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Learning from Decentralised Policy: The Demand Side*

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Abstract

A popular argument about economic policy under uncertainty states that decentralisation offers the possibility to learn from local or regional policy experiments. We argue that such learning processes are not trivial and do not occur frictionlessly: Voters have an inherent tendency to retain a given stock of policy-related knowledge which was costly to accumulate, so that yardstick competition is improbable to function well particularly for complex issues if representatives' actions are tightly controlled by the electorate. Decentralisation provides improved learning processes compared to unitary systems, but the results we can expect are far from the ideal mechanisms of producing and utilising knowledge often described in the literature.

Keywords: Policy decentralisation; fiscal competition; model uncertainty; collective learning.

JEL: H73, O31, D83.

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1 Introduction

In one of his most often-cited papers, Hayek (1968) argues that competition on the marketplace serves as a "discovery procedure" for new, previously unknown problem-solving routines. This argument, which is probably more or less undisputed with regard to the market for private goods – see, for instance, Kerber and Saam (2001) and the literature cited there – it has recently also been submitted with regard to public goods: Competition between jurisdictions is supposed to provide incentives both to conduct experiments with new policy routines and to learn from experiments conducted in other jurisdictions. This basic argument has, for example, been made by Salmon (1987), Vihanto (1992) as well as Vanberg and Kerber (1994). In his extensive survey of the economics of fiscal federalism, Oates (1999) states that this is still a relatively little researched problem.

What is common in these contributions is the (not always explicit) presumption of a motivation of individuals to learn, i.e., individuals are assumed to have some motivation to gather information on institutional evolution or on the evolution of economic policy in other jurisdictions and update their knowledge accordingly. In the contribution by Vanberg and Kerber (1994), for instance, this motivation is explained by referring to the private gains that can be accrued from an efficiency-enhancing institutional change. This is certainly very plausible when we are interested in individuals considering their "exit"-option: If an individual considers herself mobile and has the option of leaving jurisdiction A for jurisdiction B, and if she can gather information about B at very low cost, then she obviously has an incentive to inform herself about the real disposable income that she can earn in B.

This incentive disappears, however, when the option of mobility does not exist and the only remaining option is "voice". In this case and from the perspective of one citizen-voter among many, a change of policy is a pure, Samuelsonian public good. If there is not a sufficiently high probability for a representative citizen-voter to cast the decisive vote and if there are no external rewards for a change of mind, then the individual has no obvious incentive to incur costs to update her given, individual stock of economic policy-related knowledge. She is rationally ignorant in a Downsian sense and has, behind a veil of insignificance, no incentive to invest resources into holding the scientifically most accurate point of view. This problem, however, seems to be widely neglected in most of the available literature on decentralised

economic policy.

If doubt is cast on the presumption that decentralised policy-making fosters learning about policies, then this is done by considering the effect of free-riding on information externalities. In an early approach, Rose-Ackerman (1980) has shown that if governments can free-ride and learn from the policy experiments of other jurisdictions, an underprovision of policy innovation in a decentralised system results. However, Strumpf (2002) shows in more elaborate model that policymakers have an increased propensity to experiment with new policies in a decentralised setting if the jurisdictions are sufficiently heterogeneous or if there are multiple policies available to experiment with. These papers have in common that they focus on the supply side of policy experiments and examine the incentives of incumbent policymakers in the presence of free-riding opportunities.

In contrast, this paper intends to focus on the demand side of the process of public good provision and therefore on the problem introduced above, namely that a change of policy is a pure public good from the perspective of a single voter. It will be shown that if incumbents are sufficiently restrained by the median voter's policy preferences, important implications for the theoretical concept of decentralised economic policy-making as a discovery procedure arise. Under realistic assumptions regarding individual incentives to gather policy-related knowledge, learning from decentralised policy may not occur at all, or, which is a result that is new to the literature, occur only in the wrong (the relatively efficient) jurisdiction. Nevertheless, it is argued that even under such unfavourable conditions, decentralised policy still offers more scope for the growth of knowledge than centralised policy.

