Policy diffusion and the competition for mobile resources

Andrea Schneider*

University of Oslo & University of Münster

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Abstract

Reforms are often introduced in one region and afterwards adapted by other regions. This paper analyzes a model where policy diffusion can be explained by competition for mobile resources. I provide conditions under which initially symmetric regions realize reforms sequentially and a reform initiated in one region is afterwards adapted by another region. Forward-looking agents anticipate the policy convergence and respond less to the reform than the current difference in policies would imply. If agents' mobility is very high, moreover, regions can be trapped in a situation where no reform is realized at all.

Keywords: policy diffusion; mobile resources; interregional competition

JEL classification: D78; F23; H77

1 Introduction

The objective of this paper is to explain policy diffusion with competition for mobile resources. In a globalized world where firms and individuals become more and more mobile reforms that affect mobile resources might foster them to relocate. If mobile resources are of value to the government since they are an important determinant to sustain welfare, e.g., due to productivity, tax revenue, positive external effects on other parts of the society etc., and governments fear to lose the resources due to relocation, they might refrain from the realization of a reform or at least delay the reform although it would be welfare improving without competition for mobile resources.

There are many examples where we observe the described pattern. In the context of environmental regulation the reform might be targeted to reduce environmental pollution. An increase in regulation, however, might drive some firms out of the region. The government's decision process can be separated into three stages: First, it chooses the general kind of reform. There are different possibilities to cope with environmental pollution. The government can, e.g., levy a tax on polluting output, introduce a cap on pollution or implement a certification trade. Deciding on the kind of reform, of course, already comes with some costs. Second, the government decides on the specific design of the chosen reform, e.g., on the level of the tax rate. The quality of the reform finally determines the costs due to relocating firms. Third, if a government decides not to initiate a reform process targeted to reduce pollution, it nevertheless might decide afterwards to adapt the reform introduced by other governments. In this case we observe diffusion of environmental regulation. Empirical evidence for such a strategic interaction in the context of environmental regulation is, e.g., given by Konisky (2007). There are two concerns related to this kind of reform process. First, competition on mobile resources might lead to inefficient low regulation. Second, firms might relocate to regions where regulation is low (pollution haven hypothesis). As another example we might think of a reform designed to reduce profit shifting. The government might first decide whether it wants to introduce withholding taxes or tighten rules for disclosure. Afterwards, the government decides about the specific design of the respective policy. Although this paper focuses on scenarios where firms are the mobile resource, the results can directly be applied to other mobile factors, e.g., individuals. There is some evidence that especially rich individuals change their country of residence if targeted by an increase in the income tax (Kleven et al. (2013)). Brülhart & Parchet (2014) analyze the effect of a reform on bequest taxation in Switzerland. Finding only small response elasticities they conclude: *"The alleged pressures of tax competition did not seem in reality to exist."*

This paper finds that competition for mobile resources and low response elasticities are no contradiction if there is policy diffusion and agents are forward looking. The model therefore gives an explanation why there is no robust evidence for the pollution haven hypothesis (see e.g. Hanna (2010) and Kheder

& Zugravu (2012)). Moreover, the model provides conditions for policy diffusion with initially identical regions. The equilibria give some implications on the level of regulation. Ceteris paribus regulation is higher if there is just one region that initiates a reform process. If both regions initiate a reform process, Nash competition on the stage where governments decide about the tightness of their reform leads to a decrease in regulation. Moreover, if resources are very mobile no region initiates a reform and both regions stay with a very low regulation.

