Financial Regulation: Regulatory Arbitrage and Regulatory Harmonization

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JEL numbers: G28
Keywords: Regulatory arbitrage; Regulatory harmonization; Principles based regulation; Rules based regulation.

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1 Introduction

This paper analyzes regulatory arbitrage, and how regulators respond to regulatory arbitrage in a competitive regulatory environment of financial regulation. Regulatory arbitrage is rent seeking through exploiting regulatory loopholes, often closely associated with financial regulation where firms are able to relocate their businesses cheaply from one regulatory regime to another. Fleischer (2010), who gives an overview of what forms regulatory arbitrage often takes, expresses a negative view on this type of activity: “Most of us share a vague intuition that the rich, well-advised, and politically connected somehow game the system to avoid regulatory burdens the rest of us comply with; this Article explains how it’s done.” Recently, we have also seen reports that some European banks have restructured their businesses in ways to “mute the impact of tough new regulations that were adopted as a response to the financial crisis.”1 The view that probably reflects the general perception is, therefore, that regulatory arbitrage is harmful to welfare

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because it lowers the overall strength of regulation. If we accept this premise, we may also consider the line that regulatory harmonization is the solution to the problem. If all regulators agree on how to regulate there would be nowhere to hide for companies that seek to exploit regulatory loopholes. The convergence of regulatory approaches internationally is probably the most pronounced in financial regulation and this area is also probably the most affected by various forms of regulatory arbitrage.\textsuperscript{2} It is, however, far from straightforward that there is consistency between the objective of achieve an optimal regulation within a given jurisdiction, and attracting firms that seek to avoid regulation in other jurisdictions. Moreover, it is also not clear that harmonization necessarily represents a solution that is welfare maximizing. This paper seeks to address the problem of designing optimal regulation in a framework where there is both regulatory competition and regulatory arbitrage by creating a theoretical framework within which these issues can be evaluated.

It is not straightforward to define harmonization. It seems natural that harmonization involves regulators do similar things. However, doing similar things can lead to loss of discretion to regulate effectively locally, in particular where there are differences in the regulatory “technology” across jurisdictions. Harmonization is in our paper essentially defined by regulators agreeing on a common framework but retaining some discretion to optimize welfare locally in their respective jurisdictions. We need, therefore, a sensible divide between what regulators commit to across jurisdictions and what they can control within their own jurisdiction. All approaches to regulation must eventually converge as the regulatory environment improves, as the underlying market failure to be corrected is the same. However, if we never reach the final destination point it matters what approach is chosen because the way regulation fails depends on approach. In this paper we distinguish regulatory approaches by the type of regulatory failures that are made. We can think of at least two types of regulatory failures. The first type is the failure of verification, where it cannot be

\textsuperscript{2}For a historical perspective see Jordan and Majnoni (2002), and for more recent developments in the area of bank regulation see the website of the Bank for International Settlement’s www.bis.org where various documents describe the work that the Committee on Banking Supervision has carried out in this respect.
established whether a firm should be regulated or whether it complies with regulation. The second failure is the failure of over-regulation or under-regulation, where some firms accidentally are caught up in complying unnecessarily to regulation and some firms that should be regulated accidentally escape complying with regulation. Harmonization means here simply that the regulators “agree” (for lack of a better word) on the kind of failure that is incurred in their respective jurisdictions, but they can nonetheless exercise power to minimize the impact of these losses within their own jurisdictions. To make an analogy to real life, we can think of UK’s “principles based” approach to financial regulation as a representative of a type of regulation where failures are essentially verification failures. UK’s regulators decide how strongly it applies its principles, but due to some residual vagueness in the way one can interpret these principles, some firms will get caught in a grey zone where it is unclear whether they actually comply with regulation. US’s rules based approach to financial regulation can fix this problem as clear cut rules makes it easier to tell whether the firm complies or not. However, this type of regulation introduces a new set of problems since rules cannot in general be written in such a way as to perfectly implement the underlying principles. Therefore, we find here the classical Type I and II errors of over and under-regulation. The US regulators decide which how strong the specific rules should be to minimize the impact of these errors but in general there is always a risk that firms comply with the rule-book but may nonetheless violate the spirit of regulation, or alternatively that healthy firms may fail to comply with existing rules and incur unnecessary costs.\(^3\)

Harmonization in this context means that the regulators both apply similar rules, or both apply similar principles, but that they can tweak the rules or the principles to maximize the welfare within their own jurisdiction.

Our model assumes that some financial firms operate in a way that creates negative network externali-

\(^3\)The distinction between the rules based and the principles based approaches to regulation is common but not universally agreed upon although regulators themselves tend to use this terminology. For instance, the FSA outlines the principles based approach in fairly clear cut terms in Financial Services Authority (2007). The US regulators reliance on specific rules is generally accepted. There is a parallel to the accounting literature where a distinction is made between rules based and principles based accounting standards.
ties onto the financial system. Regulation can fix this problem if the regulator can identify the firms that are “systemic”. This process is costly and the nature of the costs depends on the approach the regulator applies to implement the regulation. The regulator chooses between two technologies – one where verification failures occur – and one where failures of over and under regulation occur. The regulator adjusts the strength of the regulation to maximize welfare within its own jurisdiction, but may coordinate approach with other regulators. The regulatory approach that is chosen locally and the regulatory approach that is chosen in other jurisdictions create incentives for regulatory arbitrage, and when a firm enters another jurisdiction the regulator anticipates this and internalizes the welfare of this firm into its decision problem. We investigate the competitive game played by two regulators who regulate their own jurisdictions in this way, so as to investigate the welfare effects of regulatory arbitrage, and the welfare effects of regulatory responses such as harmonization.

The key question is whether harmonization is welfare optimal. Here, we find that the answer is surprisingly often negative. In particular, we find that principles based harmonization is never optimal, which is perhaps surprising as this approach is probably the one that is the most suited to a general agreement to formulate a unified framework for “global” regulation. Nonetheless, this is probably not the main lesson we should take from our work. There are three important conclusions. The first conclusion is that regulatory arbitrage matters to a surprising degree. For instance, it is possible that the optimal approach to regulation in autarky is optimally discarded when the economies are opened to allow regulatory arbitrage. Regulatory arbitrage creates first order effects on the optimal choice of regulation. Therefore, one needs to take great care when making general statements on optimal regulation in an area where regulatory arbitrage is a possibility. Second, it is not in general optimal to regulate to prevent incidences of regulatory arbitrage.

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4As noted by Zingales (2004), the mere presence of externalities is not a sufficient condition for imposing regulatory intervention – in particular note his recount of the Coase (1960) criticism of Pigou’s (1938) classical theory of regulation. We do not take this debate further here.

5Perhaps the best example of international coordination of principles based regulation is the report prepared by the Basel Committee on Banking Supervision on the “Core Principles for Effective Banking Supervision”.

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Regulatory arbitrage and welfare are not closely related. This finding is probably counter intuitive, but we would think this may be due to the public perception of regulatory arbitrage being driven too much by the “tax haven syndrome”: that we assume that some jurisdictions adopt a lighter regulatory regime than is welfare optimal as a form of business model. The academic literature also sometimes alludes to the idea that regulatory arbitrage equals regulatory failure, expressed for instance in Fleischer (2010) who talks about regulatory arbitrage as undermining regulation, “crafted by lawyers to meet the letter of the law while undermining its spirit”. The effects of actual regulatory arbitrage in equilibrium is not really the key issue. The main effects appear from the fact that regulatory arbitrage is possible at all: the mere possibility of arbitrage activity creates incentives for the regulators to deviate from their optimal autarky form of regulation because they discount in the effect that arbitrage would have on welfare. The fact that some level of regulatory arbitrage still takes place in any given equilibrium is more or less incidental. This point is often missing from the policy debate. Third, regulatory diversity can be optimal. A debate on global issues in regulation will almost automatically be assumed to produce as its ultimate goal an agreement on a standard approach for regulation, rather than to achieve a situation where different regulators complement each other by their choice of different approaches to regulation. We show, however, that diversity can have such effects, and this effect arises from the idea that some form of regulatory arbitrage cannot be described as a “flight” from regulation, but rather as a “safety-value” mechanism that allows financial firms to choose the optimal regime within which to be regulated such that welfare is enhanced rather than reduced.

We extend the analysis into corporate lobbies, which we know in practice can have a strong impact on the way regulation is formulated. Lobbying is likely to be driven by various forms of under regulation since the firms improve their profits by escape regulatory intervention. This includes firms that should be effectively regulated but can escape regulation because they can evade the rules set out by the regulator, or because they are caught up in a regulatory “grey zone” where a principles based approach to regulation has no bite. We find here that there is no systematic relationship between welfare optimizing regulation
and lobbying activity. Some optimal regulation equilibria have zero lobbying (implying that the corporate and social profit maximization agree), others have positive measures of lobbying (implying disagreement). It is possible that corporations are inclined to lobby against harmonization, but it is also possible that they are inclined to lobby for harmonization. The direction depends on the parameters of the model.

There is little in terms of directly related literature in this area, with one notable exception cited below, but of course the broader area of financial regulation is vast. Brunnermeier et al (2009) gives an extremely helpful overview to the problem of regulating a financial system. One of their main points is the distinction between macro-prudential regulation which aims to regulate the system “as a whole” and micro-prudential regulation which aims to regulate the individual firms within the system. Our paper is set within the latter category in the sense that we focus on problems of regulating individual firms, and as alluded to above the key problem is the identification problem of finding the right firms to regulate.

It is not immediately obvious how we can link financial regulation to the classical theory of regulation outlined in Pigou (1938) and subsequently refined by Coase (1960). This theory deals with situations where the identification problem is trivial, and where systemic problems linked to contagion do not arise. Pigou (1938) argues that externalities creates a rationale for government intervention. Coase (1960) on the other hand argues that private individuals can – provided their individual rights are properly defined – use the legal system to sue for compensation from the offending firm. Either approach achieves the desired internalization of the externality. In a financial system the link between the firm and the externality is much less clear cut. For instance, a systemic shock typically contains an initial shock and a propagation or contagion mechanism. Therefore, the externality is typically in part caused by the firm that provides the initial shock, and in part by the firms which cause propagation, which makes Pigou and Coase’s approaches somewhat inadequate in prescribing regulatory policy. Two books discuss the unique nature of the problem of financial regulation in detail, Dewatripont and Tirole (1993) and Freixas and Rochet (1997), and they
cite the vast literature in this area. Zingales (2004) argues that we can apply Coasian principles to argue for disclosure requirements to make the identification job easier, and also that the regulator should acknowledge in the cost-benefit analysis the private cost of regulation to firms, which can be considerable.\textsuperscript{6} Finally, a growing literature expresses scepticism of the positive welfare effects of any micro prudential approach to regulation. Acharya (2009), for instance, argues that such an approach has adverse effects in the sense that price bubbles in some markets (such as housing, for instance) may lead banks to switch to these assets as their high values bring comfort to the regulator. But of course this may put the sector as a whole in jeopardy. None of these papers addresses the problem of regulatory arbitrage which is the main focus for this paper.

At the other end of the spectrum we find a paper that does address a closely related problem to ours. Morrison and White (2009) discuss the effects of imposing “level playing field” in international financial regulation. Their model see capital requirements and screening/monitoring as two distinct parts of financial regulation. If the regulator is more or less able to monitor banks, it can reduce or increase, respectively, capital requirements for banks to allow banks to operate more or less cheaply. This gives rise to relocation activity and different capital requirements and regulatory screening and monitoring in different jurisdictions. A level playing field where capital requirements are harmonized across jurisdictions prevents such relocation activity and will have positive and negative effects locally, and Morrison and White (2009) discuss factors that contribute to the overall desirability of such international standards. It is essential here that capital requirements may be set subject to international agreements, whereas the ability to screen and monitor cannot. There are several distinctions between our paper and Morrison and White (2009). First, whereas they discuss harmonization across jurisdictions of standards that are fully implementable, we discuss harmonization with respect to regulatory approaches that are subject to considerable local control.

\textsuperscript{6}Franks, Schaefer and Staunton (1998) make empirical estimates of the cost of regulation for the UK for financial firms, and find these to be considerable.
A level playing field is implementable only if local regulators have the ability and the incentive to apply the same type of regulation across jurisdictions. If local “tweaking” is permitted, a level playing field is not necessarily achievable. However, the welfare effects of harmonization are not necessarily dependent on achieving a level playing field in the first instance, and we carry out an analysis of this more nuanced form of harmonization to document welfare effects when harmonization does not necessarily create a perfectly level playing field. Second, the differences in regulation across jurisdictions arise in the context of the “ability” of the various regulators in Morrison and White (2009), whereas in our model the differences arise in the context of the choices that regulators make with respect to the approach they choose and the strength with which this approach is implemented. Third, in Morrison and White (2009), the relocation activity of banks that wish to improve their profits is driven by the flight of the strong banks to the jurisdiction of a high ability regulator. In our model, we also consider the relocation activity of firms that may seek to avoid a strong regulator. For these reasons, we believe our paper complements Morrison and White’s (2009) study. On the empirical side, there is evidence that this effect is in play. Houston, Lin and Ma (2009), for instance, find that banks tend to transfer funds to jurisdictions where there are fewer regulatory restrictions.

The paper proceeds as follows. In Section 2 we describe the basic setup. In Section 3 we derive the optimal autarky equilibrium level of regulation, which is extended into a two-jurisdiction model of regulatory harmonization in Section 4. Section 5 evaluates the welfare benefits of this harmonization. Section 6 comments on the level of regulatory arbitrage activity in the welfare-maximizing equilibria, and the emergence of lobbies. Section 7 concludes.

2 The Model

We consider a population of infinitesimal firms within each regulatory jurisdiction. Each firm is characterized by a point \((x, y)\) on the space \([0, 1] \times [0, 1]\), and the firms are distributed uniformly on this space.
within each jurisdiction. When relocating, the firm moves from the point \((x, y)\) in one space, leaving an empty space behind, to the same point \((x, y)\) in the destination jurisdiction where there already is a firm of the same type. We assume an unregulated firm has private profits

\[
\Pi(\emptyset, x, y) = 1
\]  

(1)

and social profits

\[
\Pi_S(\emptyset, x, y) = 1_{y \geq \theta}
\]  

(2)

where \(\emptyset\) indicates the absence of regulation, the number \(\theta \in (0, 1)\) indicates the threshold for negative externalities, and \(1_{\text{condition}}\) is an indicator function equal to 1 if the condition is met and zero otherwise. The externality associated with the firm's operations is the difference between social and private profits

\[
\Pi_S(\emptyset, x, y) - \Pi(\emptyset, x, y) = 1_{y \geq \theta} - 1 = -1_{y < \theta}
\]  

(3)

and these affect the firms where \(y < \theta\). The \(y\)-parameter is the firm's true type which therefore determines whether the firm should be regulated or not. A principles based approach to regulation will aim to regulate the firms according to their true type \(y\). The \(x\)-parameter is the firm's observable type which is independent of \(y\) - essentially we allow a firm of true type \(y\) to appear in the form of a firm of any observable type \(x\).