To be able to focus on collective learning processes involving voters and citizens, we assume a tightly controlled government throughout the paper. The policies preferred by the majority of voters are executed frictionlessly and there are no control problems to be solved. The argument will proceed as follows: In the following section, the dissipation of policy-related theories within a population will be modelled as a frequency-dependent process leading to a stable equilibrium with a clear-cut majority theory. *Section 3* introduces a hypothetical, yet very general starting point for factor migration as well as a distinction between loyal and perfectly mobile individuals. *Section 4* discusses the incentives following from factor migration to critically examine given policy routines and to experiment with new routines. Finally, *Section 5*

offers some conclusions.

2 Individual uncertainty and the emergence of common beliefs

2.1 The dissemination of policy-related conjectures

The point of departure of the argument presented here is fundamentally different from that of approaches to fiscal competition which involve omniscient maximisers of welfare, rents or something alike and ask whether such a maximising effort by a number of decentralised social planners leads to a result that would be considered optimal by an omniscient, centralised social planner. Instead of following this lead, the notion of model uncertainty is used here: individuals are theoretically uncertain in the sense that they do not know the true model describing the actual properties of the economy within which they are acting and making decisions.

Because the quality of economic policy is a public good and because we assume that there is a large number of citizens, so that the individual probability of having the decisive vote is approximately zero, individuals do not feel a need to invest into acquiring "rational expectations" regarding economic policy, i.e. to utilise all available information in order to gain the most precise theoretical and empirical knowledge about their economy that can be gained at a given point in time. Individuals might be expected to build rational expectations if the necessary information was available costlessly and if it could be learned effortlessly. But both requirements are not met here.

Following Hirschman (1989), however, it is assumed that individuals do feel an intrinsic need to have *some* point of view on issues of economic policy – but, given the public good problem, they do not feel a need to take the scientifically most up to date point of view. On the contrary, it is assumed that, once individuals have learned a set of conjectures about different economic policy measures, they will attempt to retain them. To explain this tendency, assume that at a time $t = 0$, a representative individual is completely uncertain and has no a priori knowledge at all to fortify an opinion on economic policy. Given her assumed intrinsic need for such an explanation, she will assume some set of conjectures $\Omega^n \in \{\Omega^1, \ldots, \Omega^N\}$ that is supplied to her in the public discourse. The supply side of the theory market is not explicitly modelled here. Following Lord Keynes' famous quote that "*Practical men, who believe themselves to be*

quite exempt from any intellectual influences, are usually the slaves of some defunct economist" (Keynes 1936, chapter 24), one may simply assume that every Ω has been introduced by economists into the public discourse.

As a preliminary to explaining the choice of an Ω^n, we assume for simplicity that citizens are homogenous with regard to their maximand. They all wish to maximise the same objective of economic policy, such as the level of disposable income, employment, output growth rates or something alike. Since we focus on the general learning process about economic policy measures and not on some specific, well-defined policy problem, we do not need to concern ourselves with the details of the maximisation problem here and can simply assume that there is a common maximisation problem which concerns economic policy-makers and citizens.

In this case, a plausible criterion for choosing one Ω^n among a possibly large number $N > 0$ of available sets is the number of individuals who are already convinced that Ω^n gives an accurate description of the true working properties of the economy. If one is completely uncertain about the relative accuracy of the $N > 0$ available theories, then the number of individuals who already hold an Ω^n may be interpreted as a signal for its usefulness relative to the other sets. It also may be the case that the uncertain citizen decides upon choosing an Ω^n following personal communication with other, already decided individuals. In this case, the probability that the uncertain individual communicates with an individual advocating Ω^n will usually rise with the fraction of already decided individuals who adhere to that set of conjectures.

Thus, it should be possible to model the individual selection of a set of conjectures about economic policy as a frequency-dependent process:[1] A relatively large number of individuals who already hold an Ω^n reassures an uncertain individual that Ω^n is not an obscure, but a reasonable choice. One tool among others to model such processes of frequency-dependent self-organisation is the generalised Polya process, as proposed by Arthur et al. (1985) and further

[1]To some degree, there is obviously a similarity to Kuran (1987) here, in the sense that individuals decide on taking a certain position according to the number of other individuals who already hold that position. The important difference, however, is that in our model there is no place for preference falsification: There is no difference between what individuals privately believe in and what they publicly advocate. Nevertheless, the result, for which Kuran coined the term "collective conservativism", will be quite similar.