The paper is related to two strands of literature. First, it relates to the literature on policy diffusion. Policy diffusion can be explained in at least two different ways. It can be the result of either social learning or economic competition (Boehmke & Witmer (2004)). In the first scenario incomplete information makes reforms an experiment with uncertain outcome and therefore gives some incentives to delay reforms to learn from successful or failed reforms in other regions. An analysis of this scenario is given by Callander & Harstad (2015). In the second scenario, which is in the focus of this paper, governments have complete information but might lose valuable resources due to relocation if they introduce a reform. To the best of my knowledge there is no paper analyzing policy diffusion in the context of economic competition. Thus, this paper aims to provide a complement to Callander & Harstad (2015) and might help to provide testable hypotheses to distinguish between both ways of explaining policy diffusion. Second, the paper also relates to the literature that explains the race to the bottom by competition for mobile resources. This literature goes back to the seminal papers by Zodrow & Mieszkowski (1986) and Wilson (1986). The literature on competition for mobile resources mainly focuses on the choice of a tax rate on capital and more complex policy structures are not discussed. In general, however, it is not clear that a reduction in the tax rate is the best instrument to provide benefits to attract capital or firms. Increasing the set of possible policy instruments scenarios that allow for policy diffusion seem to be more appropriate. Although recent literature has endogenized the leadership in tax competition (see Kempf & Rota-Graziosi (2010) and Ogawa (2013)), I am not aware of any paper that allows for policy adaption which is per assumption less expensive then initiating a reform from scratch.

The next Section 2 presents the model. Section 3 uses backward induction to derive the subgame perfect equilibria. Section 4 finally summarizes the main results and provides a discussion on possible extensions of the basic model.

2 The model

There are two regions $i \in \{A, B\}$. Both decide about a reform that might foster some firms to relocate to another region. Initially each region consists of a unit mass of firms. Firms, however, might relocate between the two regions. Relocation is costly and firms are heterogenous with respect to their relocation costs θ. Relocation costs within each region are independently uniformly distributed with support on $[0, \bar{\theta}]$. For simplicity reasons I assume that relo-

cation costs are not affected by previous moving decisions. Without a reform all firms realize equal profits π and profits do not depend on the location of the firm. The reform is some kind of regulation $r \in \mathbb{R}_{\geq 0}$ that reduces the profit of the firm, that is, $\pi(r)$ with $\pi' < 0$ and $\pi'' \geq 0$. The regulation can be, e.g., an increase in an environmental standard but also a regulation that reduces profit shifting possibilities of the firms. If regulation in both regions is differently severe firms' profits depend on their location. The profit of a firm that is located in region i at the beginning of period $t \in \{1, 2\}$ is $\pi(r_{it})$. If a firm with relocation costs θ relocates from region i to region i' in period t, it realizes profits $\pi(r_{i't}) - \theta$. Anticipating relocation of firms a region decides about its reform. The government's decision process consists of three stages: In period 1 each region firstly decides whether to start a reform process or not. Starting a reform process implies fixed costs F. The idea here is that regions that want to reform have to collect some data, appoint a committee of experts that develop ideas what kind of reform is suitable, etc. Afterwards, if a region has started a reform process it has to decide about the intensity of the regulation, i.e. $r_{i1} \in \mathbb{R}_{\geq 0}$. If, e.g., a region has decided to implement an upper limit for carbon dioxide in the production process, it afterwards has to decide about the precise level of this upper limit. In line with Callander & Harstad (2015), I refer to these two stages of the reform process as the quantity of reforms and the quality of reforms, respectively. In period 2, each region decides whether to stay with its current regulation or to adapt the regulation of the other region, i.e. $r_{i2} \in \{r_{A1}, r_{B1}\}$. The basic idea is that regions can more easily realize reforms that are already implemented in other regions. For simplicity reasons I assume that adaptation is costless. However, the results would qualitatively not change if adaptation implies fixed costs as long as these fixed costs are smaller than the fixed costs that arise when a reform process is initiated. The governments face a trade-off when they decide about their regulation. On the one hand, they want to increase their regulation up to an ideal point. On the other hand, the number of firms located in the region (weakly) decreases in regulation. More precisely, government i minimizes the sum of costs that arise due to a deviation from an ideal point $\hat{r}_i$ and costs that arise due to a loss in mobile resources. Costs of deviating from the ideal point are $\hat{c}(r_i)$ with $\hat{c}(\hat{r}_i) = \hat{c}(\hat{r}_i) = 0$, $\text{sign}(\hat{c}') = \text{sign}(r_i - \hat{r}_i)$, and $\hat{c}''(r_i) > 0$. If a fraction $\tilde{n}_{i \to i', t}$ of firms relocate from region i to region i' in period t, region i faces cost $c(\tilde{n}_{i \to i', t})$ with $c' > 0$ and $c'' \geq 0$. Analogously, we interpret $-(\tilde{n}_{i' \to i, t})$ as the gain region i can realize when it attracts firms from region i'. The ideal point $\hat{r}_i$ is the regulation that government i would choose without relocation of firms. Thus, this ideal point might already capture a trade-off between an increase in regulation that increases welfare on the one hand but also implies some costs of, e.g., implementation on the other hand. I assume that the ideal point does not depend on the fraction of firms located in a region and is therefore constant over time. This assumption might be relaxed in an extension of the basic model.

