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Dynamic Loan Loss Provisioning: Simulations on Effectiveness and Guide to Implementation

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Dynamic Loan Loss Provisioning: Simulations on Effectiveness and Guide to Implementation

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Abstract

This simulation-based paper investigates the impact of different methods of dynamic provisioning on bank soundness and shows that this increasingly popular macroprudential tool can smooth provisioning costs over the credit cycle and lower banks' probability of default. In addition, the paper offers an in-depth guide to implementation that addresses pertinent issues related to data requirements, calibration and safeguards as well as accounting, disclosure and tax treatment. It also discusses the interaction of dynamic provisioning with other macroprudential instruments such as countercyclical capital.

JEL Classification Numbers: G21, G28

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I. Introduction

Reducing the procyclicality of the banking sector by way of macroprudential policy instruments has become a policy priority. The recent crisis has illustrated how excessive procyclicality of the banking system may activate powerful macro-financial linkages that amplify the business cycle and how increased financial instability can have large negative spillover effects onto the real sector.[2] Moreover, research has shown that crises that included banking turmoil are among the longest and most severe of all crises.[3]

Although there is no consensus yet on the very definition of macroprudential policy, an array of such tools, especially those of countercyclical nature, has been applied in many countries for years.[4] But it was only during the financial crisis that powerful macro-financial linkages played out on a global scale, conveying a sense of urgency.

In the wake of the crisis, policymakers therefore intensified their efforts to gear the macroprudential approach to financial stability towards improving banks' capacity to absorb shocks—a consultative process that culminated in the development of the Basel III framework in December 2010 to be phased in over the coming years. In addition to improving the quality of bank capital and liquidity as well as imposing a minimum leverage ratio, this new regulatory standard introduces countercyclical capital buffers and lends support to forward-looking loan loss provisioning, which comprises dynamic provisioning (DP).

The new capital standard promotes the build-up of capital buffers in good times that can be drawn down in periods of stress, in the form of a capital conservation requirement to increase the banking sector's resilience entering into a downturn.[5] Part of this conservation buffer would be a countercyclical buffer that is to be activated only when there is excess credit growth so that the sector is not destabilized in the downturn. Such countercyclical capital has also been characterized as potentially cushioning the economy's real output during a crisis (IMF, 2011). Similarly, dynamic provisioning requires banks to build a cushion of generic provisions during an upswing that can be used to cover rising specific provisions linked to loan delinquencies during the subsequent downturn.

Both countercyclical capital and DP have been applied in practice. Some countries have adjusted capital regulations in different phases of the cycle to give them a more potent countercyclical impact:[6] Brazil has used a formula to smooth capital requirements for interest

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[2]Borio and Furfine (2001), Panetta et al. (2009).

[3]Reinhart and Rogoff (2010).

[4]IMF(2011), Lim et al. (2011).

[5]BCBS (2010a).

[6]Lim et al. (2011).

rate risk in times of extreme volatility, China introduced a countercyclical capital requirement similar to the countercyclical buffer under Basel III, and India has made countercyclical adjustments in risk weights and in provisioning. DP was first introduced by Spain in 2000 and subsequently adopted in Uruguay, Colombia, Peru, and Bolivia, while other countries such as Mexico and Chile switched to provisioning based on expected loan loss. Peru is the only country to explicitly use both countercyclical instruments in combination.

The concept of DP examined in this paper is intriguing. By gradually building a countercyclical loan loss reserve in good times and then using it to cover losses as they arise in bad times, DP is able to greatly smooth provisioning costs over the cycle and thus insulate banks' profit and loss statements in this regard. Therefore, DP may usefully complement other policies targeted more at macroeconomic aggregates.[7] The implementation of DP can, however, be a delicate balancing exercise. The calibration is typically challenging because it requires specific data, and even if these are available, it may still be inaccurate if the subsequent credit cycle differs substantially from the previous one(s) on which the model is necessarily predicated.[8] Over-provisioning may ensue in particular instances. This said, a careful calibration that tries to incorporate as many of the stylized facts of past credit developments as possible goes a long way in providing a sizeable cushion for banks to withstand periodic downswings.

This paper provides strong support for DP as a tool for countercyclical banking policies. Our contribution to this strand of the literature is threefold. We first recreate a hypothetical path of provisions under different DP systems based on historical data of an emerging banking market and compare the outcome to the actual situation without DP. These counterfactual simulations suggest that a well-calibrated system of DP mitigates procyclicality in provisioning costs and thus earnings and capital. Second, using Monte-Carlo simulations we show that the countercyclical buffer that DP builds typically lowers a bank's probability of default. Finally, we offer a guide to implementation of the DP concept that seeks to clarify issues related to data requirements, choice of formula, parametrization, accounting treatment, and recalibration.

Other studies that have used counterfactual simulations based on historical data to assess the hypothetical performance under DP include Balla and McKenna (2009), Fillat and Montoriol-Garriga (2010), both using U.S. bank data, and Wezel (2010), using data for Uruguay.[9] All studies find support for the notion that DP, when properly calibrated, can help absorb rising loan losses in a downturn and thus be a useful macroprudential tool in this regard. Some other

[7]Drehmann et al. (2011).

[8]Saurina (2009c) notes that in Spain, where the DP system was calibrated on data that included the then worst recession in 40 years, the buffer was insufficient to cover the losses in the current crisis—the worst in a century.

[9]Burroni et al. (2010) and Saurina (2009b) present comparable simulations based on a constructed dataset.

studies (Lim et al., 2011; Peydró-Alcalde et al., 2011) even find that DP is effective in mitigating swings in credit growth, although this should not be expected of DP in general.

The paper is organized as follows. Section II describes the development of countercyclical banking regulation. Section III turns to the existing systems of DP and illustrates the specific properties of each of them. Based on actual bank data of an emerging market country, sections IV and V present the simulation outcome on effectiveness of DP, showing that DP generally is able to smooth provisioning costs over the cycle and that it diminishes banks' probabilities of default. In Section VI we provide a detailed guide to implementation for policymakers interested in introducing the DP concept. Section VII discusses whether DP and countercyclical capital should be viewed as complements or substitutes. Section VIII concludes.

II. Evolution and Elements of Countercyclical Banking Regulation

The global financial crisis was a product of many interlinked factors, but the procyclicality of banking operations has generally been perceived as a root cause. A general consensus on the need to limit the procyclicality implied by the regulatory framework, including the Basel II Accord, emerged during the crisis and rapidly crystallized due to the magnitude of the harmful macro-financial linkages. Consequently, international fora and bank regulators hastened to work on countercyclical regulation.

In April 2009, the G-20 confirmed the consensus that had been emerging since the Washington Fall 2008 summit that a system of capital buffers should be implemented and that capital requirements should be countercyclical. The G-20 (2009) recommendations were based on the report by the Financial Stability Forum (2009) on addressing procyclicality in the financial system, which itself was the product of collaborative work done by seven international bodies.[10] Ideas were also generated by regulators and academics, including the Turner Review of the Financial Services Authority (2009) that advocated in capital requirements "overt counter-cyclicality in order to offset the impact of unavoidable procyclicality elsewhere", and the Eleventh Geneva Report on the fundamentals of financial regulation (Brunnermeier et al., 2009) that stated that the main problem with Basel II was that it ignored macroprudential risk. The G-20 also asked the Basel Committee for Banking Supervision (BCBS) to produce guidelines to harmonize the definition of capital by the end of 2009 and to issue recommendations on minimum capital requirements by 2010.

The recommendations that the BCBS published in December 2010 became known as the Basel III framework. This framework explicitly provides for measures with the macroprudential goal

[10] Basel Committee on Banking Supervision, Bank for International Settlements, Committee on the Global Financial System, International Monetary Fund, International Accounting Standards Board, International Organization of Securities Commissions, and U.S. Financial Accounting Standards Board.

of mitigating credit cycles. These include the aforementioned countercyclical capital buffer and stressed inputs for internal models for counterparty credit risk. Basel III also backstops the capital requirements with a new leverage ratio and requires financial institutions to increase their ability to withstand liquidity shocks in downturn conditions (manifested in the *Liquidity Coverage Ratio* and *Net Stable Funding Ratio*). However, unlike with capital reform Basel III does not promote a clear framework for forward-looking provisioning beyond supporting the concept in general terms, not least due to the ongoing debate on the reform of international accounting standards.

A number of countercyclical measures to specifically address macroeconomic risk have been proposed, some of which are reflected in the Basel III framework. Rules that relate the accumulation of countercyclical buffers to system-wide indicators such as credit growth, leverage, or asset price dynamics have been formulated and in some instances already been implemented.[11] Rules have been proposed that take into account banks' leverage ratio and maturity mismatches between assets and liabilities, eventually categorized by currency (such as *CoVaR* by Adrian and Brunnermeier, 2008). Drehmann et al. (2010, 2011) explore the options available to implement a countercyclical capital buffer based on a conditioning variable that signals the time to build up and release capital buffers. Moreover, rules aimed at limiting the risk imposed by systemically important financial institutions onto the rest of the financial system are being implemented, both at the international and national level.[12] Measures entailing an insurance-type of approach to systemic risk have also been envisaged. These propose to issue contingent claims, which convert into equity when the need arises—so called contingent capital instruments[13]. For contingent liquidity buffers, a corresponding approach seeks to allow banks to keep funds if there is turmoil in liquidity markets.[14]

Dynamic provisioning as a countercyclical tool was more widely adopted just before or during the global financial crisis. The concept that has been promoted by regulators and scholars alike (e.g., BCBS, 2009 or Brunnermeier et al., 2009) has become more differentiated over time in the sense of applying macroeconomic trigger rules for DP accumulation and basing the DP rates explicitly on the probability of default. Regulatory efforts to allow forward-looking

[11]A few countries used reserve requirements linked to system-wide measures of credit expansion (Lim et al. 2011): Bulgaria introduced a marginal reserve requirement for banks exceeding average credit growth; China introduced caps on credit growth for major banks, and the authorities issued "verbal" guidance to banks to temporarily stop lending; in Croatia lower credit ceilings (2003 and 2007-2008) were introduced; and Peru in 2011 introduced countercyclical capital linked to GDP growth.

[12]For the international framework see Financial Stability Board (2010) and BCBS (2011); for a national example (United States) see Dodd-Frank Act (2010) and Tarullo (2011).

[13]Pazarbasioglu et al. (2011). To be sure, such instruments are not eligible for Common Equity Tier 1 capital requirements (BCBS, 2010a) nor additional capital requirements for global systemically important banks (BCBS, 2011).

[14]Nicoletti-Altimari and Salleo (2010).

provisioning (but not necessarily DP, see Section VI) have been made under the purview of the international accounting standard setters. The principal DP concepts are described in the next section.

III. Overview of Countercyclical Provisioning Systems

A. Through-the-Cycle Accumulation Systems

The Spanish DP formula, first applied in 2000 and modified in 2005 to comply with international accounting standards, is designed to build up general provisions that account for: (i) expected losses in new loans extended in a given period and (ii) the average provision over the cycle applied to the outstanding stock of loans at the end of that period after netting off specific provisions incurred during the period.

Algebraically, for new loans of a homogeneous category k, ΔC_t^k, general provisions, GP_t, should be increased by the amount $\alpha^k \Delta C_t^k$, where α^k is the rate of credit losses in category k in a cyclically neutral year. This first component is an incremental provision that accounts for expected losses in new loans.

It is also necessary to hold an amount of generic provisions that reflects the average specific provision expected to be made during the business cycle but that is not yet incurred. This amount is equal to $\beta^k C_t^k$, where $\beta^k$is the average specific provision for loans in category k through the cycle, and C_t^k is the outstanding amount of loans. Finally, this component is corrected for specific provisions incurred in the current period, SP_t^k.[15] As a result, generic provisions are accumulated (or drawn down) in any given period t according to the formula below:

$$\Delta GP_t = \sum_{k=1}^{N} \left(\alpha^k \Delta C_t^k + \beta^k C_t^k - SP_t^k \right),$$

where the different loan categories and the choice of parameters in the formula above are determined by the regulatory agency for all banks, as is the case in Spain. Hypothetically, this generic provision could be calibrated separately for each bank based on individual historical data on loan losses and provisions, which we simulate in Section IV.B.[16] The above equation indicates that banks can reduce their stock of generic provisions when specific provisions exceed expected losses from new loans and average specific provisions, a situation typically

[15]This is the net flow of provisions, comprised of provision inflows net of releases of provisions and of recoveries of written-off loans.

[16]The Bank of Spain actually allows banks to use their own internal models to determine DP rates but until recently reportedly none of them had chosen to do so.

encountered during an economic downturn. Therefore, successful implementation of a DP system hinges on building up an adequate stock of provisions early in the credit cycle.

The Spanish system provides for six different loan categories differentiated by loan risk.[17] The system also specifies that cumulative provisions must not exceed 125 percent of the inherent losses of the loan portfolio, $\sum_{k=1}^{N} \alpha^k C_t^k$.

Uruguay adopted a slightly modified version of the Spanish DP system in 2001. Apart from a diverging definition of loan categories for DP, the formula maintained a different upper limit to the DP fund, specifically a limit of 3 percent of total loans, even after Spain switched to a limit linked to latent loss in 2005. This system led to a very high cushion of dynamic provisions (as high as six times non-performing loans), which in 2011 prompted an overhaul of the formula that introduced an alpha parameter and otherwise sought to align provisioning rates with expected loss (see section VI.F on recalibration for details). Importantly, dynamic provisions are now made only against performing loans, as is also the case in Peru and Spain.

B. Trigger-based Surcharge Systems

A number of systems prescribe to accumulate (draw down) dynamic provisions only during a boom (bust) period that is determined by applying a trigger rule linked to macroeconomic or financial developments. The Peruvian DP system,[18] originally introduced in 2000 by the national Superintendence of Banks (SBS) and modified in 2008, consists of a two-tier generic loan loss provision with a fixed (or permanent) component[19] and an additional variable (or dynamic) component that is activated via a trigger rule.

In a period of strong economic growth, the variable component is added to the permanent component when the trigger prescribes to do so, and during a downturn the accumulated variable reserve is to be run down,[20] thereby fully offsetting the cost of specific provisions.

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[17]These are, in ascending order of risk (alpha, beta parameter): negligible risk—cash and public sector exposures (0.0%, 0.0%), low risk—mortgages with a loan-to-value ratio below 80% (0.6%, 0.11%), medium-low risk—mortgages with a loan-to-value ratio of 80% or above (1.5%, 0.44%), medium risk—loans not included in other categories (1.8%, 0.65%), medium-high risk—consumer durables financing (2.0%, 1.1%), and high risk—credit card exposures and overdrafts (2.5%, 1.64%).

[18]See Canta (2010).

[19]The fixed part of the generic provision is linked to the loan; that is, it cannot serve to offset rising specific provisions elsewhere in the loan portfolio but rather stays with the loan as it migrates to a delinquent classification category, reducing the required specific provision by the amount already provisioned under this fixed part of DP.

[20]Banks in Peru actually have the option of not using the DP reserves to offset loan delinquencies, as all of them did during the 2008-09 downturn. This choice may be ascribed to the preference of banks for high generic provisions or the lack of a pressing need for using them to offset costs.

Specifically, the accumulation of the dynamic part is activated if either the average of annualized GDP growth of the previous 30 months exceeds 5 percent or if this average during the previous 12 months is 2 percentage points higher than one year before. Similarly, the rule is deactivated if this average growth rate once again falls below 5 percent or if it is 4 percentage points lower than one year before—an asymmetric feature acknowledging the possibility of sudden starts/stops.

The Peruvian system assigns different DP rates for the continuum of relatively safe to risky loans, ranging from 0.3 to 1.5 percent for a total of eight loan categories.[21] These rates represent the variable component of generic provisions, while the fixed portion currently is either 0.7 or 1.0 percent, depending on the loan type. The Peruvian supervisory agency determines these components broadly as a function of the expected loss for these eight loan categories, i.e. exposure at default multiplied by the probability of default (PD) under stress times loss given default (LGD) under stress, using client-level data for a full credit cycle.

A similar countercyclical system was introduced in Bolivia in December 2008 and phased in over 27 months. The dynamic provision covers only the retail loan portfolio, with rates of 1.5 and 1.6 percent for mortgage and microcredit lending, respectively, and 2.3 percent for consumer lending. Once fully constituted, banks are to draw down (restore) their DP funds if they have experienced an increase (decrease) in the ratio of specific provisions to total loans for six consecutive months. This bank-specific trigger is in contrast to the Peruvian system that links the (de-)activation of the trigger rule to macroeconomic developments.

C. Expected Loss Provisioning Systems

Expected through-the-cycles loss provisioning represents a purer method of anticipating loan losses and is broadly in line with the Basel II principles. As explained in more detail in Section VI.E., the Basel II framework allows expected loss provisioning, but only based on point-in-time estimates and not necessarily on through-the-cycle or downturn losses.

The main difference to DP is that instead of gradually building a pool of generic provisions for covering eventual losses anywhere in the loan portfolio, this method requires a specific provision on a newly-originated loan that reflects expected through-the-cycle loss. This brings the benefit of explicitly incorporating individual borrower characteristics that drive loan performance. That is, each loan carries an individual specific provision from the outset based on a given set of criteria, even though no loan impairment has occurred yet. Typically, such

[21]These are, in ascending order of risk (fixed, variable DP rate): mortgage loans (0.7%, 0.4%), commercial loans (0.7%, 0.4%), loans to large enterprises (0.7%, 0.45%), loans to medium-size enterprises (1.0%, 0.3%), loans to small enterprises (1.0%, 0.5%), microfinance loans (1.0%, 0.5%), non-revolving consumer loans (1.0%, 1.0%), and credit card loans (1.0%, 1.5%).

loans would command a small generic provision, either at the level of the banking system, or as with DP, for a portfolio of largely homogeneous loans extended to a certain sector.

If the calibrated provisioning rates are an accurate measure of individual future delinquency rates and explicitly account for losses under downturn conditions, this provisioning system is second to none. However, if the estimation produces systematically biased provisioning rates, widespread over- or under-provisioning will ensue, and due to the lack of a general DP fund estimation errors in one part of the portfolio cannot be offset by the effect of opposite deviations elsewhere. In addition, the approach requires access to sufficiently granular borrower data for it to imply a meaningful step up from other forward-looking methods like dynamic provisioning.

For example, the Mexican system that was enacted in 2011 derives the PD of consumer and mortgage loans from including in the regression certain loan and debtor characteristics such as original and remaining value as well as tenor of the loan, the number of missed payments, the subcategory of the loan (personal, automobile etc.), and the loan-to-value ratio in the case of mortgages. The LGD is also estimated in a differentiated fashion.

A simplified expected loss model, the Chilean system of countercyclical provisions introduced in 2011 assigns to each loan category a predetermined rate of expected loss.[22] The regulator has derived quantitatively a non-linear PD and LGD for each of the six normal and four substandard categories, yielding a precise estimate of expected loss. While the degree of differentiation is less than under the Mexican system, the Chilean system is arguably easier to operate as it requires banks only to assign clients to one of these subcategories. In addition, banks can also make voluntary countercyclical provisions.

As a third example, the Colombian system can be considered a combination of a trigger-based DP system and expected loss provisioning. In place since 2007, it requires banks to accumulate countercyclical provisions, unless a total of four thresholds relating to the bank's provisioning and credit growth are crossed.[23] The accumulation of generic provisions is based on expected loss (PD and LGD), both by grade and type of loan.

[22] A first system of forward-looking provisioning based on banks' internal models was introduced in 2004 (see Banco Central de Chile, 2011).

[23]The accumulation rule is de-activated if within the previous three consecutive months all of the following occurred: a change in net provisions of more than 9 percent, ratio of net provisioning costs to interest income of more than 23 percent, ratio of net provisioning costs to the financial margin of more than 45 percent and credit growth of less than 23 percent.

IV. Simulation of DP Paths under Different Formulas

A. Sample Properties and Parameter Calibration

The following simulations illustrate the buildup and drawdown of dynamic provisions under the Spanish and the Peruvian DP formulas, using historical data of an emerging market country.[24] As will be seen, these two fundamental DP concepts are similar in their countercyclical approach but still differ considerably in the timing of DP flows, smoothing of provisioning costs, and coverage of loan delinquencies.

To apply the two DP concepts in a comparable setting, the historical simulations used as sample monthly data for 14 Chilean banks between January 2004 and June 2010, thus spanning approximately a full credit cycle.[25] The loan, provision, write-off and loan recovery data were available disaggregated by commercial, mortgage and consumer lending operations, thus representing a somewhat more aggregated level than in the actual cases of Spain and Peru that have six and eight categories, respectively.