An example of the distinction between “true” and the “observable” types is the following. A large retail bank typically poses a systemic risk for the financial system whereas a small retail bank does not. Therefore, despite the fact that they are observationally of similar type their true type may be very different. Also, an investment bank is observationally different from a retail bank, but despite this fact the investment bank may pose a systemic risk in the same way as a retail bank (which the collapse of Lehman Brothers seems to demonstrate). A firm may actually operate like a bank or cause systemic risk to the financial system in the
same way as banks, but the firm may not be immediately recognizable as a bank. The issue is, therefore, whether we should regulate these firms using simple “rules of thumbs” where they are defined as banks if certain observables are satisfied, or whether we should regulate them using more “fundamental principles”. These two approaches have different costs and advantages, which we seek to identify and evaluate in this model.

We assume that regulation can have three possible outcomes for a given firm. Regulation is a map \((x, y) \mapsto R \subset [0, 1]\) which specifies how a firm \((x, y)\) is treated under the regulatory regime \(R\) (with some abuse of notation). We assume there are three outcomes of regulation. First, the firm may escape the regulation imposed by \(R\) in which case \(y \geq y'\) for all \(y' \in R(x, y)\) and here

\[
\Pi(R, x, y) = \Pi(\emptyset, x, y), \quad \Pi_S(R, x, y) = \Pi_S(\emptyset, x, y)
\]  

(4)

If \(y < \theta\) then this is a case of under regulation. Second, the firm is effectively regulated by the regulation imposed by \(R\), in which case \(y < y'\) for all \(y' \in R(x, y)\) and

\[
\Pi(R, x, y) = \Pi(\emptyset, x, y) - \varphi, \quad \Pi_S(R, x, y) = \Pi_S(\emptyset, x, y) - \varphi + 1_{y < \theta}
\]  

(5)

If \(y \geq \theta\) then this is a case of over regulation. If \(y < \theta\), the negative externality is eliminated by \(R\), although it comes at a private (and social) cost of compliance, \(\varphi\). The cost \(\varphi\) is assumed small compared to the externality. The third possibility is that the firm does not escape the regulation imposed by \(R\), but neither is the regulation effective, and this is the case where \(y \in R(x, y)\), where

\[
\Pi(R, x, y) = \Pi(\emptyset, x, y) - \gamma, \quad \Pi_S(R, x, y) = \Pi_S(\emptyset, x, y) - \gamma
\]  

(6)

Here, there is a private (and social) cost of verification \(\gamma\), which is also assumed small compared to the
externality. Both the firm and the regulator lose from ineffective regulation. We do not make a firm decision at this stage about the relative magnitude of $\varphi$ and $\gamma$, and as we shall see the relative magnitude of these cost parameters will have an impact on the equilibrium behavior of the firms being regulated.

A principles based regulatory regime is a map $R_P(x, y; a)$ where

$$(x, y) \mapsto R_P(x, y; a) = [\theta - (\epsilon - a), \theta + a]$$

(7)

where the parameter $a \in [0, \epsilon]$ is a choice variable for the regulator. The parameter $\epsilon$, $0 < \epsilon < \min(\theta, 1 - \theta)$ is exogenously given. The principles based approach is based on the idea that it allows the regulator to design a type of regulation that depends on the firm’s true type $y$ and not its observable type $x$. This approach is however not perfect in the sense that the regulation is ineffective for the firm where $y \in R(x, y; a)$ - otherwise the approach has the property that no firm that should be unregulated will become regulated and no firm that should be regulated will become unregulated. The costs of a principles based regime is, therefore, verification costs which are measured by the parameter $\gamma$. We can illustrate the way in which this type of regulation works in the following diagram. Here, we show firms in the $(x, y)$ plane, and we plot the boundary points $\theta + a$ and $\theta - (\epsilon - a)$. The firms caught up with $y$ such that $\theta - (\epsilon - a) \leq y \leq \theta + a$ will incur verification costs with no other effects.
A rules based approach is a system $R_R(x, y; b)$ such that

$$(x, y) \mapsto R_R(x, y; b) = \{b - \nu x\}$$

(8)

where the parameter $b \in [\theta, \theta + \nu]$ is a choice variable for the regulator. The parameter $\nu$, $0 < \nu < 1 - \theta$ is exogenously given. The rules based approach is based on the idea that it allows effective regulation since it depends on the firm's observable type $x$, and this eliminates the problem of ineffective regulation. However, this approach is not perfect in the sense that some firms will be always be over or under regulated. The trade-off for the regulator is, therefore, between ineffective regulation under a principles based approach or over/under regulation under a rules based approach. The costs of a rules based regime is that in general we cannot eliminate both under and over regulation at the same time – so some costs of Type I and Type II errors of regulation must be incurred. We can illustrate rules based regulation with a diagram similar to that above. The diagonal line is $b - \nu x$, and the firms where $y < b - \nu x$ are regulated while those where $y \geq b - \nu x$ are unregulated. There is over regulation when $b - \nu x \geq \theta$ since the firms for which $\theta \leq y \leq b - \nu x$ should not be regulated but are, and under regulation when $b - \nu x < \theta$ since the firms for
which $\theta \geq y \geq b - \nu x$ should be regulated but are not.

Here, we shall make a small note of caution. With a single regulator operating in autarky the formulation above is fairly general. However, when several regulators operate together in a competitive environment, say regulator $A$ and $B$ using rules $\{b_i - \nu_i x\}$, $i = A, B$, it matters whether we make the restrictions that $b_i \geq \theta$ and $\nu_i \geq 0$, or whether we allow $b_i \geq \theta \geq b_j$ and $\nu_i > 0 > \nu_j$. In the first case we restrict the rules to be correlated in the sense that if a firm is over or under regulated in one regime it is also likely to be over or under regulated in the other regime, but in the second case we allow the rules to be negatively correlated in the sense that if a firm is over regulated in one regime it is likely to be under regulated in the other. We assume here that the restriction $b_i \geq \theta$ and $\nu_i \geq 0$ holds across jurisdictions, which is the more natural assumption but one which might be perceived as theoretically restrictive. In our context, where two regulators use a rules based approach when harmonizing their approach to regulation, the assumption of correlated rules seem appropriate also from a theoretical standpoint.

We also assume that the regulator must choose one approach, so it is not possible to apply both at the same time in some hybrid form. It may be that in practice a strict rules based approach is modified
when it is obviously “out of touch”, and conversely that a strict principles based approach becomes translated into simple “rules of thumb” so as to ease the verification problem. It is not necessarily unreasonable that we should observe hybrids to emerge in practice. However, in order to avoid too many complications we do not allow such hybrids to emerge here and leave the study of hybrid forms of regulation for the future.

Finally, we make the following assumptions about the magnitude of the parameter. The aggregate corporate profits and the associated externalities are large compared to the costs of regulation, so that

\[ 1, \theta, 1 - \theta \gg \epsilon, \nu, \varphi, \gamma \]  

(9)

The costs of regulation arises in the context of regulatory failures, whose magnitude is determined by the parameters \( \epsilon \) and \( \nu \) in the principles based and rules based regimes, respectively, and in the context of compliance and verification, by the parameters \( \varphi \) and \( \gamma \), respectively. Moreover, the differences between the technology or cost parameter \( |\epsilon_A - \epsilon_B| \) and \( |\nu_A - \nu_B| \) are small relative to their levels, so that

\[ \epsilon_i \gg |\epsilon_A - \epsilon_B|, \quad \nu_i \gg |\nu_A - \nu_B|, \quad i = A, B \]  

(10)

This assumption implies that the differences between the regulators are small when they choose to apply similar approaches.

3 Optimal Regulation in Autarky

We start out by analyzing the problem of optimal regulation in autarky. This enables us to evaluate what type of regulation maximizes welfare, and what type of regulation maximizes corporate profits, when there is no escape route for corporations.
3.1 Principles Based Regulation

Under a principles based regime, the social welfare is

\[ \int_0^1 \int_0^1 \Pi_S(R_P(x, y; a), x, y) dx dy = \int_0^1 \Pi_S(R_P(x, y; a), x, y) dy \]
\[ = (1 - \theta) + \int_0^{\theta - (\epsilon - a)} (1 - \varphi) dy + \int_{\theta - (\epsilon - a)}^{\theta + a} (-\gamma) dy \]
\[ = (1 - \theta) + (1 - \varphi) \theta - (1 - \varphi) \epsilon + (1 - \varphi) a - \gamma \epsilon \quad (11) \]

We can interpret \(1 - \theta\) as the unregulated welfare; the term \((1 - \varphi) \theta\) as the recovered welfare if regulation were perfect (i.e. with \(\epsilon = 0\)); the third term is the cost associated with imperfect regulation; the fourth term is the value of regulatory discretion to adjust the strength of the regulation; and finally the fourth term is the cost of compliance in the cases where regulation is ineffective. Since the term \((1 - \varphi) a\) is increasing in \(a\), it is optimal to set \(a = \epsilon\) maximal, and the social welfare is then

\[ \int_0^1 \int_0^1 \Pi_S(R_P(x, y; \epsilon), x, y) dx dy = 1 - \varphi \theta - \gamma \epsilon \quad (12) \]

The intuition for this result is that for every firm with \(y < \theta\) that is ineffectively regulated, the welfare is \(-\gamma\). By increasing \(a\), therefore, the regulator is transferring firms from the ineffective region where the welfare is \(-\gamma\) to the effective region where the welfare is \(1 - \varphi\). There is no other effect since whatever the regulator does, there will be a measure \(\epsilon\) that are ineffectively regulated and must pay compliance costs \(\gamma\), so the location of \(a\) will not influence this term. The regulator is, therefore, able to recover \(1 - \varphi\) from \(\theta\) percent of the unregulated social cost from the firms that should be regulated, but this comes at a cost of incurring \(\gamma\) from the \(\epsilon\) percent of the firm, i.e. those that are subject to ineffective regulation. The social incremental welfare of regulation is, therefore, \((1 - \varphi) \theta - \gamma \epsilon\), which yields the expression above. The private
profit under the welfare optimal regulation is

\[
\int_0^1 \int_0^1 \Pi(R_P(x, y; \epsilon), x, y)dx\,dy = \int_0^1 \Pi(R_P(x, y; \epsilon), x, y)dy \\
= 1 + \int_0^\theta (-\varphi)\,dy + \int_\theta^{\theta+\epsilon} (-\gamma)\,dy \\
= 1 - \varphi\theta - \gamma\epsilon
\]  

(13)

Since principles based regulation eliminates all externality by the fact that it is optimal to set \( a = \epsilon \), the social welfare and the corporate profits are the same.

### 3.2 Rules Based Regulation

Under a rules based regime, the social welfare is

\[
\int_0^1 \int_0^1 \Pi_R(x, y; b), x, y)dx\,dy = \int_0^1 \left( \int_0^{\frac{b-\theta}{b}} \Pi_S(R_R(x, y; b), x, y)dx + \int_\frac{b-a}{b}^1 \Pi_S(R_R(x, y; b), x, y)dx \right) dy \\
= (1 - \theta) + \int_0^{\frac{b-a}{b}} \left( \int_0^\theta (1 - \varphi)dy + \int_\theta^{b-\nu-x} (1 - \varphi)dy \right) dx + \int_\frac{b-a}{b}^1 \int_0^{b-\nu-x} (1 - \varphi)dy\,dx \\
= (1 - \theta) - (1 - \varphi)\frac{\nu}{2} + (1 - \varphi)b - \frac{1}{2\nu}(b - \theta)^2
\]  

(14)

The first term is, as before, the welfare in an unregulated sector. The remaining terms measure the net effect of over and under regulation. The optimal regulation maximizes the welfare, and we find that the optimal regulation is \( b = \theta + (1 - \varphi)\nu \), which then yields the welfare

\[
\int_0^1 \int_0^1 \Pi_S(R_R(x, y; \theta + (1 - \varphi)\nu), x, y)dx\,dy = 1 - \varphi\theta - \varphi(1 - \varphi)\nu
\]

(15)
The private profit under the welfare optimal regulation is
\[
\int_0^1 \int_0^1 \Pi(R_R(x, y; \theta + (1 - \varphi)\nu), x, y) \, dx \, dy = 1 - \varphi\theta - \left(1 - \frac{3}{2}\varphi\right) \nu
\] (16)
In this case, the externality is never completely eliminated unless \(\nu = 0\), so the social welfare is in general different from the corporate profits.

### 3.3 Autarky Equilibrium

**Proposition 1: Autarky** The regulator maximizes the social welfare through principles (rules) based regulation if
\[
\frac{\epsilon}{\nu} \leq (\varphi)\frac{1}{\gamma}(1 - \varphi)
\] (17)
and the corporate sector maximizes the private profits through a principles (rules) based regime if
\[
\frac{\epsilon}{\nu} \leq (\varphi)\frac{1}{\gamma}\left(1 - \frac{3}{2}\varphi\right)
\] (18)

If \(\nu\) is small compared to \(\epsilon\), so that rules based regulation is cheaper than principles based regulation, both the regulator and the corporate sector prefer rules based regulation. If \(\epsilon\) is small compared to \(\nu\), so that principles based regulation is cheaper than rules based regulation, both the regulator and the corporate sector prefer principles based regulation. If there is disagreement, the corporate sector as a whole does better under principles based regulation than under rules based regulation.

There will be areas of disagreement between the regulator and the corporate sector, and in the cases where the regulator prefers a principles based regime and the corporate sector prefers a rules based regime are given by
\[
\frac{1}{\gamma}\left(1 - \frac{3}{2}\varphi\right) \leq \frac{\epsilon}{\nu} \leq \frac{\varphi}{\gamma}(1 - \varphi)
\] (19)
which is feasible only if $\varphi$ is sufficiently large, specifically $\varphi > \frac{1}{2}$. The cases where the regulator prefers a rules based regime and the corporate sector prefers a principles based regime are given by the opposite,

$$\frac{\varphi}{\gamma} (1 - \varphi) < \frac{\varepsilon}{\nu} \leq \frac{1}{\gamma} \left( 1 - \frac{3}{2} \varphi \right)$$

(20)

which is feasible only if $\varphi$ is sufficiently small, specifically $\varphi < \frac{1}{2}$. The direction of the disagreement is, therefore, determined by the magnitude of $\varphi$, and as we assume $\varphi$ is small compared to the externality the areas of disagreement is essentially that the regulator wishes to apply rules based regulation whereas the firms prefer principles based regulation. As we open up the model to allow for relocation activity by firms across jurisdictions the autarky equilibria will in general not survive, however, so it remains to be seen if this type of disagreement is likely to survive. We discuss towards the end what sort of lobbies we might expect to find in a framework where regulatory arbitrage is allowed.

An objection that some may nonetheless feel is warranted here is that we assume the compliance cost $\varphi$ is the same regardless of the approach to regulation. The main reason for this is that we see the primary cost of compliance as the cost of changing behavior, which should be independent of approach to regulation. The differences in approach is measured by the relative magnitude of verification costs $\gamma$ and compliance costs $\varphi$. But as we can see from above, disagreement between the regulator and the corporations depends in autarky on $\varphi$ only, which is a by-product of the fact that the welfare and corporate profits are the same under principles based regulation in autarky; hence disagreements occur only in the case the regulator uses rules based regulation.
4 A Two-Jurisdiction Model of Harmonization

In this section we look at the game played by two regulators. We impose, in turn, the condition that the regulators harmonize on a principles based approach, that they harmonize on a rules based approach, and finally that they play a diverse game where they choose different approaches. The equilibrium is worked out under each of these conditions, and the section concludes with a comparison of the welfare effects going from a diversity equilibrium to a harmonization equilibrium. The general picture that quickly emerges is that the effects of regulatory arbitrage and regulatory competition on welfare are complicated – and that putting forward simple arguments can easily give a misleading picture of the underlying effects.

