Changes in Prudential Policy Instruments—A New Cross-Country Database[*]

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This paper documents a new database that focuses on changes in the intensity in the usage of several widely used prudential tools, taking into account both macroprudential and microprudential objectives. The database coverage is broad, spanning sixty-four countries, and with quarterly data for the period 2000:Q1 through 2014:Q4. The five types of prudential instruments in the database are capital buffers, interbank exposure limits, concentration limits, loan-to-value (LTV) ratio limits, and reserve requirements. A total of nine prudential tools are constructed since some useful further

decompositions are presented, with capital buffers divided into four sub-indexes: general capital requirements, specific capital buffers related to real estate credit, specific capital buffers related to consumer credit, and other specific capital buffers; and with reserve requirements divided into two sub-indexes: domestic-currency capital requirements and foreign-currency capital requirements. While general capital requirements have the most changes from the cross-country perspective, LTV ratio limits and reserve requirements have the largest number of tightening and loosening episodes. We also analyze the instruments' usage in relation to the evolution of key variables such as credit, policy rates, and house prices, finding substantial differences in the patterns of loosening or tightening of instruments in relation to business and financial cycles.

JEL Codes: E43, E58, G18, G28.

1. Introduction

Prudential instruments involving the banking system are essential in the policymaking toolkit to promote financial stability. They constitute the tools most often used to implement both microprudential and macroprudential policies.[1] A full distinction between these two types of policies is blurry, and their differences are mostly based on the particular perspective used (Crockett 2000; Borio 2003; Claessens 2015). Microprudential policy seeks to ensure the soundness of individual financial institutions, while macroprudential policy aims to contain systemic risks in the financial system as a whole. Independent of these objectives, which often intersect, there is a consensus that having a systemwide perspective is a fundamental attribute of a well-specified prudential regulatory framework (International Monetary Fund 2013). Such a prudential framework often seeks to increase the resilience of both individual firms and the financial system to shocks (e.g., by building capital buffers); to contain the buildup of vulnerabilities over time (e.g., by reducing procyclical

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[1]There are other instruments in the macroprudential toolkit, such as taxes, levies, and capital flow measurements. Nevertheless, most macroprudential tools considered to date apply to the banking system, mainly given the presence of microprudential regulatory tools that are easily adaptable and the more extensive theoretical knowledge on these instruments.

feedback between asset prices and credit); and to control structural vulnerabilities arising through interlinkages and the critical role of individual intermediaries in key markets that can render individual institutions "too big to fail."

Prudential instruments have been used by a large number of countries with either microprudential or macroprudential objectives, but analyzing the effectiveness of these tools and their potential unintended consequences (e.g., domestic and cross-border spillovers) is an undeveloped area at the international level, partly due to the lack of detailed and consistent cross-country information on changes—either loosening or tightening—in the use of prudential instruments. As part of the 2015 International Banking Research Network (IBRN) initiative, which examines domestic effects and international spillovers of changes in prudential instruments (see Buch and Goldberg 2017), the main aim of this paper and its associated database is to consistently document information on the cross-country usage of key prudential instruments during the 2000–14 period, independently of the final microprudential or macroprudential objectives that authorities might have implicitly or explicitly had.[2]

In this context, our contribution to the literature is twofold. First, we compile a detailed and unique data set of widely used prudential instruments covering the intensity in their usage over time in sixty-four countries at a quarterly frequency. The five types of prudential instruments at the center of the database are capital buffers, interbank exposure limits, concentration limits, loan-to-value (LTV) ratio limits, and reserve requirements. A total of nine prudential tools are constructed since we consider some useful breakdowns of the five types of prudential instruments analyzed (capital buffers into four sub-indexes: general capital requirements, specific capital buffers related to real estate credit, specific capital buffers related to consumer credit, and other specific capital buffers; and with reserve requirements divided into two sub-indexes: domestic-currency

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[2]The 2015 initiative of the IBRN is a multi-study project on the domestic effects and international spillovers of prudential instruments, where teams of researchers from fifteen central banks and two international organizations used confidential micro-banking data and more precise measures of prudential regulation to test their hypotheses.

capital requirements and foreign-currency capital requirements). Second, we take advantage of these quarterly series and provide a cross-country view of their usage, taking also into account their correlation with key variables such as credit, policy rates, and house prices. These statistics provide a valuable perspective on how countries are effectively using prudential instruments through business and financial cycles.

The selection of these five types of prudential instruments was based on the need to focus on the most widely used prudential instruments across countries. Following Cerutti, Claessens, and Laeven (2015), which offers the largest coverage on the introduction of macroprudential tools within 119 countries during the 2000–13 period, we selected concentration limits, reserve requirements, LTV ratio limits, and interbank exposure limits, since they are the top four instruments in terms of usage.[3] In addition, since our objective is to cover prudential instruments independent of their microprudential or macroprudential objective, we added capital buffers, a key instrument of modern bank regulation and also widely used (especially from a microprudential perspective).

The prudential database aggregates information from primary sources (e.g., central bank reports) and secondary sources (e.g., the Global Macroprudential Policy Instruments [GMPI] survey conducted by the International Monetary Fund [IMF] during 2013). The sources used for each regulatory change are documented in section 2 and in an online appendix available at http://www.newyorkfed.org/IBRN/index.html. The resulting database provides a comprehensive, multi-country, longitudinal overview of prudential policies at a quarterly frequency. Efforts to ensure the consistency of the data set were the result of feedback received directly from country regulators on the accuracy of the policy changes recorded in the database.