Spanish Formula

In the following simulations, the Spanish DP formula was calibrated using monthly data of average write-offs for the alpha parameters and net provision flows for the beta parameters (all weighted by bank size) during the sample period. In this, the calibration deviates slightly from the Spanish model in that takes as alpha the average loss rate along the cycle rather than during a cyclically neutral year, given the difficulty of determining such a year without further information.

On an annualized basis, the computed alpha parameters ranged from 0.16 percent for mortgage loans and 0.30 percent for commercial loans to 4.54 percent for consumer loans. Correspondingly, the beta parameters were calculated as 0.31, 0.49 and 5.09 percent. All these rates were converted into monthly rates to be applicable in the simulation that makes use of monthly data. As in the current Spanish model, an upper limit of 125 percent of latent loss (here, the average write-off rate—invariable through the cycle) was imposed in the simulation.

In an additional simulation the alpha and beta parameters were calculated separately for each bank in the sample, as described above. Quite naturally, the maximum rates greatly exceeded

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[24]The simulations are clearly subject to the Lucas Critique in that we do not model banks' endogenous responses to the hypothetical countercyclical regulation.

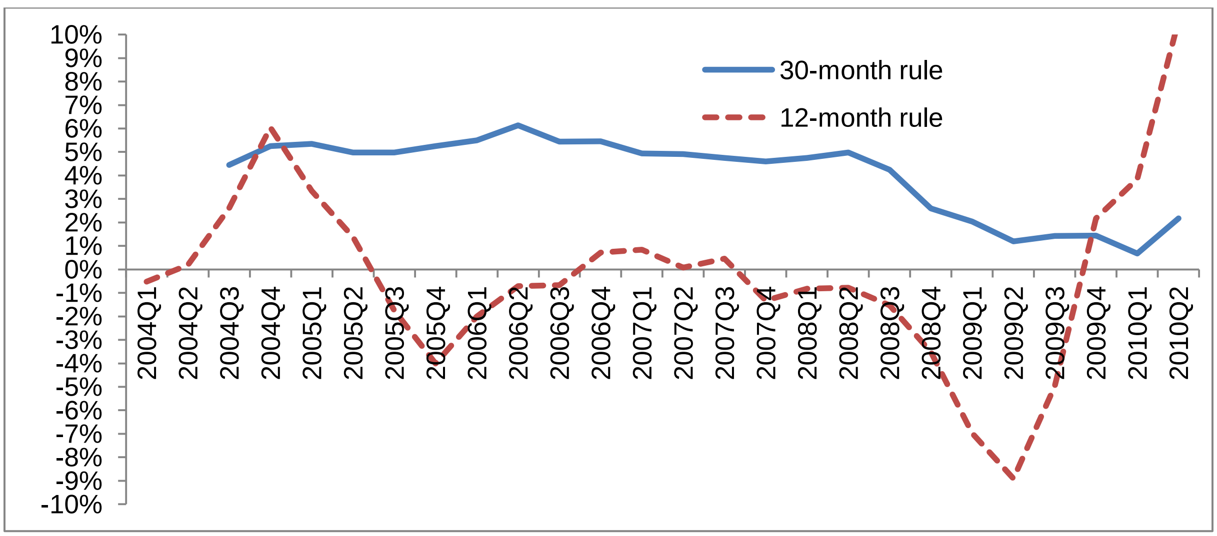
[25]Data supplied by the Superintendency of Banks and Financial Institutions Chile (SBIF). A few banks were not included in the sample because they exhibited irregular data inhibiting the application of DP formulas (e.g., zero provisions/losses in some loan categories, or higher releases of provisions than inflows of provisions).

the system-wide rates, with alpha and beta parameters for consumer loans as high as 7.56 percent and 9.22 percent, respectively.

Peruvian Formula

In the simulation, the Peruvian rule was activated in 2004Q4 when the average Chilean GDP growth rate exceeded the rate four quarters prior by 2.6 percentage points (Figure 1). In a slight deviation from the Peruvian regulation and mindful of Chile's somewhat lower trend growth, the rule was de-activated in 2008Q3 when the 30-month average growth rate fell below 4.5 percent (to 4.2 percent, after hovering between 4.6 and 4.9 percent during 2007Q1-2008Q2). At the end of the downturn, in 2009Q4, the rule was re-activated after the average rate exceeded the rate 12 months prior by 2.2 percentage points.[26]

Figure 1. Average Chilean GDP Growth Rates for Activation/De-Activation of DP Rule



Source: SBIF and staff calculations.

In the simulation the variable rates of the Peruvian DP formula were approximated by using the actual loan default rates experienced in Chile during 2004Q1-2010Q2, since debtor-level data were not available for the investigation. Notwithstanding the approximation, this approach leads to perfect-foresight results and would not be replicable in reality, as default rates vary between credit cycles. The rates also represent a somewhat narrower definition than under Basel II that regards default as non-performing loans 90 days or more past due. Specifically, as proxy for the PD and thus the fixed component of the Peruvian DP formula we took the median rates for each of the three aggregated loan categories (consumer, mortgage, commercial) of the

[26]In practice, a more thorough calibration of thresholds would be preferable.

14 banks in the sample. As stress PD and thus the variable component (i.e., stress PD minus median PD) we chose the second-to-the-highest PD observed which corresponds to the 85th percentile of the sample distribution.[27] As no information on the LGD in Chile was readily available, we resorted to applying the LGD rates used in neighboring Peru. Therefore, the variable DP rate is calculated as: (stress PD * stress LGD) – (median PD * median LGD). Table 1 summarizes the PD, LGD and DP rates used in the simulation.

Table 1. Imputed PD, LGD and DP Rates for Peruvian DP Formula (in percent)

Loan Type	Median PD	Stress PD	Median LGD	Stress LGD	Fixed DP rate	Variable DP rate
Consumer	4.72	7.08	45.00	70.00	2.12	2.84
Mortgage	0.18	0.34	35.00	45.00	0.06	0.09
Commercial	0.68	2.01	45.00	55.00	0.30	0.81

Source: SBIF/SBS and staff calculations.

B. Simulation of Counterfactual Provisioning Paths

Results at System Level

Figures 2 and 3 exhibit the simulation outcome, showing the build-up of DP funds at the system level and the monthly provisioning cost (in percent of loans) under the Spanish and Peruvian rules in addition to the actual path without DP. All formulas produce to different degrees a smoothing of provisioning costs compared to the clearly cyclical provisioning pattern in the absence of DP. The figures also show the performance of a modified Spanish system with bank-specific provisioning rates that reflect the entire range of the average loan delinquency rates of banks in the sample.

The accumulation of DP funds under the Spanish system, both actual and individualized, is gradual because each period a fraction of the entire loan portfolio is provisioned against. This process continues until either the maximum limit to the DP fund is reached or actual provisioning exceeds the average provisioning flow and the flow required by the alpha part, prompting a similarly gradual drawdown of the cushion. The gradual motion occurs because banks cannot completely offset any provisioning flow as under the Peruvian formula but only the difference between actual and average flows. The hypothetical Spanish system with individual rates commands a higher DP fund at the system level, reflecting the fact that a number of high-risk banks require larger buffers to offset eventual loan losses than is possible under the actual Spanish model with system-level rates. Interestingly, even under these

[27]This was done to deal with some extreme results of the largest PDs in each of the categories of this small sample, which, if incorporated, would have led to very high provisioning levels.

seemingly ideal conditions, some banks end up with positive DP funds at the end of the sample period because their individual credit cycles deviate considerably from the economic cycle.

By contrast, the Peruvian formula calls for a rapid build-up of the DP fund within a few months. Thereafter, the DP fund remains more or less constant as a share of total loans until the rule is deactivated and de-accumulation for offsetting all provisioning flows is permitted.

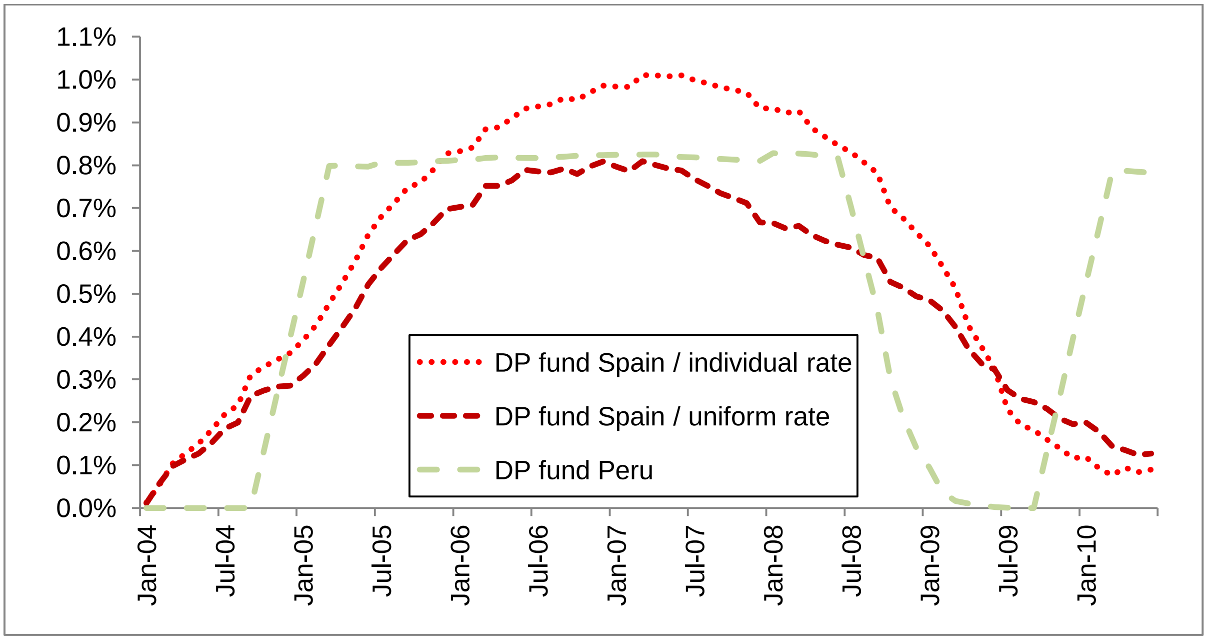
In terms of incremental provisioning costs, Figure 3 shows that the Spanish system achieves the high degree of cost smoothing over the entire credit cycle that it is capable of. Costs do rise, however, during the downturn period of 2008–09 as DP funds, notably of riskier banks, are increasingly run down and no longer absorb the above-average provisioning flows.

The official Spanish system with a uniform rate for all banks is clearly inferior to the hypothetical system using bank-specific alpha and beta parameters. The reason is that the uniform rate is optimal only for average institutions, while banks with riskier loan portfolios exhaust their buffers prematurely and safer ones never fully use up their DP funds during the downturn. Individual provisioning rates, however difficult to derive, avoid this problem altogether and tend to provide an optimal buffer for each bank.[28]

The Peruvian system causes high DP costs during the first six months of the activation phase when the additional cushion is phased in (during October 2004–March 2005 and again September 2009–March 2010). Thereafter, it mirrors the specific provisioning flow, varying only with the growth rate of new loans that require DP. There is no cost smoothing until system is deactivated, but then provisioning costs fall to zero as the extra cushion can be used to cover the entire flow of specific provisions until the DP fund is exhausted.

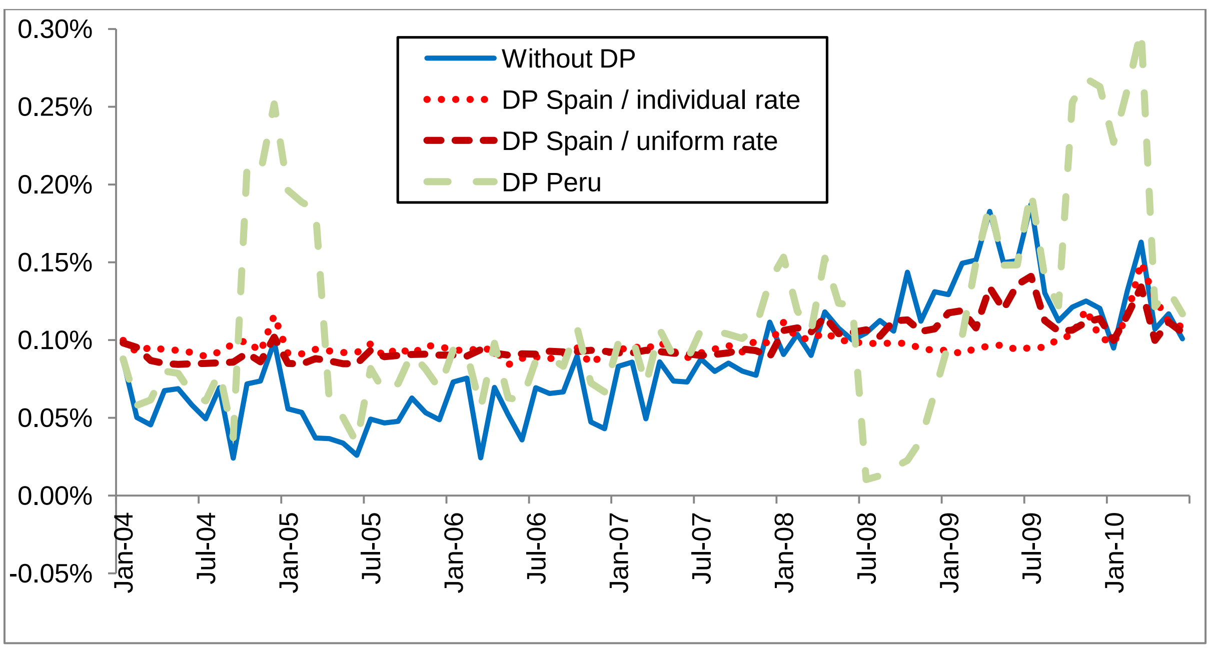
[28]In individual cases, the actual maximum DP fund may deviate from the theoretically optimal fund because either early losses during an upswing exhaust the fund during a time when it should be built or the fund hits the regulatory ceiling of 1.25 percent of total loans. In both cases, the DP fund is not as large as it would have to be to fully cover downturn losses (Section VI gives more details on this problem).

Figure 2. Accumulation Paths of DP Funds under Different DP Systems (in percent of total loans; size-weighted average)



Source: SBIF and staff calculations.

Figure 3. Total Provisioning Costs under Different DP Systems (monthly costs in percent of total loans; size-weighted average)



Source: SBIF and staff calculations.

Individual Results

Unlike the Peruvian formula under which banks differ only in how long it takes them to exhaust their DP buffers, there are a number of things that can go wrong when applying the Spanish formula. Figure 4 shows the simulation results of four banks for which the DP path and cost smoothing are clearly imperfect (the outcomes for all banks can be found in Annex I).

Consider the case of Bank 10 in the first panel where the actual system-wide model fails but bank-specific rates would achieve near-optimal buffers. As the uniform provisioning rates are too low for this bank specializing in consumer lending, the resulting DP fund is not sufficient to cover eventual loan losses. In addition, starting in late 2006 the bank registers above-average provisioning flows—well before the downturn. As a result, the bank exhausts its DP fund early and can no longer absorb the higher losses in the subsequent downturn. By contrast, the bank-specific rate is tailored to provide an optimal buffer. As this individualized fund never hits the upper limit, which would compromise an optimal accumulation, it is drawn down gradually and almost fully during the latter part of the cycle.

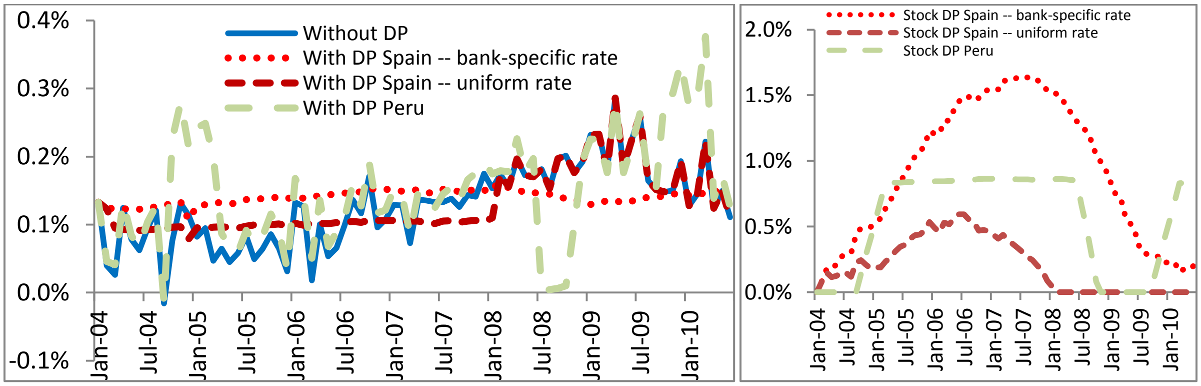
However, there are opposite cases where the bank-specific formula fails and the system-wide does not. The bank in the second panel (#3) displays a near-optimal accumulation path, as the uniform rates broadly fit the loss/provision profile of the bank. Although the bank-specific rates actually turn out to be somewhat lower, the DP fund hits the upper limit of 125 percent of the product of alpha and total loans early on. This is due to the fact that the average provision across the loan portfolio exceeds the average alpha rate, perhaps due to protracted or sporadic write-offs. In this special case, cost smoothing fails both in the upswing, when the ceiling is reached, and in the downturn, when the fund is exhausted prematurely. Apart from a brief offset in late 2007, the case is not much different from the situation without DP.

In isolated cases, neither the system-wide nor the bank-specific formula work. Bank 13 that specializes in commercial lending never manages to build its DP buffer because the system-wide rate is much too low for its relatively risky portfolio—the cost offset is near zero along the cycle. But even the bank-specific formula fails, as the bank experiences strong a-cyclical loan losses that take hold in mid-2007, i.e., before the downturn. Since the Spanish system is based on the assumption that the buffer is built completely before being drawn down, this bank's DP fund does not reach its needed size and is exhausted by a singular spike in provisions. As the main loss is transient, re-accumulation sets in soon thereafter.

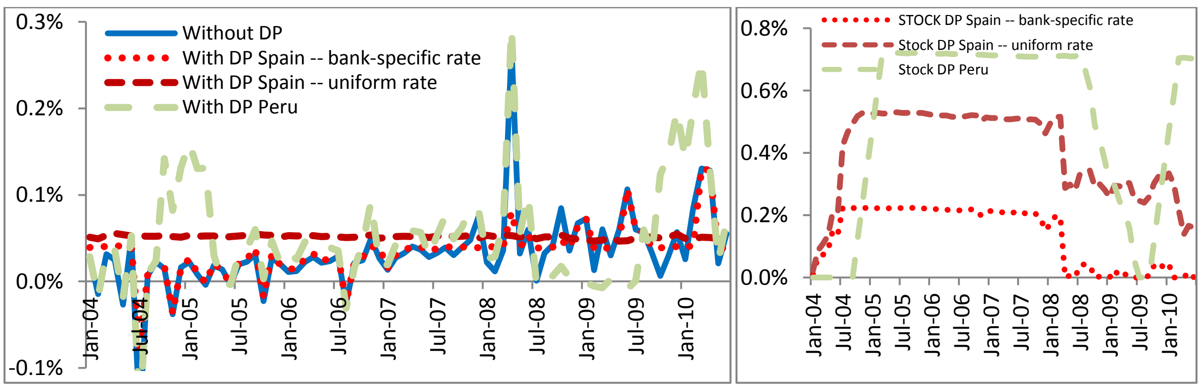
Finally, the lowermost case of Bank 12 illustrates that such a-cyclical losses can also lead to over-provisioning. The bank suffers a major provisioning hike at the beginning of the cycle (in late 2004) when its DP fund is still incipient. Since in the simulation this a-cyclical spike is factored into the calculation of the average provision, the downturn provisioning flow is too low relative to what it should be under a normal credit cycle. Hence, the bank is left with a positive DP fund at the end of the cycle. Arguably, this case is less problematic than the other three.