Consider two regulatory jurisdiction $A$ and $B$, each of which can operate a principles based regulatory approach $\epsilon_i$ or a rules based regulatory approach $\nu_i$, independently. The regulators are not allowed to operate both approaches simultaneously. Also, if both regulators operate a rules based approach, we assume that their rules are correlated so that $b_i - \nu_i x$ and $b_j - \nu_j x$ are both downward sloping. The firms within each jurisdiction are distributed precisely as in the autarky case, i.e. with uniform density $f(x, y) = 1$ on the $[0, 1] \times [0, 1]$ plane. If the firms in a neighbourhood of $(x_0, y_0)$ relocate from one jurisdiction to the other, the density function on this neighbourhood will increase to $f(x_0, y_0) = 2$ in the jurisdiction the firms relocate to and will decrease to $f(x_0, y_0) = 0$ in the jurisdiction they relocate from. The following time-line illustrates the problem.


<table>
<thead>
<tr>
<th>$t = 0$</th>
<th>$t = 1$</th>
<th>$t = 2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulator $i$ and $j$ choose $a_i$, $a_j$, $b_i$, or $b_j$</td>
<td>The firms make their relocation decisions</td>
<td>The private and social profits are realized</td>
</tr>
</tbody>
</table>

We assume the regulators choose regulation simultaneously and independently. We evaluate harmonization equilibria where both $i$ and $j$ choose the same approach to regulation, and diversity equilibria where the regulators choose different approaches. We will assume that $\epsilon_A \leq \epsilon_B$ and $\nu_B \leq \nu_A$ so that in autarky, regulator $A$ will always achieve the lowest cost of principles based regulation and regulator $B$ the lowest cost of rules based regulation. We depart from this convention, however, when there is loss of generality.

### 4.1 Principles Based Harmonization

Regulator $A$ can deliver cheaper principles based harmonization than regulator $B$ since $\epsilon_A \leq \epsilon_B$, but this still leaves us with three types of equilibria to search for, which are illustrated below. Here we define the numbers $\overline{\theta}_A = \theta + a_A$; $\overline{\theta}_B = \theta + a_B$; $\underline{\theta}_A = \theta - (\epsilon_A - a_A)$, and $\underline{\theta}_B = \theta - (\epsilon_B - a_B)$. When searching for equilibria we need to make initial assumptions about the relative magnitudes of these numbers, and the illustration below shows the various possibilities. Here, a firm $(x, y)$ such that $y \leq \theta$ (below the dotted line) should be regulated, however only firms where $y \leq \overline{\theta}_i$ (below one of the solid lines below the dotted line) are effectively regulated. The firms for which $\underline{\theta}_j < y \leq \overline{\theta}_i$ will face compliance costs but the regulation is here ineffective.
The details of the calculations can be found in the Appendix, and we find the following equilibria.

**Lemma 1** Assume both regulators use a principles based approach. For $\varphi > \gamma$ the unique equilibrium is $(a^*_A, a^*_B) = (0, 0)$, i.e. both regulators regulate with the minimum strength. For $\varphi < \gamma$, the unique equilibrium is $(a^*_A, a^*_B) = (\epsilon_A, \epsilon_B)$, i.e. both regulators regulate with the maximum strength. For $\varphi = \gamma$ there are two equilibria: one where $a^*_A = 0$ and $a^*_B \in [0, \epsilon_B]$; and one with $a^*_B = 0$ and $a^*_A \in [0, \epsilon_A - \epsilon_B]$.

Here, Case 3 will never be an equilibrium. The reason is that the regulator who has access to the cheapest regulation (regulator $A$ in this situation, because we stated at the outset that $\epsilon_A \leq \epsilon_B$) will always attract relocation by firms from jurisdiction $B$. If $\varphi > \gamma$, so that it is cheaper to pay verification costs than to comply with regulation, firms will prefer to relocate to a jurisdiction where they are caught in the “grey-zone” where $\underline{\theta} < y < \overline{\theta}$ if the alternative is that they are regulated effectively. Therefore, regulator $B$ has in this case an incentive to close the gap at the bottom between $\underline{\theta}_B$ and $\underline{\theta}_A$. We get a similar effect if $\gamma > \varphi$, only here regulator $B$ has an incentive to close the gap at the top between $\overline{\theta}_A$ and $\overline{\theta}_B$. 

22
Recall that the optimal regulation in autarky is to regulate with the maximum strength. It is worth noting that principles based harmonization has distortive effects in the sense that both regulators may choose to deviate from their optimal strategy in autarky. Note also that harmonization may have distortive effects even though there is no actual migration in equilibrium, for instance if $\varphi < \gamma$, it is a unique equilibrium that the minimum strength regulation is chosen, even though in the special case that $\epsilon_A = \epsilon_B$ there is no actual relocation activity taking place at the equilibrium point.

4.2 Rules Based Harmonization

Recall that here we assume with no loss of generality that one regulator, regulator $B$ in this case, is able to deliver cheaper rules based regulation than the other regulator, $A$, so that $\nu_B \leq \nu_A$. Each regulator chooses rules $b_A$ and $b_B$, and again we need to make initial assumptions about the relative magnitude of these numbers. Here we can restrict our search for equilibria to two cases. It must always be the case that the rules in the two jurisdictions have the same effect for a given type $(x_0, y_0)$, i.e. that $y_0 = b_A - \nu_A x_0 = b_B - \nu_B x_0$, and the two cases refer to whether $y_0 \geq \theta$ (Case 1) or $y_0 \leq \theta$ (Case 2). The cases can be illustrated as follows.

![Case 1](image1.png)  ![Case 2](image2.png)
The details can also here be found in the Appendix, and we find the following equilibrium.

**Lemma 2** There is a unique equilibrium where

\[
\begin{align*}
b^*_A &= \theta + \frac{(1-\varphi)(2\nu_A^2 - (1+\varphi)\nu_A\nu_B)}{2(2-\varphi)\nu_A - (1+\varphi)\nu_B} \\
b^*_B &= \theta + \frac{(1-\varphi)^2\nu_A\nu_B}{2(2-\varphi)\nu_A - (1+\varphi)\nu_B}
\end{align*}
\]

(21.a) \hspace{1cm} (21.b)

For \( \nu_A, \nu_B \to \nu \), the equilibrium converges to \( b^*_A, b^*_B \to \frac{1-\varphi}{\varphi} \nu \).

Here, Case 1 is never an equilibrium. The reason is that here the cheapest cost regulator (regulator B since we assumed at the outset that \( \nu_B \leq \nu_A \)) has welfare that depends negatively on \( b_B \). That this should happen is natural, since regulator B will always be able to “steal” firms from jurisdiction A in the cases where \( b_B - \nu_B x \leq y \leq b_A - \nu_A x \). This flow will always increase the welfare for regulator B and reduce the welfare for regulator A, so it creates in turn the incentive for A to reduce the strength of its rules.

The optimal strength of regulation in autarky is \( b_i = \theta + (1-\varphi)\nu_i \), so even in the special case where both regulators have access to the same set of rules \( \nu_A = \nu_B \) they choose to deviate from the autarky equilibrium. The regulator who can regulate with cheapest cost will adopt the weakest rules.

5 Regulatory Diversity and the Welfare Effects of Harmonization

In this section we derive the welfare effects of harmonization from a standpoint of diversity. This analysis will provide more useful findings in the cases where the sign of the welfare effects does not depend on the starting equilibrium, which we shall see is not unique. When harmonization takes place, the harmonizing equilibrium is as we have seen unique except in special cases where there are strong restrictions on the
parameters, but this will not be the case when the regulators apply diverse approaches to regulation, so the usefulness will depend to some extent on what we find.

We also need to discuss the appropriateness of the convention that $\epsilon_A \leq \epsilon_B$ and $\nu_B \leq \nu_A$. In a harmonizing equilibrium one regulator will in general be able to regulate more cheaply than the other one – it doesn’t matter which one. But with harmonization we need to take greater care. The problem is that there are several possibilities, illustrated below. We separate here between “universal” cost leadership, where one regulator has access to the cheapest technology in either form of regulation, and “niche” cost leadership, where one regulator is better at applying principles based regulation and the other is better at applying rules based regulation.

![Diagram](image)

Universal cost-leader  Niche cost-leader

The figure illustrates on the left the case where one regulator is the universal cost-leader regardless of approach to regulation. In this situation, we can harmonize on the regime to the cost-leader, where the cost-follower switches to the approach of the cost-leader (the second set of vertical arrows in the figure), or we can harmonize on the regime to the cost-follower, where the cost-leader switches to the approach of the cost-follower (the first set of vertical arrows). But we can also have a situation where we have niche
cost-leaders, where one regulator is the cost-leader under one approach but the cost-follower under the other, which we will adopt if we keep the convention that $\epsilon_A \leq \epsilon_B$ and $\nu_B \leq \nu_A$. But even here we can have harmonization where the cost-leader remains leader (the diagonal arrows are pointing to the right in the figure); or a situation where the cost-leader becomes cost-follower (the diagonal arrows are pointing to the left). In the following we will keep the assumption of niche cost leadership where $\text{A}$ is naturally better at formulating a principles based regulatory framework, and $\text{B}$ is naturally better at formulating a rules based regulatory framework. This is not restrictive in the following sense: the only case where it may matter is where we evaluate harmonization, and all results that follow may depend on whether there is harmonization to cost leader or cost follower, but they do not depend on whether there is harmonization to cost leader or cost follower under universal or niche cost leadership.

Next we need to start to unravel the equilibria in a diverse equilibrium, and here there are a myriad of relocation patterns. We search for equilibria by breaking the problem down to four separate cases, illustrated below. Here we use the notation we adopted above with $\bar{\theta} = \theta + a$ and $\underline{\theta} = \theta - (\epsilon - a)$.

![Diagram](image)

The separation into these cases is necessary in order to treat the relocation patterns properly, however,
the same equilibrium may arise in the different cases. For instance, if the equilibrium is to set $a = 0$ and $b = \theta$, then this may be consistent with all cases above under varying assumptions about the magnitude of $\epsilon$ and $\nu$. The findings are as follows.

**Lemma 3** The various equilibria are represented in the following table, which shows the equilibrium choices of $(a^*, b^*)$

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\varphi &gt; \gamma$:</td>
<td>Case 2: $(0, \theta)\quad$ Case 3: $(\epsilon, \theta + \nu)\quad$ Case 4: $(0, \theta)$</td>
</tr>
<tr>
<td>$\gamma &gt; \varphi$:</td>
<td>Case 1: $(0, \theta + \nu)\quad$ Case 1: $(0, \theta + \nu)$ or Case 4: $(0, \theta)$</td>
</tr>
</tbody>
</table>

If we look at the equilibrium $(a, b) = (0, \theta)$ which arises in Case 2 and Case 4, we see that there is one key driving force: it is cheaper for the firms to incur compliance costs $\gamma$ under a principles based regime than to pay the costs to comply with regulation $\varphi$ under a rules based regime. Hence, there is relocation from the principles based regime for all firms where $y \geq \theta$, and there is relocation from the rules based regime to the principles based regime for all $y \leq b - \nu x$. The optimal response for both regulators is in this case to lower the strength of the regulation maximally. If we look at Case 3, however, we see the opposite equilibrium where both regulators choose maximum strength, and in Case 1 where we find an intermediate case where the rules based regulator regulates with maximum strength and the principles based regulator regulates with minimum strength. These equilibria are supported by the relocation patterns in a similar way as above.

Note also that the regions in the table are not mutually exclusive. The third column is contained in the second column, but due to the specific nature of the condition on $\nu$ and $\epsilon$ we treat it separately. Finally, the Lemma ignores the special cases where there are stricter constraints on the parameter values, e.g. where $\varphi = \gamma$ or the restrictions on $\epsilon$ and $\nu$ are narrow, but the full details are given in the Appendix. We will
in the following restrict the discussion to the equilibria outlined in the table, and now we have sufficient information to calculate the welfare effects of principles based and rules based harmonization.

We define the welfare gain of harmonization as

$$\Delta \Pi = (\Pi_S^A + \Pi_S^B)|_A \text{ and } B \text{ harmonize approach } - (\Pi_S^A + \Pi_S^B)|_A \text{ and } B \text{ diversify approach}$$ (22)

We need to distinguish between harmonization to a principles based regime and harmonization to a rules based regime, and also we need to distinguish between harmonization to the cost leader and harmonization to the cost follower. The welfare in a harmonization equilibrium where the regulators agree on principles based regulation can be evaluated directly. The welfare in a harmonization equilibrium agree on rules based regulation is a bit more involved to pin down. Define here numbers $\Gamma_A$ and $\Gamma_B$:

$$\Gamma_A = (1-\varphi)\nu_A \frac{2\nu_A - (1+\varphi)\nu_B}{2(2-\varphi)\nu_A - (1+\varphi)\nu_B}, \quad \Gamma_B = (1-\varphi)\nu_A \frac{(1-\varphi)\nu_B}{2(2-\varphi)\nu_A - (1+\varphi)\nu_B}$$ (23)

and we can see that $0 < \Gamma_B < \Gamma_A < (1-\varphi)\nu_A$. We also define numbers $\xi_A$, $\xi_B$, and $\xi_S$:

$$\xi_A = (1 - \varphi)\Gamma_A - \frac{\Gamma_A^2}{2\nu_A} - \frac{1 - \varphi}{2} \frac{(\Gamma_A - \Gamma_B)^2}{\nu_A - \nu_B} \quad (24.a)$$

$$\xi_B = (1 - \varphi)\Gamma_A + \frac{\Gamma_A^2}{2\nu_A} - \frac{\Gamma_B^2}{2\nu_B} - \frac{1 - \varphi}{2} \frac{(\Gamma_A - \Gamma_B)^2}{\nu_A - \nu_B} \quad (24.b)$$

$$\xi_S = 2(1 - \varphi)\Gamma_A - \frac{\Gamma_A^2}{\nu_B} - (1 - \varphi) \frac{(\Gamma_A - \Gamma_B)^2}{\nu_A - \nu_B} \quad (24.c)$$

Here, we know that $\xi_S = \xi_A + \xi_B$, so if we can show that $\xi_A, \xi_B > 0$ it follows that $\xi_S > 0$. Using the parameters defined above, we write the harmonizing rules based equilibrium as $(a_A, a_B) = (\theta + \Gamma_A, \theta + \Gamma_B)$, and the regulators welfare functions as $\Pi_A = (1 - \varphi \theta) - (1 - \varphi) \frac{\nu_A}{2} + \xi_A$, $\Pi_B = (1 - \varphi \theta) - (1 - \varphi) \frac{\nu_B}{2} + \xi_B$, and the total welfare as $\Pi_S = 2(1 - \varphi \theta) - (1 - \varphi)\nu_A + \xi_S$. We find the following result.
**Lemma 4** The parameters $\xi_A, \xi_B > 0$, and consequently $(1 - \varphi)\nu_A > \xi_S > 0$.