discussed in Arthur (1988). The essence of this process is shown in (1),

$$E[w_{t+1}^n | w_t^n] = w_t^n + \frac{1}{m+t}\left(q_t^n(w_t^n) - w_t^n\right) \quad \text{with} \quad \sum^N q_t^n(w_t^n) = 1 \qquad (1)$$

which simply states that the expected value of the fraction $0 \leq w_{t+1}^n \leq 1$ of individuals in the population of already decided individuals who adhere to an Ω^n at a time $t+1$, given its fraction at a time t, depends primarily on just that w_t^n and on an arbitrary, upward-sloping function $q_t^n(w_t^n)$. Time in this model is equal to the number of individuals who have decided themselves, i.e., it is assumed that at any point in time exactly one individual decides which theory to choose. The parameter m stands for the number of individuals who were already decided at $t = 0$ and henceforth, we will simply assume $m = N$, with the underlying assumption that every Ω is backed by exactly one individual at $t = 0$. The condition for an equilibrium is easily inferred from (1): There is no expected change in the value of the fraction of Ω^n if $E[w_{t+1}^n | w_t^n] - w_t^n = 0$, which is the case if and only if $q_t^n(w_t^n) - w_t^n = 0$.[2]

2.2 Choice and equilibria on a theory market with heterogeneous individuals

The piece that is still missing in our depiction of the market for theories on economic policy is a set of assumptions on the shape of the function $q_t^n(w_t^n)$, assigning a probability for the next uncertain individual to choose Ω^n to the current market share of this theory, w_t^n. If w_t^n were the only influence in the individual choice of a theory, the matter would be rather simple: The first individual at $t = 0$ would choose randomly one theory to become the most-frequented theory Ω^* and unconstrained herding behaviour would lead all following individuals to choose exactly the same Ω^*. The process would be locked in on a path towards a stable equilibrium with $w(\Omega^*) = 1$ immediately after the first individual has made her random decision. Obviously, the resulting complete consensus among individuals regarding their beliefs about the proper economic policy contradicts even casual empirical evidence.

As an alternative, consider the situation when individuals are heterogeneous regarding their tendency to follow the majority. Let α denote the individual tendency to be conformist, with an $\alpha \leq 0$ signifying a strictly conformist

[2] For technical proofs regarding the existence and the (in-)stability of equilibria of a generalised Polya process, the reader is referred to the original work of W. Brian Arthur, Yuri M. Ermoliev and Yuri M. Kaniovski.

individual who does always and uncompromisingly choose the majority opinion and an $\alpha \geq 1$ signifiying a strictly nonconformist individual who always and uncompromisingly refuses to take the majority opinion. Values of $\alpha \in (0,1)$ reflect different degrees of conformism, with the actual choice depending on w. For example, an individual with a relatively high α just below unity is a relatively non-conformist individual by nature, but a very high w_t^n may still convince her to join the majority.

Let Ω_t^* denote the most popular theory at any given time,

$$\Omega_t^* = \arg \max_{\Omega \in \{\Omega^1, \ldots, \Omega^N\}} w_t(\Omega). \tag{2}$$

If there is no unique Ω_t^*, but a set of equally popular theories, then Ω_t^* is chosen randomly from this set, with equal probabilities of choice attached to each equally popular theory. Then we can assume individuals to value the available theories according to (3):

$$v(\Omega) = \begin{cases} (1-\alpha) \cdot w(\Omega) & \text{if} \quad \Omega = \Omega_t^* \\ \alpha \cdot w(\Omega) & \text{if} \quad \Omega \neq \Omega_t^* \end{cases} \tag{3}$$

and to simply choose that Ω^v that maximises their individual $v(\Omega)$. Again, if there is no unique Ω^v but a set of theories that yield equal values, the individual is assumed to choose randomly with equal probabilities from the theories in this set.