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Before I start solving the game by backward induction I summarize the timing of the game:

- Period 1:

    1. Both regions simultaneously decide whether to start a reform ($I_i = 1$) or not ($I_i = 0$).

    2. Regions that have started a reform decide about the intensity of the reform $r_{i1} \in \mathbb{R}_{\geq 0}$. If a region has not started a reform, regulation is zero, i.e. $r_{i1} = 0$.

    3. Firms decide whether to relocate to the other region or to stay in their current region.

- Period 2:

    4. Both regions decide whether to adapt the policy of the other region or to stay with regulation they realized in period 1. It is $r_{i2} \in \{r_{A1}, r_{B1}\}$.

    5. Firms decide again whether to relocate or not.

3 Deriving the equilibrium reform processes

For the rest of the paper I assume that regions are initially symmetric, that is, they have the same ideal point $\hat{r} \equiv \hat{r}_A = \hat{r}_B$. Moreover, I assume that without relocation of mobile firms, regions have an incentive to initiate a reform. I formalize this point in Assumption 1.

Assumption 1 *Fixed costs are sufficiently small so that without relocation of mobile resources both regions implement a reform, i.e. $F < \hat{c}(0)$.*

Since relocation only implies costs, the social efficient solution, i.e. the solution that minimizes aggregate costs in both regions, implies that both regions implement regulation at the ideal point $\hat{r}$ in period 1 and stay with this regulation in period 2. Lemma 1 summarizes this result.

Lemma 1 *The social optimal solution implies that both regions implement a reform and choose regulation at the ideal point $\hat{r}$ in both periods.*

Stage 5:
At this stage the final regulation of both regions is known to the firms. Firms compare their profits from staying at their current location with the profits they can realize if they move to the other region. A firm with relocation costs θ currently located in region i will move to region $i' \neq i$ if

$$\pi(r_{i2}) \leq \pi(r_{i'2}) - \theta$$
$$\theta \leq \pi(r_{i'2}) - \pi(r_{i2}) \tag{1}$$

The relocation costs that makes a firm indifferent between staying in region i and relocating to region i' is denoted by

$$\hat{\theta}_{i \to i',2} = \pi(r_{i'2}) - \pi(r_{i2}). \tag{2}$$

If both regions have implemented the same regulation in the second period, no firm will relocate. If there is relocation due to differences in regulation, relocation goes from the region with higher regulation to the region with lower regulation. The fraction of relocating firms depends on the relocation that appeared in period 1 since first period relocation affects the distribution of the relocation costs a region faces in period 2.

As long as regions are initially symmetric, results are not restricted by assuming that region A implements the weakly higher regulation in period 1. I formally summarize this point in the following assumption.