This enables us to make the following statements about the changes in welfare when the regulators switch from playing an equilibrium where they diversify their approach to regulation (each equilibrium is associated with one of the four cases described in Lemma 3), and also about the change in welfare when the regulators switch form playing one type of harmonization equilibrium to another type of harmonization equilibrium. The results are as follows.

**Lemma 5a: Harmonization to Principles Based Regulation** The gain from harmonizing into a principles based regulation is $\Delta \Pi_S$ is given by the following, where we separate between the the cases where $\varphi > \gamma$ and $\gamma > \varphi$. The expressions for $\varphi > \gamma$ are as follows (here we set $i = A$ and $j = B$ for harmonization to cost leader, and $i = B$ and $j = A$ for harmonization to cost follower)

$$\Delta \Pi_S(\text{Case } n) = -(1 - \varphi)\epsilon_A - (1 - \varphi + 2\varpi)\epsilon_B - \begin{cases} -2(1 - \varphi)\epsilon_i + (1 - \varphi + \gamma)\nu_j & \text{for } n = 2 \\ -2\gamma\epsilon_j + (1 - \varphi)\nu_j + (1 - \varphi + \gamma)\frac{\epsilon_j^2}{\nu_j} & \text{for } n = 3 \\ -(1 - \varphi + \gamma)\frac{\epsilon_j^2}{\nu_j} & \text{for } n = 4 \end{cases}$$

(25.a)

and the expressions for $\gamma > \varphi$ are

$$\Delta \Pi_S(\text{Case } n) = -(2\gamma\epsilon_B) - \begin{cases} (1 - \frac{\varphi}{\gamma})\nu_j & \text{for } n = 1 \\ 0 & \text{for } n = 4 \end{cases}$$

(25.b)

The welfare gains from regulatory harmonization are negative for $\gamma > \varphi$.

**Lemma 5b: Harmonization to Rules-Based Regulation** The gain from harmonizing into a rules
based regime $\Delta \Pi_S$ is given by the following. The expressions for $\varphi > \gamma$ (as for Proposition 2a, we set $i = A$ and $j = B$ for harmonization to cost leader, and $i = B$ and $j = A$ for harmonization to cost follower):

$$\Delta \Pi_S(\text{Case } n) = -(1 - \varphi)\nu_A + \xi_S - \begin{cases} 
-2(1 - \varphi)\epsilon_i + (1 - \varphi + \gamma)\nu_j & \text{for } n = 2 \\
-2\gamma\epsilon_i + (1 - \varphi)\nu_j + (1 - \varphi + \gamma)\frac{\xi^2}{\nu_j} & \text{for } n = 3 \\
-(1 - \varphi + \gamma)\frac{\xi^2}{\nu_j} & \text{for } n = 4
\end{cases}$$

(26.a)

and the expressions for $\gamma > \varphi$ are

$$\Delta \Pi_S(\text{Case } n) = -(1 - \varphi)\nu_A + \xi_S - \begin{cases} 
(1 - \frac{\varphi}{2})\nu_j & \text{for } n = 1 \\
0 & \text{for } n = 4
\end{cases}$$

(26.b)

The expressions are negative for $\gamma > \varphi$.

**Lemma 5c: Comparison of Harmonization Welfare** The welfare in principles based harmonization minus the welfare in rules based harmonization is

$$\Pi_S(\text{Principles based harmonization}) - \Pi_S(\text{Rules based harmonization})$$

$$= -(1 - \varphi + 2\gamma)\epsilon_B - \xi_S - (1 - \varphi)\epsilon_A + (1 - \varphi)\nu_A$$

for $\varphi > \gamma$

$$= -2\gamma\epsilon_B - \xi_S + (1 - \varphi)\nu_A$$

for $\gamma > \varphi$

(27)

The expression is positive for $\gamma > \varphi$.

The optimality of harmonization or diversity in regulation will in general depend on the parameters, but we can make the following general broad statements.
Proposition 3:

1. Principles based harmonization is never optimal.

2. For $\gamma > \varphi$ harmonization is never optimal to either type of regulation.

3. For $\varphi > \gamma$ and $\epsilon > \max\left(\nu, \frac{\nu}{1-\varphi+2\gamma}\right)$ harmonization to rules based regulation is always optimal.

The proof is in the appendix. A puzzling question here is why the principles based regime fares so badly in a harmonizing equilibrium. Some features in particular are contributing negatively on welfare. Regulators tend to regulate in a similar way - both regulators choose to regulate with maximum strength at the same time - and both regulators choose to regulate with minimum strength at the same time. When they regulate with maximum strength the cost of regulation is essentially measured by the verification costs but this happens also when the verification costs are the greatest. When the verification costs are the smallest they switch to minimum strength however, which carries the maximum welfare loss (in autarky).

Also, a surprise is statement number 3, which dictates that harmonization to rules based regulation is optimal when $\varphi > \gamma$ and $\epsilon > \nu$. Recall that the condition for principles based regulation to dominate rules based regulation in autarky is that $\frac{\xi}{\gamma} < \frac{\varphi(1-\varphi)}{\gamma}$. It is possible to find values for the parameters for which both sets of conditions are satisfied so that all regulators in autarky would prefer principles based regulation, and yet it is optimal to harmonize towards rules based regulation when regulatory arbitrage is permitted. The result demonstrates, therefore, the way that regulatory arbitrage can affect the optimality of the approach taken to regulation. Here it is also significant to recall that one of our assumptions is that the difference between the technology the two regulators have access to is small (specifically, that $\nu_A, \nu_B \gg |\nu_A - \nu_B|$) so that the magnitude of regulatory arbitrage is never going to be very large in equilibrium in any case. The possibility of regulatory arbitrage will affect the regulators’ equilibrium behaviour when it comes to choosing the strength of regulation locally, and it is this effect that causes the surprise element in Proposition 3.
6 Arbitrage Activities and Lobbies

6.1 Regulatory Arbitrage

Our model has three classes of equilibria: two types which involve harmonization to principles based equilibrium and rules based equilibrium, and another type which involves a diversity equilibrium. We might ask whether the harmonization equilibria lead to less relocation activity than the diversity equilibrium. We define the relocation measure

\[
\Theta = \Theta_A + \Theta_B
\]

\[
= \int_0^1 \int_0^1 1_{\text{Firm } (x, y) \text{ in } A \text{ migrates to } (x, y) \text{ in } B} \, dy \, dx
\]

\[
+ \int_0^1 \int_0^1 1_{\text{Firm } (x, y) \text{ in } B \text{ migrates to } (x, y) \text{ in } A} \, dy \, dx
\]

(28)

\(\Theta\) is simply a count of the number of firms that relocate from one regime to the other, for both regimes, in a given equilibrium, using the indicator function \(1_{\text{Condition}} = 1\) if condition is true and 0 if condition is false. If the regulators play a harmonization equilibrium \((a^*_A, a^*_B)\), \((b^*_A, b^*_B)\), or a diversity equilibrium \((a^*_i, b^*_j)\), \(i, j \in \{A, B\}, i \neq j\), we can associate with each equilibrium a relocation measure. Here we find the following (we adopt here the convention that \(\epsilon_A \leq \epsilon_B\) and \(\nu_B \leq \nu_A\)).

**Proposition 4: Relocation Activity** The relocation measure \(\Theta\) works out as follows for an equilibrium with regulatory harmonization:

\[
\Theta(a^*_A, a^*_B) = \epsilon_B - \epsilon_A
\]

(29.a)

\[
\Theta(b^*_A, b^*_B) = (\nu_A - \nu_B) \left( \frac{1}{2} - \left( \frac{2(1 - \varphi)\nu_A}{2(2 - \varphi)\nu_A - (1 + \varphi)\nu_B} \right) + \left( \frac{2(1 - \varphi)\nu_A}{2(2 - \varphi)\nu_A - (1 + \varphi)\nu_B} \right)^2 \right)
\]

(29.b)

Both relocation measures go to zero as the harmonization is improved by regulation technology, i.e. as
$\epsilon_B \to \epsilon_A$ and $\nu_A \to \nu_B$.

The relocation measure $\Theta$ works out as follows for the equilibria listed in Lemma 3:

\begin{align}
\Theta(\text{Case 1}; a^* = 0, b^* = \theta + \nu) &= \frac{\nu}{2} + \epsilon \\
\Theta(\text{Case 2}; a^* = 0, b^* = \theta) &= \epsilon \\
\Theta(\text{Case 3}; a^* = \epsilon, b^* = \theta + \nu) &= \frac{3}{2\nu} (\nu - \epsilon)^2 \\
\Theta(\text{Case 4}; a^* = 0, b^* = \theta) &= \frac{\epsilon^2}{2\nu} + \frac{\nu}{2}
\end{align}

These relocation measures are larger than any relocation measure for an equilibrium with regulatory harmonization.

The result obtains by applying the integrals above with the relocation patterns in the various equilibria. For instance, for principles based harmonization, Case 3 in the Appendix, and the associated equilibrium $a^*_A = a^*_B = 0$, we find that the firms with $y \in [\theta - \epsilon_B, \theta - \epsilon_A]$ will relocate from $B$ to $A$. The relocation measure is here

\begin{equation}
\Theta(a^*_A, a^*_B) = \int_{\theta - \epsilon_B}^{\theta - \epsilon_A} dy = \epsilon_B - \epsilon_A
\end{equation}

There are two equilibria here, but the relocation measure is the same in either. For the diversity equilibrium described in Case 1 where $(a^*, b^*) = (0, \theta + \nu)$ we find that there is relocation from the rules based regime to the principles based regime for $0 \leq x \leq 1$ and $\theta \leq y \leq \theta + \nu - \nu x$, and relocation from the principles based regime to the rules based regime for $0 \leq x \leq 1$ and $\theta - \epsilon \leq y \leq \theta$. The relocation measure is here

\begin{equation}
\Theta(\text{Case 1}; a^* = 0, b^* = \theta + \nu) = \int_0^1 f_{\theta + \nu - \nu x} \, dy \, dx + \int_0^1 f_{\theta - \epsilon} \, dy \, dx = \frac{\nu}{2} + \epsilon
\end{equation}

The remaining cases are obtained in a similar manner.
A link between regulatory arbitrage and welfare cannot be established. For instance, for $\gamma > \varphi$ we know that principles based harmonization never maximizes welfare, but the equilibrium relocation measure of the optimal diversity equilibrium can be arbitrarily large compared to that in the harmonization equilibrium. We consider four of the equilibria that emerge when the regulators use diverse regulatory approaches, and the relocation measures are here for understandable reasons greater in magnitude. However, we know that diversity can be optimal, so the claim that regulatory harmonization works because it prevents firms relocating to escape regulation cannot be sustained.

### 6.2 Lobbies

Would the corporate sector benefit from harmonization? Zingales (2004) makes the point that regulation is often shaped by the most powerful lobby and not welfare maximization. In practice, therefore, the corporate sector may shape regulation. In this section we explore the likelihood and direction of corporate lobbying activity. Since corporations bear all costs associated with regulation, the map between welfare and corporate profits is simple.\(^7\)

\[ \Pi(R_j(x, y), x, y) = \Pi_S(R_j(x, y), x, y) + 1_{j=R} \times 1_{R_R(x,y)<y<\theta} + 1_{j=P} \times 1_{\theta>y\in R_P(x,y)} \]  

(33)

Here, the condition $R_R(x, y) < y < \theta$ signifies under regulation, since the firm escapes regulation because $R_R(x, y) < y$ but the firm should be regulated because $y < \theta$. This can obviously happen only in a regime with rules based regulation where $j = R$. The condition $\theta > y \in R_P(x,y)$ signifies inefficient regulation of firms that should be regulated, since the firm is caught up in the “grey area” $R_P(x,y)$ but should be regulated since again $y < \theta$. This can obviously only happen in a regime with principles based regulation where $j = P$. The only reason the corporate sector disagrees with the regulator is on account of

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\(^7\)The cost of regulation is typically borne by the corporate sector in financial regulation. Franks et al. (1998) provide estimates of these costs for the UK.
under regulation in a rules based regime or ineffective regulation in a principles based regime. Therefore, we expect lobbies to emerge particularly in the jurisdictions in which the level of under regulation is high.

We create a lobby- measure

\[ \Sigma = \Sigma_A + \Sigma_B \]
\[ = \int_0^1 \int_0^1 \mathbb{1}_{\text{Firm} (x, y) \text{ in } A \text{ is under-regulated}} f(x, y) dy dx \]
\[ + \int_0^1 \int_0^1 \mathbb{1}_{\text{Firm} (x, y) \text{ in } B \text{ is under-regulated}} f(x, y) dy dx \]

(34)

Here, we need to specify the density function \( f(x, y) \in \{1, 2\} \) which depend on whether the location \((x, y)\) contains relocated firms from the other regulator (where \( f(x, y) = 2 \)) or not (where \( f(x, y) = 1 \)).

**Proposition 5: Lobbying Activity** In a principles based harmonization equilibrium, the lobby-measure is given by

\[ \Sigma(a_A^*, a_B^*) = \begin{cases} 
2 \epsilon_B & \text{if } \varphi > \gamma \\
0 & \text{if } \gamma > \varphi 
\end{cases} \]  

(35.a)

In a rules based harmonization equilibrium the lobby measures is given by

\[ \Sigma(b_A^*, b_B^*) = \frac{\nu_A + \nu_B}{2} - (\Gamma_A + \Gamma_B) + \frac{\Gamma_A^2}{2 \nu_A} + \frac{\Gamma_B^2}{2 \nu_B} \]  

(35.b)

where the \( \Gamma_i, i = A, B \), functions are defined in (23). Finally, the lobby measures in the diversity equilibria
listed in Lemma 3 are given by

\[
\Sigma(\text{Case 1}; a^* = 0, b^* = \theta + \nu) = 0 \tag{36.a}
\]

\[
\Sigma(\text{Case 2}; a^* = 0, b^* = \theta) = \frac{\nu}{2} + \frac{\epsilon^2}{\nu} \tag{36.b}
\]

\[
\Sigma(\text{Case 3}; a^* = \epsilon, b^* = \theta + \nu) = 0 \tag{36.c}
\]

\[
\Sigma(\text{Case 4}; a^* = 0, b^* = \theta) = \begin{cases} 
\epsilon + \frac{\nu}{2} + \frac{\epsilon^2}{2\nu} & \text{for } \varphi > \gamma \\
\nu & \text{for } \gamma > \varphi
\end{cases} \tag{36.d}
\]

These expressions are obtained by simply integrating over the instances where the firms are underregulated in a rules based regime or ineffectively regulated in a principles based regime. The results here indicate that there is no strong relationship between lobbying activity and lack of optimality. For instance, if \( \gamma > \varphi \) we know that harmonization is never optimal - but the lobby measure here varies from zero in one harmonization equilibrium and one diversity equilibrium, and positive in the other harmonization equilibrium and the other diversity equilibrium.