With these assumptions made, the theory market is determined to effectively collapse from an arbitrarily high number N of available theories to $N = 2$ after the first sufficiently nonconformist individual has made her choice. To illustrate this point, suppose that the first individual to decide randomly chooses a theory which subsequently becomes Ω^*. If the next individual to decide is sufficiently conformist, he will have $\Omega^* = \Omega^v$, pick the majority theory and all other $\Omega \neq \Omega^*$ remain equally valued. As soon as a sufficiently nonconformist individual appears, who rejects the majority theory, he will choose among those equally valued minority theories. But when one minority theory, let it be denoted by Ω^m, is picked by a nonconformist individual, it will become the preferred choice for all other, later deciding nonconformists. This follows from (3), simply because $w(\Omega^m) > w(\Omega) \forall \Omega \neq \Omega^*, \Omega^m$. Therefore, all individuals who make a nonconformist decision at later stages of the process will also choose Ω^m, while all individuals making a conformist decision will choose the majority theory Ω^*. The market shares of all other theories will

tend towards zero with more and more individuals deciding between Ω^* and Ω^m.

In other words, being a non-conformist is not the same as being intellectual hermit. On the contrary, a non-conformist is an individual who has a tendency to oppose the majority, but not an individual who seeks to distinguish himself by holding a deliberately obscure point of view. Even people who have a strong enough nonconformist tendency to pick the minority theory have a preference to be in a larger minority group, rather than a smaller minority group.

As soon as a the theory market is collapsed to $N = 2$, (3) can be written as $(3a)$,

$$v(x) = \begin{cases} (1-\alpha) \cdot w(\Omega^*) \\ \alpha \cdot w(\Omega^m), \end{cases} \tag{3a}$$

and the α for which an individual is just indifferent between conformism and nonconformism can be calculated by equating both cases of $(3a)$, which yields

$$\bar{\alpha} = \frac{w(\Omega^*)}{w(\Omega^*) + w(\Omega^m)} \quad \text{with} \quad \lim_{t \to \infty} \bar{\alpha} = w(\Omega^*). \tag{4}$$

The convergence in time of $\bar{\alpha}$ towards $w(\Omega^*)$ follows simply from the fact that, once they are determined, only the majority theory and the preferred minority theory are chosen, so that the added market shares of these theories tend towards one. That does not mean that the other $N - 2$ theories that have existed on the theory market at $t = 0$ disappear altogether, but they are marginalised and cease to have a noticeable impact on public discourse. Knowing this, and knowing that the probability that an $\Omega \neq \Omega^*, \Omega^m$ is chosen at this stage of the process is zero, the theory market is now restricted to Ω^* and Ω^m and $w_t^* + w_t^m = 1$ is assumed to hold in the long run. From (4) and assuming that an individual shuns the majority only if he clearly values being a nonconformist higher than being a conformist, we can derive a simple decision rule for uncertain individuals:

If $\alpha \leq \bar{\alpha}$*:* *choose* Ω^* *(Be a conformist)*
If $\alpha > \bar{\alpha}$*:* *choose* Ω^m *(Be a nonconformist).*

Therefore, the individual decision to adopt either the minority theory or a preferred minority theory is based upon a parameter indicating a natural propensity to make a conformist choice, α, and the actual share that the majority theory has in the population at any given point in time. To finally write down the q-function of the Polya-process discussed here, suppose that

values of α (i.e., degrees of conformism) are normally distributed over the population with mean $\mu = 0.5$ and an arbitrary standard deviation σ. Given the simple decision rule, we can then state that as soon as Ω^* and Ω^m are selected from the N available theories, we have as probabilities of choice for those two theories

$$q_t^*(w_t^*) = \int_{-\infty}^{w_t^*} \frac{1}{\sqrt{2\pi}\sigma} \cdot e^{\frac{-(w_t^* - 0.5)^2}{2\sigma^2}} \quad dw_t^* \tag{5}$$

$$q_t^m(w_t^*) = 1 - q_t^*(w_t^*). \tag{6}$$

This leads to a characteristic sigmoidal graph for the two q-functions. Given that there is a positive probability that an individual has an $\alpha < 0$ or an $\alpha > 1$, it follows that $q_t^*(0) > 0$, $q_t^*(1) < 1$, $q_t^m(0) > 0$ and finally $q_t^m(1) < 1$. The numerical values depend on σ; a rise of σ, would reflect a growing number of extreme conformists and nonconformists in the population. Such a change in the composition of the population is not modelled in this paper, however: σ is assumed to be constant.