Assumption 2 *Region A has the weakly higher regulation in period 1, i.e. $r_{A1} \geq r_{B1}$.*

Initially there is a unit mass of firms located in each region, i.e. $n_{A0} = n_{B0} = 1$. With $r_{A1} = r_{B1}$ there is no relocation in period 1 and therefore $n_{A1} = n_{B1} = 1$. In this case the fraction of firms relocating from country i to i' in period 2 is

$$\tilde{n}_{i \to i',2} = \max \left\{ \frac{\pi(r_{i'2}) - \pi(r_{i2})}{\bar{\theta}}, 0 \right\}. \tag{3}$$

If firms have a weak (incentive) to relocate from i to i' in period 2, the fraction of firms located in region i and i' at the end of period 2 are

$$n_{i2} = 1 - \tilde{n}_{i \to i',2} \quad \text{and} \quad n_{i'2} = 1 + \tilde{n}_{i \to i',2}, \tag{4}$$

respectively.

If regions differ in their regulation in the first period, i.e. if $r_{A1} > r_{B1}$, some firms might relocate in period 1. I denote the critical costs that makes a firm indifferent whether to relocate from A to B in period 1 by $\hat{\theta}_{A \to B,1}$. That is the fraction of firms that have moved in period 1 is

$$\tilde{n}_{A \to B,1} = \frac{\pi(r_{i'1}) - \pi(r_{i1})}{\bar{\theta}} \tag{5}$$

and therefore

$$n_{A1} = 1 - \tilde{n}_{A \to B,1} \quad \text{and} \quad n_{B1} = 1 + \tilde{n}_{A \to B,1}. \tag{6}$$

The distribution of relocation costs at the beginning of period 2 is then $\mathcal{U}[\hat{\theta}_{A \to B,1}, \bar{\theta}]$ in region A and $\mathcal{U}[0, \hat{\theta}_{A \to B,1}] + \mathcal{U}[0, \bar{\theta}]$ in region B.

The following cases might arise at stage 5:

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Case 5.1: If $r_{A2} = r_{B2}$, there is no relocation in period 2.

Case 5.2: If $r_{A2} = r_{A1} > r_{B2} = r_{B1}$ and $\hat{\theta}_{A \to B,1} < \hat{\theta}_{A \to B,2}$, then $n_{A2} = 1 - \frac{\hat{\theta}_{A \to B,2}}{\theta}$ and $n_{B2} = 1 + \frac{\hat{\theta}_{A \to B,2}}{\theta}$. Region B can attract some additional firms on top to the firms already attracted in period 1.

Case 5.3: If $r_{A2} = r_{A1} > r_{B2} = r_{B1}$ and $\hat{\theta}_{A \to B,1} \geq \hat{\theta}_{A \to B,2}$, then $n_{A2} = 1 - \frac{\hat{\theta}_{A \to B,1}}{\theta}$ and $n_{B2} = 1 + \frac{\hat{\theta}_{A \to B,1}}{\theta}$. Region B realizes (as in period 1) the weakly lower regulation but cannot attract additional firms. There is no relocation in period 2.

Case 5.4 If $r_{A2} = r_{B1} < r_{B2} = r_{A1}$ and $\hat{\theta}_{A \to B,1} \leq \hat{\theta}_{B \to A,2}$, then $n_{A2} = 1 + \frac{\hat{\theta}_{B \to A,2}}{\theta}$ and $n_{B2} = 1 - \frac{\hat{\theta}_{B \to A,2}}{\theta}$. Region A can attract back the firms that it has lost in period 1 and attracts the same type of firms form region 2. Moreover, if $\hat{\theta}_{A \to B,1} < \hat{\theta}_{B \to A,2}$ there are additional cost types that have not relocated in period 1 but now relocate to region A. The fraction of firms finally located in region A is with certainty larger than 1, that is, there are more firms located in region A than at the beginning of the game.