7 Conclusions

In this paper we have investigated the issue of regulatory arbitrage and regulatory competition and harmonization. The following conclusions can be drawn. First, the optimal autarky level of regulation is not necessarily optimal in open economies in which regulatory arbitrage can happen. It is possible that the optimal regulation in an open economy is in the form of harmonizing regulation to the approach that is the worst option in autarky. Second, the actual magnitude of regulatory arbitrage in equilibrium is not really the important issue. The damage is done from the mere possibility of regulatory arbitrage, since it affects the strength of regulation locally even if in equilibrium the amount of firms seeking to escape regulation is negligible. This is not caused by the failure to maximize welfare, but by the fact that regulating “as if
regulating in autarky” is a third best solution. The second best solution will recognize regulatory arbitrage effects whether it happens or not. Third, diversity in regulation can be desirable even though in equilibrium, the number of firms relocating for reasons linked to the behaviour of the local regulator is greater than in any harmonization equilibrium. Internationally, there is a drive towards regulatory harmonization but this is optimal only in special cases, and even here it may show surprising effects (as alluded to above in the first point). Therefore, it may be useful to recognize that international agreements should not necessarily end up with a “unified framework for regulation” but rather that it is helpful that regulators “agree to disagree” on the form of regulation.8

Extensions are possible. Whereas general principles are likely to be applied across all types of firms, specific rules apply differently to different types of firms. Some types of firms are, therefore, likely to be discriminated against in a rules based system, and some types of firms are likely to benefit. As a result we expect that the firms discriminated against will over time disappear and re-emerge as firms that will benefit from regulation. A possible extension of our model is to recognize these dynamics to be incorporated into the framework. Note that in the most rational form this extension would be fairly trivial. The firms suffering harmful effects by regulation who can “change their spots” to eliminate the problem will do so. As a result, a rational regulator will not really worry about over regulation since all the firms that become over regulated will ultimately escape by re-emerge as firms that can escape this type of treatment. The firms that should be regulated will not have this option, and they become, therefore, regulated efficiently. In some sense, this can be seen as an intertemporal form of regulatory arbitrage. We may introduce switching costs to create a “drag” on regulatory arbitrage activity to make the extension less trivial.

Also, we might consider regulators who are not necessarily welfare driven, for instance regulators who

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8There have been a number of calls for harmonization of the regulation of bank and investment bank activity following the current credit crisis – see for instance the Financial Times June 8, 2008: “NY Fed Chief Urges Global Bank Framework”.
may be swayed by corporate lobbies so that regulation in their jurisdictions internalizes too much of corporate profits. In this paper we have discussed corporate lobbying in the context of welfare maximizing regulators, and moreover we have assumed that the regulators can not apply their regulation in ways that are obviously dysfunctional, for instance, we prevent principles being applied if they are too weak (i.e. \( a < \theta \) in the notation used in our paper) and rules being applied if they are too loose (i.e. \( b < \theta \)). But, the regulator may have an incentive to violate these restrictions and that may be an interesting avenue for research into “tax haven jurisdictions”.

References


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Appendix

**Principles Based Harmonization:** Here we assume that $\epsilon_A \leq \epsilon_B$.

**Case 1:** $\theta + a_B \leq \theta + a_A$ and $\theta - (\epsilon_A - a_A) \leq \theta - (\epsilon_B - a_B)$.

In this case the firms with $y \in [\theta + a_B, \theta + a_A]$ originally in $A$ will relocate to $B$ to increase their private profit from $1 - \gamma$ to $1$. Also, all firms with $y \in [\theta - (\epsilon_A - a_A), \theta - (\epsilon_B - a_B)]$ in $A$ will relocate to $B$ to increase their profit from $1 - \gamma$ to $1 - \varphi$ if $\gamma > \varphi$, but those in $B$ will relocate to $A$ if $\varphi > \gamma$, and no firms will relocate if $\gamma = \varphi$. The welfare of $A$ is, therefore

$$
\Pi^A_2 = (1 - \theta) + (1 - \varphi)\theta - (1 - \varphi)\epsilon_A + (1 - \varphi)a_A - \gamma \epsilon_A
- \int_{\theta + a_B}^{\theta + a_A} (1 - \gamma)dy + \int_{\theta - (\epsilon_B - a_B)}^{\theta - (\epsilon_A - a_A)} (1 - \varphi - \gamma)(1 - \varphi - \gamma)dy
= (\text{terms not involving } a_A) + (\gamma - \varphi)a_A - \mathbf{1}_{\varphi > \gamma}(1 - \varphi - \gamma)a_A + \mathbf{1}_{\varphi < \gamma}(1 - \varphi - \gamma)a_A
$$

(A.1)

If $1 > 2\gamma, 2\varphi$ it is optimal to put $a_A = 0$ if $\varphi > \gamma$ and $a_A = \epsilon_A$ if $\varphi < \gamma$. In the special case where $\varphi = \gamma$ the welfare $\Pi^A_2$ is independent of $a_A$.
The welfare of $B$ is

$$
\Pi_S^B = (1 - \theta) + (1 - \varphi)\theta - (1 - \varphi)\epsilon_B + (1 - \varphi)a_B - \gamma\epsilon_B \\
+ \int_{\theta + a_B}^{\theta + \epsilon_B} dy - \int_{\theta - (\epsilon_B - a_B)}^{\theta - (\epsilon_B - a_B)} (\mathbb{1}_{\varphi > \gamma} - \mathbb{1}_{\varphi < \gamma})(1 - \varphi) dy \\
= (\text{terms not involving } a_B) - \varphi a_B - \mathbb{1}_{\varphi > \gamma}(1 - \varphi)a_B + \mathbb{1}_{\varphi < \gamma}(1 - \varphi)a_B
$$

(A.2)

It is optimal to set $a_B = 0$ if $\varphi \geq \gamma$ and $a_B = \epsilon_B$ if $\varphi < \gamma$.

To summarize, for $\varphi > \gamma$, $a_A = 0$ and $a_B = 0$; for $\varphi < \gamma$, $a_A = \epsilon_A$ and $a_B = \epsilon_B$; and for $\varphi = \gamma$, $a_A \in [0, (\epsilon_A - \epsilon_B)]$ and $a_B = 0$. These are all consistent with the initial assumptions of Case 1.

**Case 2:** $\theta + a_A < \theta + a_B$ and $\theta - (\epsilon_A - a_A) \leq \theta - (\epsilon_B - a_B)$.

In this case the firms with $y \in [\theta + a_A, \theta + a_B]$ in $B$ will relocate to $A$ to increase their profit from $1 - \gamma$ to $1$, and the firms with $y \in [\theta - (\epsilon_A - a_A), \theta - (\epsilon_B - a_B)]$ will relocate as for Case 1.

The welfare of $A$ is

$$
\Pi_S^A = (1 - \theta) + (1 - \varphi)\theta - (1 - \varphi)\epsilon_A + (1 - \varphi)a_A - \gamma\epsilon_A \\
+ \int_{\theta + a_A}^{\theta + \epsilon_A} dy + \int_{\theta - (\epsilon_A - a_A)}^{\theta - (\epsilon_A - a_A)} (\mathbb{1}_{\varphi > \gamma} - \mathbb{1}_{\varphi < \gamma})(1 - \varphi - \gamma) dy \\
= (\text{terms not involving } a_A) - \varphi a_A - \mathbb{1}_{\varphi > \gamma}(1 - \varphi - \gamma)a_A + \mathbb{1}_{\varphi < \gamma}(1 - \varphi - \gamma)a_A
$$

(A.3)

It is optimal to put $a_A = \epsilon_A$ if $\varphi < \gamma$. If $1 > 2\varphi + \gamma$, it is optimal to set $a_A = 0$ if $\varphi \geq \gamma$.

The welfare of $B$ is

$$
\Pi_S^B = (1 - \theta) + (1 - \varphi)\theta - (1 - \varphi)\epsilon_B + (1 - \varphi)a_B - \gamma\epsilon_B \\
- \int_{\theta + a_B}^{\theta + \epsilon_B} (1 - \gamma) dy - \int_{\theta - (\epsilon_B - a_B)}^{\theta - (\epsilon_B - a_B)} (\mathbb{1}_{\varphi > \gamma} - \mathbb{1}_{\varphi < \gamma})(1 - \varphi) dy \\
= (\text{terms not involving } a_B) + (\gamma - \varphi)a_B - \mathbb{1}_{\varphi > \gamma}(1 - \varphi)a_B + \mathbb{1}_{\varphi < \gamma}(1 - \varphi)a_B
$$

(A.4)

If $1 > 2\varphi - \gamma$ and $\varphi < \gamma$, it is optimal to put $a_B = \epsilon_B$; if $\varphi > \gamma$ it is optimal to put $a_B = 0$. In the case that $\varphi = \gamma$, any $a_B$ is optimal.

To summarize, if $\varphi < \gamma$, then $a_A = \epsilon_A$ and $a_B = \epsilon_B$, which contradict the initial assumptions; if $\varphi > \gamma$ and $1 > 2\varphi + \gamma$, $a_A = 0$ and $a_B = 0$ which also contradict the initial assumptions; and finally for $\varphi = \gamma$, we find $a_A = 0$ and $a_B$ free, which is consistent with the initial assumptions for $a_B > 0$.

**Case 3:** $\theta + a_A < \theta + a_B$ and $\theta - (\epsilon_B - a_B) < \theta - (\epsilon_A - a_A)$.

The firms with $y \in [\theta + a_A, \theta + a_B]$ will relocate as in Case 2. The firms with $y \in [\theta - (\epsilon_B - a_B), \theta - (\epsilon_A - a_A)]$ in $B$ will relocate to $A$ to increase their profit from $1 - \gamma$ to $1 - \varphi$ if $\gamma > \varphi$, but these firms in $A$ will relocate to $B$ to increase their profit from $1 - \varphi$ to $1 - \gamma$ if $\varphi > \gamma$, and either type firm stays put if $\varphi = \gamma$. 

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The welfare of $A$ is

$$
\Pi^A_s = (1 - \theta) + (1 - \varphi)\theta - (1 - \varphi)\epsilon_A + (1 - \varphi)a_A - \gamma\epsilon_A + \int_{\theta + a_A}^{\theta + a_B} dy - \int_{\theta - (\epsilon_A - a_A)}^{\theta - (\epsilon_B - a_B)} (1_{\varphi > \gamma} - 1_{\varphi < \gamma})(1 - \varphi) dy
$$

$$
= (\text{terms not involving } a_A) - \varphi a_A - 1_{\varphi > \gamma}(1 - \varphi)a_A + 1_{\varphi < \gamma}(1 - \varphi)a_A
$$

(A.5)

If $\varphi > \gamma$ and $1 > 2\varphi$ or if $\varphi = \gamma$ it is optimal to put $a_A = 0$, if $\varphi < \gamma$ it is optimal to put $a_A = \epsilon_A$.

The welfare of $B$ is

$$
\Pi^B_s = (1 - \theta) + (1 - \varphi)\theta - (1 - \varphi)\epsilon_B + (1 - \varphi)a_B - \gamma\epsilon_B - \int_{\theta + a_A}^{\theta + a_B} (1 - \gamma)dy + \int_{\theta - (\epsilon_A - a_A)}^{\theta - (\epsilon_B - a_B)} (1_{\varphi > \gamma} - 1_{\varphi < \gamma})(1 - \varphi - \gamma) dy
$$

$$
= (\text{terms not involving } a_B) - (\gamma - \varphi)a_B - 1_{\varphi > \gamma}(1 - \varphi - \gamma)a_B + 1_{\varphi < \gamma}(1 - \varphi - \gamma)a_B
$$

(A.6)

If $\varphi > \gamma$ and $1 > 2\gamma$ it is optimal to put $a_B = 0$; if $\varphi < \gamma$ and $1 > 2\varphi$ it is optimal to put $a_B = \epsilon_B$; and if $\varphi = \gamma$ the welfare does not depend on $a_B$.

To summarize, for $\varphi > \gamma$, $a_A = a_B = 0$; if $\varphi < \gamma$, $a_A = \epsilon_A$ and $a_B = \epsilon_B$; and finally, if $\varphi = \gamma$, $a_A = 0$ and $a_B$ is free, which are all inconsistent with the initial assumptions for this case.

**Rules Based Harmonization:** Here we assume that $\nu_B \leq \nu_A$.

**Case 1:** $\frac{b_A - b_B}{\nu_A - \nu_B} \leq \frac{b_A - \theta}{\nu_A} \leq \frac{b_B - \theta}{\nu_B}$.

There are three regions to consider: region I where $0 \leq x \leq \frac{b_A - b_B}{\nu_A - \nu_B}$ and $b_B - \nu_B x \leq y \leq b_A - \nu_A x$, where the firms in $A$ relocate to $B$ because they increase their private profits from $1 - \varphi$ to 1, at a social loss of $1 - \varphi$ for $A$ and a social gain of 1 to $B$ for each firm; region II where $\frac{b_A - b_B}{\nu_A - \nu_B} < x \leq \frac{b_B - \theta}{\nu_B}$ and $\max(b_A - \nu_A x, \theta) \leq y < b_B - \nu_B x$, where the firms in $B$ relocate to $A$ to increase their private profits from $1 - \varphi$ to 1, at a social gain of 1 to $A$ and a social loss of $1 - \varphi$ to $B$; and region III where $\frac{b_A - \theta}{\nu_A} < x \leq 1$ and $b_A - \nu_A x \leq y \leq \min(\theta, b_B - \nu_B x)$, where the firms in $B$ relocate to $A$ to increase their private profits from $1 - \varphi$ to 1, at a social gain of zero to $A$ and a social loss of $1 - \varphi$ to $B$.

The social welfare of $A$ is

$$
\Pi^A_s = (1 - \theta) - (1 - \varphi)\nu_A^2 + (1 - \varphi)b_A - \frac{1}{2}\frac{(b_A - \theta)^2}{\nu_A} + \int_0^{b_A - b_B} \int_{b_B - \nu_B x}^{b_A - \nu_A x} (1 - \varphi)dydx + \int_0^{b_B - \nu_B x} \int_{b_A - \nu_A x}^{b_A - b_B} dydx + \int_0^{b_B - \nu_B x} \int_{\nu_B}^{b_B - \nu_B x} dydx
$$

$$
= (\text{terms not involving } b_A) + (1 - \varphi)b_A - \frac{(b_A - \theta)^2}{\nu_A} + \frac{1}{2}\frac{(b_A - b_B)^2}{\nu_A - \nu_B}
$$

(A.7)
The welfare of \( B \) is, similarly,

\[
\Pi_S^B = (1 - \theta) - (1 - \varphi) \frac{\nu_B}{2} + (1 - \varphi)b_B - \frac{1}{2} \frac{(b_B - \theta)^2}{\nu_B} \\
+ \int_0^{b_A - \theta} \int_{b_B - \nu_B x}^{1} d y d x - \frac{1}{2} \int_{v_A - \nu_B x}^{b_B - \nu_B x} d y d x
\]

\[
= (\text{terms not involving } b_B) - \frac{1}{2} \frac{(b_B - \theta)^2}{\nu_B} + \frac{1}{2} \nu_B^2 \frac{(b_A - b_B)^2}{\nu_A - \nu_B} \tag{A.8}
\]

Since \( B \)'s profits are decreasing in \( b_B \) the assumptions of Case 1 cannot be met.