Figure 4. Provisioning Costs and Paths of DP Funds of Individual Banks

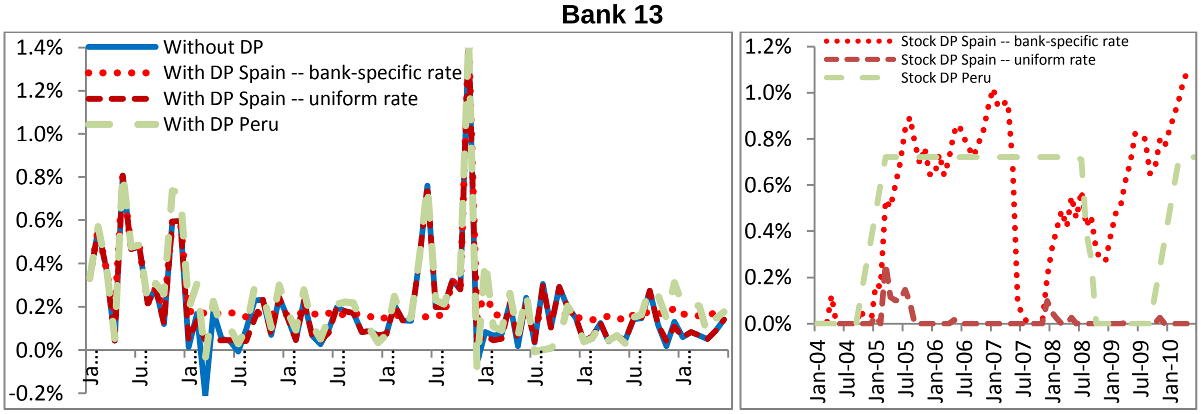
Bank 10



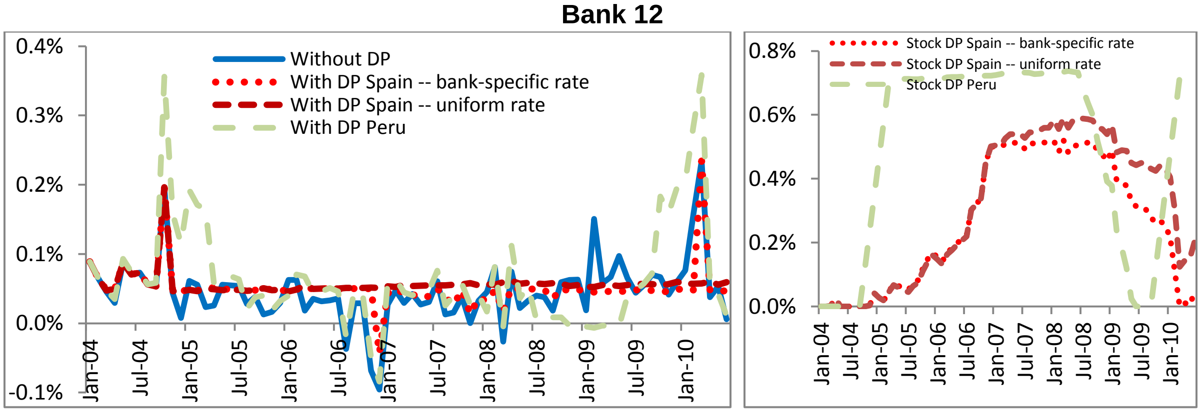
Bank 3



Bank 13



Bank 12



Source: SBIF and staff calculations.

V. Impact of DP on Bank Soundness

A. Simulation Design

The counterfactual simulations have shown that DP can mitigate the procyclicality of provisions and thus smooth costs over the cycle. However, no study has attempted to answer quantitatively the question whether DP can actually improve financial stability by lowering a bank's probability of default.[29] To show that it does, we run Monte-Carlo simulations that seek to determine the probability of exhausting loan loss reserves under standard provisioning and DP. The assessment of bank soundness was carried out by applying the Spanish DP rule to the same sample of 14 banks in Chile between 2004 and mid-2010. The parameters of the Spanish system were calibrated individually for each bank based on its historical data on loans, provisions, and write-offs.

The choice of an individual bank calibration rather than a system-wide calibration was guided by substantial differences in business models across banks, which suggests that a one-size-fits-all model may not be appropriate. For instance, some banks are not active in mortgage lending, and some banks lend mainly to upper-income households while others target the middle and low-middle income segment.

Simulation analysis was used to assess differences in bank solvency under the provisioning regime in operation during the sample period and, alternatively, under DP. The simulation analysis was based on 20,000 draws of a loan loss cycle lasting 78 months (6½ years) for each bank. In each simulation draw, the initial stock of provisions was set equal to 1.5 percent of the total amount of outstanding loans. The loan origination in each loan category (consumer, commercial, and mortgage) was set equal to the observed historic series. Dynamic provisions were calculated using historical bank-specific data on provisions, loan losses and recoveries (as explained in Section IV.A.). For each bank, the aggregate losses were generated randomly from either unit root or autoregressive processes of order one (AR (1)) fitted to the bank's historical write-off series to capture as closely as possible the cyclical nature of loan losses.[30] Since the residuals in the estimated processes exhibited non-normality, they were generated from extreme value distributions fitted to the data (Table 2). Once the artificial write-off data was generated, the path of provisions under the current regime and dynamic provisions were calculated.

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[29] To be sure, Ball and Mc Kenna (2009) link after-provision profit to the capital level and so show that a bank applying dynamic provisioning can avoid failing the capital requirement, but this broad result is specific to the particular assumptions made in the example.

[30] A comprehensive simulation would have required the joint estimation of the loan generation and write-off processes—a complex econometric exercise. To simplify, the loan generation history was kept fixed and different write-off histories were generated in order to see how banks would have fared under alternative write-off shocks consistent with past developments. We use an AR (1) process since write-offs likely exhibit serial correlation.

Table 2. Write-off series: Unit Root Tests, AR (1) Coefficients and Extreme Value Distribution Parameters

	Augmented Dickey-Fuller test		AR (1)	Residuals, EV distribution 3/	
Bank	T-statistics	P-values 1/	Coefficient 2/	Location	Scale
1	-8.28	0.00	0.17	154.6	309.0
2	-1.43	0.56	1.00	1435.9	3273.9
3	-9.20	0.00	0.17	540.6	1109.3
4	-2.77	0.07	0.93	2545.8	5095.5
5	-0.74	0.83	1.00	510.2	1100.7
6	-1.45	0.55	1.00	848.8	1674.4
7	-1.12	0.70	1.00	293.3	729.4
8	-3.62	0.01	0.35	2923.7	4589.5
9	-4.72	0.00	0.23	311.1	491.6
10	-2.05	0.27	1.00	258.9	626.8
11	-1.77	0.39	1.00	1424.6	2785.0
12	-7.67	0.00	0.23	5388.6	12779.9
13	-7.84	0.00	0.59	571.5	903.4
14	-2.53	0.11	1.00	1029.6	2439.3

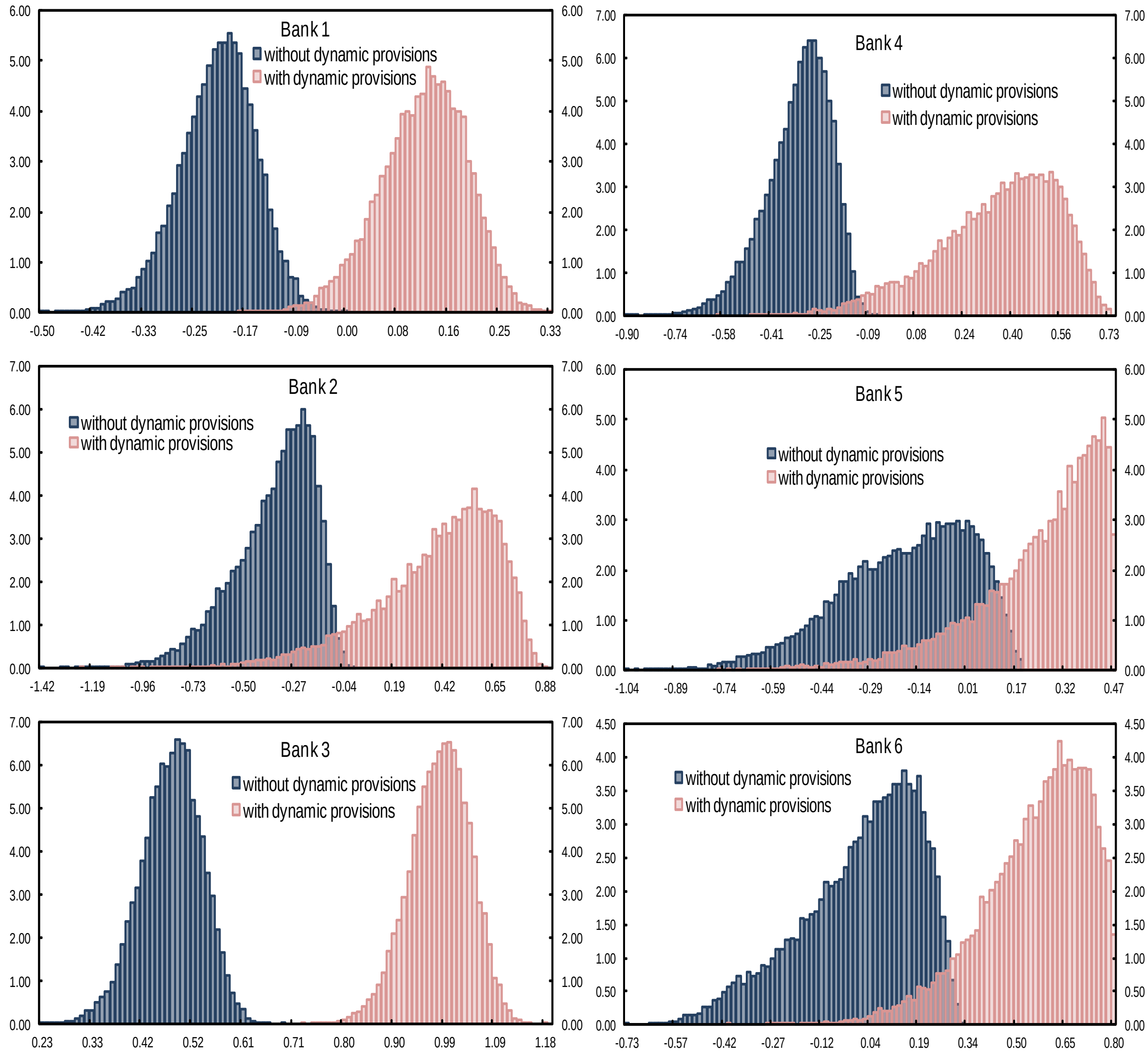
Source: SBIF and staff calculations.
1/ McKinnon one-sided probabilities.
2/ A value of 1 indicates write-offs follow a unit root process.
3/ Extreme value distribution type 1, fitted to residuals of unit root or AR (1) process, in million pesos.

Upon performing the simulation, the impact of the different provisioning processes was assessed by examining the distribution of the minimum provision buffer, or minimum provision shortfall. In each simulation draw, the minimum provision buffer was calculated as the lowest level of provisions net of write-offs (or loan losses) measured in percent of total loans. If the minimum provision buffer was negative, it indicated that the bank could not meet the loan losses by using provisions exclusively and would have to tap into net earnings or capital. Figure 5 shows the distribution of the minimum provision buffer under regimes with and without dynamic provisions.

B. Simulation Results

The adoption of dynamic provisions improves substantially the soundness of financial institutions. Under DP the distribution of the minimum provision buffer typically shifts markedly to the right in most cases, implying a lower likelihood of the provisions being insufficient to cover bank losses (see Figure 5). Because loan losses exhibit fat tails, even the introduction of a dynamic provisions regime could not avoid prevent provisions from falling short, as shown by negative realizations of the minimum provision buffer. Nevertheless, the likelihood and magnitude of these events are lower than under standard provisioning.

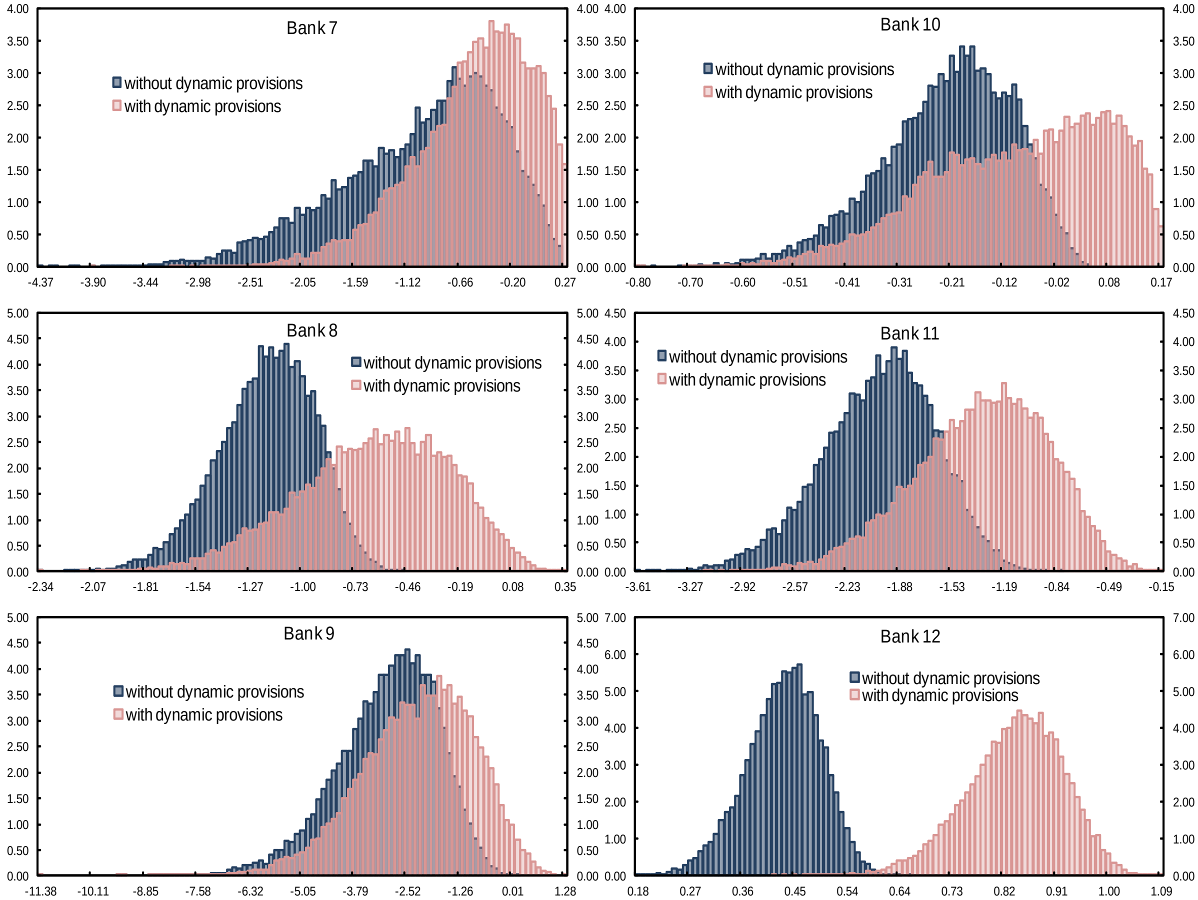
Figure 5. Minimum Provision Buffer and Probability Distributions[1, 2/]



Source: SBIF and staff calculations.
1/ Horizontal axis: provisions in percent of total loans; vertical axis; probability, in percent.
2/ A negative number indicates that provisions are insufficient to cover loan losses.

Source: SBIF and staff calculations.
1/ Horizontal axis: provisions in percent of total loans; vertical axis; probability, in percent.
2/ A negative number indicates that provisions are insufficient to cover loan losses.

Figure 5. Minimum Provision Buffer and Probability Distributions[1, 2/] (cont.)



Source: SBIF and staff calculations.
1/ Horizontal axis: provisions in percent of total loans; vertical axis; probability, in percent.
2/ A negative number indicates that provisions are insufficient to cover loan losses.

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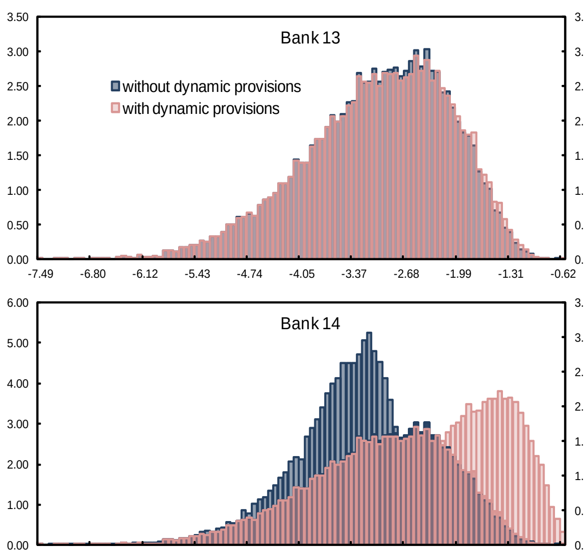


Source: SBIF and staff calculations.
1/ Horizontal axis: provisions in percent of total loans; vertical axis; probability, in percent.
2/ A negative number indicates that provisions are insufficient to cover loan losses.

The degree of shifting to the right depends on two factors: one, the extent to which banks are able to build substantial DP buffers given the restrictions imposed by the formula and, two, the size of tail-risk shocks that themselves depend on the risk inherent in banks' portfolios. In the simulations, the only institution that is subject to the first factor is Bank 13 that, as mentioned, is unable to build any meaningful buffer, and as a result, the two distributions are virtually identical. Moreover, a number of banks experience large tail losses due to the riskiness of their portfolios that are geared towards consumer lending. This loss potential is evidenced in the historic simulation by both the size of the buffer under ideal conditions (i.e. under bank-specific DP rates) and the speed at which the buffer is depleted in the 2008–09 downturn (see Annex I). The distribution for such banks (e.g., Banks 8 through 10) does shift to the right, but at the same time the left-tail minimum practically stays put. By the same token, banks whose entire distribution shifts markedly to the right, sometimes completely into positive territory, have manageable tail risks and are able to build near-optimal buffers.

The descriptive statistics of the minimum provision buffer distributions also illustrate how dynamic provisions can contribute to enhancing bank solvency (Table 3). For almost every bank, the mean and median of buffers in regime with dynamic provisions are higher than in a regime without them. The kurtosis in the dynamic provisions regime tends to be higher but since the mean is also higher, the left-tail minimum buffers are smaller.

Table 3. Minimum Provision Buffers and Descriptive Statistics

Bank	Without dynamic provisions						With dynamic provisions					
	Mean	Median	Standard deviation	Skewness	Kurtosis	VaR 95	Mean	Median	Standard deviation	Skewness	Kurtosis	VaR 95
1	-0.21	-0.21	0.06	-0.37	3.40	-0.33	0.12	0.13	0.07	-0.35	3.06	0.00
2	-0.36	-0.32	0.19	-0.94	3.83	-0.72	0.39	0.44	0.29	-1.06	4.26	-0.18
3	0.48	0.48	0.06	-0.29	3.06	0.38	0.98	0.99	0.06	-0.31	3.09	0.88
4	-0.32	-0.31	0.11	-0.77	3.67	-0.53	0.35	0.38	0.21	-0.72	3.15	-0.05
5	-0.18	-0.15	0.21	-0.61	2.90	-0.55	0.23	0.29	0.20	-1.31	4.67	-0.17
6	0.01	0.05	0.19	-0.75	2.97	-0.36	0.56	0.59	0.17	-0.95	3.87	0.23
7	-1.00	-0.87	0.71	-0.73	3.18	-2.34	-0.54	-0.46	0.53	-0.86	3.73	-1.54
8	-1.18	-1.16	0.25	-0.42	3.08	-1.62	-0.63	-0.61	0.39	-0.39	2.82	-1.32
9	-3.00	-2.86	1.22	-0.63	3.56	-5.20	-2.26	-2.14	1.37	-0.51	3.36	-4.66
10	-0.22	-0.21	0.12	-0.62	3.26	-0.45	-0.09	-0.07	0.17	-0.56	2.72	-0.39
11	-2.01	-1.99	0.38	-0.35	3.03	-2.68	-1.33	-1.30	0.44	-0.40	2.96	-2.11
12	0.43	0.44	0.07	-0.35	3.08	0.32	0.84	0.84	0.08	-0.43	3.20	0.69
13	-3.07	-2.96	0.96	-0.57	3.14	-4.83	-3.05	-2.95	0.98	-0.55	3.09	-4.83
14	-0.46	-0.42	0.20	-1.11	4.65	-0.85	0.04	0.09	0.26	-0.96	3.99	-0.46

Source: SBIF and staff calculations.

This simulation analysis suggests that under the Spanish DP rule provision buffers against losses would be higher compared to those accumulated under normal practices. The analysis also suggests that calibration based on historical data may not be adequate to deal with the presence of fat-tails in realized loan losses, therefore requiring careful calibration or complementing it with another instrument.

VI. GUIDE TO IMPLEMENTATION

The discussion so far has illustrated that DP can have unambiguous merits in smoothing provisioning costs over the credit cycle, thus endowing the regulator with a powerful countercyclical tool that acts as a first line of defense against shocks and consequently lowers banks' PD by safeguarding capital buffers. At the same time, DP lives up to such high expectations only if the model is properly calibrated and model-specific pitfalls are avoided.

As some of the practical difficulties are not obvious at first sight, we aim to provide policymakers with a guide to implementation that stipulates data requirements, assists with the choice between DP formulas, addresses calibration problems, clarifies issues surrounding accounting and tax treatment, suggests ways to keep the model up-to-date and discusses the role of DP as a macroprudential tool.