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[3]In Cerutti, Claessens, and Laeven (2015), an instrument is being used if it is written into a law or into regulatory rules. Their analysis shows that concentration limits were used (in at least one year) in 64 percent of the 119 countries in their sample, reserve requirements in 37 percent of the countries, and LTV ratio limits and interbank exposure limits in 29 percent of the countries. The same top four instruments are selected following their paper's definition of use frequency (the ratio of country-years using a given instrument to the total number of country-years using a macroprudential policy over the 2000–13 sample period).

Our database represents further progress in recent efforts to measure the use of prudential tools across a large number of countries (e.g., Lim et al. 2011; Zhang and Zoli 2014; Aysan et al. 2015; Cerutti, Claessens, and Laeven 2015). The closest to our data set is Akinci and Olmstead-Rumsey (2015), which analyzes macroprudential policies in fifty-seven advanced and emerging economies covering the period from 2000:Q1 to 2013:Q4, with tightening and easing recorded separately for seven macroprudential tools, and with a primary focus on tools applied to address housing-sector developments. Compared with Akinci and Olmstead-Rumsey (2015), our database captures a broader set of instruments that impact the balance sheets of banks, such as capital and reserve requirements, which makes it more appropriate for studying the effects of prudential regulations on banking activities. In contrast, Akinci and Olmstead-Rumsey (2015) is better suited for analyzing imbalances in the domestic housing sector.

More generally, beyond a larger coverage of countries or instruments compared with other data sets capturing regulatory changes, our data set includes instruments that are used to achieve microprudential objectives, in addition to some of the macroprudential instruments covered by other databases. This is not a minor detail, because surveys of macroprudential instruments rely on the authorities' formal intentions and interpretations of the use of these instruments (i.e., whether the instrument is strictly used to comply with a macroprudential objective), which could trigger important omissions in the reporting of instruments that have been used in the past. Moreover, we also cover omissions that are triggered by implicit classifications under other objectives (e.g., monetary objectives for reserve requirements). For example, the usage of reserve requirements in China was not captured in several surveys on macroprudential instruments (e.g., GMPI) despite the fact that some specific studies such as Ma, Xiandong, and Xi (2013) highlighted their broad usage and multiple objectives, including prudential.

We find several interesting patterns when analyzing the changes in prudential indexes as documented in our database. First, even though concentration limits and interbank limits are two widely used prudential instruments, their intensities (in terms of loosening or tightening) are not often adjusted. Second, LTV ratio limits and reserve requirements (on foreign and local currency) have the

largest numbers of tightening and loosening episodes. Third, instruments linked to capital buffers, concentration limits, and interbank exposures have been used to achieve structural objectives, such as creating capital buffers and lowering risks either with a microprudential or macroprudential perspective. Conditional on usage, this observation is supported by the low correlation between the changes in instrument intensity and key financial variables like credit, policy rates, and house prices. Fourth, the correlations for LTV ratio limits, and foreign- and local-currency reserve requirements, with credit growth signals a countercyclical usage by authorities in most cases. The correlations with respect to house prices are mostly not statistically significant across most countries with available data, except for a few Asian countries. Last, the correlations of LTV ratio limits and reserve requirements with countries' policy interest rates reveal heterogeneous policy actions across countries: many statistically significant correlations indicate both complementarities and non-complementarities between these prudential instruments and policy rates.

The rest of the paper is organized as follows. Section 2 documents the construction of the prudential instruments and the sources used to code the changes in these indexes. Section 3 documents the variation in the different prudential instruments over time and across countries. Section 4 analyzes the usage of these prudential instruments in relation to the evolution of key variables such as credit, policy rates, and house prices. Section 5 concludes.

2.   Description of the Database

The IBRN Prudential Instruments Database includes quarterly changes for nine prudential policy indexes that have been used by policymakers with some frequency across a sample of sixty-four countries during the period between 2000 and 2014.[4] This section provides a general description of the construction of the indexes, as well as detailed information about each specific instrument.

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[4]A list of the sixty-four countries included in the database is reported in table 3 in the appendix. Out of these sixty-four countries, we have limited coverage for seven countries, which are highlighted in bold in table 3.

2.1   Construction of the Prudential Instrument Indexes

To construct the prudential policy indexes reported in the database, we use a method to map policy changes into simple indexes that has recently been used in studies focusing on the intensity of capital controls (Ahmed and Zlate 2014; Pasricha et al. 2015) and macroprudential policies (Akinci and Olmstead-Rumsey 2015). Nine indexes are constructed for the five types of prudential instruments covered, and the indexes are presented in two ways. The first presentation of index data records the changes in a policy instrument with a 1 or –1 entry, depending on whether the prudential tool was tightened or loosened in a given quarter. The index equals 0 in those quarters when no change occurs. The entries in the database for a given instrument are coded as missing if policymakers cannot use that policy tool.[5] An example of such a case is a country that has not enacted a rule to set LTV ratio limits; the index for this instrument is coded as missing until such a rule is passed.

An advantage of this type of coding is that it can capture the intensity of a policy change while incorporating qualitative traits from the policy that cannot be measured by a unique numerical statistic. For example, in certain circumstances, policymakers may decide to change LTV ratio limits on specific types of real estate transactions while maintaining others unchanged. To fully measure the intensity of such a change in the instrument as a single numerical statistic would require a weighted index of all LTV ratio limits applied to the different transactions. For this purpose, one would need to have specific information on all types of real estate transactions. By recording the change with the discrete index described above, a policy change can simply be captured by entries of 1 and –1 in the index. The intensity of the change, although captured imperfectly by this index, measures the direction of the policy change.