**Case 2:** \( \frac{b_A - b_B}{\nu_A - \nu_B} \geq \frac{b_A - \theta}{\nu_A} \geq \frac{b_B - \theta}{\nu_B} \).

There are, again, three regions to consider: region I where \( 0 \leq x \leq \frac{b_A - \theta}{\nu_A} \) and \( \max(b_B - \nu_B x, \theta) \leq y \leq b_A - \nu_A x \), where the firms in \( A \) relocate to \( B \) to increase their private profits from \( 1 - \varphi \) to \( 1 \), at a social loss of \( 1 - \varphi \) to \( A \) and a social gain of \( 1 \) to \( B \) for each firm; region II where \( \frac{b_B - \theta}{\nu_B} \leq x \leq \frac{b_A - b_B}{\nu_A - \nu_B} \) and \( b_B - \nu_B x \leq y \leq \min(\theta, b_A - \nu_A x) \), where the firms in \( A \) relocate to \( B \) to increase their private profits from \( 1 - \varphi \) to \( 1 \), at a social loss of \( 1 - \varphi \) to \( A \) and a social gain of \( 0 \) to \( B \); and region III where \( \frac{b_A - b_B}{\nu_A - \nu_B} \leq x \leq 1 \) and \( b_A - \nu_A x \leq y \leq b_B - \nu_B x \), where the firms in \( B \) relocate to \( A \) to increase their private profits from \( 1 - \varphi \) to \( 1 \), at a social gain of \( 0 \) to \( A \) and a social loss of \( 1 - \varphi \) to \( B \).

The social welfare of \( A \) is

\[
\Pi_S^A = (1 - \theta) - (1 - \varphi) \frac{\nu_A}{2} + (1 - \varphi)b_A - \frac{1}{2} \frac{(b_A - \theta)^2}{\nu_A} \\
- \int_0^{\frac{b_A - \theta}{\nu_A - \nu_B}} \int_{b_B - \nu_B x}^{b_A - \nu_A x} (1 - \varphi) d y d x
\]

\[
= (\text{terms not involving } b_A) + (1 - \varphi)b_A - \frac{1}{2} \frac{(b_A - \theta)^2}{\nu_A} - \frac{1}{2}(1 - \varphi) \frac{(b_A - b_B)^2}{\nu_A - \nu_B} \tag{A.9}
\]

The social welfare of \( B \) is, similarly,

\[
\Pi_S^B = (1 - \theta) - (1 - \varphi) \frac{\nu_B}{2} + (1 - \varphi)b_B - \frac{1}{2} \frac{(b_B - \theta)^2}{\nu_B} \\
+ \int_0^{\frac{b_B - \theta}{\nu_B}} \int_{b_B - \nu_B x}^{b_A - \nu_A x} d y d x + \int_{\frac{b_B - \theta}{\nu_B}}^{\frac{b_A - \theta}{\nu_A - \nu_B}} \int_{\theta}^{\frac{b_A - \theta}{\nu_A - \nu_B}} d y d x - \frac{1}{2} \int_{\nu_A - \nu_B x}^{b_B - \nu_B x} (1 - \varphi) d y d x
\]

\[
= (\text{terms not involving } b_B) - \frac{(b_B - \theta)^2}{\nu_B} - \frac{1 - \varphi}{2} \frac{(b_A - b_B)^2}{\nu_A - \nu_B} \tag{A.10}
\]
Here we can write the marginal profit functions as

\[
\frac{d\Pi^A}{dA} = \left(1 - \varphi - \frac{b_A - \theta}{\nu_A} - (1 - \varphi) \frac{b_A - b_B}{\nu_A - \nu_B}\right) db_A \tag{A.11.a}
\]

\[
\frac{d\Pi^B}{dB} = \left(-2 \frac{b_B - \theta}{\nu_B} + (1 - \varphi) \frac{b_A - b_B}{\nu_A - \nu_B}\right) db_B \tag{A.11.b}
\]

In equilibrium both are zero, which implies

\[
b^*_A = \theta + (1 - \varphi) \frac{(2\nu_A^2 - (1 + \varphi)\nu_A\nu_B)}{2(2 - \varphi)\nu_A - (1 + \varphi)\nu_B} \tag{A.12.a}
\]

\[
b^*_B = \theta + \frac{(1 - \varphi)^2\nu_A\nu_B}{2(2 - \varphi)\nu_A - (1 + \varphi)\nu_B} \tag{A.12.b}
\]

and which yields the result.

**Regulatory Diversity:**

When studying this case one regulator operates a principles based regime with exogenous parameter \(\epsilon\) and endogenous parameter \(a\); and the other operates a rules based regime with exogenous parameter \(\nu\) and endogenous parameter \(b\) - we may ignore subscripts in this case.

**Case 1:** \(b \geq \theta + a \geq b - \nu \geq \theta - (\epsilon - a)\).

Relocation activity: region I \(0 \leq x \leq \frac{b - \theta - a}{\nu}\) and \(\theta + a \leq y \leq b - \nu x\), where firms in the rules based regime relocate to the principles based regime to increase private profits from \(1 - \varphi\) to 1, at a social loss of \(1 - \varphi\) to the rules based regime and a social gain of \(1\) to the principles based regime; region II \(\frac{b - \theta}{\nu} \leq x \leq 1\) and \(b - \nu x \leq y \leq \theta\), where firms in the principles based regime relocate to the rules based regime to increase private profits from \(1 - \gamma\) to 1, at a social gain of \(\gamma\) to the principles based regime and a social gain of zero to the rules based regime; region III \(\frac{b - \theta - a}{\nu} \leq x \leq 1\) and \(\max(b - \nu x, \theta) \leq y \leq \theta + a\), where firms in the principles based regime relocate to the rules based regime to increase the private profits from \(1 - \varphi\) to 1, at a social loss of \(1 - \gamma\) to the principles based regime and a social gain of \(1\) to the rules based regime; region IV \(0 \leq x \leq \frac{b - \theta}{\nu}\) and \(\theta \leq y \leq \min(\theta + a, b - \nu x)\), where firms in the rules (principles) based regime relocate to the principles (rules) based regime to increase private profits from \(1 - \varphi\) \((1 - \gamma)\) to \(1 - \gamma\) \((1 - \varphi)\), at a social loss (gain) of \(1 - \varphi\) to the rules based regime and a social gain (loss) of \(1 - \gamma\) to the principles based regime, if \(\varphi > \gamma\) \((\varphi < \gamma)\); and finally region V \(0 \leq x \leq 1\) and \(\theta - (\epsilon - a) \leq y \leq \min(\theta, b - \nu x)\), where firms in the rules (principles) based regime relocate to the principles (rules) based regime to increase private profits from \(1 - \varphi\) \((1 - \gamma)\) to \(1 - \gamma\) \((1 - \varphi)\), at a social loss (gain) of \(1 - \varphi\) to the rules based regime and a social loss (gain) of \(\gamma\) to the principles based regime, if \(\varphi > \gamma\) \((\varphi < \gamma)\).
The welfare effects are:

\[
\Pi_S(R_P(x,y,a), x, y) = (1 - \theta) + (1 - \varphi)\theta - (1 - \varphi)\epsilon + (1 - \varphi)a - \gamma\epsilon \\
+ \int_0^{b - \theta - a \nu \theta} \int_{\theta + a}^{\theta + b - \nu x} dy dx + \int_0^{1} \int_{b - \theta}^{\theta} \gamma dy dx \\
- \int_0^{b - \theta - a \nu \theta} \int_{\theta + a}^{\theta + b - \nu x} (1 - \gamma) dy dx - \int_0^{1} \int_{b - \theta}^{\theta} (1 - \gamma) dy dx \\
+ (1_{\varphi > \gamma} - 1_{\gamma > \varphi}) \left( \int_0^{b - \theta - a \nu \theta} \int_\theta^{\theta + a} (1 - \gamma) dy dx + \int_0^{b - \theta} \int_{\theta}^{b - \nu x} (1 - \gamma) dy dx \right) \\
- (1_{\varphi > \gamma} - 1_{\gamma > \varphi}) \left( \int_0^{b - \theta - a \nu \theta} \int_\theta^{\theta - (\epsilon - a)} \gamma dy dx + \int_0^{1} \int_{\theta}^{b - \nu x} \gamma dy dx \right) 
\] 

(A.13)

\[
\Pi_S(R_R(x,y,b), x, y) = (1 - \theta) - (1 - \varphi)\frac{\theta}{2} + (1 - \varphi)b - \frac{1}{2\nu}(b - \theta)^2 \\
- \int_0^{b - \theta - a \nu \theta} \int_{\theta + a}^{\theta + b - \nu x} (1 - \varphi) dy dx + \int_0^{1} \int_{b - \theta}^{\theta} \gamma dy dx + \int_0^{1} \int_{\theta}^{\theta + a} dy dx \\
- (1_{\varphi > \gamma} - 1_{\gamma > \varphi}) \left( \int_0^{b - \theta - a \nu \theta} \int_\theta^{\theta + a} (1 - \varphi) dy dx + \int_0^{b - \theta} \int_{\theta}^{b - \nu x} (1 - \varphi) dy dx \right) \\
- (1_{\varphi > \gamma} - 1_{\gamma > \varphi}) \left( \int_0^{b - \theta - a \nu \theta} \int_\theta^{\theta - (\epsilon - a)} (1 - \varphi) dy dx + \int_0^{1} \int_{\theta}^{b - \nu x} (1 - \varphi) dy dx \right) 
\] 

(A.14)

\[
d\Pi_S(R_P(x,y,a), x, y) = \left[ \left( \gamma - \varphi - \gamma \frac{b - \theta}{\nu} + \gamma \frac{a}{\nu} \right) + (1_{\varphi > \gamma} - 1_{\gamma > \varphi}) \left( \gamma + (1 - \gamma) \frac{b - \theta}{\nu} - (1 - \gamma) \frac{a}{\nu} \right) \right] da
\] 

(A.15.a)

\[
d\Pi_S(R_R(x,y,b), x, y) = \left[ \left( (1 - \varphi) - \varphi \frac{a}{\nu} - (2 - \varphi) \frac{b - \theta}{\nu} \right) - (1_{\varphi > \gamma} - 1_{\gamma > \varphi}) (1 - \varphi) \left( 1 + \frac{a}{\nu} - \frac{b - \theta}{\nu} \right) \right] db 
\] 

(A.15.b)
We find the system

\[
\frac{d\Pi_S}{da} = K_1 \left( b - \theta - a + \frac{(\gamma - \varphi) + \gamma (1_{\varphi > \gamma} - 1_{\gamma > \varphi})}{-\gamma + (1 - \gamma)(1_{\varphi > \gamma} - 1_{\gamma > \varphi})} \right) \nu \quad (A.16.a)
\]

\[
\frac{d\Pi_S}{db} = K_2 \left( b - \theta + \frac{\varphi + (1 - \varphi)(1_{\varphi > \gamma} - 1_{\gamma > \varphi})}{(2 - \varphi) + (1 - \varphi)(1_{\varphi > \gamma} - 1_{\gamma > \varphi})} a - \frac{(1 - \varphi) - (1 - \varphi)(1_{\varphi > \gamma} - 1_{\gamma > \varphi})}{(2 - \varphi) + (1 - \varphi)(1_{\varphi > \gamma} - 1_{\gamma > \varphi})} \nu \right) \quad (A.16.b)
\]

\[
K_1 = \frac{\gamma}{\nu} + \frac{1 - \gamma}{\nu} (1_{\varphi > \gamma} - 1_{\gamma > \varphi}) \\
K_2 = \frac{2 - \varphi}{\nu} - \frac{1 - \varphi}{\nu} (1_{\varphi > \gamma} - 1_{\gamma > \varphi}) \quad (A.16.c) \quad (A.16.d)
\]

The constants \( K_1 \) and \( K_2 \) are non-zero, and negative except for \( \varphi > \gamma \) where \( K_1 \) is positive (\( K_2 \) remains here negative). We find the following.

**Corners:** The corner \( a = 0 \) and \( b = \theta \) obtains for \( \epsilon \geq \nu \) and \( \varphi \geq 2\gamma \); the corner \( a = 0 \) and \( b = \theta + \nu \) obtains for \( \gamma > \varphi \); and the corner \( a = \epsilon \) and \( b = \theta + \nu \) obtains for \( \gamma > \varphi \) and \( \nu \geq \epsilon \geq (1 - \varphi)\nu \).

**Interiors:** The interior solution \( a = \frac{1 - \varphi}{2} \nu \) and \( b = \theta + \frac{1 - \varphi}{2} \nu \) obtains for \( \varphi = \gamma \) and \( (2 - \varphi) \epsilon \geq \nu \).

**Semi-corners:** We are left checking the cases where one of the first derivatives is equal to zero and the other is not, i.e. cases where \( \frac{d\Pi_S}{da} \geq (\leq)0 \) and \( a = \epsilon (a = 0) \) and \( \frac{d\Pi_S}{db} = 0 \) is used to determine \( b \), and cases where \( \frac{d\Pi_S}{da} \geq (\leq)0 \) and \( b = \theta + \nu (b = \theta) \) and \( \frac{d\Pi_S}{da} = 0 \) is used to determine \( a \). The semi-corner \( a = 0 \) and \( b = \frac{1 - \varphi}{2} \nu \) obtains for \( \varphi = \gamma \) and \( (2 - \varphi) \epsilon \geq \nu \).