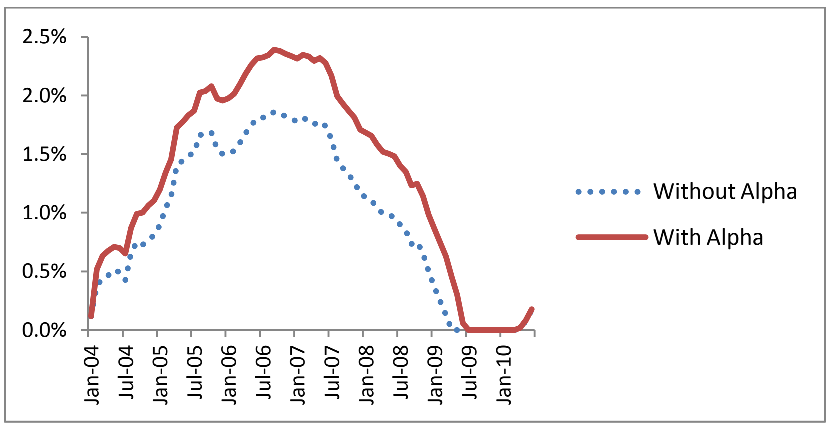
A. Data Requirements and Timing of Implementation

The scope and granularity of *required data* differ greatly between the provisioning systems. While for some formulas ordinary bank-level data suffice, others require debtor-level data and/or trigger indicators. In fact, the unavailability of certain loan or debtor data, perhaps due to the lack of or restricted access to a credit registry, may preclude the use of formulas with extensive data requirements.

At the one extreme, the expected loss approach found for example in Mexico requires access to debtor-level data that serve as input in the calculation of the PD, which, in turn, determines the provisioning rate; this information will already be available at banks that apply the Internal Risk Based Approach under Basel II. The Peruvian formula also relies on granular debtor information for calculating the average and stress PD. Still, the PD may be proxied, however imperfectly, by other loan delinquency data such as NPL flows or write-offs as a share of loans, the latter being the case in the present simulation. Beyond the bank-level data, the Peruvian formula nevertheless needs a reliable trigger for the activation of the rule. Here, the challenge lies in devising a suitable indicator, preferably at the level of the economy or the banking system, that signals reliably the beginning of a credit boom and slowdown using real-time data. As Drehmann et al. (2010) remark concerning the activation of countercyclical capital, different indicators may be needed for upswing and downturn, or, as in Peru, a long-run GDP growth-related rule that is complemented by a short-run rule for sudden starts and stops. Identifying such a consistent trigger mechanism is a daunting task and may require auxiliary data and calculations, such as computing trend growth and the output gap.

At the other end of the spectrum, the Spanish system at its core only requires knowledge of the average flow of specific provisions (inflows less releases) through the credit cycle for determining the beta parameter. If data on such flows is unavailable, the change in the stock of specific provisions can be used, but, importantly, it must be augmented by write-offs made in the period.[31] The alpha parameter that levies a generic provision on new loans is, strictly speaking, not necessary for the proper functioning of the countercyclical offset, as new loans are by definition also captured in the beta part. The reason it exists is that during slowdowns dynamic provisions are released, leaving new loans theoretically uncovered. This is especially true in cases where the upswing phase is short or mild relative to the subsequent downturn. Also, inasmuch as rapid credit growth is a precursor of higher loan losses due to relaxed lending standards, as has been shown inter alia by Jiménez and Saurina (2006), the alpha parameter makes adequate amends by building an extra buffer for the uptick in portfolio risk. As the example of a fast-growing bank in the sample illustrates (see Figure 6), the alpha part creates a DP fund that is about one-third larger at the peak than without and that provides for a prolonged coverage of downturn losses. Finally, the alpha parameter serves as reference point for the ceiling of the DP fund, but may be replaced by a limit related to total loans as in the Uruguayan formula.

Figure 6. Effect of the Alpha Component on DP Fund
(in percent of total loans)



Source: SBIF and staff calculations.

As regards the *timing* of the implementation, some observers (e.g., Saurina, 2009a) have suggested that a DP system should be introduced only during an upswing. While doing so indeed maximizes the size of the countercyclical buffer, an introduction later in the cycle would still represent an improvement, as long as the modest buffer can still absorb some of the rising provisioning cost during the impending downturn.

Consider the example of Bank 13: An idiosyncratic effect (very high provisioning flow in November 2007) depletes this bank's DP fund months ahead of the general downturn,

[31]For example, if the stock of specific provisions is initially 100 and the net inflow is 20, the end-period stock should be 120, but any write-off will lower this number. If the write-off is, say, 5, the stock will end up at 115. Hence, the write-off must be added back to obtain the true net flow of provisions.

prompting a re-accumulation phase lasting through mid-2008. Under both the uniform and especially the bank-specific versions of the Spanish rule, the DP fund accumulates up to 0.1 and 0.5 percent of total loans, respectively, and so provides certain coverage for above-average specific provisioning in the course of 2008 and smoothing out total provisioning cost. From a prudential perspective, the bank is still somewhat better off than in the actual state of no DP (ignoring any cost of regulation).

B. Choice of Formula

As mentioned before, the scope and granularity of banking and economic data may already determine the choice of formula. Generally speaking, the less disaggregated the available data are, the more likely will be the adoption of a straightforward DP formula like the Spanish version. However, one could think of hybrid systems; for example, adding a countercyclical rule to a generic provision that already exists in many countries (see below).

Selection Criteria

If data are adequate to apply any of the three systems (continuous, trigger-based, expected loss) and the regulator does not mind the effort of calibrating a more complex system, the question becomes which of the formulas would be most adequate for the banking system. There are a number of aspects for consideration that may help guide the decision:

- **Correlation between credit and economic cycle:** The higher the co-movement of the credit cycle and macroeconomic aggregates that may serve as reliable indicator for boom/bust phases, the more favorable will be the application of a trigger-based model like the Peruvian. This does not necessarily mean that a continuous system without activation mechanism will be less beneficial. In fact, the Spanish system was instituted on the finding that there was almost a perfect negative correlation (-0.97) between credit growth and specific provisions during 1991–99.[32] Lower correlations, however, imply a higher share of idiosyncratic, a-cyclical losses that compromise the ability of the Spanish formula to provide adequate buffers during systemic events.

- **Variability of credit cycle**: If a banking sector is subject to swings in the duration of the credit cycle, the Spanish formula may deliver inferior results because it lacks a direct macroeconomic activation rule like the one in Peru that ensures that the buffer can only be accessed during economic downturns but is not used for covering idiosyncratic losses ahead of time. If, for example, the DP system is to be predicated on a cycle lasting seven years with five years of upswing and two years of downturn, a subsequent credit cycle that is much shorter or longer will likely lead to under-or over-

[32]Saurina (2009a). The correlation for the U.S. economy was reportedly -0.58 during 1987-2009 (Fillat and Montoriol-Garriga, 2010).

provisioning, respectively, as the downturn losses occur earlier (or later) than programmed. The same consideration goes for varying amplitudes between cycles, with stronger swings exhausting a set buffer earlier, other things equal. In this case, the regulator could set a higher ceiling (e.g., a multiple of latent loss, see Section VI.D). Burroni et al. (2009) point to these problems in their simulations, showing that large swings combined with a long cycle can cause a Spanish-type DP buffer to repeatedly hit the ceiling and then be soon exhausted in the downturn, since an adequate buffer cannot be built when the fund is at its upper limit. By contrast, the Peruvian formula with its macroeconomic trigger seeks to ensure that coverage is provided only when it is most needed to deal with systemic risk. Expected through-the-cycle loss provisioning systems are largely immune to the length of cycles, but varying amplitudes will have an impact on the coverage provided.

- **Heterogeneity among banks**: If loan portfolios differ significantly in their risk exposures to certain sectors such as loans to households (i.e. some banks cater to much riskier clients than others), the *hypothetical* Spanish formula with bank-specific rates performs better than the actual Spanish or Peruvian systems.[33] If such a differentiation appears infeasible for political reasons, the regulator could still differentiate rates between broad types of banks (e.g., banks specializing in commercial, consumer and mortgage lending as measured by the share of any such loan type in total loans).

- **Regulatory constraints**: In some cases the regulator may be concerned about the accuracy of the calibration or may not have the clout to levy an additional provision onto the banking sector. Or there is uncertainty as to whether specific provisions or provisioning rates are in line with the likelihood of eventual loan losses, meaning that systematic under-provisioning impairs the role of the average provision as reference point under the Spanish system. In such instances, the regulator may resort to letting the banks use an existing generic provision to cover specific provisions (or a fraction thereof) during a downturn. An example is provided below.

- **Principle of provisioning for point-in-time expected loss**: If the regulator is eager to comply with the principle of provisioning exclusively for expected loan loss at a given point in time (see Section VI.E), the need for generic provisions should be re-assessed each period in line with an updated estimate of expected loss. This amounts to applying time-varying parameters or DP fund limits.[34] Such a proposal deviates somewhat from the principle of DP as a rules-based system and may neither provide adequate coverage of downturn losses nor bring about substantial cost smoothing. We present an alternative more rules-based approach to recalibration in Section VI.F. Another

[33]The limitation posed by system-wide rates is recognized by the Spanish regulator, see Saurina (2009a).

[34]Balla and McKenna (2009).

alternative method proposes to apply only the alpha part of the Spanish formula, which keeps the dynamic reserves in line with expected loss without requiring a cap on the DP fund.[35] While rules-based, this approach may fail to build up an adequate DP buffer in time.

Table 4 provides a summary of key aspects to consider when choosing between a continuous and a trigger-based system.

Table 4. Summary of Characteristics of Principal DP Systems

Criterion	Continuous System (e.g., Spain)	Trigged-Based System (e.g., Peru)
Complexity/Data Requirements	Low. Requires net provisioning flow of period during at least one full credit cycle (and write-offs in a cyclically neutral year), preferably disaggregated by type of loan. May require auxiliary calculation of upper limit to DP fund.	High. Requires debtor-level data to compute average and downturn PD and LGD (or use of proxy, e.g., write-offs) during at least one full credit cycle, preferably disaggregated by type of loan, as well as derivation of macroeconomic indicator as reliable trigger for activation rule.
Accumulation Path	Gradual accumulation and de-accumulation. Accumulation process based on difference between actual and average provisioning flow.	Rapid accumulation and de-accumulation. Accumulation process based on difference between downturn PD/LGD and average PD/LGD.
Degree of Cost Smoothing	High. Provides for fully smoothing of total provisioning costs under ideal conditions.	Low. Does not aim for cost smoothing, offsets costs only early into the (de-)activation phase.
Use of a Macroprudential Rule	*Indirect* macroprudential rule, as smoothing itself can be considered a rule. Is always in operation and thus offsets idiosyncratic above-average provisioning flows even during normal times. DP fund may be exhausted before a downturn.	*Direct* macroprudential rule. Activation rule ensures that above-average provisioning costs are offset fully and only during downturns. DP fund is accessed only during a downturn.
Performance under Volatile/Irregular Credit Cycles	Fair. Does not perform well if amplitude and duration of credit cycles are highly variable.	Good. If properly calibrated, system is likely to identify start of boom and bust phase well.
Risk of Over-provisioning	Moderate. Needs properly calibrated upper limit to guard against over-provisioning.	Low. Coverage provided by DP is predetermined based on PD/LGD.

[35] Burroni et al. (2009).

A Synthesis: Hybrid Systems

As we have shown, the continuous and trigger-based formulas each feature distinct advantages and challenges. In the following, we propose a hybrid system that seeks to combine the merits of two as well as another one that "dynamizes" a flat generic loan loss allowance as it exists in many countries.

The Spanish system has the characteristic of permitting to offset idiosyncratic losses that are not linked to cyclical developments, and hence it does not ensure adequate coverage during a systemic event. Recognizing this limitation, Jiménez and Saurina (2006)—proponents of the Spanish DP system—suggest an alternative countercyclical provision tied to the deviation of credit growth from its through-the-cycle value, i.e., a direct relationship with a macroeconomic variable. Clearly, this presupposes a tight inverse relationship between credit growth and loan impairment along the cycle, which used to be the case in Spain. Their alternative rule has a macroprudential focus because it both links the build-up of provisions to credit growth and gives incentives to rein in the latter. Obviously, identifying the parameter for the deviation from credit growth from its cycle average that will lead to near-perfect coverage of downturn losses is more difficult than under the actual Spanish formula directly based on specific provisions.

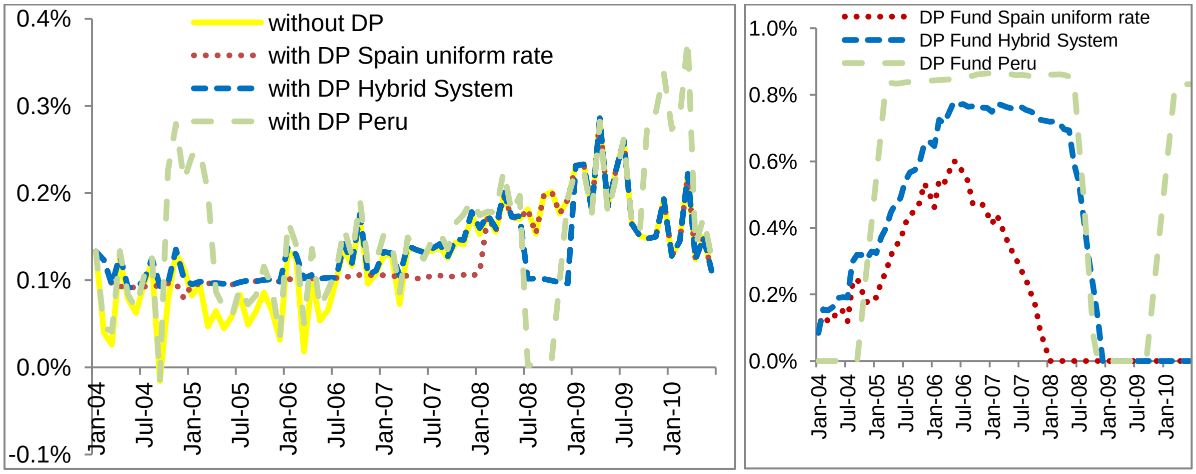
In a similar vein, we offer a hybrid system that adds a macroprudential trigger to the actual Spanish formula, aimed at ensuring that losses are offset only during the downturn. Until this trigger is activated, a bank is not allowed to access its DP fund to cover "idiosyncratic" losses outside a downturn phase,[36] i.e. the contribution ΔGP_t cannot be negative. Therefore, the periodic contribution to generic provisions before the downturn becomes:

$$\Delta GP_t = \max\left\{0, \sum_{k=1}^{N}\left(\alpha^k \Delta C_t^k + \beta^k C_t^k - SP_t^k\right)\right\}.$$

For convenience, we use the trigger mechanism of the Peruvian formula as calibrated in the simulation, which identifies July 2008 through September 2009 as the downturn phase. Figure 7 displays the path of provisioning costs and the DP fund under the hybrid system relative to the Spanish and Peruvian rules for Bank 11 that prematurely exhausts its buffer under the Spanish formula.

[36] This restriction could be modified so as to let banks offset a certain fraction of above-average provisioning ahead of the downturn phase.

Figure 7. Provisioning Costs and Paths of DP Funds under a Hybrid System



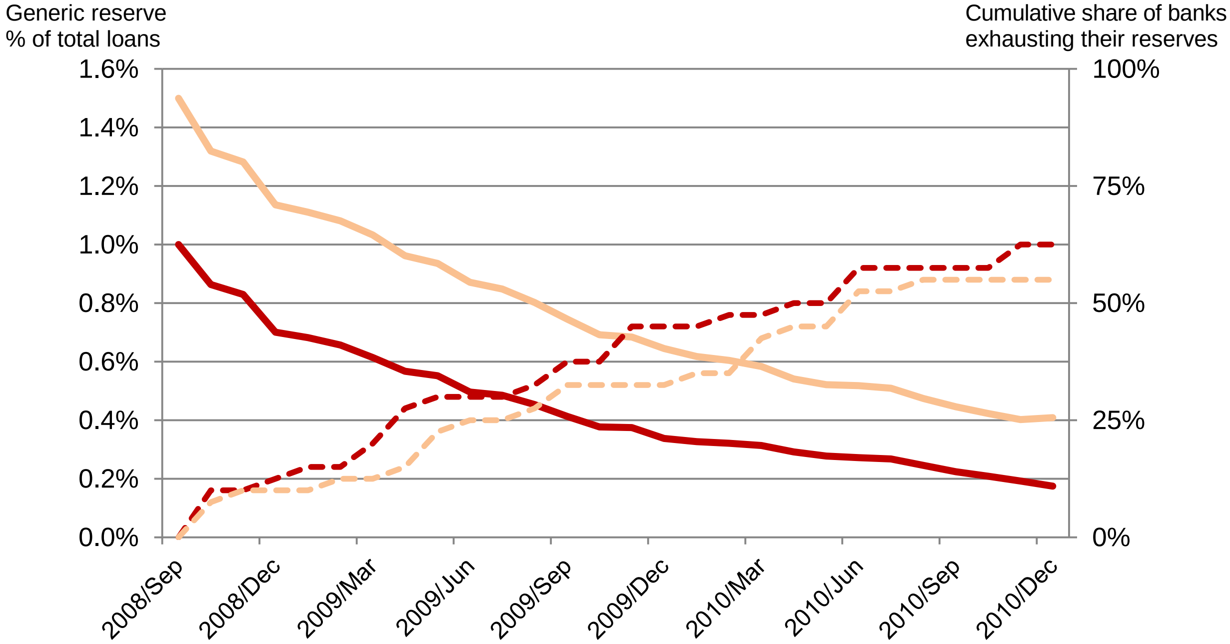
Source: SBIF and staff calculations.

The simulation shows that the bank is not allowed to cover above-average provisioning flows from 2006 until the trigger signals the beginning of the downturn in July 2008, thus keeping the DP fund at its peak for another two years (the ratio falls slightly due to credit expansion). The hybrid system then provides coverage for six months (this number would vary across bank with the severity of downturn losses). This adjusted path of the DP fund resembles that under the Peruvian formula except for a more gradual accumulation early in the cycle. In exchange for preserving the DP buffer, the hybrid system forgoes any cost smoothing when the Spanish formula calls for drawing down the buffer to cover idiosyncratic losses during 2006–07. The drawback of this hybrid formula is the added layer of complexity that the trigger mechanism implies.

For a less intricate alternative, we point to another hybrid system that would render a typical generic provision dynamic. This straightforward system stipulates that banks can access their generic provisions of typically one or two percent of total loans to cover specific provisions during a downturn fully or partially. As before, a macroprudential rule for determining the beginning of the downturn phase will have to be devised. Of course, the size of the generic buffer will have to be broadly in line with expected downturn losses to ensure adequate coverage.

Figure 8 depicts the gradual drawdown of a generic reserve of 1 percent and, alternatively, 1.5 percent of loans at the system level in a stylized example unrelated to the simulations presented above (solid line; left axis). It also informs about the cumulative share of banks exhausting their buffers at each point during the downturn (broken line; right axis).

Figure 8. De-Accumulation of a Generic Provision under a Dynamic Rule



Source: staff calculations.

Such a system may be particularly attractive in cases where banks are opposed to any additional cost, even if only during the upswing and not through the cycle, and thus reject a surcharge like that of the Peruvian system.

C. Parametrization

Having decided on the appropriate DP formula, the regulator will face a number of issues in calibrating the necessary parameters. Among these are:

- **Beginning/end of credit cycle:** In many cases, the beginning and end of the previous credit cycle(s), on which the DP system needs to be calibrated, will not be clear-cut. For purposes of determining the parameters of the Spanish formula a timing that leads to optimal behavior of the DP fund is critical. For example, to safeguard a rapid accumulation of the DP fund it would be prudent to take as starting point in the calibration of the average provision the period of the past cycle in which the average provision begins to exceed the current provision, which clearly implies an iterative process. Similarly, under the Peruvian formula the PD/LGD or viable proxies are to be computed for a fully credit cycle whose beginning and end need to be determined with care.

- **Size-weighted rates:** When calibrating the Spanish alpha and beta parameters or the variable DP rates under the Peruvian formula, the regulator can take either the average of banks' individual rates (hence, unweighted) or the average rate at the system level (size-weighted). This is largely a matter of preference, although a highly concentrated banking system may require taking unweighted rates to protect the interests of smaller banks.

- **Alpha parameter in Spanish formula:** To derive the alpha parameter under the Spanish rule, the loan loss in a cyclically-neutral year is to be taken. If determining this mid-cycle point is difficult due to data or methodological problems, the regulator may want to consider the average loss rate over the past credit cycle (or the expected rate for a more forward-looking approach), provided that the cycle itself is sufficiently well-defined.