For some policy instruments, we are able to record the intensity of the changes more precisely. This is the case for those instruments

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[5]Observations are also coded as missing for a few countries without any information for the concentration and interbank exposure limits. We also record the entries for the general capital requirements index of seven countries, listed in bold in the appendix (table 3), as missing. This type of missing value is coded differently in the database from those that reflect the lack of availability of the policy instrument.

that can be summarized by a single numerical indicator. An example of these instruments is reserve requirements on local- or foreign-currency deposits. Although there is some variation across countries, changes in reserve requirements can be captured by a single statistic (Cordella et al 2014; Federico, Vegh, and Vuletin 2014). Using that statistic, we use positive and negative integers to capture the intensity of the instrument's change relative to the starting date, which in the database is the first quarter of 2000.

Recording the intensity of the change in the policy instrument allows us to produce a second class of index, which we call the "cumulative" index. In each quarter, the cumulative index is the sum, since the first quarter of 2000, of all changes in the policy index recorded prior to, and during, the quarter of interest. The purpose of this cumulative index is to capture the level of "tightness" ("looseness") of an instrument at a given point in time.

Although the properties of this index are appropriate for capturing the intensity of policy changes in a given country over time, they are not ideal for assessing differences in the policy stance across countries. For example, the level of an instrument may be different at the starting point in 2000 or the changes in the instruments may have different qualitative implications across countries, which may not be captured by the index. Thus, the instrument indexes should be used with caution when making cross-sectional comparisons with regards to the tightness (or looseness) of a particular instrument.

2.2 Sources of Information

We use a combination of primary and secondary sources to record the changes in the nine policy instruments included in the database. The starting point to determine these instruments' changes is the GMPI survey (see Cerutti, Claessens, and Laeven 2015 for a description). This survey provides a comprehensive view of the set of macroprudential policies that have been used across a large sample of 125 countries.[6] We also use primary information provided directly by national authorities either through the IBRN or the IMF

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[6]Even though the GMPI survey included a question asking about the changes in the covered instruments from 2000 to 2013, the responses to these questions are to a large degree missing or incomplete, constituting one of the main challenges in our documentation not only on usage but also on the intensity of usage.

or our searches in national authorities' web pages. We complement these data with other secondary sources like the earlier IMF data set compiled by Lim et al. (2011) and with information drawn from other general databases that have been compiled in recent years by Akinci and Olmstead-Rumsey (2015), Kuttner and Shim (2013), and Reinhardt and Sowerbutts (2015). Additionally, we also complement this information with specific secondary sources of information that apply to the different prudential instruments, as described in the online appendix.

Lastly, one of the main contributions of the database is the participation of IBRN members in the process of constructing the database. All versions of the database were reviewed by staff from central banks participating in the IBRN to ensure its accuracy and completeness. For instance, they provided information on instrument changes that were not recorded in the aforementioned databases, or noted inaccuracies that were corrected. We also received valuable feedback from country representatives who filled the GMPI survey through staff at the IMF.

2.3   Details on Specific Prudential Instruments

2.3.1   General Capital Requirements

The general capital requirements index is based on the regulatory changes introduced in the Basel Accords through the four revisions: I, II, II.5, and III. The index takes a value of 1 when a capital regulation is implemented or tightened and 0 when no changes in capital regulations take place. We assume that the implementation of the Basel Accords never loosens the existing regulation. Therefore, the index never takes the value of –1. The main sources of information for the implementation of the Basel II, II.5, and III agreements are the Basel Committee on Banking Supervision progress reports on members' implementation and country supervision authorities' websites.[7] For those countries not covered by these publicly available sources,

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[7]The Bank for International Settlements (BIS) sources are the "Progress Report on Implementation of the Basel Regulatory Framework" (http://www.bis.org/bcbs/implementation.htm) and the "FSI Survey — Basel II, 2.5 and III Implementation" (http://www.bis.org/fsi/fsiop2015.htm).

we directly submitted inquiries to the country authorities through the IBRN or IMF.

The capital requirements index records policy changes at the point in time when the law is implemented and not when it is passed. More importantly, we code the Basel I, II.5, and III agreements as a tightening (an entry equaling 1) of capital requirements, whereas Basel II is coded as neutral (an entry of 0). The decision to record Basel II as not changing the intensity of capital requirements is based on evidence that suggests that the introduction of this agreement did not lead to a tightening nor a loosening of overall capital requirement regulations.[8] As stated by the Basel Committee, the objective of Basel II regarding the overall level of minimum capital requirements was "to broadly maintain the aggregate level of minimum capital requirements, while also providing incentives to adopt the more advanced risk-sensitive approaches of the revised framework" (Basel Committee on Banking Supervision 2006).

2.3.2 Sector-Specific Capital Buffers

The sector-specific capital buffer index is another bank-capital-based indicator that captures regulatory changes that are aimed at curtailing the growth in bank claims to specific sectors of the economy. Changes in this type of prudential instrument usually take the form of adjustments to the risk weights of specific bank exposures, which are tightened or loosened with the financial cycle.

We separately record changes for three categories of credit depending on the borrower's type, namely real estate credit, consumer credit, and other credit. The aggregate sector-specific capital buffer index is equal to the sum of prudential instrument changes across the different types of credit. As such, the index can take on values greater or lower than 1 or –1 in a given quarter, which would signal changes in the capital buffers for more than one sector at the same time.