**Case 2:** \( \theta + a \geq b \geq \nu \geq \theta - (\epsilon - a) \).

Relocation activity: region I \( 0 \leq x \leq 1 \) and \( \max(b - \nu x, \theta) \leq y \leq \theta + a \), where firms in the principles based regime relocate to the rules based regime to increase their profit from \( 1 - \gamma \) to \( 1 \), at a social loss of \( 1 - \gamma \) to the principles based regime and a social gain of \( 1 - \gamma \) to the rules based regime; region II \( \frac{b - \theta}{\nu} \leq x \leq 1 \) and \( b - \nu x \leq y < \theta \), where firms in the principles based regime relocate to the rules based regime to increase their profit from \( 1 - \gamma \) to \( 1 \), at a social gain of \( \gamma \) to the principles based regime and zero social gain to the rules based regime; region III \( 0 \leq x \leq \frac{b - \theta}{\nu} \) and \( \theta \leq y < b - \nu x \), where firms in the rules (principles) based regime relocate to the principles (rules) based regime to increase their profit from \( 1 - \varphi (1 - \gamma) \) to \( 1 - \gamma \) (1 - \varphi) if \( \varphi > \gamma \) (\( \gamma > \varphi \)), at a social loss (gain) to the rules based regime of \( \gamma - \varphi \) and a social gain (loss) to the principles based regime of \( 1 - \gamma \); and region IV \( 0 \leq x \leq 1 \) and \( \theta - (\epsilon - a) \leq y < \min(\theta, b - \nu x) \), where firms in the rules (principles) based regime relocate to the principles (rules) based regime to increase their profit from \( 1 - \varphi (1 - \gamma) \) to \( 1 - \gamma (1 - \varphi) \) if \( \varphi > \gamma \) (\( \gamma > \varphi \)), at a social loss (gain) of \( 1 - \varphi \) to the rules based regime and a social loss (gain) of \( \gamma \) to the principles based regime.
The welfare effects are:

$$\Pi_S(R_P(x, y; a), x, y) = (1 - \theta) + (1 - \varphi)\theta - (1 - \varphi)\epsilon + (1 - \varphi)a - \gamma \epsilon$$

$$- \int_0^{b-\theta \gamma} \int_{b-\nu x}^{\theta + a} (1 - \gamma) dy dx - \int_{b-\theta}^{b-\nu x} \int_0^{\theta + a} (1 - \gamma) dy dx + \int_{b-\theta}^{b-\nu x} \gamma dy dx$$

$$+ (1_{\varphi>\gamma} - 1_{\gamma>\varphi}) \left( \int_0^{b-\theta \gamma} \int_{\theta - (\epsilon - a)}^{\theta - (\epsilon - a)} (1 - \varphi) dy dx + \int_{b-\theta}^{b-\nu x} \int_{\theta - (\epsilon - a)}^{\theta - (\epsilon - a)} (1 - \varphi) dy dx \right)$$

(A.17)

$$\Pi_S(R_R(x, y; b), x, y) = (1 - \theta) - (1 - \varphi)\frac{\nu}{2} + (1 - \varphi)b - \frac{1}{2\nu}(b - \theta)^2$$

$$+ \int_0^{b-\theta \gamma} \int_{b-\nu x}^{\theta + a} dy dx + \int_{b-\theta}^{b-\nu x} \int_0^{\theta + a} dy dx$$

$$- (1_{\varphi>\gamma} - 1_{\gamma>\varphi}) \left( \int_0^{b-\theta \gamma} \int_{\theta - (\epsilon - a)}^{\theta - (\epsilon - a)} (1 - \varphi) dy dx \right)$$

$$- (1_{\varphi>\gamma} - 1_{\gamma>\varphi}) \left( \int_0^{b-\theta \gamma} \int_{\theta - (\epsilon - a)}^{\theta - (\epsilon - a)} (1 - \varphi) dy dx + \int_{b-\theta}^{b-\nu x} \int_{\theta - (\epsilon - a)}^{\theta - (\epsilon - a)} (1 - \varphi) dy dx \right)$$

(A.18)

$$\frac{d\Pi_S}{da}(R_P(x, y; a), x, y) = [(\gamma - \varphi) + (1_{\varphi>\gamma} - 1_{\gamma>\varphi}) \gamma] da$$

(A.19.a)

$$\frac{d\Pi_S}{db}(R_R(x, y; b), x, y) = [(1 - \varphi) - 2\frac{b - \theta}{\nu} - (1_{\varphi>\gamma} - 1_{\gamma>\varphi}) (1 - \varphi)] db$$

(A.19.b)

We see that \(\frac{d\Pi_S}{da}\) depends on exogenous parameters only. We find the following.

**Corners:** For \(\varphi > \gamma\) and \(\epsilon \geq \nu\), \(a = 0\) and \(b = \theta\).

**Interiors:** For \(\varphi = \gamma\), \(a \in \left[\frac{1-\epsilon-a}{\nu}, \frac{1-\epsilon-a}{\nu}\right]\) and \(b = \theta + \frac{1-\epsilon-a}{\nu}\).

**Case 3:** \(b > \theta + a \geq \theta - (\epsilon - a) \geq b - \nu\).

Relocation activity: region I \(0 \leq x \leq \frac{b-\theta-a}{\nu}\) and \(\theta + a \leq y \leq b - \nu x\), where firms in the rules based regime relocate to the principles based regime to increase their profit from \(1 - \varphi\) to 1, at a social loss of \(1 - \varphi\) to the rules based regime and a social gain of 1 to the principles based regime; region II \(\frac{b-\theta}{\nu} \leq x \leq 1\) and \(\max(b - \nu x, \theta) \leq y \leq \theta + a\), where firms in the principles based regime relocate to the rules based regime to increase their profit from \(1 - \gamma\) to 1, at a social loss of \(1 - \gamma\) to the principles based regime and a social gain of 1 to the rules based regime; region III \(0 \leq x \leq \frac{b-\theta}{\nu}\) and \(\theta \leq y < \min(\theta, b - \nu x)\), where firms in the rules (principles) based regime relocate to the principles (rules) based regime to increase their
profit from $1 - \varphi \ (1 - \gamma)$ to $1 - \gamma \ (1 - \varphi)$ if $\varphi > \gamma \ (\gamma > \varphi)$, at a social loss (gain) of $1 - \varphi$ to the rules based regime and a social gain (loss) of $1 - \gamma$ to the principles based regime; region IV $\frac{b - \theta}{\nu} \leq x \leq 1$ and $\max(b - \nu x, \theta - (\epsilon - a)) \leq y < \theta$, where firms in the principles based regime relocate to the rules based regime to increase their profits from $1 - \gamma$ to $1$, at a social gain of $\gamma$ to the principles based regime and zero social gain to the rules based regime; region V $0 \leq x \leq \frac{b - \theta + (\epsilon - a)}{\nu}$ and $\theta - (\epsilon - a) \leq y < \min(\theta, b - \nu x)$, where firms in the rules (principles) based regime relocate to the principles (rules) based regime to increase their private profits from $1 - \varphi \ (1 - \gamma)$ to $1 - \gamma \ (1 - \varphi)$, at a social loss (gain) of $1 - \varphi$ to the rules based regime and a social loss (gain) of $\gamma$ to the principles based regime; and region VI $\frac{b - \theta + (\epsilon - a)}{\nu} \leq x \leq 1$ and $b - \nu x \leq y < \theta - (\epsilon - a)$, where firms in the principles based regime relocate to the rules based regime to increase their profit from $1 - \varphi$ to $1$ at zero social gain to the rules based regime and a social loss of $1 - \varphi$ to the principles based regime.

The welfare effects are:

$$
\Pi_S(RP(x, y; a), x, y) = (1 - \theta) + (1 - \varphi)\theta - (1 - \varphi)\epsilon + (1 - \varphi)a - \gamma\epsilon
+ \int_0^{\frac{b - \theta - a}{\nu}} \int_{\theta + a}^{b - \nu x} dydx - \int_{\frac{b - \theta + (\epsilon - a)}{\nu}}^{\theta - (\epsilon - a)} (1 - \varphi)dydx
- \int_{\frac{b - \theta - a}{\nu}}^{\theta + a} \int_{b - \nu x}^{(1 - \gamma)dydx} - \int_{\frac{b - \theta + (\epsilon - a)}{\nu}}^{\theta + a} \int_{b - \nu x}^{(1 - \gamma)dydx}
+ (1 > \varphi \gamma \varphi) \left( \int_{\frac{b - \theta - a}{\nu}}^{\theta + a} \int_{\theta}^{\theta + a} (1 - \gamma)dydx + \int_{\frac{b - \theta + (\epsilon - a)}{\nu}}^{\theta + a} \int_{b - \nu x}^{(1 - \gamma)dydx} \right)
+ \int_{\frac{b - \theta + (\epsilon - a)}{\nu}}^{\theta} \int_{b - \nu x}^{\gamma dydx} + \int_{\frac{b - \theta + (\epsilon - a)}{\nu}}^{\theta} \int_{\theta - (\epsilon - a)}^{\gamma dydx}
- (1 > \varphi \gamma \varphi) \left( \int_{\frac{b - \theta - a}{\nu}}^{\theta} \gamma dydx + \int_{\frac{b - \theta + (\epsilon - a)}{\nu}}^{\theta} \gamma dydx \right)
$$

(A.20)
\[ \Pi_S(R_R(x, y; b), x, y) = (1 - \theta) - (1 - \varphi) \frac{\nu}{2} + (1 - \varphi) b - \frac{1}{2\nu}(b - \theta)^2 \\
- \int_0^{b - \theta - a} \int_{\theta + \alpha}^{b - \theta - \alpha} (1 - \varphi) dydx + \int_0^{b - \theta + \alpha} \int_{\theta + \alpha}^{b - \theta + \alpha} dydx + \int_0^{b - \theta} \int_{\theta}^{b - \theta} (1 - \varphi) dydx \\
- (\mathbb{1}_{\varphi > \gamma} - \mathbb{1}_{\gamma > \varphi}) \left( \int_0^{b - \theta - \alpha} \int_{\theta - \alpha}^{b - \theta - \alpha} (1 - \varphi) dydx + \int_0^{b - \theta + \alpha} \int_{\theta + \alpha}^{b - \theta + \alpha} (1 - \varphi) dydx \right) \\
- (\mathbb{1}_{\varphi > \gamma} - \mathbb{1}_{\gamma > \varphi}) \left( \int_0^{b - \theta - \alpha} \int_{\theta - (\epsilon - \alpha)}^{b - \theta - (\epsilon - \alpha)} (1 - \varphi) dydx + \int_0^{b - \theta + \alpha} \int_{\theta + (\epsilon - \alpha)}^{b - \theta + (\epsilon - \alpha)} (1 - \varphi) dydx \right) \] (A.21)

\[ d\Pi_S(R_P(x, y; a), x, y) = \left[ \left( -1 + (1 - \varphi) \frac{b - \theta}{\nu} + (1 - \varphi) \frac{\epsilon - a}{\nu} + \gamma \frac{\epsilon}{\nu} \right) \\
+ (\mathbb{1}_{\varphi > \gamma} - \mathbb{1}_{\gamma > \varphi}) \left( (1 - \gamma) \frac{b - \theta}{\nu} + 2 \gamma \frac{\epsilon - a}{\nu} \right) \right] \] (A.22.a)

\[ d\Pi_S(R_R(x, y; b), x, y) = \left[ \left( (1 - \varphi) - \varphi \frac{a}{\nu} + \varphi \frac{b - \theta}{\nu} \right) - (\mathbb{1}_{\varphi > \gamma} - \mathbb{1}_{\gamma > \varphi})(1 - \varphi) \frac{\epsilon}{\nu} \right] \] (A.22.b)

We find the system

\[ \frac{d\Pi_S}{da} = K_3 \left( \frac{b - \theta - (1 - \varphi) + 2 \gamma (\mathbb{1}_{\varphi > \gamma} - \mathbb{1}_{\gamma > \varphi})}{(1 - \varphi) + (1 - \gamma) (\mathbb{1}_{\varphi > \gamma} - \mathbb{1}_{\gamma > \varphi})} a + (1 - \varphi + \gamma) + 2 \gamma (1 - \varphi - \mathbb{1}_{\varphi > \gamma} - \mathbb{1}_{\gamma > \varphi}) \right) \] (A.23.a)

\[ \frac{d\Pi_S}{db} = \frac{\varphi}{\nu} \left( b - \theta - a + \frac{1 - \varphi}{\varphi} + \frac{1 - \varphi}{\varphi} (\mathbb{1}_{\varphi > \gamma} - \mathbb{1}_{\gamma > \varphi}) \right) \] (A.23.b)

\[ K_3 = \frac{1 - \varphi}{\nu} + \frac{1 - \gamma}{\nu} (\mathbb{1}_{\varphi > \gamma} - \mathbb{1}_{\gamma > \varphi}) \] (A.23.c)

The constant \( K_3 \) is positive. We find the following.

**Corners:** For \( \varphi = \gamma \) and \( \epsilon = \nu \), and for \( \varphi > \gamma \) and \( \nu > \epsilon \), we find \( a = \epsilon \) and \( b = \theta + \nu \); and for \( \epsilon - \nu = (\varphi - 2\gamma) = 0 \), \( a = 0 \) and \( b = \theta \).

**Interiors:** For \( \varphi > 3\gamma \) and \( \epsilon = \nu \), we find \( a = (\varphi - 3\gamma) \epsilon \) and \( b = \theta + (\varphi - 3\gamma) \nu \).

**Case 4:** \( \theta + a \geq b \geq \theta - (\epsilon - a) \geq b - \nu \).

Relocation activity: region I \( 0 \leq x \leq 1 \) and \( max(b - \nu x, \theta) \leq y \leq \theta + a \), where firms in the principles based regime relocate to the rules based regime to increase their profit from \( 1 - \gamma \) to \( 1 \), at a social loss of \( 1 - \gamma \) to the principles based regime and a social gain of \( 1 \) to the rules based regime; region II \( 0 \leq x \leq \frac{b - \theta}{\nu} \) and \( \theta \leq y < b - \nu x \), where firms in the rules (principles) based regime relocate to the principles (rules)
based regime to increase their profit from $1 - \varphi$ $(1 - \gamma)$ to $1 - \gamma$ $(1 - \varphi)$, at a social loss (gain) of $1 - \varphi$ to the rules based regime and a social gain (loss) of $1 - \gamma$ to the principles based regime, if $\varphi > \gamma$ $(\gamma > \varphi)$;
region III $0 \leq x \leq 1$ and $\max(b - \nu x, \theta - (\epsilon - a)) \leq y < \theta$, where firms in the principles based regime relocate to the rules based regime to increase their profit from $1 - \gamma$ to 1, at a social gain of $\gamma$ to the principles based regime and zero social gain to the rules based regime; region IV $0 \leq x \leq \frac{b - \theta + (\epsilon - a)}{\nu}$ and $\theta - (\epsilon - a) \leq y < \min(\theta, b - \nu x)$, where firm in the rules (principles) based regime relocate to the principles (rules) based regime to increase their profit from $1 - \varphi$ $(1 - \gamma)$ to $1 - \gamma$ $(1 - \varphi)$, at a social loss (gain) of $1 - \varphi$ to the rules based regime and a social loss (gain) of $\gamma$ to the principles based regime, if $\varphi > \gamma$ $(\gamma > \varphi)$; and region V $\frac{b - \theta + (\epsilon - a)}{\nu} \leq x \leq 1$ and $b - \nu x \leq y < \theta - (\epsilon - a)$, where firms in the principles based regime relocate to the rules based regime to increase their profit from $1 - \varphi$ to 1, at zero social gain to the rules based regime and a social loss of $1 - \varphi$ to the principles based regime.