- **Data on loan recoveries in Spanish formula:** One could omit recoveries of written-off loans in the DP formula if such data are unavailable; in this case, the alpha and beta parameters will be biased upward and should be manually adjusted using general information on the LGD of the system or of comparable countries.

- **Stress PD/LGD in Peruvian formula:** The Peruvian formula relies on the precise calculation of the PD/LGD under stress. When the PD cannot be computed due to a lack of debtor-level information, it needs to be proxied by NPL flows or default rates. For the LGD, it is permissible to resort to taking data from comparable countries.[37]

- **Trigger mechanism in Peruvian formula:** As mentioned, deriving a consistent trigger mechanism is a challenge. Under the Peruvian formula, DP is initiated or suspended if economic growth passes through certain thresholds related to trend growth. If estimates of trend growth are imprecise, the regulator may compare current growth of GDP or credit with a longer-run floating average in order to trigger the rule.

D. Selection of DP Fund Limit

As already mentioned, a limit to the DP fund is needed to guard against over-provisioning, notably under the Spanish formula (Saurina, 2009a). Over-provisioning occurs when the stock of dynamic provisions winds up exceeding expected loss, while with under-provisioning the reverse is the case. In keeping with the principle of providing for expected loss, the limit should be near 100 percent of this loss. In the above simulations, latent loss was taken to be average loss over the cycle, but not downturn loss which would have produced a higher limit and allowed a larger DP fund. Because of this discrepancy, a regulator may choose to apply a multiple of average loss for the upper limit, but the eventual decision is also guided by the

[37]Moreover, in systems with a small number of banks (e.g., less than 20), it may not be possible to directly use the 95th percentile for the Stress PD that the Peruvian formula calls for, as is the case in the above simulation. In this case, one will have to choose between taking the largest or second-largest realization or use interpolation.

aversion of the regulator to over-provisioning (i.e., aversion to unnecessary costs) and under-provisioning (i.e., aversion to the risk of an insufficient DP buffer).

Using a loss function approach that aggregates the deviations of end-period DP funds from zero—the goal being to fully use up the fund—we show in Annex II that for every degree of the regulator's aversion to the risk of over- or under-provisioning there is an optimal limit to the fund. In the simulation, the size of optimal funds range from 20 percent of latent loss (for extreme cost aversion) to 175 percent (for extreme risk aversion), with the neutral position amounting to 100 percent. Expressed as a share of total loans, the corresponding limits range from 0.1 percent to 2.05 percent, with a mid-point of 0.75 percent of loans. Some loss functions produce a range of virtually identical losses, such as for risk neutral decision-makers. As a result, the aforementioned values should in some cases be understood as mid-points of a range of near-optimal DP limits.

The possibility of setting a latent loss limit of more than 100 percent (or 125 percent as in the Spanish case) would seem to run counter to accounting standards (see section VI.E.). However, since any such ceiling is predicated on historical data, one could justify a much higher (or lower) bound by assuming that the current credit cycle is likely to cause much higher (or lower) loan losses than the previous one or, if referring to downturn losses, that there is a large wedge between downturn losses and average losses. In the simulations on miscalibration loss, setting such a high limit would happen to give a risk-averse regulator maximum coverage of downturn loan delinquencies. Nevertheless, in keeping with the accounting principles it would be better to acknowledge that expected loss has increased by raising the DP rates rather than adjusting the limit to the DP fund.

E. Accounting, Disclosure and Tax Treatment

Accounting Standards

The merits of DP are plain, but is the concept in accordance with international accounting standards? So far, DP has generally been rejected by the accounting profession because it anticipates the extent of loan delinquencies in an eventual downturn and thus deviates from the principle of incurred loss. This principle, however, has been criticized for promoting the procyclicality of provisions and so to have aggravated the crisis of 2008–09.

In the wake of the financial crisis, the standard setters IASB and FASB embarked on an overhaul of accounting rules for loan losses, notably a transition of the all-important norm IAS 39 to the new IFRS 9. Annex III summarizes the course of action so far. Under the current incurred loss model of IAS 39, loans may be written down (i.e., provisions made) only when evidence is available that a loan or a portfolio of loans will not be repaid in full, requiring a "trigger event". The compromise still under deliberation (IFRS Foundation, 2011) is to augment the concept of estimating expected cash flows and recognizing additional losses periodically over the life of the asset by a “minimum allowance balance” or floor for expected losses for the “foreseeable future” (but certainly not the entire cycle). For a summary of the ongoing deliberations and remaining sticking points see Ren (2011). Broadly speaking, the proposed reform of IAS 39 seeks to replace the current incurred loss impairment method with one based on expected loss. Expected credit losses are *estimated* losses on a loan portfolio over the life of the loans and considering the loss experience over the complete economic/credit cycle (BCBS, 2009). A typical application for this expected loss rule would be the retail loan portfolio where individual assessment may be less cost efficient. Such a group assessment is permissible under the current standard (IAS 39.64) whenever individually non-impaired loans with similar risk characteristics are assessed collectively and, judging by history, certain reductions in estimated future cash flows are likely but cannot be assigned to individual loans yet. Impairment in such groups is estimated on the basis of historical loss experience, but adjusted for changes in current conditions (IAS 39.AG89).

The Spanish regulators have cited the IAS rules to justify their system of DP, pointing to statistical experience that shows that a certain percentage of homogenous loans (e.g., credit card loans) are lost, although it is not clear which individual loans will default (Saurina, 2009a). However, it is still doubtful whether the Spanish system is fully in line with current and forthcoming accounting standards because it is based exclusively on historical loss experience and also on through-the-cycle losses (Gebhardt and Nowotny-Farkas, 2011). As an alternative to DP that circumvents the accounting issue, Panetta et al. (2009) mention the *credit valuation adjustment* approach already used for market risk under Basel II. Banks would compute value adjustments based on loan deterioration, which impacts Tier 1 capital but does not affect the income statement.

As noted long ago by Wall and Koch (2000), the standard setting bodies continue to struggle with striking a balance between aligning provisions with reliable information when it comes due (i.e. *realized* or *highly probable* loan impairment) and allowing banks to build a cushion in good times based on potentially unreliable information (i.e., *estimated* loan impairment).

The benefit of sticking to known information is higher transparency in terms of giving investors a truthful and timely picture of loan quality and earnings, if with a certain lag. The clear downside is, however, that banks may underreport or delay the recognition of losses that are already identified as sufficiently probable but not yet realized in the books. An example is that changes in certain borrower characteristics or demeanor raise the likelihood of a loan delinquency before impairment is evident in loan arrears. Critics of incurred loss accounting argue that high-risk loans command risk premia that lead to overstated earnings in the upswing as no adequate provisions are made, while the recognition of loan losses is left to the downswing when earnings are low anyway, thereby leading to even higher procyclicality in earnings (Gebhardt and Novotny-Farkas, 2011). However, bank managers and owners are generally averse to such procyclicality and would rather smooth earnings by overstating provisions in good times and vice versa. Hence, there are reasons why banks should embrace

DP as long as the degree of buffer-building stays within reasonable bounds, although in practice they may not due to high setup costs (Saurina, 2011).

The immediate benefit of the expected credit loss approach is that it reflects economic reality in the longer run and builds a buffer of loan loss provisions when a loan is generated, which is especially instrumental in the early part of the credit cycle. It also enhances transparency as expected loss is updated periodically and the change reflected in both the balance sheet and the income statement of a bank. At the same time, many Basel II-banks have been using PDs/LGDs for only one year ahead instead of incorporating the long-run default experience that the Basel II Accord calls for.[38] This practice is not in line with the principle of prudence since this short a time horizon does not allow to cover the true expected losses to the full extent. Indeed, Hlawatsch and Ostrowski (2010) show that Basel II underestimates the through-the-cycle expected loss, while IAS recognizes the full impairment only at the time of default, yet nothing ahead of the trigger event. As a downside, the expected loss model is operationally more complex and costly than the incurred loss model as it is necessarily based on a forecast of expected losses across the loan portfolio—a characteristic that has led the IASB to oppose the concept in its purest form. To be sure, improperly executing this forecast may lead to a valuation error that can actually be as detrimental as the belated recognition of loan losses under the current system.

The new accounting rule is more compatible with the aforementioned expected loss model of countercyclical provisioning, such as the models introduced in Mexico and Chile. To permit DP based on a buffer of generic provisions the BCBS has proposed that the replacement of IAS 39 allow for provisions for groups of loans with similar risk characteristics (BCBS, 2009).

Balance Sheet Position of DP Fund

A naïve view would suggest keeping as high a share of dynamic provisions in equity capital, as doing so bolsters capital adequacy. Accounting rules allow banks applying Basel I or the Standardized Approach of Basel II to record general provisions of up to 1.25 percent of risk-weighted credit assets in Tier 2 capital. For banks applying the Internal Risk Based approach under Basel II this limit amounts to 0.6 percent of risk weighted assets. However, while this buffer can mitigate a credit risk shock by absorbing rising provisioning costs, DP recorded as capital have to be released, causing a negative impact on the capital adequacy ratio.[39] For Basel

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[38]Such assessments must be consistent with conditions that are likely to occur over the business cycle. In turn, LGDs should reflect downturn conditions. To be sure, when the Basel II Accord was implemented starting in 2006, many banks did not have data series at their disposal that would have allowed calculating downturn PDs/LGDs and instead opted to apply a one-year ahead estimate.

[39]The necessary assumption for making this comparison is that banks would choose to hold the same amount of capital with or without dynamic provisions.

II banks, putting DP in capital additionally carries the risk of having to adjust capital whenever generic provisions fall short of expected loss, since this shortfall must be deducted from capital (evenly from Tier 1 and 2).[40] Conceptually, only the share of dynamic provisions that exceeds the expected downturn loss should be eligible for recording in capital (Burroni et al., 2009).

A simple numerical example, presented in Annex IV, illustrates that a combination of recording DP mostly in equity capital and a high dividend payout can actually lower banks' capital adequacy ratio, if the DP are released to absorb a higher-than-average provisioning flow. In other words, the benefit of DP in covering downturn costs and thus shoring up profits in bad times may be outweighed by the direct impact on capital of using up the DP buffer. The calculations show that for each dividend payout ratio there is a minimum share of DP in liabilities, below which the capital adequacy ratio actually worsens compared to the situation without DP. For example, a dividend payout ratio of 25 percent would suggest keeping half of DP or more in liabilities, while a payout ratio of 75 percent would call for close-to-full recording as liabilities. These thresholds are independent of the size of the DP fund and the average provision to be made.

All told, to preclude a worsening in the capital adequacy ratio in relative terms, at least half of total DP should be held as liabilities (barring very high dividend payments).[41] In the case of a bank that is likely to suspend its dividend payment during a downturn, a larger share of DP in capital would appear acceptable. Recording DP exclusively in capital, however, always worsens the capital adequacy ratio in relative terms—regardless of the payout ratio and the size of the shock. The argument would not apply if the DP were allowed to be part of the new countercyclical capital buffer under Basel III, but however sensible such a step may be, these reserves may not meet the stringent criteria for quality of capital that Basel III imposes for this countercyclical buffer.

Disclosure and Income Smoothing

Some observers have criticized DP for disguising crucial information about the current state of lending operations expressed in the cost of loan allowances. To be sure, financial accounting plays a fundamental role in promoting market discipline by investors, a building block of which is the availability of timely, consistent and reliable information on bank performance and risk exposures (Bushman and Williams, 2011). The fact that provisioning costs for incurred and anticipated losses are lumped together is seen as running counter to this objective. The obvious solution to this transparency problem is to single out in the income statement the part of provisioning costs that is due to dynamic provisions.

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[40]Burroni et al. (2009).

[41]In Bolivia up to half of dynamic provisions may be placed in capital, whereas Peru requires all dynamic provisions to be liabilities.

In Spain, dynamic provisions are to be characterized as fully transparent, since banks must publish the amount of their general provisions so that the public can observe the extent of both specific and dynamic provisions. This disaggregation provides information about a bank's financial position in terms of both generating net earnings and risk-taking. In fact, without the disclosure of "incurred costs not yet individually identified" under DP bank managers are given incentives to keep increasing credit growth and to under-price credit risk (Saurina, 2009a). In the end, the argument may be turned on its head by reasoning that the disclosure of DP signals to the public differences between dynamic provisions representing loss expectations based on historical data and specific provisions for losses actually identified in the loan portfolio (Balla and McKenna, 2009).

Another argument leveled against DP is that it allows for excessive income smoothing and thus earnings management. In fact, some of the formulas produce a high degree of cost smoothing and intentionally so, as this is considered an important characteristic in mitigating procyclicality. However, even without DP banks tend to smooth earnings via discretionary choices in accounting, as is well documented in the literature.[42] Therefore, the real question is whether DP aggravates the problem or whether it merely formalizes cost smoothing over the cycle by substituting rules for discretion.

Empirical evidence points to a limited negative impact of DP in this sense. Pérez et al. (2010) find empirical evidence that dynamic provisions in Spain have made income smoothing through discretionary loan loss provisions unnecessary. Put plainly, DP uses rules to produce income smoothing by prescribing provisions for all banks alike, where conventional provisioning practices permit discretion to the same end. Regarding effects on procyclicality, Bushman and Williams (2011) find evidence for a cross-country panel of banks that explicit forward-looking provisions that capture the extent to which current provisioning anticipates future loan losses appear to enhance discipline of bank risk-taking and thus mitigate one of the sources of procyclicality.

Tax and Dividend Treatment

DP affects a bank's "bottom line" by lowering net earnings in an upswing, while mitigating a profit crunch in a downturn. This will also mean lower tax payments and dividends in good times, unless other arrangements are made. There is no single preferred approach since it is a matter of preference when the tax benefit takes effect. Some jurisdictions allow tax deduction, such as Spain where general provisions like DP are tax-deductible expenses up to 1 percent of the increase in gross loans (except mortgages); beyond that limit they are accounted for as

[42]See Hsieh, Shen and Lee (2008) for a survey of the literature on income smoothing through provisioning and newer panel data results supporting the income-smoothing hypothesis.

deferred tax assets becoming deductible when the impairment is assigned to an individual loan (Saurina, 2009a). In Peru, dynamic provisions are tax-deductible only when they are used to cover specific provisions. Such a tax shield can be useful in providing an extra buffer under downturn conditions, in addition to the DP buffers themselves. On the other hand, allowing banks to use the tax benefit when making dynamic provisions may improve their acceptance.

A related question is whether DP should be associated with restrictions on dividend payments as it may lead to distributable profits in a downturn when otherwise losses would be recorded. Proponents of such restrictions argue that extra profits caused by the shield that DP provided should be taken out of profits and be put in a restricted capital account (Fillet and Montoriol-Garriga, 2010). In any case, no international standard exists in this regard. An alternative system of dividend restrictions that may also act as an alternative to DP altogether is the "Economic Cycle Reserve" proposed by the Turner Review (Financial Services Authority, 2009). The idea is to keep applying the incurred loss approach that leads to higher (procyclical) earnings in good times and thus avoid conflict with the accounting profession. The countercyclical element lies in mandating a non-distributable economic cycle reserve that prevents the buoyant profits from exiting the bank until they are eventually used to cover the downturn losses that DP explicitly anticipates. The Turner Review, however, does not propose concrete rules for operating such a countercyclical buffer.

F. Recalibration

Periodic recalibration of the DP formula is called for to keep reserves in line with expected loss and so avoid over- or under-provisioning. This would seem to depart from the principle of DP being rules-based, but the way and frequency of recalibration itself may be laid out in the rules to avoid misguided regulatory discretion. The pioneers of DP, Spain, Peru and Uruguay, recalibrated their formulas in 2004, 2008, and 2011, respectively. Spain merged the formulas for generic and dynamic provisions and also reset provisioning rates[43] to comply as closely as possible with IFRS, while Uruguay completely overhauled its formula following very high levels of dynamic provisions relative to non-performing loans.

An instructive example of a comprehensive recalibration, the Uruguayan regulatory agency decided to (i) introduce an alpha parameter; (ii) apply DP only to loans classified in the three uppermost categories rather than the entire loan portfolio; (iii) switch the DP fund limit from a fixed share of total loans to a volume- and risk-weighted share of loans in these three categories; (iv) recalibrate DP rates for loans in these categories; and (v) introduce an additional macroprudential rule that prevents further accumulation of DP whenever credit growth turns negative. The measures were expected to lower the stock of dynamic provisions on impact and further over time, aligning it with loss expectations.

[43]This recalibration caused the stock of general provisions to fall by more than 10 percent (see Saurina, 2009a).

Recalibration can help align DP with forthcoming accounting standards. As mentioned, periodically adjusting DP rates or the fund ceiling as new information on expected loss surfaces will bring the concept closer to the envisaged point-in-time provisioning standards. A more rules-based way to keep the Spanish formula current would be to update the through-the-cycle loan loss and average provision with incoming data each year, replacing the data of the corresponding year of the previous credit cycle (assuming that cycles are well defined and comparable). This would imply recalibrating the rates periodically, although the stock of DP need not change immediately because, for example, excess provisions would be brought down only as above-average specific provisions materialize.

G. Dynamic Provisioning as a Macroprudential Instrument

In summary, when properly calibrated, DP acts as a dependable macroprudential policy instrument in reducing the procyclicality of banks' provisions and earnings and thus their probability of default, thereby also shoring up credit supply in a downturn and limiting the reverberations of macro-financial linkages.

However, there are a number of caveats. DP is no "silver bullet" for dealing with procyclicality in lending operations in full (Saurina, 2011), nor is it a "quick fix" in the face of banking system fragility. Notwithstanding some evidence that DP may restrain credit growth noticeably (Lim et al., 2011, Peydró-Alcalde et al., 2011), it is not designed to prevent credit booms as trying to do so would require prohibitively high DP rates for banks to crowd out new "marginal" borrowers with an highly adverse risk profile (e.g., no or poor payment history, precarious employment, low value of collateral). Such high rates would likely exceed expected loss and thus also be at odds with the accounting standards. The Spanish case exemplifies the inability of DP to prevent exuberance in bank lending to inherently risky sectors of the economy, even though at the margin it likely had a palliative effect.

Moreover, DP does not offer short-run solutions for correcting excessive risk exposures because it unfolds its beneficial effect fully only in the medium-term. In fact, by helping to stabilize bank profits in a downturn and so keeping capital above the required minimum, DP may be regarded as preventing prompt corrective action. Bank supervisors should therefore look beyond headline profitability and seek to correct perceived imbalances by applying the supervisory review process under Pillar 2 of Basel II or by adding another macroprudential instrument.

Finally, DP cannot fully insulate bank capital from cyclical effects because it does not address the procyclical variation of risk-weighted assets that follow a point-in-time methodology rather than a more desirable through-the-cycle approach. Also, tail events cannot be absorbed, as DP is based on expected loss. These circumstances justify the use of countercyclical capital buffer in addition to DP.

Within the macroprudential toolkit DP assumes a somewhat separate role. Most other instruments such as loan-to-value and debt-to-income ratios or other explicit exposure limits target the build-up of risk in banks' portfolio and, as a result, seek to mitigate systemic risk. DP does not directly limit risk-taking but rather seeks to limit the consequences of such risk exposures during a downturn, which certainly contributes to safeguarding financial stability. Because of this restricted and indirect impact, DP needs to be complemented by other macroprudential instruments that more directly address specific banking risks.

In this context, it needs to be mentioned that such instruments may reduce the risk exposures that DP seeks to distribute over the credit cycle, thereby possibly requiring lower DP rates. This was the case in Uruguay where persistent regulatory reforms during the past decade in conjunction with improved macroeconomic stability lowered loan impairment considerably. Regulators seeking to apply multiple instruments should therefore exercise judgment in setting DP parameters by trying to quantify the likely impact of other macroprudential tools on portfolio risk. The next section analyzes the interaction with one of them, countercyclical capital.

VII. Dynamic Provisions versus Countercyclical Capital: Substitutes or Complements?

In the absence of a widely-applied framework for forward-looking provisioning, the countercyclical capital buffer under Basel III would require additional capital also for changes in expected loss along the cycle. This notion is clearly not in line with international accounting standards that allow limited provisions for expected loss in capital. Similarly, while DP can remove the procyclicality in provisions for expected loss, it cannot substitute countercyclical capital buffers. This is because it does not address the variability of the minimum capital requirement as a function of a common risk factor under Basel II.[44] Mindful of this, the Basel III framework states clearly that the measures on procyclicality are designed to complement each other, as the initiatives on provisioning focus on strengthening the banking sector against expected losses, while the capital measures focus on unexpected losses (BCBS, 2010a).