Case 5.5: If $r_{A2} < r_{B2}$ and $\hat{\theta}_{A \to B,1} > \hat{\theta}_{B \to A,2}$, then $n_{A2} = n_{A1} + 2\frac{\hat{\theta}_{B \to A,2}}{\theta}$ and $n_{B2} = n_{B1} - 2\frac{\hat{\theta}_{B \to A,2}}{\theta}$. Region A can at most attract back the cost types that it has lost in period 1. However, it attracts this type of firm two times as it also attracts the firms initially located in region B. In general, it is ambiguous whether the final fraction of firms located in region A is smaller or larger than one.

Stage 4:
At this stage regions decide whether to stay with the regulation they have implemented in period 1 or to adapt the policy introduced by the other region. Four different scenarios in pure strategies might arise:

Case 4.1: $(r_{A2}, r_{B2}) = (r_{A1}, r_{A1})$: Both regions implement the high regulation in the second period, that is, there is policy convergence towards high regulation. Case 5.1 applies.

Case 4.2: $(r_{A2}, r_{B2}) = (r_{B1}, r_{B1})$: Both regions implement the low regulation in the second period, that is, there is policy convergence towards low regulation. Case 5.1 applies.

Case 4.3: $(r_{A2}, r_{B2}) = (r_{A1}, r_{B1})$: Both regions stay with the regulation they have implemented in period 1. There is no policy convergence. Cases 5.2 or 5.3 apply.

Case 4.4: $(r_{A2}, r_{B2}) = (r_{B1}, r_{A1})$: Both regions adapt the policy that the other region has implemented in period 1. There is no policy convergence. Cases 5.4 or 5.5 apply.

Depending on the specific cost functions the governments face, in general, all four scenarios might constitute an equilibrium outcome at this stage and there might also be mixed equilibria. To get some first results I restrict the following analysis to the assumption that the costs regarding a loss in mobile resources are linear in the fraction of firms.

Assumption 3 *The costs that arise in region i if fraction $\tilde{n}_{i \to i',t}$ of firms move to region i' is $\gamma \tilde{n}_{i \to i',t}$ with $\gamma > 0$.*

If both regions have implemented the same regulation in period 1, i.e. if $r_{A1} = r_{B1} \equiv r_1$, there is a unique Nash equilibrium at stage 4 where both regions set $r_{A2} = r_{B2} = r_1$. Suppose instead country A has implemented a higher regulation in period 1 than country B, i.e. if $r_{A1} > r_{B1}$. Then, regions balance the marginal costs that arise due to deviation from the ideal point and marginal costs associated with a loss in firms. Lemma 2 summarizes the results.

Lemma 2 *If both regions have implemented the same regulation in period 1, that is, $r_{A1} = r_{B1}$, regulation in period 2 is $(r_{A2}, r_{B2}) = (r_{A1}, r_{B1})$. If region A has implemented a higher regulation than region B in period 2, two equilibria can arise: (i) If $\hat{c}(r_{B1}) - \hat{c}(r_{A1}) > \gamma \frac{\pi(r_{B1}) - \pi(r_{A1})}{\bar{\theta}}$, there is a unique equilibrium $(r_{A2}, r_{B2}) = (r_{A1}, r_{A1})$. (ii) Otherwise, there is a unique equilibrium $(r_{A2}, r_{B2}) = (r_{B1}, r_{B1})$.*

Proof: The first part of the lemma is trivial. If regulation is the same in both regions in period 1, there is no possibility to choose another regulation and regions have to stay with the regulation they have previously implemented. If the costs implied by moving firms, that is, $\gamma \frac{\pi(r_{B1}) - \pi(r_{A1})}{\bar{\theta}}$, are low (and therefore also the benefits of attracting firms) both regions choose the high standard r_{A1}. If on the contrary, the costs implied by moving firms are high, both regions choose the low standard r_{B1}. Costs are sufficiently low if the following inequality holds

$$\hat{c}(r_B) - \hat{c}(r_A) > \gamma \frac{\pi(r_{B1}) - \pi(r_{A1})}{\bar{\theta}}. \tag{7}$$

