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Bank capital regulation and climate change

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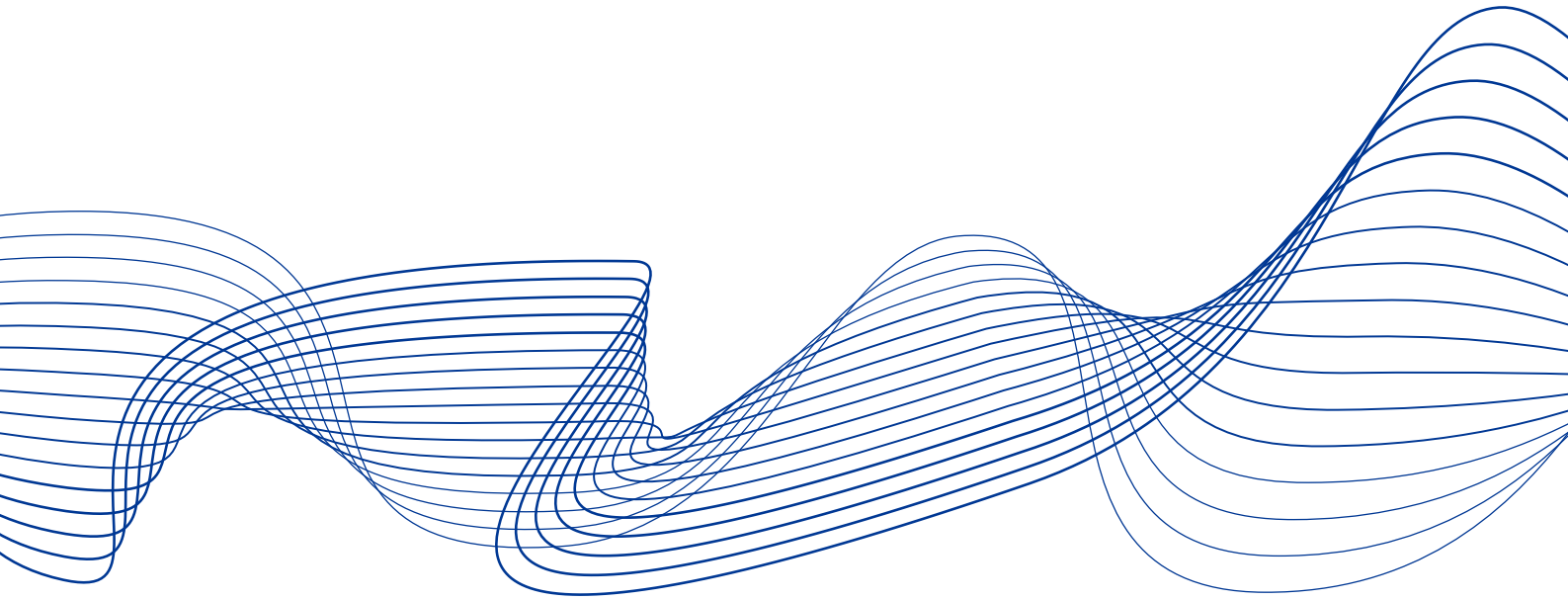

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Abstract

Bank capital regulation and climate change

Climate change has become a major topic of discussion at central banks and financial regulators. Key aspects of this debate include whether and how monetary policy and financial regulation should take climate change and the associated risks into account.

This note focuses on the bank capital regulation aspect of the debate. Climate change is relevant for bank regulators along two potential dimensions. First, climate change may expose the banking sector to financial risks that the current regulatory framework does not account for. In particular, prudential capital requirements based on historical default frequencies are unlikely to fully account for future physical and transition risks arising from climate change. Second, bank capital regulation has been proposed as a tool for tackling the consequences of climate change more broadly by supporting the transition to a low-carbon economy (see, for example, Dombrovskis, 2017), so long as no global carbon tax has been implemented.

Based on recent academic research (Oehmke and Opp, 2022), Section 1 of this note describes a conceptual framework for assessing the introduction of differentiated capital requirements for “clean” and “dirty” loans. Building on this framework, Section 2 discusses bank capital regulation in the presence of climate risks and carbon externalities, and Section 2.1 presents a categorisation of climate risks for financial regulators based on cause and effect. Section 2.2 discusses capital requirements as a regulatory tool for addressing climate-related prudential risks. Section 2.3 assesses capital regulation as a regulatory tool for reducing carbon emissions and associated externalities.