The relationship between the actual fraction w_t^* and the probability q_t^* of the next individual also choosing Ω^* is depicted graphically in *Figure 1.* There

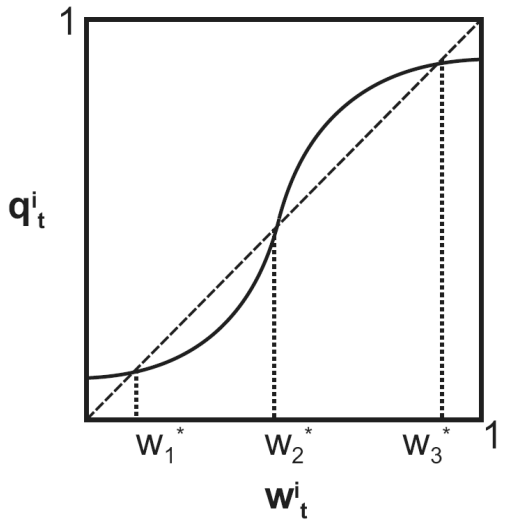

Figure 1: Equilibria on the theory market

are two stable equilibria for w^* on this theory market, one at w_1^* and one at w_3^*. In both cases, the probability of the next individual choosing Ω^* is higher

than the actual fraction w_t^* for an interval around $w_{1,3}^*$ where $w_t^* < w_{1,3}^*$ and lower for an interval where $w_t^* > w_{1,3}^*$. The attracting intervals are delimited by the unstable equilibrium at $w_2^* = \mu = 0.5$. For any $w_t^* < w_2^*$, the process will converge towards w_1^* and for any $w_t^* > w_2^*$ it will converge towards w_3^*. Since Ω^* has been defined the majority theory at the outset, we can expect its market share to converge towards w_3^* without further interventions into the process; the market share of the preferred minority theory Ω^m will then converge towards $w^m = 1 - w_3^*$ if the process runs long enough to make the $N - 2$ other theories that competed on the market at the outset negligible.

3 Interjurisdictional labour and capital markets

3.1 Loyal and perfectly mobile individuals

Suppose that every individual i can be characterised by additively separable preferences for both income and policy,

$$U_i(x, y) = y_i + u(x) \tag{7}$$

where $u(x)$ is a positive utility that can be gained from a policy vector x and that follows not from the outcome of a policy, but from the fact that the policy vector is in concurrence with the theory Ω^i held by the individual. Let $u(x)$ be a step function with $u(x) = \bar{u}$ if the individual lives in a jurisdiction where Ω^i determines policy and $u(x) = 0$ if not. Suppose further that the individual can invest some fixed amount c of her income into searching for other jurisdictions where a higher monetary income can be earned. However, if the jurisdictions are heterogeneous with regard to their majority theories, the utility $\bar{u}$ would be lost with a relocation. Assuming that i has an infinite time horizon and some a priori belief regarding the distribution of incomes that can be earned in other jurisdictions, at time $t = \tau$ she has an incentive to invest into gathering information about other jurisdictions if

$$\sum_{t=\tau}^{\infty} \delta^{-(t-\tau)} \left[E\left(y^F\right) - y - \bar{u} \right] > c \tag{8}$$

where $\delta > 1$ is a discount factor, $E(y^F)$ is the expected value of income-earning opportunities to be discovered in foreign jurisdictions and the assumption is made that with given policies, all jurisdictions are in their respective steady states with constant per-capita incomes. It is evident from (8) that for levels of

utility $\bar{u} \geq \hat{\bar{u}}$ where individuals abstain from investing resources into gathering information about foreign jurisdictions. Let the individuals for whom this is the case be called *loyal* individuals. These individuals gain sufficient utility from the policy conducted in their own jurisdiction to have no interest in pondering the idea of relocating. Given the veil of insignificance, they have also no incentive to search for information in other jurisdictions that might help to improve domestic politics. Loyal individuals are believers in splendid isolation and do not gather information about foreign jurisdictions.