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[8]For a detailed analysis of the quantitative impact of Basel II, see the Financial Stability Institute's report titled "Results of the Fifth Quantitative Impact Study (QIS 5)," which can be found at http://www.bis.org/bcbs/qis/qis5results.pdf.
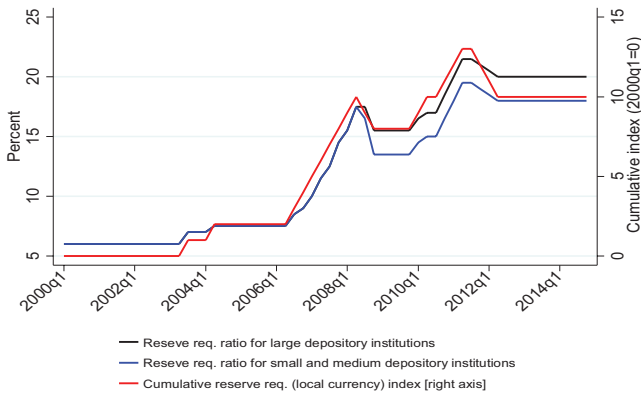
2.3.3   Reserve Requirements

Reserve requirements have typically been used as instruments to conduct monetary policy. However, as noted by Cordella et al. (2014), these requirements have also been used as countercyclical macroprudential tools by emerging economies. The GMPI survey explicitly asked respondents whether they use this tool as a macroprudential or monetary policy tool. We rely on this information to determine whether changes in the instrument should be included in the database, which we complement with other sources if the GMPI does not report whether the country uses reserve requirements to achieve macroprudential objectives.

After we determine that reserve requirements are used in a country to satisfy prudential objectives, we proceed to collect information on the changes in these requirements over time. We separately collect information on changes in reserve requirements for deposit accounts denominated in domestic and foreign currency. The principal sources of information to determine these policy changes are central banks' websites, the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER), and the database by Federico, Vegh, and Vuletin (2014).

Although reserve requirement ratios are typically reported as a number, these requirements can apply to different types of accounts. For example, within deposit accounts, there may be several subcategories, such as demand and savings accounts. Similarly, reserve requirement ratios may apply to deposits of different maturities. We use the numeric index defined earlier to capture the overall level of reserve requirements within a broad category. Given the mostly quantitative nature of this instrument, we also use numbers above or below 1 and –1 to record the intensity in the changes. As shown in figure 1, the cumulative index that records changes in reserve requirement ratios in China tracks the contour of the level of this instrument well. This is one of the strengths of the index, as it is able to capture changes in these policies while at the same time implicitly taking into account qualitative changes like the differentiated treatment of large, and small and medium depository institutions in mid-2008.

**Figure 1. Reserve Requirement Ratios and
Cumulative Index for China**

—— Reseve req. ratio for large depository institutions
—— Reserve req. ratio for small and medium depository institutions
—— Cumulative reserve req. (local currency) index [right axis]

2.3.4   Concentration Limits and Interbank Exposure Limits

Limits on concentrated exposures and on exposures to other banks are multifaceted policies that affect claims between banks and their borrowers. As opposed to reserve requirement ratios, these limits can be changed by modifying at least five elements that characterize these exposures:

(i) The definition of large exposures: As defined by the Basel Committee on Banking Supervision (2014), an exposure should be classified as large if "the sum of all exposure values of a bank to a counterparty or to a group of connected counterparties ... is equal to or above 10% of the bank's eligible capital base." However, there are some differences in the specific definitions across countries. For example, France characterizes large exposures as those representing 10 percent of eligible capital of a bank or those with a value of more than 300 million euros.

(ii) The level of the limit: The limit on these exposures may be defined as a share of a bank's capital or in monetary terms. These exposures are weighted by the appropriate risk weights.

(iii) Differentiation across counterparties: Weights on exposures may depend on the "riskiness" of the counterparty and the duration of the claims.

(iv) Aggregate limits: Banks may also face aggregate concentration limits, totaled across all large exposures, which should not exceed a threshold expressed as a share of eligible capital.

(v) Sectors and assets that are covered by the regulation: The regulation may cover the exposures of depository institutions, or it may apply to a larger group, incorporating those of non-bank financial institutions. On the counterparty side, some sectors may be exempted from banks' concentration limits. In other cases, the definition of qualified assets that are counted toward exposures limits may also change over time (e.g., interbank exposures).

These layers that encompass the concentration and interbank exposure limits require a careful assessment of the changes in the characteristics of these regulatory requirements over time. We use our index to record these changes using information from the GMPI survey. In the process, we rely on three assumptions to code the changes. First, if multiple changes to the characteristics defined above are implemented, we determine whether, on net, the policy tightened or loosened these exposures limits. Second, if the rules determining the concentration limits, including interbank exposures, are changed in a given quarter, we only code the change for concentration limits and not for interbank exposures. If the changes mostly apply to interbank exposures, we only code a change for this index. Last, in cases when the authorities do not specify the exact quarter, within a year, when the policy changes were implemented, we use the first quarter of that year as the date of implementation.

2.3.5   Loan-to-Value Ratio Limits

LTV ratio limits, or caps, are restrictions on the maximum amount that an individual or firm can borrow against their collateral. The most common form of LTV cap is applied to real estate transactions. In this particular case, authorities may limit the amount that an individual can borrow against the value of the property. The instrument is said to affect the demand for credit, as it applies to any transactions covered by the policy regardless of the type of lender.

