The Tier 1 ratio has a stronger association with macroprudential policy tightening in financially developed countries than in other countries.

Table 5.1: Main Regression Results (Author's Calculations).

Dependent variable: Number of Macroprudential tightening actions

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Baseline controls only (same for all regressions)				
log(GDP)	1.74	4.01**	0.83	4.47**
	(1.55)	(1.94)	(2.59)	(1.64)
Credit to GDP	-0.068***	-0.0039	-0.015*	-0.012
	(0.018)	(0.024)	(0.0078)	(0.18)
Inflation target	0.40	-0.71	0.083*	-0.56***
	(0.47)	(0.72)	(0.45)	(0.16)
High inflation	-0.93**	-0.00054	-0.74*	-1.13***
	(0.39)	(0.38)	(9.43)	(0.16)
Country FE	Yes	Yes	Yes	Yes
R-squared (within)	0.18	0.11	0.080	0.143
N (countries)	18	25	25	22
Observations	182	247	268	237
Adding proxies for financial stability in separate regressions				
Tier1 capital to RWA	-0.013	0.080*	0.10**	0.28***
	(0.030)	(0.044)	(0.046)	(0.054)
Regulatory capital to RWA	-0.016	0.075*	0.095**	0.23***
	(0.029)	(0.040)	(0.044)	(0.054)
Non-perf. loans to total gross loans	0.023*	-0.051	-0.0058	-0.13
	(0.012)	(0.030)	(0.025)	(0.083)
Bank Z-score	-0.0094	0.064	-0.035	0.062*
	(0.031)	(0.045)	(0.029)	(0.032)
Bank ROE	-0.00013*	0.0071	0.0039	-0.0054
	(0.000068)	(0.014)	(0.0045)	(0.011)
Changing inclusion indicator				
Tier 1 cap. to RWA	0.021	0.073	0.054	0.22***
	(0.026)	(0.052)	(0.065)	(0.041)

	Financial development index			
		Below median		Median or higher
Tier 1 cap. to RWA		0.067**		0.20***
		(0.032)		(0.040)

Robust standard errors in parentheses (* $p<0.1$, ** $p<0.05$, *** $p<0.01$)

While these regression results seem to indicate that only the CARs show trends consistent with the hypothesis and that the model behaves in a way that is consistent with other findings, there are several signs of endogeneity bias in them. Looking at the statistically significant coefficients for other indicators of financial stability first, non-performing loans positively affect macroprudential policy usage for first inclusion quartile countries. This is intuitive as a higher ratio of loans at risk of default indicates risks in the financial system. Meanwhile, bank z-score and return on equity have statistically significant positive and negative effects in fourth and first quartile countries, respectively. Both are counterintuitive, as a higher bank Z-score indicates less financial sector risk, while the same can be said for ROE.

This problem is most present in the case of CARs. While the trend of stronger association may partly be attributable to the hypothesis I have proposed, the coefficients have the same problem of counterintuitive direction. Therefore, the regression results indicate that financial system capital adequacy increases lead to increased macroprudential policy usage if I am to interpret the results causally. This is highly unlikely to be a genuine causal relationship indicating that reverse causality or simultaneity may be biasing the estimates upwards. Efforts to combat endogeneity are needed and will be discussed in the subsequent section.

5.2.1   Endogeneity robustness check

As earlier discussed, avoiding endogeneity in the absence of a robust instrumental variable tends to be done by using lagged variables and timing assumptions of the effects macroprudential policy has on indicators of financial stability. The original model effectively relies on the dubious timing assumption that macroprudential policy tightening does not affect these indicators within the same calendar year. This timing assumption only holds if the macroprudential tool used is entirely ineffective.

It is unreasonable to argue that a framework including lags could eliminate endogeneity while still providing valuable estimates. That entails a theoretical framework in which macroprudential policy actions are based on year-old macroeconomic developments. While long-term trends can play a part in determining policy actions, that strategy is unlikely to lead to reliable estimates as none of the proposed determinants are characterised by rigidity in the face of financial stability threats

Effectively using lagged variables demands more frequent data, i.e., quarterly or monthly. Compiling a similar set of independent variables and trimming it to account for the number of countries that do not report economic data quarterly results in a remarkable fall in the number of observations. Only 2-4 first inclusion quartile and 11-14 second quartile countries remain depending on the specific set of variables chosen when moving down to the quarterly level. This is down from 18 and 25 countries in the original specification. Therefore, addressing this research question with higher frequency data requires an entirely different approach to the one used here.

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In an effort to reduce the endogeneity bias, I estimate an alternate specification of the model. Table 5.2 presents the Tier 1 capital ratio estimates with the following changes. The four macroprudential policy tools identified as potential direct sources of simultaneity in the preceding chapter are removed from the total sum of macroprudential actions. The four are added back in as control variables. The reasoning for that is that the new control could absorb the direct effects they have on the capital ratio. Other control variables remain the same. The coefficient on the capital buffer measurements can be interpreted as the correlation between their usage and the usage of other macroprudential tools. Using this specification, the earlier observed trend vanishes. The estimated coefficients are consistently lower than before, possibly indicating reduced upward endogeneity bias. However, statistical significance outside the highest level of financial inclusion is lost, and the direction remains counterintuitive. It can be assumed that this method is not sufficient to mitigate endogeneity in this methodological approach.