The welfare effects are:

$$\Pi_S(R_P(x, y; a), x, y) = (1 - \theta) + (1 - \varphi)\theta - (1 - \varphi)\epsilon + (1 - \varphi)a - \gamma\epsilon$$

$$- \int_0^{b - \theta} \int_0^\theta (1 - \gamma)dydx - \int_0^{b - \theta} \int_0^\theta (1 - \gamma)dydx$$

$$+ (\mathbb{1}_{\nu > \gamma} - \mathbb{1}_{\gamma > \varphi}) \left( \int_0^{b - \theta} \int_0^{b - \nu x} (1 - \gamma)dydx \right)$$

$$+ \int_0^{b - \theta + (\epsilon - a)} \int_0^\theta \gamma dydx + \int_0^{b - \theta + (\epsilon - a)} \int_\theta^{\theta - (\epsilon - a)} \gamma dydx$$

$$- (\mathbb{1}_{\nu > \gamma} - \mathbb{1}_{\gamma > \varphi}) \left( \int_0^{b - \theta} \int_0^\theta \gamma dydx + \int_0^{b - \theta + (\epsilon - a)} \int_\theta^{\theta - (\epsilon - a)} \gamma dydx \right)$$

$$- \int_0^{1 - \theta + (\epsilon - a)} \int_0^{b - \nu x} (1 - \varphi)dydx$$

(A.24)
\[\Pi_S(R_R(x, y; b), x, y) = (1 - \theta) - (1 - \varphi) \frac{\nu}{2} + (1 - \varphi)b - \frac{1}{2\nu}(b - \theta)^2\]
\[+ \int_0^{b - \theta} \int_{b - \nu x}^{\theta + a} dydx + \int_0^1 \int_{b - \theta}^{\theta + a} dydx\]
\[- (\mathbf{1}_{\varphi > \gamma} - \mathbf{1}_{\gamma > \varphi}) \left( \int_0^{\frac{b - \theta}{\nu}} \int_{\theta - (a - \varphi)}^{b - \nu x} (1 - \varphi)dydx \right)\]
\[- (\mathbf{1}_{\varphi > \gamma} - \mathbf{1}_{\gamma > \varphi}) \left( \int_0^{\frac{b - \theta}{\nu}} \int_{\theta - (a - \varphi)}^{b - \nu x} (1 - \varphi)dydx \right)\]
\[\text{(A.25)}\]

\[d\Pi_S(R_R(x, y; a), x, y) = \left[ \left( -1 + (1 - \varphi + \gamma) \left( \frac{\varepsilon - a}{\nu} + \frac{b - \theta}{\nu} \right) \right) + (\mathbf{1}_{\varphi > \gamma} - \mathbf{1}_{\gamma > \varphi}) \gamma \left( \frac{\varepsilon - a}{\nu} + \frac{b - \theta}{\nu} \right) \right] da\]
\[\text{(A.26.a)}\]

\[d\Pi_S(R_R(x, y; b), x, y) = \left[ \left( (1 - \varphi) - 2 \frac{b - \theta}{\nu} \right) - (\mathbf{1}_{\varphi > \gamma} - \mathbf{1}_{\gamma > \varphi}) (1 - \varphi) \left( \frac{\varepsilon - a}{\nu} + \frac{b - \theta}{\nu} \right) \right] db\]
\[\text{(A.26.b)}\]

We find the system.

\[\frac{d\Pi_S}{da} = K_4 \left( b - \theta - a + \varepsilon - \frac{1}{(1 - \varphi + \gamma) + \gamma(\mathbf{1}_{\varphi > \gamma} - \mathbf{1}_{\gamma > \varphi})} \right) \]
\[\text{(A.27.a)}\]

\[\frac{d\Pi_S}{db} = K_5 \left( b - \theta - \frac{(1 - \varphi)(\mathbf{1}_{\varphi > \gamma} - \mathbf{1}_{\gamma > \varphi})}{2 + (1 - \varphi)} (a - \varepsilon) + \frac{1 - \varphi}{2 + (1 - \varphi)(\mathbf{1}_{\varphi > \gamma} - \mathbf{1}_{\gamma > \varphi})} \right) \]
\[\text{(A.27.b)}\]

\[K_4 = \frac{1 - \varphi + \gamma}{\nu} (\mathbf{1}_{\varphi > \gamma} - \mathbf{1}_{\gamma > \varphi})\]
\[\text{(A.27.c)}\]

\[K_5 = -2 \frac{1 - \varphi}{\nu} (\mathbf{1}_{\varphi > \gamma} - \mathbf{1}_{\gamma > \varphi})\]
\[\text{(A.27.d)}\]

The constant \(K_4\) is positive and \(K_5\) is negative. We find the following.

**Corners:** For \(\varphi = \gamma\) and \(\nu \geq \varepsilon\); for \(\varphi > \gamma\) and \(\varepsilon - \nu \leq \min(0, (\varphi - 2\gamma)\varepsilon)\); and for \(\gamma > \varphi\) and \(\nu \geq \varepsilon\), \(a = 0\) and \(b = \theta\).

**Sign of \(\xi_i\), \(i = A, B\):** Using the definition of \(\Gamma_A\) and \(\Gamma_B\) in the text, we can write the statement that
\( \xi_A \) is positive as

\[
0 < \xi_A
\]

\[
= (1 - \varphi)^2 \nu_A - (1 + \varphi) \nu_B - (1 - \varphi)^2 \frac{\nu_A^2}{2(2 - \varphi) \nu_A - (1 + \varphi) \nu_B} - (1 - \varphi)^2 \frac{\nu_B^2}{2(2 - \varphi) \nu_A - (1 + \varphi) \nu_B}^2
\]

\[
- \frac{(1 - \varphi)^3 \nu_A^3}{2(\nu_A - \nu_B)} \left( \frac{2 \nu_A - (1 + \varphi) \nu_B}{2(2 - \varphi) \nu_A - (1 + \varphi) \nu_B} \right)^2
\]

(A.28)

Eliminating terms and dividing by common factors, we find

\[
0 < 2 \nu_A - (1 + \varphi) \nu_B - \nu_A + \frac{2(3 - \varphi) \nu_A - (1 + \varphi)^2 \nu_B}{4(2 - \varphi) \nu_A - 2(1 + \varphi) \nu_B}
\]

(A.29)

which again reduces to

\[
0 < (\nu_A - \nu_B) + \frac{4((1 - \varphi)^2 - \varphi) \nu_A - (1 - \varphi)^2 \nu_B}{4(2 - \varphi) \nu_A - 2(1 + \varphi) \nu_B}
\]

(A.30)

which by inspection has to be true when \( \varphi \) is small compared to 1 and \( \nu_B \leq \nu_A \). Noticing that \( \Gamma_A > \Gamma_B > 0 \), it also follows that \( \xi_B > 0 \). We know that regardless of regulation, the welfare in any jurisdiction cannot exceed \( 1 - \theta \varphi \), hence it follows trivially that \( (1 - \varphi)^2 \frac{\nu_A^2}{2} > \xi_A, \xi_B \) and hence \( (1 - \varphi)^2 \nu_A > \xi_A, \xi_B \).

**Welfare Effects of Harmonization:**

We study here the transition from a diversity equilibrium to a harmonization equilibrium described in the Lemmas in the text. Assume throughout that \( \varphi \neq \gamma \).

**Harmonization to Principles Based Regulation:** Recall that under principles based regulation there are only two equilibria: \((a_A^*, a_B^*) = (0, 0)\) for \( \varphi > \gamma \) and \((a_A^*, a_B^*) = (\epsilon_A, \epsilon_B)\) for \( \gamma > \varphi \). The welfare for \( \varphi > \gamma \) is given by

\[
\Pi_S^A = 1 - \varphi \theta - \gamma \epsilon_A - (1 - \varphi) \epsilon_B
\]

(A.31.a)

\[
\Pi_S^B = 1 - \varphi \theta - 2 \gamma \epsilon_B - (1 - \varphi - \gamma) \epsilon_A
\]

(A.31.b)

\[
\Pi_S = 2(1 - \varphi \theta) - (1 - \varphi) \epsilon_A - (1 - \varphi + 2 \gamma) \epsilon_B
\]

(A.31.c)

and for \( \gamma > \varphi \),

\[
\Pi_S^A = 1 - \varphi \theta - \epsilon_A + (1 - \gamma) \epsilon_B
\]

(A.32.a)

\[
\Pi_S^B = 1 - \varphi \theta + \epsilon_A - (1 + \gamma) \epsilon_B
\]

(A.32.b)

\[
\Pi_S = 2(1 - \varphi \theta) - 2 \gamma \epsilon_B
\]

(A.32.c)

Here it is assumed by convention that \( \epsilon_A < \epsilon_B \). When we consider harmonization to one of these equilibria from a diversity equilibrium, we find harmonization to the cost leader if the diversity equilibrium is given
in the form \((\epsilon_A, \nu_B)\) and harmonization to the cost follower if the diversity equilibrium is given in the form \((\epsilon_B, \nu_A)\). When we work out the welfare prior to harmonization, we need to consider the various cases outlined in the lemma separately. Even if the same equilibrium strategies of the two regulators are played in two different cases, the welfare is not necessarily the same because the migration patterns varies. Therefore, we start with Case 1 from above, where we find the equilibrium \((a, b) = (0, \theta + \nu)\) played for \(\gamma > \varphi\). This yields the welfare functions (here we use the general notation \(\Pi_S(a)\) for the regulator who uses a principles based approach and \(\Pi_S(b)\) for the regulator who uses a rules based approach - since regulator \(A\) and \(B\) may be either)

\[
\begin{align*}
\Pi_S(a|\text{Case 1:}(0, \theta + \nu)) &= 1 - \varphi \theta - (1 - \varphi) \epsilon + \frac{\nu}{2} \\
\Pi_S(b|\text{Case 1:}(0, \theta + \nu)) &= 1 - \varphi \theta + (1 - \varphi) \frac{\nu}{2} + (1 - \varphi) \epsilon \\
\Pi_S(\text{Case 1}) &= 2(1 - \varphi \theta) + \left(1 - \frac{\varphi}{2}\right) \nu
\end{align*}
\]

(A.33.a) \hspace{1cm} \text{(A.33.b)} \hspace{1cm} \text{(A.33.c)}

Next, we find Case 2 which applies to \(\varphi > \gamma\) and \(\epsilon \geq \nu\), where the equilibrium \((0, \theta)\) is played. The welfare functions are as follows.

\[
\begin{align*}
\Pi_S(a|\text{Case 2:}(0, \theta)) &= 1 - \varphi \theta - (1 - \varphi) \epsilon + \gamma \nu \\
\Pi_S(b|\text{Case 2:}(0, \theta)) &= 1 - \varphi \theta - (1 - \varphi) \epsilon + (1 - \varphi) \nu \\
\Pi_S(\text{Case 2}) &= 2(1 - \varphi \theta) - 2(1 - \varphi) \epsilon + (1 - \varphi + \gamma) \nu
\end{align*}
\]

(A.34.a) \hspace{1cm} \text{(A.34.b)} \hspace{1cm} \text{(A.34.c)}

Then follows Case 3 which applies to \(\varphi > \gamma\) and \(\nu \geq \epsilon\), where the equilibrium \((\epsilon, \theta + \nu)\) is played. The welfare functions are as follows.

\[
\begin{align*}
\Pi_S(a|\text{Case 3:} (\epsilon, \theta + \nu)) &= 1 - \varphi \theta - 2 \gamma \epsilon + \frac{\nu}{2} - \left( \frac{1}{2} - \gamma \right) \frac{\epsilon^2}{\nu} \\
\Pi_S(b|\text{Case 3:} (\epsilon, \theta + \nu)) &= 1 - \varphi \theta + \left( \frac{1}{2} - \varphi \right) \nu + \left( \frac{3}{2} - \varphi \right) \frac{\epsilon^2}{\nu} \\
\Pi_S(\text{Case 3}) &= 2(1 - \varphi \theta) - 2 \gamma \epsilon + (1 - \varphi) \nu + (1 - \varphi + \gamma) \frac{\epsilon^2}{\nu}
\end{align*}
\]

(A.35.a) \hspace{1cm} \text{(A.35.b)} \hspace{1cm} \text{(A.35.c)}

Finally, we have Case 4 which applies to \(\varphi > \gamma\) and \(\nu \geq \epsilon - \min(0, (\varphi - 2 \gamma) \epsilon)\), or \(\gamma > \varphi\) and \(\nu \geq \epsilon\), where
in either case the equilibrium \((0, \theta)\) is played. The welfare functions are as follows.

\[
\Pi_S(a) \text{Case 4: } (0, \theta) = 1 - \varphi \theta - (1 - \varphi) \frac{\nu}{2} - (1 - \varphi + \gamma) \frac{\nu^2}{4} - (1_{\varphi > \gamma} - 1_{\gamma > \varphi}) \frac{\nu^2}{2} \tag{A.36.a}
\]

\[
\Pi_S(b) \text{Case 4: } (0, \theta) = 1 - \varphi \theta + (1 - \varphi) \frac{\nu}{2} - (1_{\varphi > \gamma} - 1_{\gamma > \varphi}) (1 - \varphi) \frac{\nu^2}{2} \tag{A.36.b}
\]

\[
\Pi_S(\text{Case 4}) = 2(1 - \varphi \theta) - (1 - \varphi + \gamma) \frac{\nu^2}{2} - (1_{\varphi > \gamma} - 1_{\gamma > \varphi}) (1 - \varphi + \gamma) \frac{\nu^2}{2} \tag{A.36.c}
\]

**Harmonization to Rules Based Regulation:** There is here only one equilibrium \((b_A^*, b_B^*) = (\theta + A, \theta)\), where we define \(A = \frac{(1 - \varphi)|\nu_A|}{(2 - \varphi)|\nu_A - \nu_B|}\). Using the expressions above we can work out the welfare as

\[
\Pi_A = 1 - \varphi \theta - (1 - \varphi) \frac{\nu_A}{2} + \xi_A \tag{A.37.a}
\]

\[
\Pi_B = 1 - \varphi \theta - (1 - \varphi) \frac{\nu_B}{2} + \xi_B \tag{A.37.b}
\]

\[
\Pi_S = 2(1 - \varphi \theta) - (1 - \varphi) \nu_A + \xi_S \tag{A.37.c}
\]

where \(\xi_A, \xi_B,\) and \(\xi_S\) are defined as in the text. Using the expressions for \(\Pi_S(\text{Case } i), i = 1, \ldots, 4\) derived above we arrive at the result in a straightforward way.

**Proof of Proposition 3:** For (1) we need to consider only \(\varphi > \gamma\) since it follows in a straightforward way that principles based harmonization is never optimal from (2), which is immediate from Lemma 5a-b. We need to evaluate Case 2, where from Lemma 5a harmonization is unprofitable if \((1 - \varphi)(\epsilon_i - \epsilon_A) + (1 - \varphi)(\epsilon_i - \epsilon_B) - 2\gamma \epsilon_B - (1 - \varphi + \gamma) \nu_j < 0\), which must be true because the difference \(|\epsilon_A - \epsilon_B|\) is small; Case 3, where harmonization is unprofitable if \(-(1 - \varphi)\epsilon_A - (1 - \varphi + 2\gamma) \epsilon_B + 2\gamma \epsilon_i - (1 - \varphi) \nu_j - (1 - \varphi + \gamma) \frac{\nu^2}{2} < 0\), which also must be true since \(\gamma\) is small; and finally Case 4 where harmonization is unprofitable for \(-(1 - \varphi)\epsilon_A - (1 - \varphi + 2\gamma) \epsilon_B + (1 - \varphi + \gamma) \frac{\nu^2}{2} < 0\). This follows because for this case, \(\nu \geq \epsilon - \min(0, (\varphi - 2\gamma)\epsilon)\) and hence \(\frac{\nu^2}{2j}\) is of the same order of magnitude or smaller than \(\epsilon_i\). This leaves (3). For these parameters, Case 2 applies, and from Lemma 5b we find that harmonization to rules based regulation is profitable for \((1 - \varphi)(\epsilon_i - \nu_A) + (1 - \varphi)(\epsilon_i - \nu_j) + \xi_S - \gamma \nu_j > 0\) which must be true since \(\gamma\) is small.