In our index, we record changes in LTV ratio limits that affect real estate transactions. Changes in banks' risk weights associated

with LTV ratios are not considered since they do not necessarily constrain the maximum borrowing capacity for borrowers. Nevertheless, two additional types of changes in maximum LTV ratio limits are taken into account: (i) changes related to the maximum amount insured in real estate transactions in Canada and Hong Kong; and (ii) changes in LTV regulations related to the maximum LTV allowed in covered bonds (Denmark and Finland). In those cases, although the regulation does not directly target the characteristics of all the loans, the impact is broadly similar (e.g., covered bonds are the main source of mortgage funding in Nordic countries).

As is the case with reserve requirements, changes in LTV caps can be broadly tracked over time by following the evolution of this numeric variable. However, those changes can also affect subsamples of the universe of mortgages, such as first residential purchases or mortgages on properties that fall in specific price ranges. For cases in which LTVs are tightened for specific types of transactions and loosened for others, we assess whether, on net, the policy change falls in one category or the other and code it accordingly.

3.   Usage of Prudential Policies

This section presents information on the changes recorded in the indexes for the policy instruments described before, and for their subcomponents. The database contains information for five types of prudential instruments and sixty-four countries. For two of the instruments, we also calculate subcomponents. For the sector-specific capital buffers, we calculate indexes for buffers that apply separately to real estate loans, consumer loans, and other loans. Similarly, for reserve requirements, we calculate separate indexes for policy changes that apply to accounts denominated in foreign currency and domestic currency. Adding these subcomponents, the total number of prudential indexes increases to nine.

Table 1 presents information on the number of quarterly episodes recorded in each of the nine indexes. As expected, in any given quarter most indexes do not change, which explains the large mass of observations at the value zero. LTV ratio limits and reserve requirements (on foreign and local currency) have the largest numbers of tightening and loosening episodes. The index on general capital requirements differs from all the others because it only encompasses

Table 1. Changes in the Prudential Instrument Indexes

Value	SSCB Real Estate Loans	SSCB Consumer Loans	SSCB Other Loans	Concent. Limits	Interbank Exposures	RR: Foreign Currency	RR: Local Currency	Loan-to-Value Ratio Limits	General Capital Reqs.
−3	0	0	0	0	0	2	1	0	0
−2	0	0	1	0	0	8	8	0	0
−1	15	3	4	2	1	41	157	25	0
0	3,787	3,828	3,819	2,023	1,100	3,699	3,543	1,201	3,320
1	38	9	14	32	24	85	126	72	100
2	0	0	2	0	0	3	2	0	0
3	0	0	0	0	0	1	0	0	0
4	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	1	1	0	0
Total	3,840	3,840	3,840	2,057	1,125	3,840	3,838	1,298	3,420

Notes: This table presents the frequencies of non-missing observations in the prudential database tabulated by instrument and the value of the index in any given quarter. SSCB stands for sector-specific capital buffer and RR stands for reserve requirements. We use all subcomponents of the indexes, including the SSCBs for real estate, consumer, and other loans, and RRs split between those applied to local- and foreign-currency deposit accounts. The value 0 is coded when a given policy instrument is not changed in a quarter. Tightening episodes are recorded with positive values in the index, and loosening episodes are recorded with negative values.

tightenings. These one-sided changes are explained by the way the index is coded, which only incorporates information on the implementation of the Basel Accords (these regulatory changes are coded as neutral or tightenings).

Note that the total number of episodes varies across instruments. As explained in the previous section, instruments that are not available to policymakers due to the absence of legislation that authorizes their use are coded as missing in the database. For some countries, instruments that are introduced during the sample period are coded as of the date the legislation to authorize them is passed. In these cases, if the introduction of the instrument is considered a tightening of the policy stance, it is coded as 1 in the index. There are other instances when the introduction of the instrument does not affect the policy stance, such as introducing reserve requirements and setting them at 0, which are coded as 0 in the index.

The information in table 2 reports the number of countries with policy changes in the sample period, as opposed to the number of total episodes. As expected, most countries made changes to the general capital requirements, as they adopted different versions of the Basel Accords in the past fifteen years. Similarly, reserve requirements on local-currency accounts and LTV ratio limits are instruments broadly used by countries in the sample, but in contrast to capital requirements, these policy tools are both tightened and loosened by many countries in the sample. On the other side of the spectrum, we find that interbank exposures are only modified by one-fifth of the sample, and most of these changes involve a tightening.

As shown in these tables, the usage of prudential instruments varies notably across the different types, both in the frequency of changes and in the direction of these changes. The use of prudential instruments also changes markedly across the sample period. Figure 2 presents information on the number of countries tightening or loosening three selected prudential policies in every quarter over the sample period. We focus on capital requirements, reserve requirements on local-currency deposits, and LTV ratio limits, some of the indexes with more variation or wider usage across countries. As noted previously, capital requirements are only shown to be tightened during the sample period (graph A), which is explained by the definition of the index. More importantly, those tightenings

Table 2. Use of the Prudential Instruments across Countries

	Distinct Countries with Instrument Changes	Countries with Tightening Episodes	Countries with Loosening Episodes	Countries with Instrument
SSCB Real Estate Loans	22	20	9	64
SSCB Consumer Loans	9	7	3	64
SSCB Other Loans	12	11	3	64
Concentration Limits	22	21	2	36
Interbank Exposures	14	13	1	22
RR: Foreign Currency	21	20	17	64
RR: Local Currency	46	29	44	64
Loan-to-Value Ratio Limits	36	33	14	38
General Capital Requirements	55	55	0	57

Notes: This table reports information on the number of countries with policy changes for each instrument. The database contains a total of sixty-four countries. SSCB stands for sector-specific capital buffer and RR stands for reserve requirements. We use all subcomponents of the indexes, including the SSCBs for real estate, consumer, and other loans, and RRs split between those applied to local- and foreign-currency deposit accounts. The last column shows the number of countries with access to a given instrument at any point in time during the sample period or those countries for which we have any information.