In what ways can DP and countercyclical capital complement each other? First, DP affects banks' income statement, while countercyclical capital does not, and therefore it acts as a "first line of defense" in smoothing the cost of varying loan losses through the cycle and thus shielding profits and also capital.[45] This virtue effectively lessens the extent to which

[44]Capital requirements are linked to shifts in risk-weighted assets that themselves react to two distinct procyclical effects: the migration of borrowers to lower loan grades in a point-in-time fashion and the recalibration of PDs along the cycle (Burroni et al., 2009).

[45]Beyond this protection of profits, DP has an effect on the incentives of bank managers given that the base for calculating dividends and bonus payments is diminished.

countercyclical capital buffers are needed. In fact, in Peru, where the two concepts co-exist, banks have to exhaust their DP funds before being allowed to tap their countercyclical capital buffer, thereby reducing the needed size of the latter. Second, countercyclical capital can mitigate the remaining procyclicality in unexpected loss by accumulating a buffer in good times for the increase in PDs and thus risk-weighted assets toward the end of the credit cycle. Third, countercyclical capital is also needed for cases of miscalibrated DP, i.e., when higher-than-expected losses on which the DP system is built are effectively unexpected losses to be covered by capital. In this sense, the joint use of DP and countercyclical capital creates a much needed backstop against faulty calibrations of capital and provisioning requirements. Finally, DP can usefully complement measures that are harmonized across countries by international agreements, such as countercyclical capital, because it allows a tailoring to the national cycles which are often not synchronized (Brunnermeier et al., 2009).

Several studies have pointed to the need for a countercyclical capital buffer to mitigate the cyclical fluctuations in minimum capital requirements. Even before the enactment of Basel II in 2006, the problem of procyclical risk-weights and thus capital was flagged by Kashyap and Stein (2004) based on counterfactual simulation. Repullo et al. (2010) find that capital requirements vary significantly along the business cycle based on point-in-time PDs (in the order of 57 percent between peak and trough).[46] Using a dynamic stochastic general equilibrium model, Angelini et al. (2010) find that Basel II produces a modest increase in procyclicality, as the sensitivity of the risk weights and of loan growth to the cycle is relatively strong under Basel II. While DP takes care of the fluctuations in specific provisions, it does not affect such variations in point-in-time PDs (and LGDs) used for capital requirements.

A range of countercyclical regulatory measures to address microeconomic risks via capital adjustments have been proposed.[47] These measures aim at adjusting the capital of banks to smooth its changes through the cycle via adjustment of the capital function or of capital through the cycle. Adjustments of the capital function may be obtained by (i) smoothing the input parameters that quantify risks in the capital function of Basel II; (ii) adjusting the capital function itself (using a time-varying confidence level or asset correlation); or (iii) smoothing the output of the capital function (based on an autoregressive mechanism or a time-varying multiplier[48]); see Panetta et al. (2009) for an appraisal of the various reform proposals.

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[46]Using a dynamic equilibrium model of banking with cyclical capital buffers in a two-state cycle, Repullo and Suarez (2009) find that the extra buffers that banks choose to hold under cyclical capital requirements are not sufficient to absorb the impact of a recession, suggesting that the advantage of cyclically-varying capital requirements are disproportionately small relative to the credit crunch effects that it may produce.

[47]Panetta et al. (2009).

[48]Several mechanisms have been proposed. For example, Gordy and Howells (2006) suggest a multiplier tied to a moving average of the default rate, Repullo and Suarez (2009) propose the deviation of GDP growth from trend,

(continued)

The Basel Committee eventually decided against a change in the capital function and in favor of an outright countercyclical buffer of up to 2.5 percent of risk-weighted assets (BCBS, 2010a) but left its design essentially to national regulators. To be sure, the BCBS did propose the *aggregate private sector credit-to-GDP gap* as common reference point based on the findings by Drehmann et al. (2010) that this measure performs best as leading indicator for financial distress; Alessi and Detken (2009) come to a similar conclusion. This finding is confirmed by a recent IMF study for a sample of advanced and emerging countries (IMF, 2011). Still, the BCBS expects the authorities to apply judgment in the setting of the buffer and the choice of the trigger variable, thereby introducing elements akin to Pillar 2.[49] Nonetheless, Repullo and Saurina (2011) take issue with the credit-to-GDP gap as trigger, cautioning that it is unlikely to emit correct cyclical signals if, as in a sample of six industrial countries, its correlation with GDP growth is actually negative (unlike credit growth for which the correlation is found to be positive). While the credit-to-GDP ratio may work well as indicator in some cases, Ren (2011) points out that it may not be practical for developing countries with a steep trend trajectory due to persistent financial deepening that could be mistaken for a credit bubble. In light of this, Repullo et al. (2010) propose to adjust the capital requirements based on point-in-time PDs by using a multiplier that responds to deviations of GDP growth from its long-run average.[50] In the end, national regulators will have to devise their own approaches to operating the countercyclical capital buffer, choosing the trigger variable that best predicts an impending boom or bust phase.

VIII. Conclusions

This paper has provided a thorough analysis of the merits and challenges associated with dynamic provisioning—a macroprudential tool that deserves attention from policymakers and regulators for its capacity to distribute the burden of loan impairment evenly over the credit cycle and so quench an important source of procyclicality in banking. Our simulations that apply the Spanish and Peruvian DP formulas to a full cycle of banking data of an advanced emerging market leave little doubt that the countercyclical buffer built under DP not only smoothes costs but actually bolsters financial stability by lowering banks' PD in severe downturn conditions. We also show that for best countercyclical results DP should be tailored to the different risk exposures of individual banks and the specific circumstances of banking

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and CEBS (2009) suggests a mechanism that is based on a quantitative assessment of the gap between current PDs and downturn PDs and a corresponding mapping into countercyclical capital requirements.

[49]According to the BCBS (2010b), this buffer incorporates elements of both Pillar 1 and 2. It can be regarded as a Pillar 1 approach in that it is a framework consisting of a set of mandatory rules, but its use of jurisdictional judgment in setting buffer levels and the discretion provided in terms of how authorities explain buffer action are more akin to a Pillar 2 approach.

[50]Repullo et al. (2010) regard this multiplier as superior to through-the-cycle approaches in terms of simplicity, transparency, cost of implementation and consistency with banks' pricing and risk management, and also in line with the common risk factor orientation of Basel II.

sectors, presenting measures such as bank-specific rates or hybrid systems combining the virtues of formulas.

While the simple concept of providing in good times for lean years is intuitive, it has its operational challenges. When calibrating a DP system great care must be taken to keep countercyclical reserves in line with expected loan losses and so avoid insufficient buffers or excessive coverage. As many of the features and needed restrictions are not easily understood or operationalized, we offer a comprehensive primer for regulators eager to implement one of the variants of DP analyzed in the paper. The discussion of practical challenges also includes thorny issues like compliance with accounting standards. In fact, policymakers have long tended to dismiss DP on grounds that it is not legitimate from an accounting perspective and therefore focused on other tools such as countercyclical capital. To remedy this problem, we propose ways to recalibrate the formula periodically and so keep it in line with expected loan loss. Further, while recognizing that countercyclical capital has its definite place in the macroprudential toolkit, we argue that DP acts as a first line of defense by directly shielding bank profits, thereby lowering the degree to which other countercyclical instruments are needed. However, there should be no doubt that due to the limited impact of DP in restraining excessive credit growth complacency in supervision due to DP buffers should be avoided and that DP needs to be accompanied by other macroprudential tools aimed at mitigating particular systemic risks.

Clearly, further research is needed on the interaction between DP and countercyclical capital as well as other macroprudential tools to answer the question in what ways they can complement one another in providing an integrated countercyclical buffer. As an early example, Saurina (2011) analyzes DP and countercyclical capital side-by-side but not their possible interaction. Another area of needed research is the impact of DP on credit cycles and other macroeconomic aggregates. Newer studies (e.g., Peydró-Alcalde et al., 2011; Chan-Lau, 2012) evaluate the implications of DP for credit availability, yet broader-based results are certainly warranted. The ongoing efforts by a number of countries towards adopting DP systems and other forms of forward-looking provisioning will provide a fertile ground for such future research.

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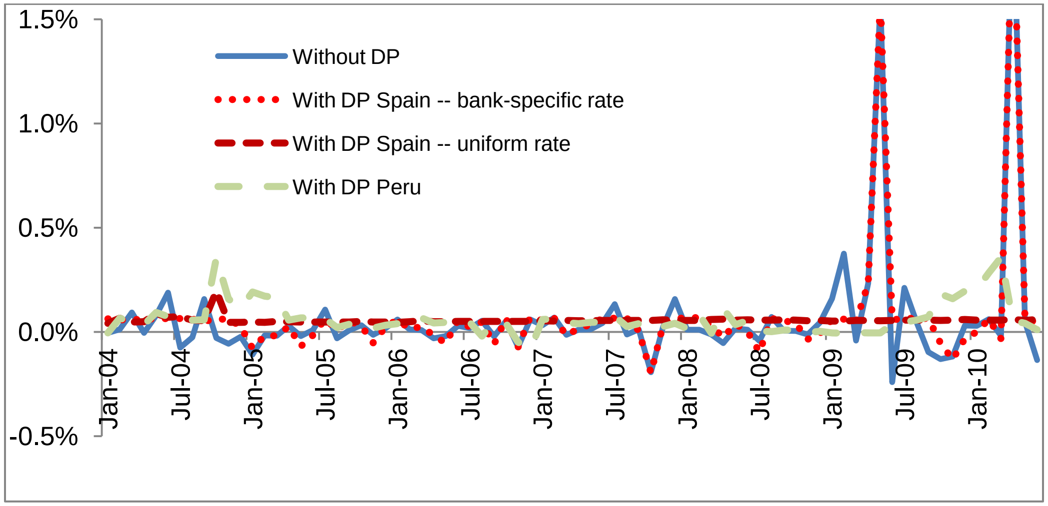
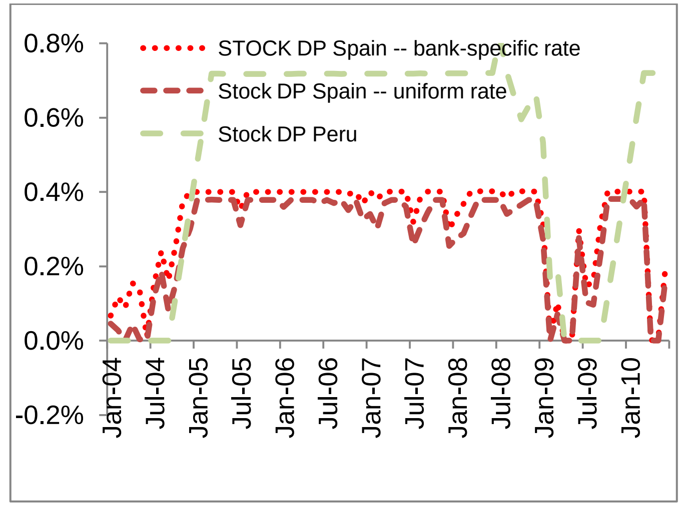
Annex I: Individual Simulation Results under Different DP Formulas

Annex Figure 1. Monthly Net Provisioning Cost and Size of Dynamic Provisions Fund

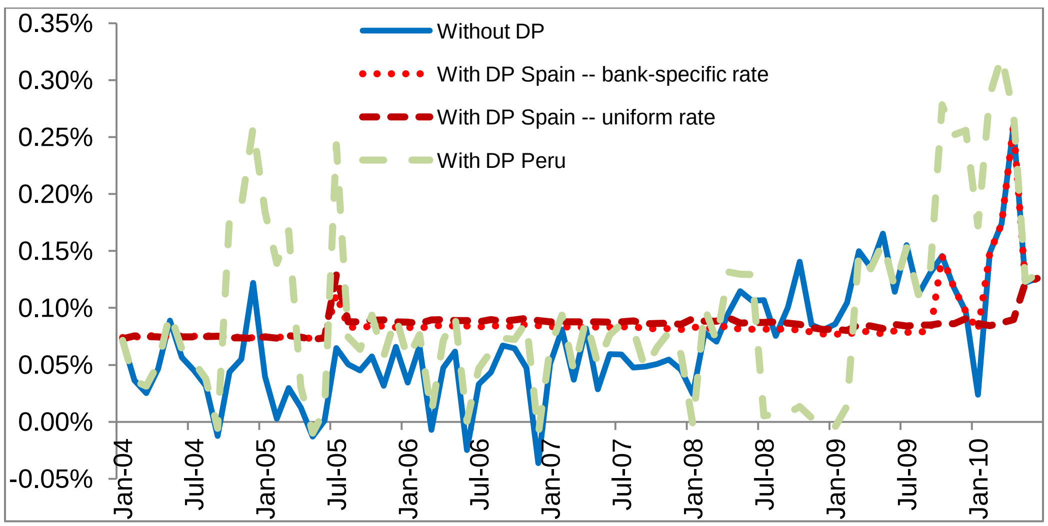
(in percent of total loans)

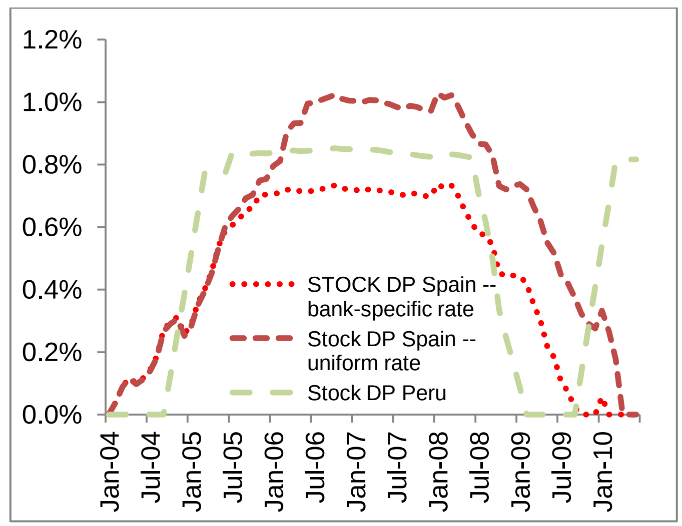
Bank 1





Bank 2



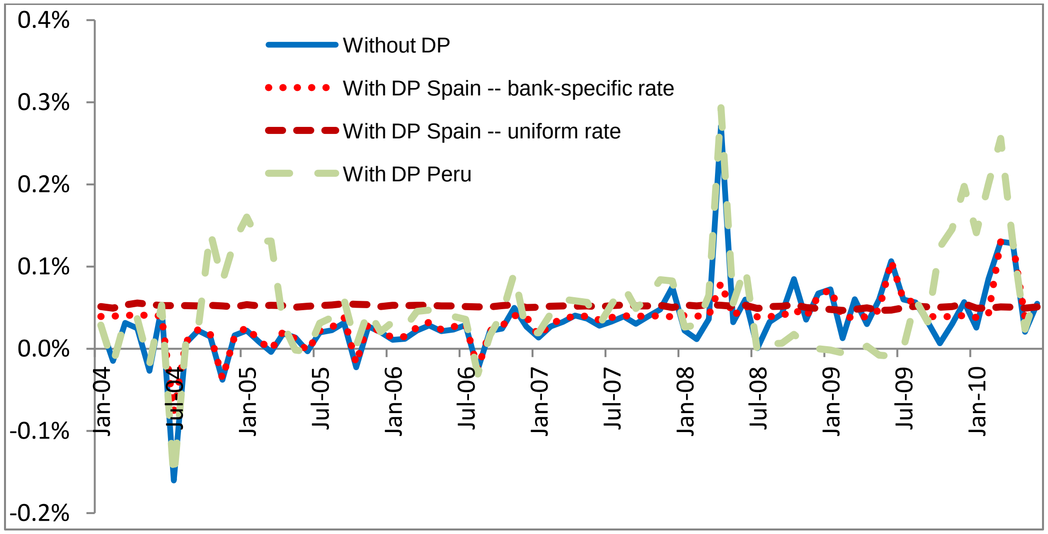


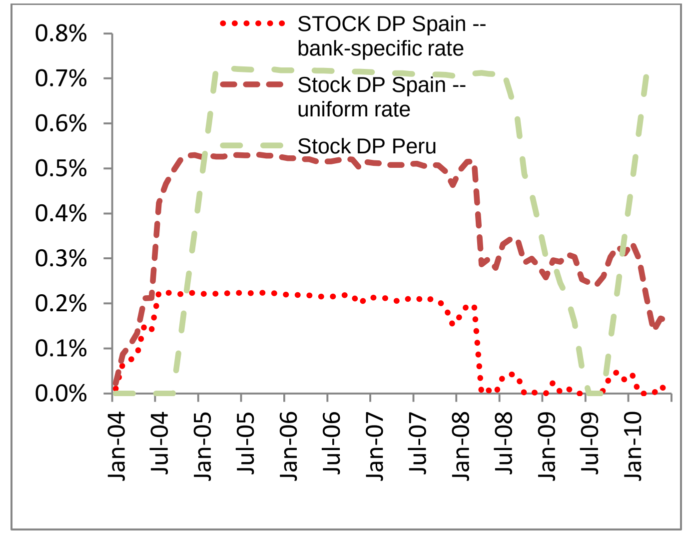
Sources: SBIF and staff calculations.

Annex Figure 1. Monthly Net Provisioning Cost and Size of DP Fund (cont.)

(in percent of total loans)

Bank 3





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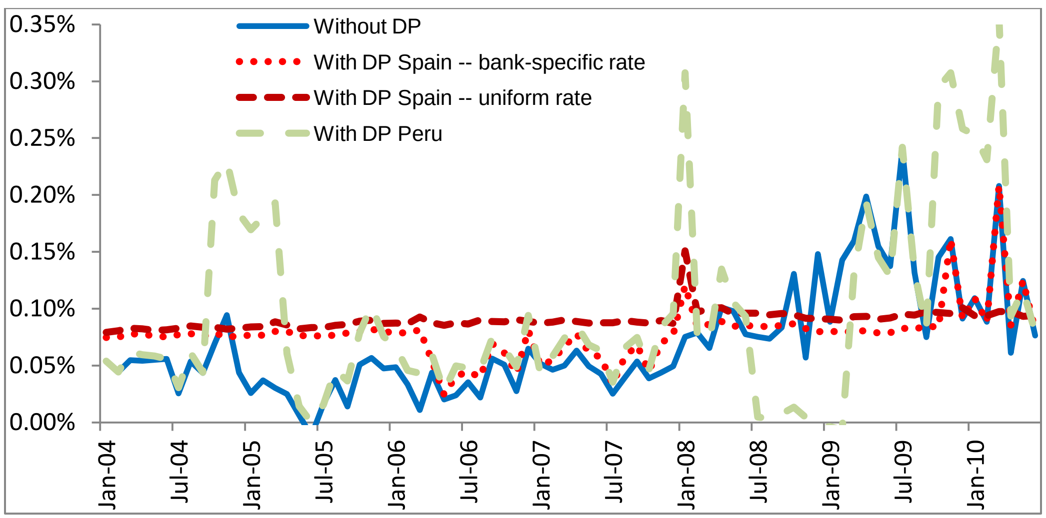
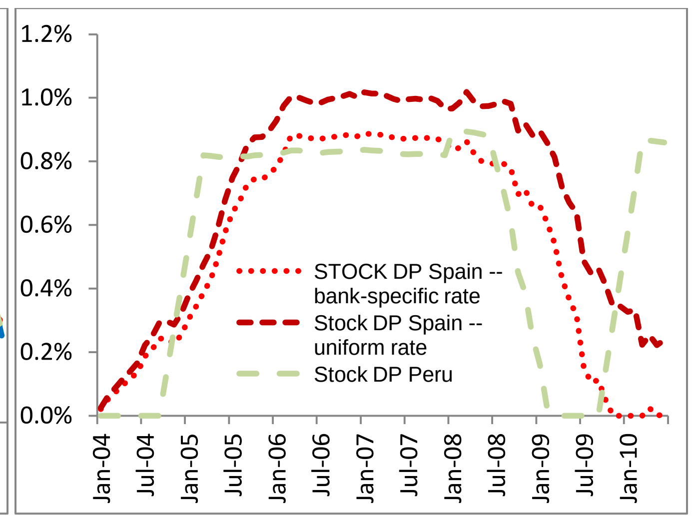
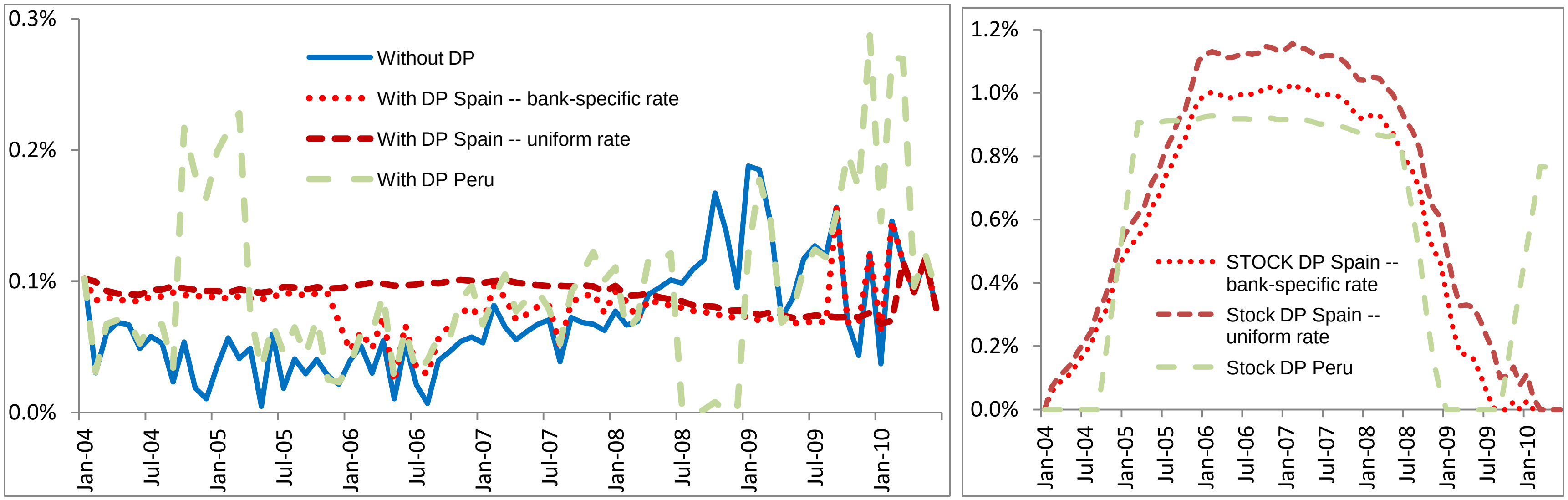