A second group of individuals are those with $\bar{u} < \hat{\bar{u}}$. They will invest into gathering information about income earning opportunities in other jurisdictions and they will migrate whenever they find a jurisdiction where the income to be earned is sufficiently high. Thus, individuals who adhere to a minority opinion can be expected to relocate whenever they find a foreign jurisdiction offering a $y^F > y$ because for them, $u(x) = 0$. Finally, we assume that there always exists a fraction of individuals with $u(x) = 0$ who are nevertheless immobile – for example because they are socially tied to loyal individuals. This group of individuals is characterised by a general interest to implement the most efficient set of policies available and is at the same time not bound to the majority theory that prevails in their home jurisdiction.

3.2 Signals produced by decentralised policy

To investigate the signals produced by factor migration, we introduce probably the simplest equilibrium conditions available in the literature on decentralised fiscal policy. We assume that individuals supply homogeneous labor and own homogeneous capital. They allocate their factors between two regions, A and B, with the private sectors in both regions being characterised by standard, neoclassical production functions. Adding to this, we assume that the vector $x = (\lambda, \theta, G)$ comprises the policy conducted by the public sector with θ denoting a head tax, G denoting the quantity of a public good and λ denoting the technology used to provide the public good. Presuming a perfectly controlled government which frictionlessly enforces the majority's preferred policy in order to suppress control problems, the entire tax revenue is used to provide productive public goods and no rents are accrued by individuals in the public sector. Public policy enters the private sector production function through a function $\rho(x)$ with $\rho > 0 \forall x$. The effect of $\rho(x)$ is exactly the same as that of a Hicks-neutral, factor-augmenting public input. Thus, the complete production

function for each of the two jurisdictions $m \in A, B$ is

$$Y = \rho(x_h) \cdot F(L_j, K_j). \tag{9}$$

Individuals are assumed to be uncertain regarding the function $\rho(x)$, and uncertainty here implies not only parameter uncertainty, but also uncertainty regarding the functional form of ρ – in other words, individuals act under model uncertainty and are compelled to act upon fallible hypotheses about the effects of policy changes on the aggregate output and on the marginal productivities of labour and capital. While the individuals know that $\frac{\partial \rho}{\partial G} > 0$ and $\frac{\partial \rho}{\partial \theta} < 0$, they do not know the exact functional form and can therefore not simply determine the optimal size of the public sector in a marginal calculus. Similarly, they know that a higher λ generates higher incomes than a lower λ, but gathering information about superior technologies of supplying public goods is, as already mentioned, costly.

Since we assume a perfectly controlled government and exclude rent-seeking activities, it is evident that the entire tax revenue is used to provide the public good G. The effective level of G, however, is assumed to also depend upon the technology of public good provision, which is represented by the technology parameter $\lambda > 0$, so that

$$G = \lambda \theta L. \tag{10}$$

In essence, the choice of policy can then be reduced to a choice of a tax rate θ and of a technology λ, with the level of public goods being fully determined by these parameters. In our context, the term "technology" is supposed to encompass a wide range of real-world phenomena: not only physical means of production, but also the composition of a portfolio of different types of public goods. For instance, a relatively low value for λ could signify an excessive emphasis on redistibutive activities compared to efficiency-enhancing public capital, whereas a relatively high value for λ signifies the opposite. This rather imprecise account of possible influences on λ mirrors the problem of model uncertainty that the individuals in the model face.[3]

Let labour be paid according to its marginal product and, looking at small regions, let capital be paid the uniform world interest rate r^* on the stock of

[3]Since the policy-space is not one-dimensional here, involving the choice of λ and θ, this would traditionally contradict the stability of a median voter equilibrium and therefore the assumption of a tightly controlled government frictionlessly following the median preferences. Note, however, that stability here effectively comes from the theory market, where majority preferences are clearly defined in a stable equilibrium.

capital.

$$l_j = \rho(x_j)\frac{\partial F}{\partial L_j} - \theta_j \tag{11}$$

and

$$k_j \cdot K_j = \rho(x_j)F(L_j, K_j) - l_j - \theta_j = r^* \cdot K_j. \tag{12}$$

It is important to note that this does not imply that capital owners are fully informed about the effects of policy in other jurisdictions. One reason may be that, when deciding how to invest their capital, they observe only overall rates of return in other jurisdictions and cannot disentangle how large the effect of $\rho(x)$ on this rate of return is. Another, and quite realistic reason, may be that the vast majority of capital owners delegates the actual spatial allocation of capital to a very small group of individuals specialised in this field and who do not have a large enough impact on public discourse to affect equilibrium choice on the theory market. As far as labour is concerned, we assume no mobility at all at the initial stage (e.g., due to laws preventing migration) and introduce mobility between regions with a relatively efficient and a relatively inefficient policy subsequently.