This note concludes that bank capital requirements can be an effective tool for dealing with prudential risks arising from climate change. Conceptually, addressing these risks through bank capital regulation is no different to dealing with traditional financial risks. The main difficulty is the measurement of climate risks, given that historical data series contain limited information on the nature of these risks. Despite recent progress – for example, relating to climate stress tests – measuring climate risks poses a significant challenge for regulators.

In contrast, bank capital requirements are likely not the most effective tool for reducing carbon emissions. As long as carbon-intensive activities remain profitable, using capital requirements to induce banks not to finance these activities may be impossible or may involve sacrificing financial stability. In addition, even if capital regulation deters banks from funding such activities, firms may turn to bond markets, private equity investors or internally generated funds. More direct policy measures, such as carbon taxes, are more effective when the goal is to reduce emissions and the associated externalities, as opposed to when the goal is to ensure that the banking system can withstand prudential risks resulting from climate change. While capital requirements alone are not an effective tool for reducing carbon emissions, they can play a supporting role by facilitating more direct policy measures. In particular, in the absence of a sufficient equity cushion in the banking sector, governments may be reluctant to impose carbon taxes for fear of triggering a banking crisis.

1 Differentiated capital requirements for clean and dirty loans

This section presents a simple conceptual framework of capital regulation with differentiated capital requirements for clean and dirty loans. Clean loans are defined as loans that fund low-carbon activities, whereas dirty loans finance activities associated with significant carbon emissions.[1]

Understanding the effects of differentiated capital requirements for clean and dirty loans requires knowledge of how changes in capital requirements affect prudential risks and the allocation of credit via the banking sector.

A direct consequence of higher capital requirements is that they create an equity cushion, thereby increasing the banking sector's ability to absorb unexpected losses and withstand bank runs. The ability to absorb losses in turn reduces distortions arising from explicit or implicit government guarantees resulting from deposit insurance or bailouts. A more indirect consequence of capital requirements is the effect on credit allocation in the economy. If equity capital is costly for banks, changes in capital requirements will affect which loans banks choose to make.

An analysis of differentiated capital requirements for carbon-intensive loans requires considering both the direct and indirect consequences. While the direct effect on loss-absorbing capacity is generally well understood, the impact on credit allocation is more subtle and therefore merits further elaboration.

The discussion below is based on a stylised model of the banking sector developed by Oehmke and Opp (2022). In this model, competitive banks finance their lending business using a combination of insured deposits and equity capital. Because of the well-known safety net guarantees associated with insured deposits, banks find deposit funding cheaper than equity funding at the margin.

1.1 Capital requirements and credit allocation: an analogy with consumer theory

To understand the effects of capital requirements on credit allocation, we can draw an analogy with consumer theory. Like a standard demand curve that ranks consumers according to their willingness to pay, the demand curve for bank equity can be constructed by ranking potential loans according to the maximum return on equity (ROE) they generate for the lending bank.

The maximum ROE is the ratio of the bilateral surplus that the bank and the borrower generate when agreeing on a loan and the amount of bank equity required for the loan. The bilateral surplus consists of two components, the net present value (NPV) that results from the investment funded

[1] To keep the focus on capital regulation, this note does not consider other practical difficulties that arise when classifying loans as clean or dirty, such as those resulting from informational frictions.

by the loan, and the value of the additional deposit insurance put option or bailout subsidy the loan generates for the bank:

$$ROE_{max} = \frac{NPV + deposit\ insurance\ subsidy}{required\ equity}.$$

This expression, which provides a ranking of loans from a bank's perspective, clarifies that changes in capital requirements affect the demand curve for bank loans through two channels. First, higher capital requirements increase the denominator because more equity is required to make the loan. Second, an increase in capital requirements reduces the numerator because it lowers the value of the deposit insurance subsidy associated with the loan.[2]

1.2 Changes in capital requirements have income and substitution effects

How do changes in capital requirements affect the allocation of credit? As before, an analogy with consumer theory is instructive. If we think of the capital requirement as the price of making a loan, then changes in capital requirements lead to the usual income and substitution effects.

To illustrate this, consider an increase in the capital requirement for dirty loans. The income effect captures that every dirty loan the bank continues to make now takes up more equity. If increasing equity capital is costly for banks (a realistic assumption, at least in the short to medium term), the banking sector's balance sheet constraint tightens. As a result, banks can provide fewer loans in total if the capital requirement for carbon-intensive loans increases. However, it is not necessarily the loans for which capital requirements have increased that are driven out. Instead, banks will cut back on their marginal loans when ranked by maximum ROE. These marginal loans could be loans to low-emission companies. Therefore, higher capital requirements for dirty loans may reduce lending to clean firms.