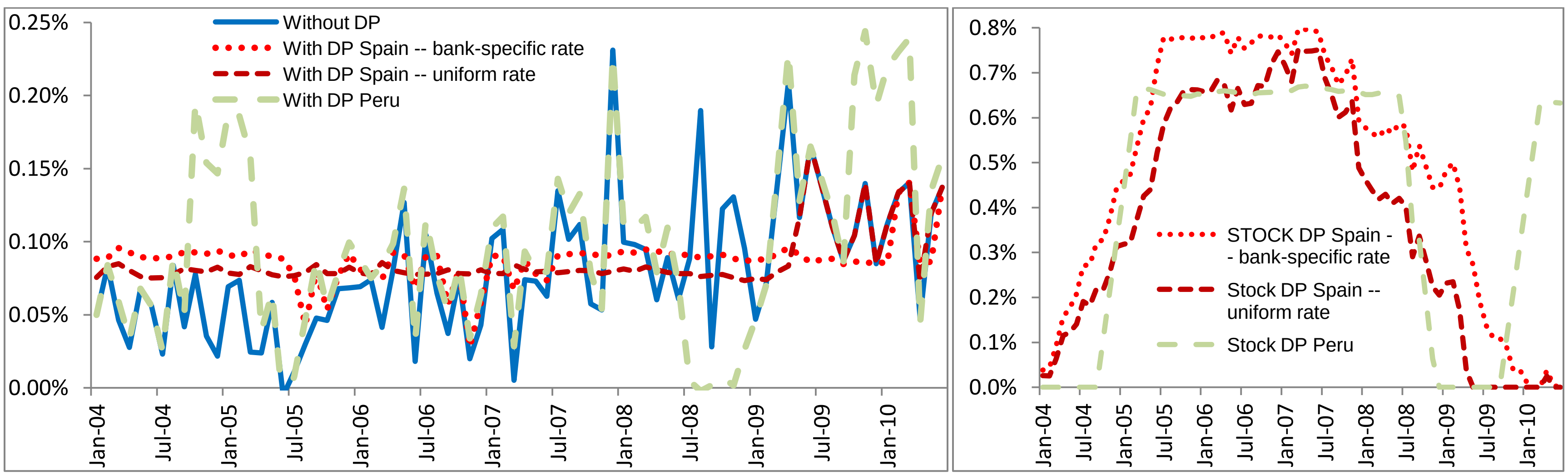
Annex Figure 1. Monthly Net Provisioning Cost and Size of DP Fund (cont.)

(in percent of total loans)

Bank 5

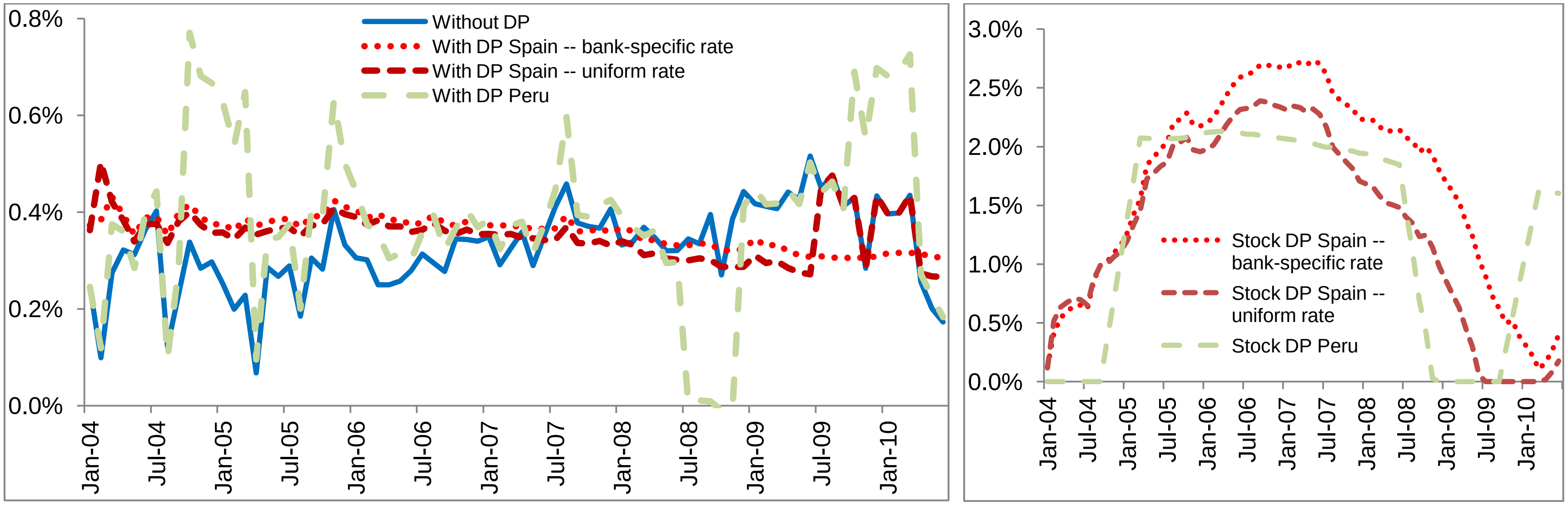


Bank 6



Annex Figure 1. Monthly Net Provisioning Cost and Size of DP Fund (cont.)
(in percent of total loans)

Bank 7



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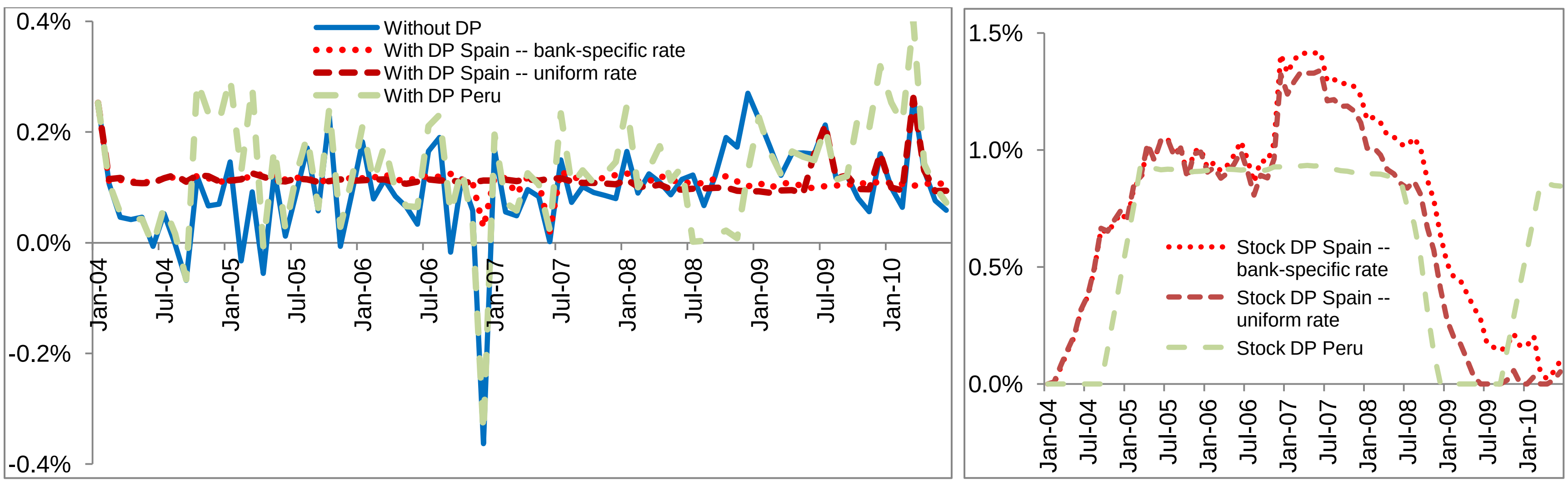
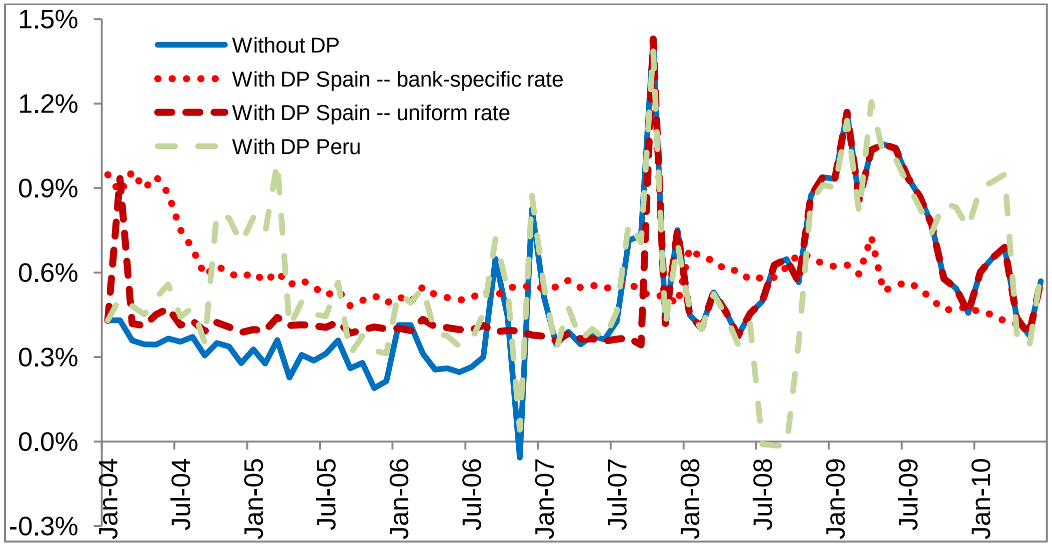
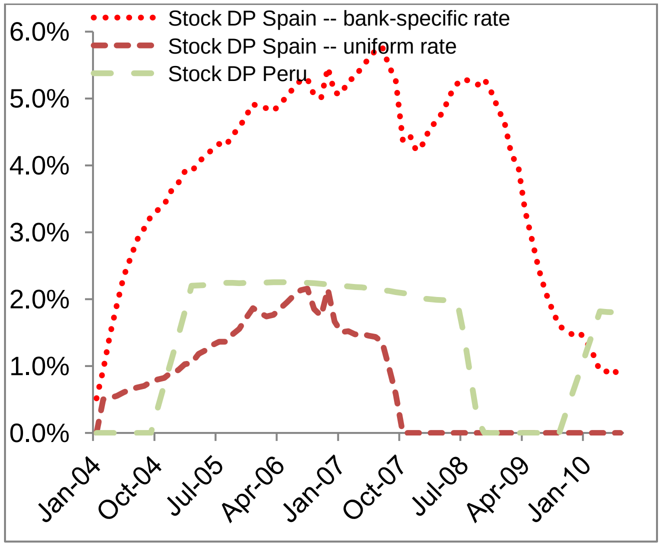


Annex Figure 1. Monthly Net Provisioning Cost and Size of DP Fund (cont.)

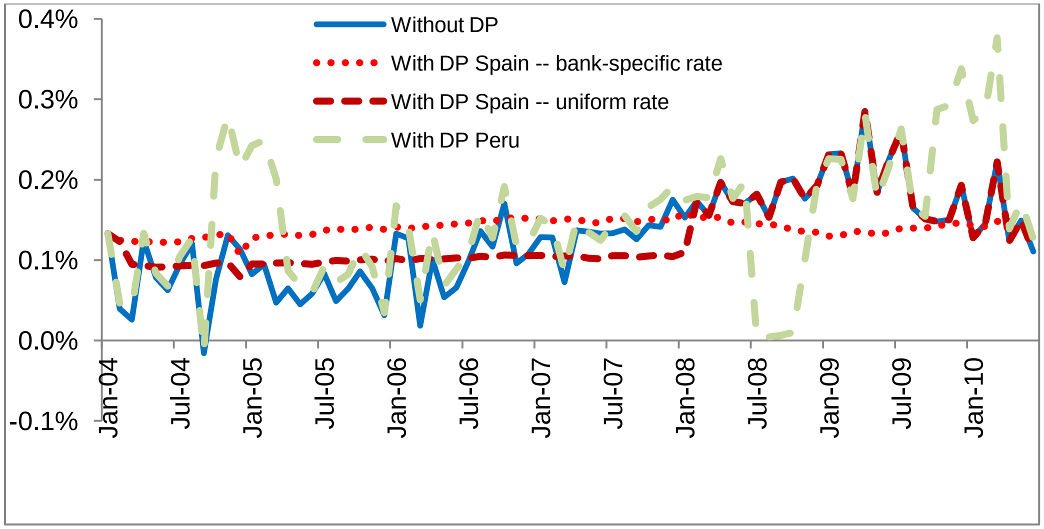
(in percent of total loans)

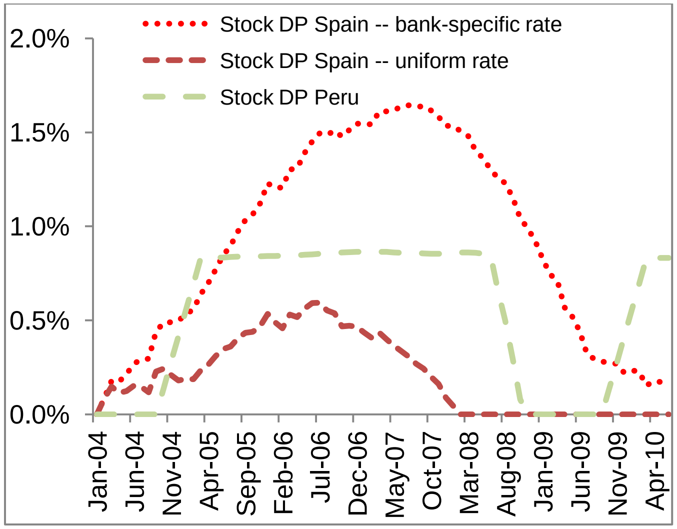
Bank 9





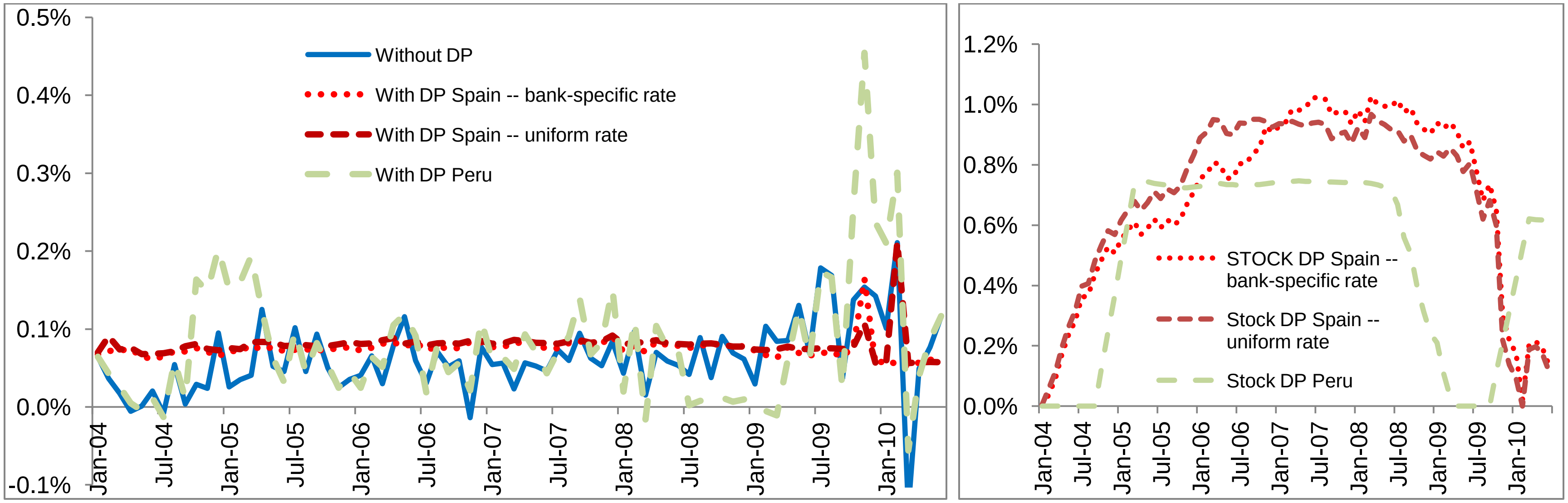
Bank 10



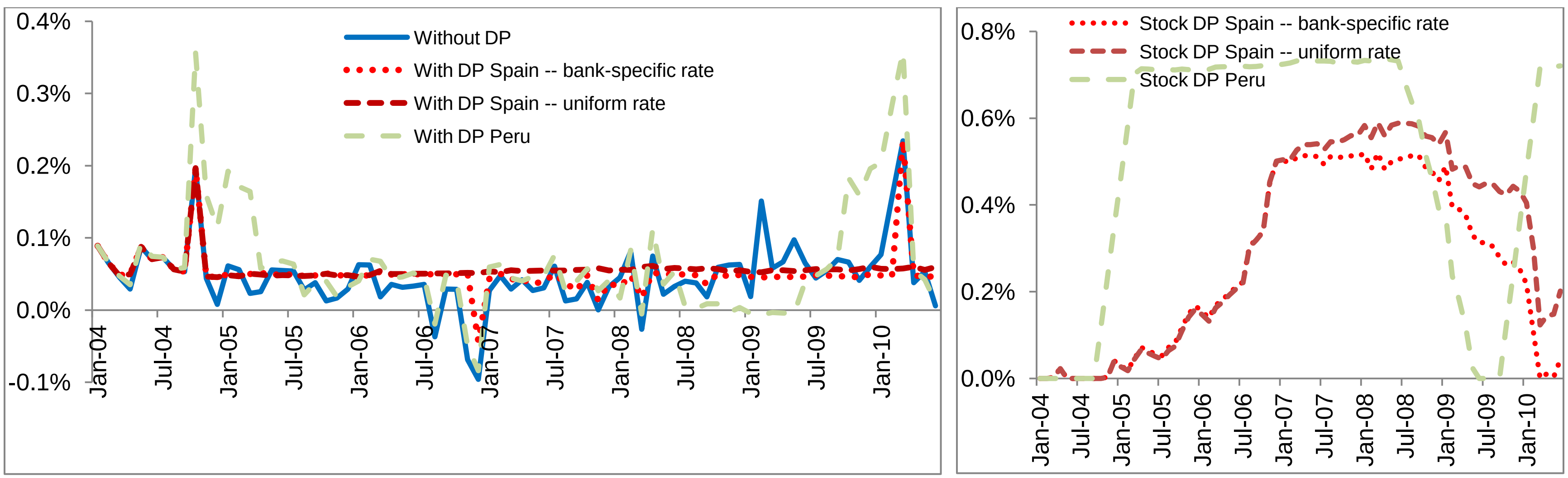


Annex Figure 1. Monthly Net Provisioning Cost and Size of DP Fund (cont.)
(in percent of total loans)