The LHS of the inequality describes the benefit that is implied by implementing r_{A1} instead of r_{B1} and therefore being closer to the ideal point. The implementation of r_{A1} instead of r_{B1} comes, however, for the costs of losing firms (RHS of the inequality). If the inequality holds, both countries implement the high regulation, i.e. Case 4.1. Otherwise both countries realize the low regulation (Case 4.2). $\square$

Lemma 2 shows that there is always policy convergence in period 2. If resources are very mobile, that is, if $\bar{\theta}$ is very small, convergence towards an equilibrium with low regulation becomes more likely. This is in line with the argument that competition on mobile firms leads to low regulation, e.g., in the case of environmental regulation.

The result, of course, is driven by Assumption 3. Thus, let me discuss what happens if cost implied by the loss of mobile resources are non-linear. First, if the cost function is convex[1], that is, if each additional firm that relocates implies higher marginal costs, there is an asymmetry between losing firms and attracting firms. More precisely, given the same fraction of firms attracting a marginal firm generates less benefit than costs that arise due to a loss of a marginal firm. Second, the benefit of higher regulation (that is the benefit of being closer to the ideal point) is larger the more firms are already located in the region. That is, with relocation in the first period the regulation decisions in period 2 are not symmetric for both regions. Summarized, removing Assumption 3 there might be equilibria where policies of do not converge in the second period.

Stage 3:
At this stage firms observe current regulations and anticipate the regulations implemented at stage 5. Lemma 3 summarizes the relocation decision of the firms in period 1.

Lemma 3 *If both regions have implemented the same regulation in period 1, i.e. if $r_{A1} = r_{B1}$, no firm relocates in period 1. If region A has implemented a higher regulation than region B in period 1, firms with $\theta \leq \pi(r_{B1}) - \pi(r_{A1})$ relocate from region A to region B. The fraction of firms that relocates is $\tilde{n}_{A \to B,1} = \frac{\pi(r_{B1}) - \pi(r_{A1})}{\bar{\theta}}$.*

Proof: Since there is policy convergence in period 2 (see Lemma 2), the only incentive to relocate in the first period is the short run gain realized due to the differences in regulations in period 1. Thus, there is no relocation if $r_{A1} = r_{B1}$. If $r_{A1} > r_{B1}$ firms initially located in region A can generate a one-period gain in profits if they relocate to region B. This gain is $\pi(r_{B1}) - \pi(r_{A1})$. Firms that have smaller relocation costs than this gain relocate from region A to region B. □

The moving decision is driven by the short run gain realized due to the differences in regulation. The fraction of firms that relocate does not depend on the anticipated policy at stage 5 since the regulation will be the same in both regions.[2] Lemma 3 implies that the response to reform is lower as in

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[1]Suppose e.g. that regions interest in firms is due to tax revenue. In this case, the cost that arise due to a loss in mobile resources (that is in the tax base) is convex.

[2]If I relax Assumption 3, there might be additional relocation in period 2 due to differences in regulation in the two regions in period 2.

the case where future changes in policies by regions A or B are not taken into account. If regions are myopic and do not take future changes in policies into account, the fraction of firms relocating from region A to region B is $\frac{2(\pi(r_{B1})-\pi(r_{A1}))}{\bar{\theta}}$. Thus, if resources are mobile and we just focus on current differences in policies to evaluate relocation of firms, we might overestimate response elasticities. In the context of tax competition this point has recently be mentioned by Langenmayr & Simmler (2016).[3] This observation also relates to a discussion taken up by Brülhart & Parchet (2014). They estimate response elasticities of individuals regarding a reform of bequest taxation in Switzerland. Finding relatively inelastic responses they conclude that competition did not seem in reality to exist. The previous analysis, however, shows that in a scenario with policy diffusion and forward-looking firms low response elasticities are in no way evidence for the absence of competition for mobile resources.