The substitution effect captures that a higher capital requirement for dirty loans makes these loans less attractive from the bank's perspective. Therefore, banks may tilt their credit allocation towards clean loans, analogous to a consumer who substitutes away from a product after its price increases.

The breakdown into income and substitution effects clarifies that raising capital requirements for dirty loans is not equivalent to lowering capital requirements for clean loans. The substitution effect is similar for both policies, as both increase the relative attractiveness of clean loans. In contrast, the direction of the income effect depends on whether capital requirements increase or decrease: a brown penalising factor is associated with a negative income effect because it tightens the bank's balance sheet constraint. Conversely, a green supporting factor relaxes the bank's balance sheet constraints and is therefore associated with a positive income effect. Thus, while raising the capital

[2] In this framework, banks assess the return from each loan in isolation, based only on the loan's NPV and the contribution to the put option resulting from deposit insurance or bailout subsidies. In practice, other considerations may enter the bank's lending decision. For example, banks may prefer making dirty loans if clean loans negatively affect the value of the bank's carbon-intensive legacy assets (see Degryse et al., 2022).

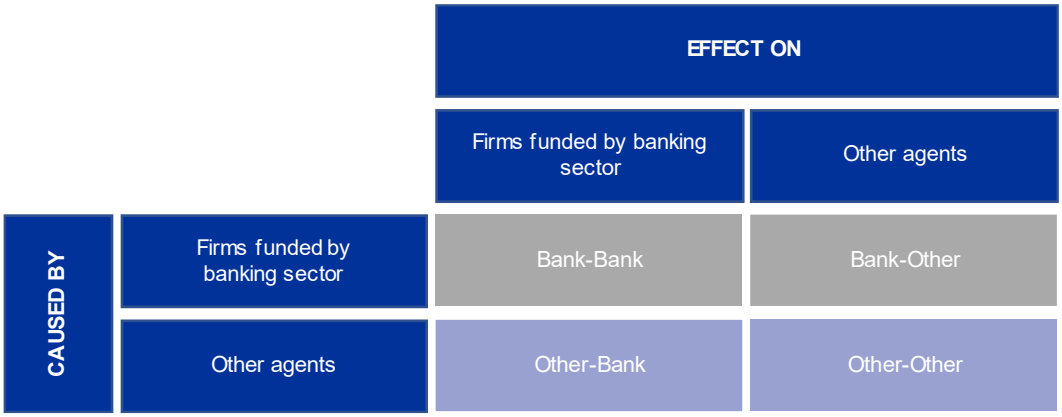
requirements for carbon-intensive loans has the advantage of not sacrificing prudential goals (as pointed out by Boot and Schoenmaker, 2016), it can lead to clean lending being crowded out if some of the bank's marginal loans are clean.

2 Capital regulation in the face of climate change

2.1 A categorisation of climate risks for financial regulators

For regulatory purposes, it is valuable to categorise climate risks and climate externalities in terms of cause and effect: who causes certain risks or externalities, and who is affected by them? Figure 1 illustrates this.

Figure 1
A categorisation of climate risks for bank regulators



Source: author's elaboration.

The "Bank-Bank" category covers the effects of emissions caused by bank-funded firms on risks in the banking sector. For example, physical risks caused by emissions generated by bank-funded firms could lower the profitability or increase the risk of other bank-funded firms. The "Bank-Other" category covers risks or externalities caused by the emissions of bank-funded firms which in turn affect firms or consumers outside the bank regulatory perimeter. For example, a bank-funded oil refinery might cause environmental damage that harms the inhabitants of a nearby town. The "Other-Bank" category includes risks that are caused outside the banking sector but affect bank-funded firms. For example, transition risks resulting from future environmental regulation could negatively affect bank balance sheets. Finally, the "Other-Other" category, which is less relevant for the purposes of this note, covers risks that originate outside the banking sector and affect firms or consumers outside the bank regulatory perimeter.

These categories clarify which risks and externalities bank regulators consider when setting capital requirements according to their regulatory mandates. For example, a prudential regulator takes into account climate risks only to the extent that they affect the stability of the banking system. These risks include the "Bank-Bank" and "Other-Bank" categories. A regulator that, in addition to prudential concerns, has a mandate to reduce externalities caused by carbon emissions of bank-funded firms also considers the category "Bank-Other".

2.2 Prudential capital requirements in the presence of climate risks

A prudential regulator's objective is to ensure the stability of the banking system. Prudential regulation, therefore, does not consider carbon emissions per se. Instead, carbon emissions affect prudential capital requirements only if they are associated with additional financial risks for the banking sector.