Bank 11

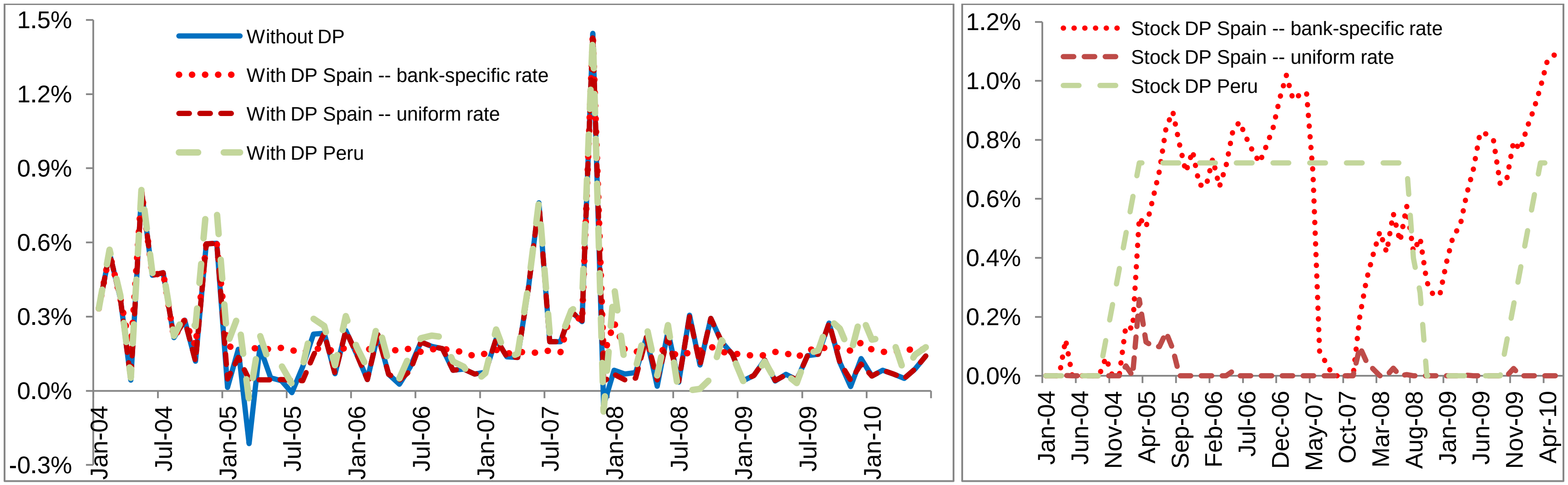


Bank 12

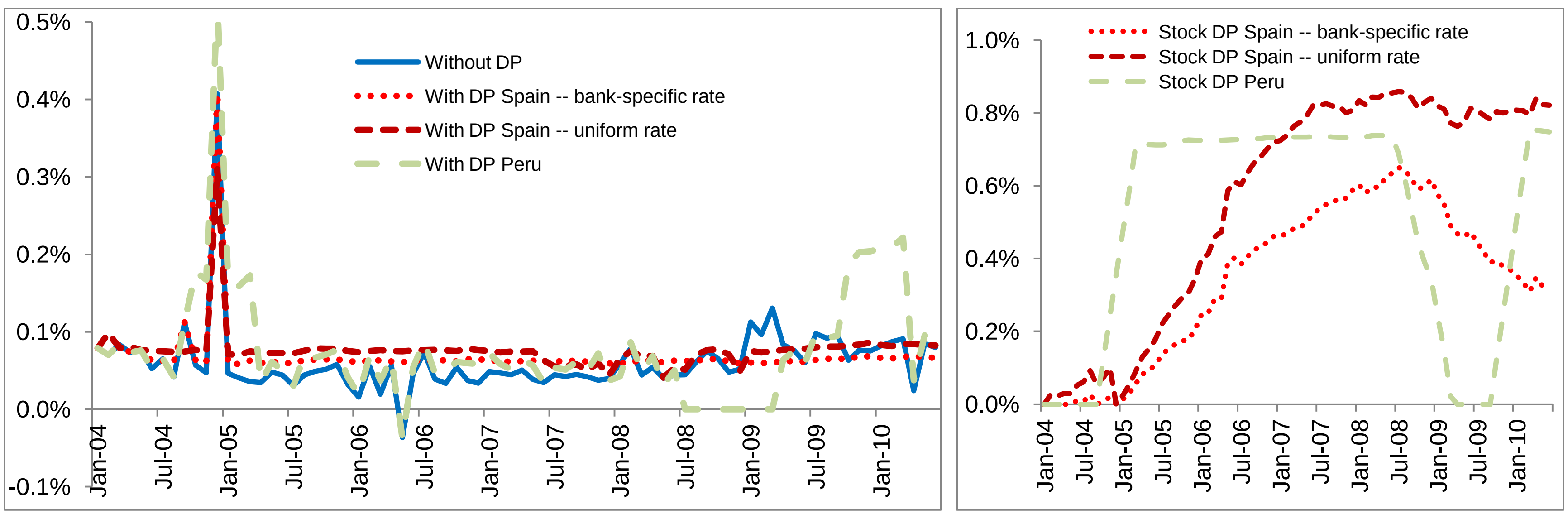


Annex Figure 1. Monthly Net Provisioning Cost and Size of DP Fund (cont.)
(in percent of total loans)

Bank 13



Bank 14



ANNEX II. DETERMINATION OF THE DP FUND LIMIT USING A LOSS FUNCTION APPROACH

In the following example, the regulator seeks to minimize a loss function capturing the deviations of the realizations of banks' DP funds from the optimal path that prescribes to fully exhaust the fund at the end of the cycle (here, in *T*=78 or June 2010). To this end, both surpluses and deficits are considered losses to the regulator.

The *surplus* DP funds at *T* of banks that never exhausted their funds during the downturn period are divided by total loans in that period and then summed across banks. The resulting number is weighted by a cost-risk aversion parameter *p*, with *p* close to 1 indicating aversion to the cost of having accumulated unused DP at the end of the cycle and *p* close to 0 indicating the risk of prematurely exhausting the DP fund.

For the *deficit* DP funds only losses related to cyclical developments are considered but not idiosyncratic losses occurring at other times (this downturn period was chosen to span July 2008 (*R*) to September 2009, in line with the deactivation period under the Peruvian rule). Correspondingly, the theoretical deficits of DP funds (or unabsorbed specific provisions when the fund is exhausted) as a share to total loans are first summed over *S*=15 months and then across banks. This sum is then weighted by the complement (1-*p*). Note that by construction a bank can only have a surplus *or* a deficit, as any deficit during the evaluation period means that the DP fund was exhausted in an interim period.

Finally, the total losses thus defined are summed and expressed as an average by dividing by the number of banks *N* (here, *N*=14):

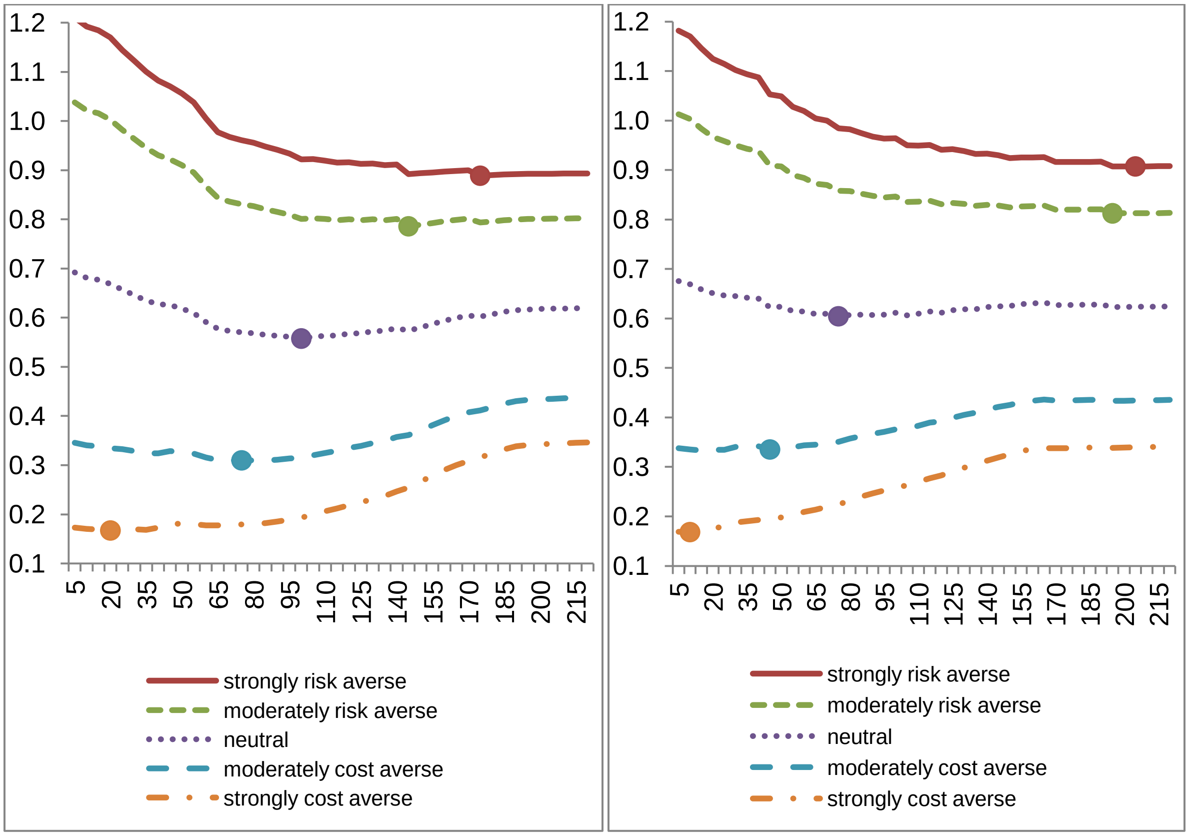
$$min!\, L = \left(\frac{1}{N}\right)\left[p\left(\sum_{i=1}^{N}\frac{SurplusDP_{i,T}}{Total\ Loans_{i,T}}\right) + (1-p)\left(\sum_{i=1}^{N}\sum_{s=1}^{S}\frac{DeficitDP_{i,R+s}}{Total\ Loans_{i,R+s}}\right)\right]$$

Having defined the loss function, we proceed to calculate the loss under different upper limits to the DP funds. These limits can be expressed as a percentage of latent loss as under the Spanish rule or as a share of total loans as under the Uruguayan rule.

Annex Figure 2 depicts the five loss functions according to different risk attitudes of the regulator (strongly risk averse (*p*=1/8); moderately risk averse (*p*=1/4); neutral (*p*=1/2); moderately cost averse (*p*=3/4); strongly cost averse (*p*=7/8)).

Annex Figure 2. Miscalibration Loss as a Function of the Limit to the DP Fund

Loss score (vertical axis); and fund limit (horizontal axis) as share of *latent loss* (percent, left panel) and *total loans* (basis points, right panel)



Source: SBIF and staff calculations.

In line with the minima of the loss functions, a risk-neutral regulator would set the boundary at 100 percent of latent loss or 0.75 percent of total loans. A cost averse decision-maker (p=3/4) would choose a limit of 75 percent of latent loss or 0.45 percent of total loans (strong risk aversion would call for limits of 20 and 0.1 percent, respectively). Conversely, risk averse stance (p=1/4) would suggest choosing an upper limit of 145 percent of latent loss or 1.95 percent of loans (under the more extreme stance, 175 percent and 2.05 percent, respectively). It is noteworthy that with very high ceilings the restriction ceases to be binding (loss function turns into a horizontal line), since banks' DP funds increasingly do not hit that limit. Some loss functions have a range of virtually identical losses, such as under risk neutrality. As a result, the aforementioned minima should in some cases be understood as mid-points of a range of near-optimal DP limits.

Annex III. Proposed Reform of Accounting Standard on Loan Loss Recognition (IAS 39/IFRS 9)

In 2008, the International Accounting Standards Board (IASB) and the US Financial Accounting Standards Board (FASB) launched an initiative to overhaul the critical regulation on valuing the impairment of financial assets as part of a three-part project to replace IAS 39 with IFRS 9. This effort led to the publication of proposals by the IASB in November 2009, by the FASB in May 2010 and finally by the IFRS Foundation in January 2011. It is currently expected that the new norm becomes effective in 2015. The rationale for this initiative in the wake of the global financial crisis was to permit a more timely recognition of expected loss.

The proposed reform of IAS 39 seeks to replace the current incurred loss impairment method with one based on expected loss. IAS 39 mandates that loans may be written down only when evidence is available that a loan or a portfolio of loans will not be repaid in full—a "trigger event" specific to an individual loan or likely leading to defaults across a portfolio of loans. Requiring a triggering event implies that loan losses are recognized only if the PD approaches 100 percent (Novotny-Farkas and Toniato, 2010). The Financial Accounting Standards that are used in the United States provide somewhat more leeway to evaluate homogeneous groups of loans that share common risk characteristics, using both loss history and environmental factors in impairment analysis (Financial Accounting Standards Statement 5; for details, see Balla and Mc Kenna, 2009).

By contrast, expected credit losses are *estimated* losses on a loan portfolio over the life of the loans and considering the loss experience over the complete economic/credit cycle (BCBS, 2009). Specifically, the expected loss model requires (i) determining such expected loss when financial assets (here, loans) are acquired; (ii) building a provision for expected credit loss over the life of the asset; and (iii) reassessing the expected loan loss each period and, if necessary, recognizing the change in value at once (IASB, 2009).

Initially, there was disagreement between the IASB and the FASB about the extent to which non-incurred losses could be recognized before a credit event. After joint deliberations, a common impairment model was presented in January 2011 in which the time-proportional approach favored by the IASB, i.e. estimating expected cash flows and recognizing additional credit losses periodically over the life of the asset, was augmented by the FASB's proposition of a "minimum allowance balance" or floor for expected losses for the "foreseeable future" (but not necessarily lifetime) of loans in a bank's "good book". According to the IASB, the "foreseeable future" time period is the period for which reasonable and supportable information exists to support specific projections of events and conditions (IFRS Foundation, 2011). As of mid-2011, the two Boards were discussing the possibility of recognizing for homogeneous loans an allowance equal to losses expected to occur in the next 12 months based on internal expectations plus change in expected credit loss (IASB, 2011). The discussion in the two bodies was ongoing at the time of writing.

ANNEX IV. THE EFFECT OF RECORDING DYNAMIC PROVISIONS AS CAPITAL OR LIABILITIES

A simple numerical example illustrates why dynamic provisions should be recorded mostly in liabilities for the purpose of maintaining capital adequacy. Suppose that a bank applying Basel I (for simplicity) has risk-weighted assets of 100 currency units (and no other assets), total capital of 10 (i.e., a capital adequacy ratio of 10 percent), earnings before provisioning and taxes of 3, and is subject to a corporate tax rate of 25 percent. The provisioning flow *under stress* is assumed to be 2, implying a pre-tax return on assets of 1 percent in the absence of dynamic provisioning. In line with current accounting rules, the bank can provide of up to 1.25 percent of risk-weighted assets in Tier 2 capital.

In the example, three different cases are assessed: (i) a DP fund of 1.25; (ii) a DP fund of 0.6—both under the Spanish formula—; and (iii) a DP fund of 1.25 under the Peruvian formula. To apply the Spanish formula, we assume an average provisioning flow of 1 unit or ß=1 percent of loans p.a., which roughly corresponds to the Chilean case. Thus, in the case of the Spanish formula an amount of up to 1 (0.6 in the second case due to the smaller size of the DP fund) can be covered by DP. The assumption of an average provisioning flow is not needed for the Peruvian formula, since the system provides full coverage of the flow of specific provisions during the de-activation phase in a downturn (effectively, ß=0).

Annex Table 1 shows the impact on the capital adequacy ratio of including the different DP amounts in capital under the Spanish and Peruvian formula, ranging from 0 percent (i.e., all DP are recorded as liabilities) to 100 percent (i.e., all DP are recorded in capital, yet subject to the limit of 1.25 percent of risk-weighted assets). Another differentiation is made regarding the dividend payout ratio, also ranging from 0 to 100 percent.

Consider the first case of DP=1.25 and ß=1 under the Spanish formula, with the share of DP in capital of 50 percent and a dividend payout ratio of 0 percent. In this case, the DP buffer of 1.25 exceeds the absorbable provisioning flow of (2-1)=1 and so provides 100 percent loss coverage. After-tax earnings are (3-1)*(1-0.25)=1.5. However, 0.5 units held in capital are used up to cover the provisioning cost, so that capital increases by 1.5-0.5=1, leading to a capital adequacy ratio of 11.0 percent. In the absence of dynamic provisioning, after-tax earnings would be (3-2)*(1-0.25)=0.75, causing the ratio to rise to 10.75 percent. In this specific case, dynamic provisioning has a net benefit of ¼ percentage points in terms of the capital adequacy ratio. However, a dividend payment of more than 1/3 of net earnings would cause a net loss in the capital adequacy ratio compared to the situation without DP.

As the size of DP diminishes to 0.6 percent of risk-weighted assets in the second case, the negative impact of recording DP largely in capital also declines in absolute terms, but the thresholds remain the same across the board. This even holds true for the third case of the Peruvian formula where the assumption of having to make the average provision at all times is dropped, although the differences in the capital adequacy ratio are more pronounced.

Annex Table 1. Impact on Capital Adequacy of Including DP in Capital or Liabilities

(capital in percent of risk-weighted assets)

	Capital Adequacy Ratio after Provisioning Shock (DP Fund=1.25; ß=1)					
Share DP in capital %	0%	25%	50%	75%	100%	*w/o DP*
Dividend payout %						
0%	11.50	11.25	11.00	10.75	10.50	*10.75*
25%	11.13	10.88	10.63	10.38	10.13	*10.56*
50%	10.75	10.50	10.25	10.00	9.75	*10.38*
75%	10.38	10.13	9.88	9.63	9.38	*10.19*
100%	10.00	9.75	9.50	9.25	9.00	*10.00*

	Difference in Ratio Compared to Situation Without DP					
Share DP in capital %	0%	25%	50%	75%	100%	*w/o DP*
Dividend payout %						
0%	0.75	0.50	0.25	-	(0.25)	-
25%	0.56	0.31	0.06	(0.19)	(0.44)	-
50%	0.38	0.13	(0.13)	(0.38)	(0.63)	-
75%	0.19	(0.06)	(0.31)	(0.56)	(0.81)	-
100%	-	(0.25)	(0.50)	(0.75)	(1.00)	-

	Capital Adequacy Ratio after Provisioning Shock (DP Fund=0.60; ß=1)					
Share DP in capital %	0%	25%	50%	75%	100%	*w/o DP*
Dividend payout %						
0%	11.20	11.05	10.90	10.75	10.60	*10.75*
25%	10.90	10.75	10.60	10.45	10.30	*10.56*
50%	10.60	10.45	10.30	10.15	10.00	*10.38*
75%	10.30	10.15	10.00	9.85	9.70	*10.19*
100%	10.00	9.85	9.70	9.55	9.40	*10.00*

	Difference in Ratio Compared to Situation Without DP					
Share DP in capital %	0%	25%	50%	75%	100%	*w/o DP*
Dividend payout %						
0%	0.45	0.30	0.15	-	(0.15)	-
25%	0.34	0.19	0.04	(0.11)	(0.26)	-
50%	0.23	0.07	(0.08)	(0.23)	(0.38)	-
75%	0.11	(0.04)	(0.19)	(0.34)	(0.49)	-
100%	-	(0.15)	(0.30)	(0.45)	(0.60)	-

	Capital Adequacy Ratio after Provisioning Shock (DP Fund=1.25; ß=0)					
Share DP in capital %	0%	25%	50%	75%	100%	*w/o DP*
Dividend payout %						
0%	11.69	11.38	11.06	10.75	10.44	*10.75*
25%	11.27	10.95	10.64	10.33	10.02	*10.56*
50%	10.84	10.53	10.22	9.91	9.59	*10.38*
75%	10.42	10.11	9.80	9.48	9.17	*10.19*
100%	10.00	9.69	9.38	9.06	8.75	*10.00*

	Difference in Ratio Compared to Situation Without DP					
Share DP in capital %	0%	25%	50%	75%	100%	*w/o DP*
Dividend payout %						
0%	0.94	0.63	0.31	-	(0.31)	-
25%	0.70	0.39	0.08	(0.23)	(0.55)	-
50%	0.47	0.16	(0.16)	(0.47)	(0.78)	-
75%	0.23	(0.08)	(0.39)	(0.70)	(1.02)	-
100%	-	(0.31)	(0.63)	(0.94)	(1.25)	-

Source: Staff calculations.