Table 5.2: Endogeneity Robustness Check Regression (Author's Calculations).

Dependent variable: Number of Macroprudential tightening actions excluding capital tools

	Quarter 1	**Quarter 2**	**Quarter 3**	**Quarter 4**
	Baseline controls are unchanged; see Table 5.1			
Capital tools	*0.36***	*0.32***	*0.18**	*0.093*
	(0.28)	*(0.13)*	*(0.10)*	*(0.092)*
Tier 1 cap. to RWA	*-0.0087*	*0.064*	*0.052*	*0.16****
	(0.018)	*(0.037)*	*(0.037)*	*(0.052)*
	Robust standard errors in parentheses (* $p<0.1$, ** $p<0.05$, *** $p<0.01$)			

6   Conclusion

This study investigated the relationship between financial inclusion and macroprudential policy in greater detail. To that aim, I have analysed the usage of macroprudential policy by countries at different inclusion levels. Further, I have proposed a dynamic that may explain macroprudential policymaking differences based on countries' financial inclusion.

The results from the frequency analysis show that usage of macroprudential tools is positively correlated with financial inclusion. My findings indicate that these differences do not stem from countries with lower financial inclusion facing different challenges in managing financial system risks. Specific tools are likely to be used more often at some inclusion levels than others if that was the case. Previous research found this relationship, which indicated substantial policy mix differences between AEs and EMDEs. My results contradict those findings. Further, analysis of average LTV limits suggests that low-inclusion countries do not take stricter measures less often to make up for the frequency gap, at least in the case of the LTV tool. The two have not been analysed in this way before, although the results on usage frequency may be expected.

In an effort to explain the frequency differences, I proposed a hypothesis that macroprudential policymakers require greater impetus to regulate in low-inclusion countries due to the adverse effects the policies may have on financial inclusion. Regressions were run based on a novel and exploratory model meant to capture the determinants of macroprudential policy use to test that hypothesis. These regressions are entirely inconclusive as the model contains endogenous regressors that bias its estimates.

Therefore, why low-inclusion countries use macroprudential tools less often remains unanswered. Financial inclusion may still play a role. Determining whether it does or if frequency differences are caused by institutional factors, governance characteristics, financial complexity, systemic risk differences, or a combination of these factors would be beneficial. Future research may want to revisit the question of whether frequency differences lead to the manifestation of greater financial stability risks in low-inclusion countries compared to other countries, as that may be the result regardless of what causes frequency differences. This thesis suggests that more knowledge of the determinants of macroprudential policy action is needed before that question can be answered.

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Appendix A

Table 6.1: Full List of Countries by Inclusion Level

First quartile			Second quartile		
Algeria	*Ghana*	*Niger*	*Albania*	*Indonesia*	*Paraguay*
Angola	*Greece*	*Nigeria*	*Azerbaijan*	*Jamaica*	*Peru*
Bangladesh	*India*	*Pakistan*	*Bosnia & H.*	*Jordan*	*Romania*
Benin	*Ivory Coast*	*Philippines*	*Bulgaria*	*Kenya*	*Saudi Arabia*
Bhutan	*Kyrgyzstan*	*Senegal*	*Colombia*	*Latvia*	*Serbia*
Botswana	*Laos*	*Sudan*	*Costa Rica*	*Lithuania*	*South Africa*
Burkina Faso	*Lesotho*	*Tanzania*	*Ecuador*	*Mexico*	*Sri Lanka*
Burundi	*Mali*	*Togo*	*Haiti*	*Moldova*	*Tajikistan*
DR Congo	*Mauritania*	*Tunisia*	*Honduras*	*Nepal*	*Thailand*
El Salvador	*Morocco*	*Yemen*	*Hungary*	*N. Macedonia*	*Uganda*
Ethiopia	*Mozambique*	*Zambia*			
Third quartile			**Fourth quartile**		
Argentina	*Dominican*	*Montenegro*	*Australia*	*Israel*	*South Korea*
Armenia	*Republic*	*Netherlands*	*Austria*	*Italy*	*Spain*
Bahrain	*Estonia*	*Poland*	*Belgium*	*Japan*	*Sweden*
Belarus	*Georgia*	*Portugal*	*Canada*	*Luxembourg*	*Taiwan*
Brazil	*Kazakhstan*	*Russia*	*Denmark*	*Malta*	*Turkey*
Cambodia	*Kuwait*	*Slovakia*	*Finland*	*New Zealand*	*UA Emirates*
Chile	*Lebanon*	*Trinidad &*	*France*	*Norway*	*Great Britain*
China	*Malaysia*	*Tobago*	*Germany*	*Seychelles*	*United States*
Croatia	*Mauritius*	*Ukraine*	*Hong Kong*	*Singapore*	*Uruguay*
Cyprus	*Mongolia*	*Vietnam*	*Ireland*	*Slovenia*	
Czech Republic					