Stage 2:
Depending on the first stage decision, at this stage there are three scenarios that have to be distinguished. If no region has decided to initiate a reform at stage 1, the game directly ends after stage 1. If only one region has decided to initiate a reform, this region is by Assumption 2 region A. In this scenario region B does not decide at stage 2 and $r_{B1} = 0$ per definition. If both regions have decided for a reform at stage 1, they simultaneously decide about the quality of their regulation.

Let us first assume that only region A has initiated a reform at stage 1. Region A anticipates that its initial regulation will be realized in both periods. There is no rationale to choose the very low standard $r_{B1} = 0$ at the second stage. Since $\hat{r}_{A1} > 0$ is optimal with relocation of firms in the first period, it must be rationale without relocation. Lemma 4 summarizes regulation in the first period with one or two initiated reforms.

Lemma 4 *If there is only a reform in region A in period 1, the equilibrium regulation is implicitly given by*

$$\frac{\gamma}{\bar{\theta}} = -\frac{\hat{c}'}{\pi'}. \tag{8}$$

If both regions have initiated a reform process, the only symmetric equilibrium implies regulation that is implicitly given by

$$\frac{2\gamma}{\bar{\theta}} = -\frac{\hat{c}'}{\pi'}. \tag{9}$$

Solutions of equations (8) and (9) are denoted by r_1^A and $r_1^{A,B}$, respectively.

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[3]A preliminary version of the working paper in the working paper "Why the current tax rate tells you little: competing for mobile and immobile firms" is available at http://www.sv.uio.no/econ/english/research/centres/ofs/news-and-events/events/2016/langenmayr1111.html.

Proof: If only region A has initiated a reform at stage 1, it minimizes costs over both periods, i.e.

$$2\left[\hat{c}\left(\hat{r}_{A1} - r_{A1}\right) + \gamma\frac{\pi(r_{B1}) - \pi(r_{A1})}{\bar{\theta}}\right].\tag{10}$$

The corresponding first-order condition for first period regulation is given by (8). If both regions have initiated a reform process, they choose their regulation simultaneously. Suppose both regions choose the same regulation $r_1 \leq \hat{r}$. Then, there is a unique regulation where deviation is not beneficial. Due to Assumption 3 deviating into both directions, i.e. region i chooses $r_1 + \epsilon$ or $r_1 - \epsilon$ given that the opponent chooses r_1, leads to the same incentives. On the one hand, marginal decrease in regulation increase the fraction of firms in both periods, since there is no relocation in period 2. Thus, the marginal gain from a decrease in regulation is $2\frac{\pi'}{\theta}$. On the other hand, a marginal decrease in regulation leads to a further deviation from the ideal point. However, due to policy adaption in the second period, these costs just arise in one period. The first-order condition given in (9) results. $\qquad\square$

There are some implications of Lemma 4. First, an increase in the quantity of reforms (i.e. both regions initiate a reform at stage 1) leads to a decrease in regulation, that is, to a decrease in the quality of the reform. The possibility to adapt the other region's regulation in period 2 increases the incentive to attract firms due to low regulation. Second, the higher the mobility of the firms, i.e. the lower $\bar{\theta}$, the lower is ceteris paribus regulation.

Stage 1:
At this stage both regions decide whether to initiate a reform process or not. Lemma 5 summarizes the result.

Lemma 5 *If fixed costs are large, i.e. if*

$$F > 2\left[\hat{c}(0) - \hat{c}(r_1^A) - \gamma\frac{\pi(0) - \pi(r_1^A)}{\bar{\theta}}\right],\tag{11}$$

there is no reform at all. If

$$F < 2\left[\hat{c}(0) - \hat{c}(r_1^A) - \gamma\frac{\pi(0) - \pi(r_1^A)}{\bar{\theta}}\right] \quad and \quad \frac{\hat{c}(r_1^{A,B})}{\hat{c}(r_1^A)} > \frac{3}{2}\tag{12}$$

there is only one reform in region A. Otherwise both regions initiate a reform process.