Figure 2. Changes in Prudential Instruments across Time
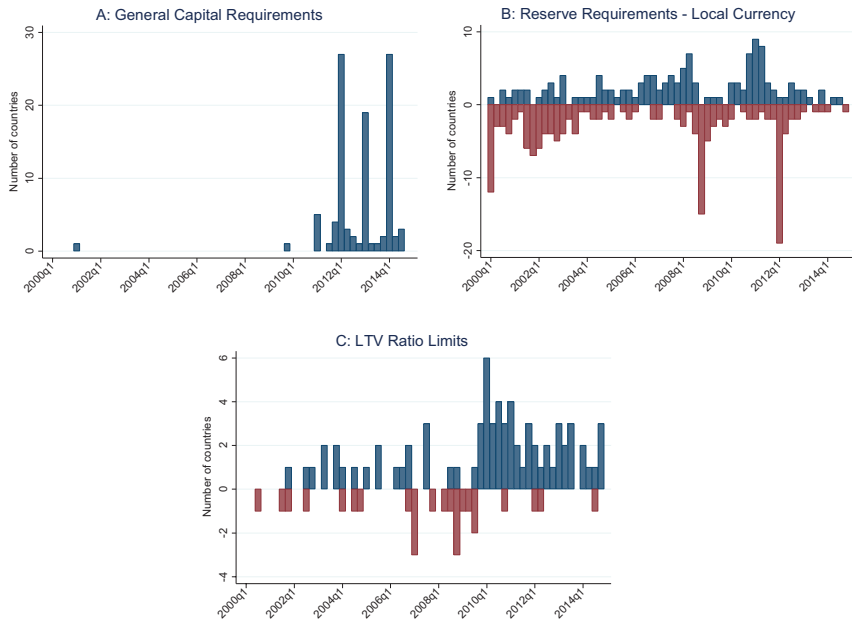
are clustered after the global financial crisis, as regulators implemented the new requirements embedded in the Basel II.5 and III Accords. In contrast, reserve requirements (graph B) and LTV ratio limits (graph C) exhibit changes throughout the sample period, with both tightenings and loosenings. In the case of reserve requirements, there are two important loosening periods that coincided with the global financial crisis and the European sovereign debt crisis. LTV ratio limits were largely tightened after the global financial crisis, perhaps as a result of loose monetary policies in several countries.

These patterns prompt several questions, especially about the reaction functions of regulators and supervisors to financial stability vulnerabilities and the use of prudential policies. Some instruments appear to be used more frequently and co-move with the financial cycle, while others are changed less often and perhaps as a reaction to financial crises. We explore these issues in the next section.

4.   Cyclical or Countercyclical Usage?

This section analyzes whether changes in the usage of prudential instruments in each country are correlated with the evolution of credit growth, house prices, and policy rates. These correlations cannot fully reveal the underlying microprudential or macroprudential emphasis used by the authorities (which could change over time), but they offer an overview of the cyclicality of prudential instruments with respect to, for example, bank credit or house prices.

In principle, if a prudential instrument is used with a macroprudential intent, then, to some degree, we would expect a positive correlation between the intensity of this instrument and credit growth, indicating a countercyclical usage (e.g., tightening during high credit growth periods and loosening during low credit growth periods). In addition, the correlation of prudential instruments with respect to the policy rate of each country offers some clues as to whether the usage of these financial stability tools has been complementary to the monetary policy objectives, as captured by the evolution of the policy rate.
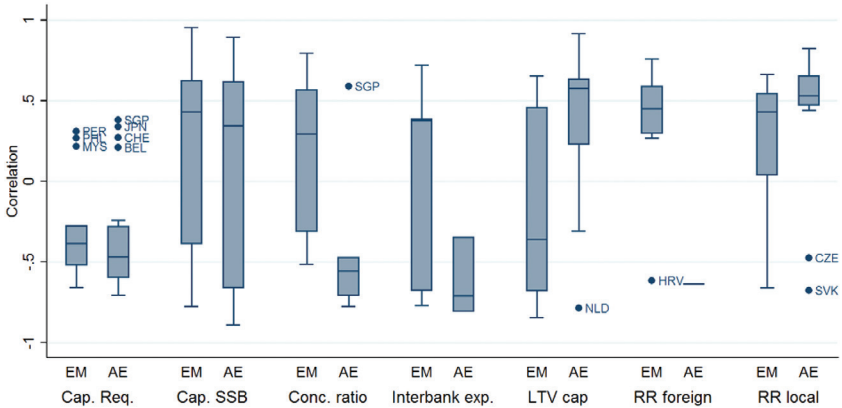
Figure 3 shows the distribution of the statistically significant correlations between the usage of prudential instruments and real credit growth in each country.[9] These correlations are calculated based on the cumulative index of seven prudential indexes presented in the previous sections (with the three sector-specific capital buffers presented as an aggregate) and real credit growth (annualized, using the most recent four quarters, and deflated using CPI inflation) from series produced by the Bank for International Settlements (BIS) and the IMF International Financial Statistics (IFS).[10] Countries that register some fluctuation in the usage of prudential instruments over time are the only ones with correlations, so the number of correlations plotted varies across instruments. In the case of capital requirements (Cap. Req.), it is possible to calculate correlations with credit

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[9]Correlations are similar if we use nominal credit growth instead of real credit growth.