Suppose for simplicity,and without loss of generality, that there are two jurisdictions. B is the relatively efficient region, i.e., the same amount of public goods is financed in B with a lower tax rate, or a higher amount of public goods is, due to a more advanced technology, financed with the same tax rate in B, compared to A. At the initial stage, before labour mobility is introduced, we thus have higher net incomes from labour in the low-tax jurisdiction B, $l_B > l_A$. This is the first type of signal produced by decentralised economic policy, namely a price signal, which sends two messages: (i) given the current policies, a positive number of units of labour could be utilised more efficiently in B than in A and (ii) the policies in A and B lead to different incomes from supplying labour. This type of signal will henceforth be called a *differential signal*. If we also introduce labour mobility, then this will obviously lead to a change of l_A and l_B, as labour and capital migrate out of A into B. An equilibrium on the interregional labour and capital markets is reached when both conditions $l_A = l_B$ and $k_A = k_B = r^*$ hold simultaneously.

The sign of the impact of migration on l_A and l_B is not determined in this model, and it is probably not fully determined in reality. An unambiguously negative sign for the derivative of l with regard to L would only result in the special case of a linear-homogeneous production function. However, while the assumption of such a production is frequently made in theory in order to

facilitate calculations, they still remain a special case empirically. Generally, differentiating (11) yields

$$\frac{\partial l}{\partial L} = \frac{\partial \rho(x)}{\partial L} \cdot \frac{\partial F(L,K)}{\partial L} + \rho(x) \cdot \left[\frac{\partial^2 F(L,K)}{\partial L^2} + \frac{\partial^2 F(L,K)}{\partial L \partial K} \cdot \frac{\partial K}{\partial L} \right] \qquad (13)$$

and there may exist intervals for L where the positive first term overcompensates a bracketed term that is negative on aggregate. A migration of productive factors from the relatively inefficient region A to the relatively efficient region B then leads to a rise of l_A via the direct effect of out-migration on marginal productivity, but it also leads to less capital being used in A and to a decline of $\rho(x)$ via a loss of tax revenue. Similarly, an inflow of additional units of labour to B would then lead to a decline of marginal labour productivity, but that would be overcompensated by the positive effects generated by the additional productive public input financed with an enlarged tax base. It is therefore not ex ante clear whether the net effect of migration on the net incomes in A and B will be positive or negative. This ambiguity of the effects on labour income leads to four different scenarios, which are summarised in *Table 1*.

Scenario	**I**	**II**	**III**	**IV**
$\frac{\partial l_A}{\partial L_A}$	> 0	> 0	< 0	< 0
$\frac{\partial l_B}{\partial L_B}$	> 0	< 0	> 0	< 0

Table 1: Possible reactions of wages to factor migration.

While the differential signal results from given prices, we observe here changing prices of labour in A and B resulting from a regional shifting of resources. Such signals associated with price changes will thus be called *shift signals*.

Note that a reliable equilibriating tendency is asscociated only with scenario IV. In scenario I, there is a clear disequilibriating tendency resulting from factor migration, and in the other two scenarios the existence of an equilibrium depends on the relative velocity of the income effects of migration. If the marginal effect of migration on marginal productivity and on the tax base in B are consistently smaller than that in A, then there will be a tendency towards an equilibrium, associated with higher (III) or lower (II) incomes in both A and B. However, given the fact that there is a group of immobile individuals in our model, factor migration can come to a rest even with persisting income differentials.