Proof: Since region A is always better off when both regions initiate a reform process, it is sufficient to compare region A's costs in a scenario without any reform and therefore $\hat{c}(0)$ in both periods and the costs it faces when introducing a reform solely. Condition (12) directly follows by comparing

these costs. Region B compares the costs that arise if it initiates a reform and the costs that arise if it does not reform in period 1 but adapts the regulation previously implemented by region A in period 2. Comparing the costs that arise under both scenarios, region B initiates a reform if

$$F < \hat{c}(0) + \hat{c}(r_1^A) - 2\hat{c}(r_1^{A,B}) - 2\gamma \frac{\pi(0) - \pi(r_1^A)}{\bar{\theta}}, \qquad (13)$$

Comparing the two conditions for the fixed costs given in (12) and (13), it is in general not clear which of the conditions is stronger. If $\frac{\hat{c}(r_1^{A,B})}{\hat{c}(r_1^A)} < \frac{3}{2}$, condition (12) is stronger and both regions initiate a reform. $\qquad \square$

Region A initiates a reform if the fixed costs are sufficiently small. It becomes more likely that region A initiates a reform the lower the degree of mobility is. Region B does not implement a reform if the cost function capturing the deviation from the ideal point is very convex. In this case region B tries to avoid competition in the first period since this leads to a decrease in regulation. Based on Lemma 2–5, Proposition 1 summarizes the equilibrium paths that might arise.

Proposition 1 *There are three possible equilibrium paths.*

(i) If condition (11) holds, there is no reform at all and no relocation of firms.

(ii) If condition (12) holds, only region A initiates a reform in period 1 and chooses regulation r_1^A. Region A stays with this regulation in period 2. Region B adapts this regulation in period 2.

(iii) Otherwise, both regions initiate a reform in period 1 and implement regulation $r_1^{A,B} < r_1^A$. Both regions stay with this regulation in period 2.

If fixed costs are sufficiently low and costs of deviating from the ideal point are not too convex, competition on mobile resources leads to policy diffusion, that is, one region introduces a regulation and the other region adapts this regulation afterwards. Due to the difference in regulation in the first period, some firms relocate. If firms are very mobility, however, it might be that no region has an incentive to initiate a reform process and both regions are trapped in a situation where regulation is very low.

4   Conclusion

This paper explains policy diffusion as a result of competition for mobile resources. It provides conditions so that only one region out of two initially identical regions starts a reform process. The other region delays regulation to attract firms and afterwards adapts the regulation previously implemented by the opponent. If firms are forward looking, they anticipate the policy

convergence. Only firms with very low relocation costs can gain due to the short run difference in regulation policies and therefore response elasticities are very low. As a conclusion, observing that mobile resources, e.g., firms or capital, respond inelastic to reforms that hurt the mobile factor does not imply that there is no competition for mobile resources.

The above model assumes that costs associated with the loss of the mobile resources are linear. The paper already provides some insights how relaxing this assumption might affect the results. With convex costs policy convergence might not arise although regions are initially symmetric. Introducing more complex cost functions might also endogenize the ideal point. This aspect is not captured by the literature explaining policy diffusion by social learning. However, at least in some situations it seems to be reasonable that the ideal point depends on the fraction of mobile resources. If there are a lot of firms and therefore a lot of pollution, the ideal point might be higher than in a situation where there are only some firms leading to minor effects on the environment.

It might also be of worth to relax the assumption of symmetric regions to get some insights who are the leaders in the reform process. The empirical literature points relatively clear to the fact that policy diffusion is the more relevant the more similar regions are. Allowing for asymmetries the model might provide an explanation for this observation.

Finally, in the above set up firms are heterogenous with respect to their relocation costs but they are homogenous with respect to the value they have for the region and the unique firm has a negligible effect on the regions' decision. It might be of interest to analyze whether firms with larger market power can change the characteristics of the reform process.

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