Table 6.2: Summary of Data Sources

| Variable	Explanation	Source
Log(GDP)	GDP per capita	World Development Indicators, World Bank (2022a)
Credit to GDP	Domestic credit to private sector by banks (% of GDP)	World Development Indicators, World Bank (2022b)
Inflation target	Dummy for monetary policy framework. 0/1 = no=yes	Cross-Country Database of Country Characteristics (Ha, Kose & Ohnsorge 2019; IMF 2020)
High inflation	Dummy, 1 if inflation is over the 90th percentile of observed inflation rates.	World Development Indicators, World Bank (2022c)
Tier1 capital to RWA	CAR. Tier 1 regulatory capital to risk-weighted assets.	Financial Soundness Indicators (IMF, 2019)
Regulatory capital to RWA	CAR. Total regulatory capital to risk-weighted-assets	Financial Soundness Indicators (IMF, 2019)
Non-perf. loans to total gross loans	Non-performing loans to total gross loans	Financial Soundness Indicators (IMF, 2019)
Bank Z-score		Global Financial Development Database (Cihák et al., 2012)
Bank ROE	Bank return on equity	Financial Soundness Indicators (IMF, 2019)
All MaPP data	Count of adjustment instances and mean value of LTV limits	IMF iMaPP Database (Alam et al., 2019)
Financial inclusion variables	Used to separate countries into quartiles	Global Findex Database (Demirgüc-Kunt et al., 2018)
Financial Development Index		Svirydzenka (2016)

Appendix B
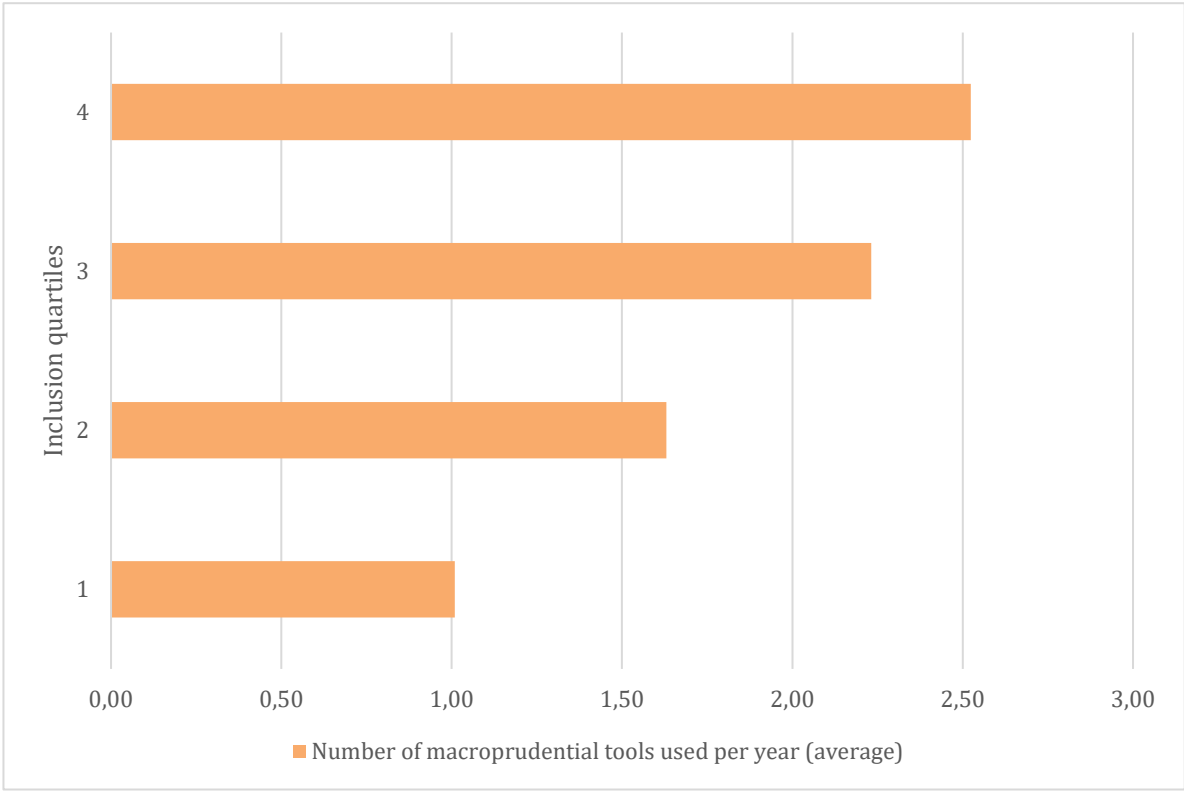
Figure 6.1: Adjustment Frequency per year (2010-2020 average) vs Inclusion Level based on account holding (Author's Calculation, see Appendix A for summary of data sources)