[10]Results are broken down into emerging markets (EM) and advanced economies (AE), following the IMF October 2015 World Economic Outlook (WEO) classification.

Figure 3. Distribution of Correlations between Intensity Changes in Prudential Instruments and Real Credit Growth

Note: Only statistically significant correlations at the 10 percent level or less are plotted.

growth for fifty-one countries, of which thirty-three are statistically significant. Most of the distribution of these statistically significant correlations is clearly on the negative side (especially the distribution within the 25th and 75th percentiles that is captured by the boxes in the standard box plot figure). This is driven by the fact that capital requirements are not frequently changed, and the timing of changes is linked with the implementation of Basel reforms that often happen after crises or financial turmoil, coinciding with slowdowns in credit growth. The distribution of the correlations is more broadly distributed in the case of the sector-specific capital buffer (Cap. SSB) than the general capital requirements (sixteen statistically significant correlations out of twenty-five available correlations), with the median being slightly above zero for the EM and AE groupings. Despite being among the most widely used instruments (Cerutti, Claessens, and Laeven 2015), changes in the intensity of usage in the concentration ratio (Conc. ratio) and interbank exposure (Interbank exp.) limits do not show many significant correlations with the evolution of credit growth. This result is not explained by the correlations being insignificant, but by the fact that the intensity in the

usage of these two instruments does not change for most countries (fourteen statistically significant correlations out of eighteen calculated for concentration limits, and eight statistically significant out of eleven calculated for interbank exposure limits). Moreover, most of these statistically significant correlations are for EMs, and the distribution of correlations is broadly across positive and negative values. Therefore, this evidence suggests that instruments linked to capital buffers, concentration limits, and interbank exposure limits are used with more structural objectives in mind (e.g., creating capital buffers, and lowering risks either with a microprudential or macroprudential perspective), instead of business or credit cycle considerations.

In contrast, the correlations for the LTV ratio limits (LTV cap) and foreign-currency (RR foreign) and local-currency (RR local) reserve requirements with credit growth signal a countercyclical usage in most cases. The correlations of the local-currency reserve requirement index (twenty-six statistically significant correlations out of thirty-nine calculated) are positive for both emerging markets and advanced economies. With the exception of Argentina, there are nine emerging markets (Hungary, Croatia, Ukraine, Romania, Philippines, Lithuania, Peru, Brazil, and Turkey) with significant positive correlations. The results are similar for the index of foreign-currency reserve requirements in emerging markets (eight statistically significant correlations out of fourteen calculated; these countries are Romania, Argentina, Peru, Chile, Russia, Colombia, Brazil, and Croatia, which is an outlier on the negative side). These results are in line with those presented in the related literature. For example, Federico, Vegh, and Vuletin (2014) find a positive correlation between the evolution of reserve requirements and countries' real GDP growth. Although not expected, there are fourteen advanced economies with local-currency reserve requirements that exhibit positive and significant correlations (such as Italy, Spain, Portugal, Greece, Singapore, Netherlands, Slovenia, France, etc.).[11] Foreign-currency reserve requirements appear to be irrelevant in advanced economies, with only three calculated correlations, of which only one (Slovakia) is statistically significant.

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[11] For euro-area countries, reserve requirements ratios are determined by the European Central Bank.

## Figure 4. Distribution of Correlations between Intensity Changes in LTV Ratio Limits and House Prices
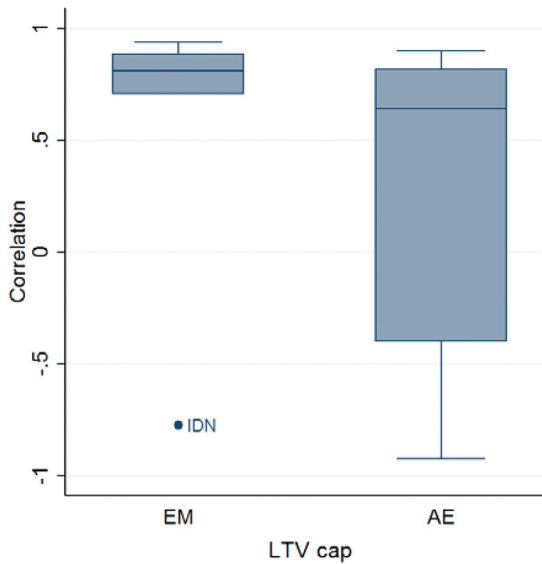
Note: Only statistically significant correlations at the 10 percent level or less are plotted.

The correlations between LTV ratio limits and credit growth (there are seventeen statistically significant correlations out of twenty-one calculated) suggest that some advanced economies have used this instrument more countercyclically. Several countries have positive correlations with respect to credit growth (Spain, Norway, Denmark, Singapore, Iceland, Luxembourg, Hong Kong, and Canada), with the only exceptions being Korea and the Netherlands. As highlighted in the literature (Cerutti, Claessens, and Laeven 2015), the effect of LTV ratio limits on house prices is not clearly specified on average across countries. This is also visible in figure 4 for AEs, where the statistically significant correlations between LTV ratio limits and house prices are above and below zero.[12]

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[12]The positive significant correlations between LTV ratio limits and house prices are mostly from Asia (e.g., Hong Kong, South Korea, Malaysia, and India). This correlation captures the effect of lending standards on house prices, and is