When setting capital requirements for clean and dirty loans, the prudential regulator needs to assess the extent to which each loan type is exposed to climate risks. Some climate risks, such as extreme weather and other physical risks, are likely to affect clean and carbon-intensive activities equally. In contrast, other climate risks are likely to disproportionately affect carbon-intensive activities, for example, transition risks arising from changes in consumer behaviour or future environmental regulation.

How do climate risks affect optimal prudential capital requirements? Let us consider a transition risk scenario. Due to shifts in consumer preferences, potential future environmental regulation or carbon taxes, firms engaged in carbon-intensive activities become riskier.[3] A prudential regulator responds to such risks by increasing capital requirements for carbon-intensive loans. This increase in capital requirements has two effects.

First, higher capital requirements help to ensure that banks have sufficient capital to withstand unexpected losses associated with loans to companies exposed to climate risks. For these loans, the prudential regulator does not induce a change in bank funding decisions away from climate risks. Instead, the primary objective of higher capital requirements is to increase the banking sector's ability to absorb additional losses resulting from climate risks.

Second, higher capital requirements can remove some climate exposures from bank balance sheets altogether. This effect occurs when a higher capital requirement induces banks not to make a particular loan. In this case, capital requirements increase financial stability via their impact on credit allocation, in addition to ensuring sufficient loss-absorbing capacity for the loans that banks continue to make.

The analysis by Oehmke and Opp (2022) shows that when transition risks affecting firms engaged in carbon-intensive activities are moderate, it is optimal for the regulator to raise the capital requirement for dirty loans. This increases the equity cushion available to withstand losses from transition risks. However, the regulator still wants these loans to be funded and does not attempt to push them out of the banking system. As a result, it can be optimal for the prudential regulator to increase capital requirements for dirty loans even if doing so crowds out bank lending to (marginal) clean firms. This illustrates that prudential resilience to climate risks is not necessarily tantamount to lowering carbon emissions. When transition risks are more significant, the regulator further increases the capital requirement for dirty loans. At some point the regulator begins to use the high

[3] Stroebel and Wurgler (2021) present survey evidence that regulatory risk is considered the top climate risk to businesses and investors over the next five years, which corresponds to the horizon most relevant for capital regulation. Physical risks are considered the top risk over the next thirty years.

capital requirements for dirty loans to incentivise the migration of dirty loans and the associated transition risks out of the banking sector. However, even in this case, the prudential regulator's objective is to ensure that the banking sector is insulated from climate risks and not necessarily to prevent the underlying high-emitting activities.

As a broader observation, prudential regulation does not change fundamentally in the presence of climate risks. The underlying motivation for capital regulation remains unchanged, except that capital requirements now reflect climate risks in addition to more traditional financial risks. As a result, bank capital requirements can be an effective tool for dealing with prudential risks arising from climate change. The main challenge that climate risks pose for prudential regulators is therefore not conceptual but one of measurement: how can climate risks be reliably estimated given that historical data series contain limited information regarding their nature? Despite recent progress on climate stress testing, more work remains to be done to understand the financial sector's exposure to climate risks, some of which will materialise over a time horizon that exceeds the horizon usually considered for prudential regulation. If these measurement challenges can be overcome, prudential risks arising from climate change can generally be dealt with, even when the underlying activity continues to be funded by the banking sector or elsewhere. As we will explore in the next section, this is no longer the case when bank capital regulation aims to prevent the activity financed by the loan in order to reduce emissions.

2.3 Capital requirements as a means to transition to a low-carbon economy?

Some commentators have suggested that, in addition to the traditional prudential objective that considers climate risks, bank capital regulation could serve as a tool to target carbon emissions per se, for example, to support the transition to a low-carbon economy (see Dombrovskis, 2017). In this case, capital requirements would aim to prevent or reduce the funding of carbon-intensive activities, in contrast to the purely prudential policies discussed above, which focus on financial risks resulting from climate change.

As we established in Section 1.2, higher capital requirements for carbon-intensive loans can shift credit allocation towards greener funding opportunities when the substitution effect is sufficiently large. However, using capital requirements to reduce the funding of carbon-intensive activities poses two challenges that are not present when capital requirements are used solely as a financial stability tool.