Figure 5. Distribution of Correlations between Intensity Changes in Prudential Instruments and Policy Rates
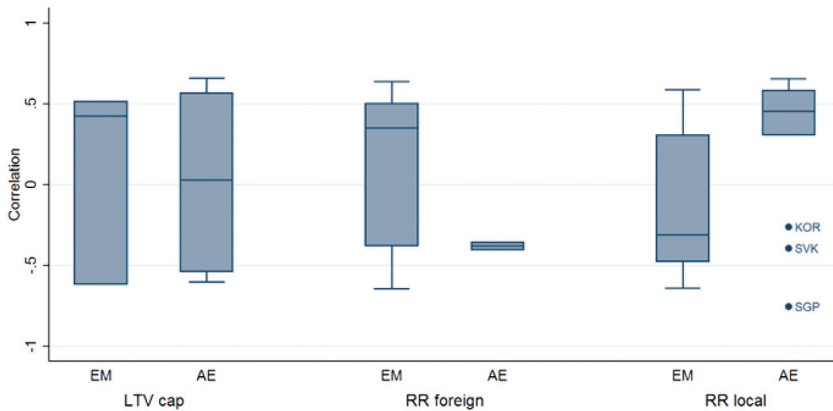
Note: Only statistically significant correlations at 10 percent or less are plotted.

The correlations of both LTV ratio limits and reserve requirements with countries' policy interest rates are also revealing and are shown in figure 5.[13] In the case of LTV caps, unlike the correlations with credit growth, there are advanced economies with statistically significant positive correlations (Denmark, Luxembourg, and Iceland), as well as another group with statistically significant negative correlations (Singapore, Hong Kong, and Canada). The median is around zero. We find a similar result for three emerging economies. These findings suggest that LTV caps are used in several countries together with higher policy rates to achieve, perhaps, complementary objectives. But this pattern does not apply in all countries, as shown by some statistically significant negative correlations.

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supported by some studies (e.g., Igan and Kang 2011; International Monetary Fund 2011; Akinci and Olmstead-Rumsey 2015; Cerutti, Dagher, and Dell'Ariccia 2015) that have found a positive relationship between LTV limits and house price increases over time. Other studies like Vandenbussche, Vogel, and Detragiache (2015), which focuses on Eastern Europe, find that other instruments, such as capital and non-standard liquidity measures, had a larger impact on house prices.

[13]The correlations (not reported) between policy rates and the intensity of usage of capital buffers, concentration limits, and interbank exposures limits are in line with the correlations with credit growth. The changes in the usage intensity of these instruments is not related to the monetary policy stance.

In the case of reserve requirements, many EMs appear to use this instrument, especially for local-currency accounts, as a way to (at least partially) offset the effects of changes in the policy rate (for example, India, Argentina, the Philippines, China, and Bulgaria have negative and significant correlations between reserve requirements and policy rates). However, we find the opposite pattern in a smaller group of countries, since Romania, Poland, and Lithuania display statistically significant positive correlations. Among advanced economies, changes in local-currency reserve requirements are positively correlated with policy rates in ten countries (all members of the euro area), showing that in most cases, changes in local-currency reserve requirements and policy rates were used as complementary policies.

5.   Conclusions

We have compiled and documented a unique data set measuring changes in the intensity of use for nine widely used prudential tools, covering a large sample of sixty-four countries over the period between 2000:Q1 and 2014:Q4. We find that LTV caps and reserve requirements (on foreign and local currency) have the largest number of tightening and loosening episodes. We also provide evidence related to the correlations between changes in prudential instruments and key financial variables such as credit, policy rates, and house prices. Changes in capital buffers, concentration limits, and interbank exposures are aimed at achieving more structural objectives, such as enhancing the resilience of the banking sector, and lowering risks either with a microprudential or macroprudential perspective. In contrast, we show that the use of LTV ratio limits and foreign and local-currency reserve requirements appear more consistent with countercyclical policy objectives in most cases, but with some important heterogeneity across countries. Lastly, some of our tests indicate complementary and non-complementary interactions between a few of the prudential policy instruments and monetary policy rates.

As part of the initiative of the IBRN on cross-border prudential policy spillovers, which consisted of a research project involving multiple countries and international organizations, the data set documented in this paper makes a clear contribution. While this

database is used across all of the studies of that initiative, and helps inform the analysis of the effectiveness of prudential instruments and their potential unintended consequences at the international level, the database has much broader relevance. Given the unique nature of the data set, it will further provide a service to future analyses in the research and policy communities on the use and the effectiveness of microprudential and macroprudential policies toward either controlling credit growth or increasing the resilience of the financial sector.

Appendix

Table 3. List of Countries

Argentina	Germany	Malaysia	Singapore
Australia	Greece	Malta	Slovak Republic
Austria	Hong Kong	Mexico	Slovenia
Belgium	Hungary	**Mongolia**	South Africa
Brazil	Iceland	Netherlands	South Korea
Bulgaria	India	New Zealand	Spain
Canada	Indonesia	**Nigeria**	Sweden
Chile	Ireland	Norway	Switzerland
China	Israel	Peru	Taiwan
Colombia	Italy	Philippines	Thailand
Croatia	Japan	Poland	Turkey
Czech Republic	**Kuwait**	Portugal	Ukraine
Denmark	Latvia	Romania	United Kingdom
Estonia	**Lebanon**	Russian Federation	United States
Finland	Lithuania	**Saudi Arabia**	**Uruguay**
France	Luxembourg	Serbia	**Vietnam**

Note: Countries with limited information are in bold font.

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