The first challenge is that if carbon-intensive investments are sufficiently profitable, banks may choose to fund them even at high capital requirements. While suitably high capital requirements can always address the financial stability concerns arising from a loan, they do not necessarily prevent banks from financing the underlying activity. If carbon-intensive loans are profitable even at high capital requirements, the regulator may simply be unable to deter banks from making these loans. Moreover, even in cases in which the regulator can prevent the funding of carbon-intensive loans, this may necessitate lowering the capital requirements for clean loans below the prudentially

optimal level. Using bank capital requirements to reduce carbon emissions can, therefore, require a sacrifice in terms of the traditional prudential mandate.[4]

The second challenge is that other funding sources may sustain carbon-intensive activities, even if higher capital requirements deter banks from funding these activities. For example, polluting firms may turn to bond markets, private equity investors or internal funds if capital requirements make bank loans too expensive. If the regulator is mainly concerned with prudential objectives, such substitution is desirable because it removes risks from the run-prone banking system. In contrast, if the regulator's objective is to eliminate carbon emissions, migration of carbon-intensive activities to other funding markets defeats the regulator's objective.

Because of these challenges, bank capital requirements alone are unlikely to be effective if the goal is to reduce carbon emissions. More direct policy measures, such as carbon taxes, are almost certain to be more effective. However, capital requirements could still play an indirect role in reducing emissions. This indirect role arises from an interaction between financial and environmental regulation. Stricter environmental regulation or the introduction of a carbon tax will likely lead to a significant reduction in the value of carbon-intensive assets, including bank loans and other bank exposures to high-emitting firms. Unless the banking sector has a sufficiently large equity cushion to absorb losses from stranded assets, governments may be reluctant to impose higher carbon taxes or stricter environmental regulations. Therefore, capital requirements play an indirect role in reducing carbon emissions by facilitating government interventions.

[4] Despite their attractiveness in terms of low carbon emissions, loans to clean companies can entail significant prudential risks. In some cases, clean loans could be riskier than dirty loans, for example, when comparing an established carbon-intensive company that has a proven business model with a novel but unproven green technology.

3 Conclusion

How should climate change and the associated climate risks be reflected in bank capital regulation? Drawing on recent academic research, this note has argued that capital requirements can be an effective tool for dealing with prudential risks arising from climate change, but are less effective as a tool for lowering the emissions that cause climate change.

Conceptually, using capital requirements to address climate risks is no different from managing "traditional" risks. However, in contrast to traditional risks, climate risks pose novel measurement challenges, because historical data series contain limited information about future climate risks. Despite recent progress in the form of climate stress tests and other research, more work needs to be done to understand the financial sector's exposure to climate risks, some of which will materialise over a time horizon that exceeds the horizon usually considered for prudential regulation.

Using capital requirements to discourage the funding of carbon-intensive activities is less likely to be effective for two reasons. First, as long as activities with high carbon emissions remain profitable, removing loans that fund these activities from the banking sector may either be impossible or may require lowering capital requirements on loans with small carbon footprints below the prudentially optimal level, thereby sacrificing financial stability. Second, even if capital regulation can successfully remove dirty loans from the banking system, high-emitting activities will likely attract funding elsewhere as long as they offer a positive return to investors. Therefore, interventions that directly reduce the profitability of carbon-intensive investments, for example, a carbon tax, are more effective tools for reducing emissions. In this context, capital requirements can play an indirect role. By ensuring sufficient loss-absorbing capital in the banking sector, they can help to facilitate the introduction of carbon taxes or stricter environmental regulation, which governments may be reluctant to introduce so long as the resulting revaluation of bank assets and the associated stranded asset risk could trigger a banking crisis.

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Appendix: A brief discussion of underlying assumptions and the resulting qualifications

All assumptions underpinning the analysis presented in this note are discussed in detail in the underlying research paper, Oehmke and Opp (2022). This appendix briefly discusses some of these assumptions and how they affect the conclusions drawn above.

- In the model, the aggregate amount of equity capital in the banking sector is fixed. This assumption is not crucial for the results. If banks could raise equity capital at a cost, the results would be similar. Holding aggregate bank capital fixed or assuming that it is costly for the banking sector to increase the amount of equity capital is a reasonable assumption when considering the short or medium term. Views differ on whether bank equity capital is also costly in the long term. This note does not take a stance on this issue.
- The model is static. This implies that the model does not capture inherently dynamic effects, such as an increasing incidence of climate risks over time or the dynamic trade-offs associated with the transition path to lowering emissions.
- In the model, banks find it optimal to make loans up to the point where their regulatory capital constraint is binding. The model would generate similar results if regulatory capital constraints were not strictly binding, for example, if banks aimed to keep a specific distance from their regulatory constraints.

Imprint and acknowlegements

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For specific terminology please refer to the **ESRB glossary** (available in English only).

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