4 Learning from another jurisdiction's policies

4.1 Collective learning on the theory market

Picking up the thread of *Section 2.2* , some statements regarding the stability of an equilibrium on the theory market can be made. Let stability s be defined as the absolute number of individuals who simultaneously need to change their minds in order to transform the status quo majority theory Ω^* into a minority theory. In this case, we have

$$s = s(\mu, t) \geq 0 \quad \text{with} \quad \frac{\partial s}{\partial \mu} \leq 0; \frac{\partial s}{\partial t} > 0. \tag{14}$$

With a rising μ, the population becomes on average more non-conformist. As a result, the distance $w_3^* - w_2^*$ in *Figure 1* is reduced, so that the attracting region of w_3^* becomes smaller while the attracting region of w_1^*, where Ω^* is transformed into an equilibrium minority theory, is enlarged. For sufficiently large values of μ, the equilibrium w_3^* disappears, which leads to an $s(\mu, t) = 0$. In this case, the social networks that support Ω^* are not strong enough to stabilise their majority theory against strong nonconformism in the population. Even if none of the already decided individuals changes their minds, the tendency of newly deciding individuals to shun Ω^* implies that w_3^* is not sustainable.

The positive impact of time on the stability of an equilibrium follows from the technical assumption that at any point in time t exactly one individual decides which theory she wants to pick. As a result, the frequencies are stable in equilibrium, but the absolute number s of individuals that need to change their minds to move the theory market to another equilibrium rises with t. This may appear to be an unrealistic feature of the model on first sight, but it can also be argued that is helps to approximate the fact that long-conveyed, traditional modes of thinking about economic policy are more difficult to change than theories that have only recently been introduced and that are not as deeply rooted.

It is one of the delightful properties of the generalised Polya process that the q-function is allowed to change over time, so that changes of μ can be accounted for within the model. This allows for experience to have an impact on the equilibirum. At the outset, before experience was considered, $\mu = 0.5$ was assumed, i.e., individuals are assumed to be symmetrically distributed along the lines of conformism and nonconformism. But it appears to be a

plausible assumption that μ changes when, based upon experience, individuals have reason to believe that Ω^* is faulty.

If a policy based upon the majority theory produces disappointing results, we should expect that for individuals who still have to decide themselves, the propensity to be a conformist is reduced. The more implausible the theory appears in the light of evidence, the higher would the internal costs – e.g., cognitive dissonance – be that have to be born when such a theory is held. But this necessitates high external benefits – a large and influential network of similarly thinking individuals – to make the relatively implausible theory nevertheless the preferred choice. The more contradictory the evidence is, the higher $w(\Omega^*)$ has to be in order to make a conformist choice probable. In other words, μ rises when the majority theory grows dubious. Once the transition is made and popularity of the two theories is reversed, so that $\Omega_1^* = \Omega_2^m$ and $\Omega_1^m = \Omega_2^*$, we can assume the distribution of α to normalise again with $\mu = 0.5$. A change of collective opinion thus simply follows from a temporary rise of nonconformism, which enters the model as a rise of μ for a transitory period.

The actual learning process can then be expected to set in amongst the remaining supporters of the now dethroned Ω_1^*, who have just experienced their set of conjectures to be gravely inept and who saw the social network supporting their conjectures collapse to a small number of staunch believers. In this situation, they are unlikely to give up their entire set of conjectures – they are staunch believers, after all – but it is obvious that the vast majority of individuals has lost confidence, so that some revision of the falsified set of conjectures is necessary to be able to regain popularity and influence. The supporters of the now popular Ω_2^* on the other hand have no reason to revise their theories. Having gained popularity and influence and having seen the rival Ω_1^* fail, their confidence is likely to be bolstered and reasons for scepticism are scarce. Thus, while Ω_2^* is stabilised, Ω_1^* is likely to be revised. The question is, however, under which conditions the two signals identified in *Section 3* trigger efficient learning processes.

4.2 Learning from differential signals

What seems particularly appealing about learning from differential signals is that individuals can learn from the policies conducted in neighbouring jurisdictions without the occurrence of any potentially distorting spatial factor movements. This is what, among others, Besley and Case (1995) have em-

pirically analysed under the term "yardstick competition". On first sight, the evidence is encouraging as far as the usefulness of yardstick competition as a learning mechanism is concerned: "*Voters are able to appraise incumbents' relative performance. From the media or other sources, voters can gain access to information about what other incumbents are doing, which serves as a benchmark for their own jurisdiction*" (Besley and Case 1995: 30). Besley and Case do indeed show that voters tend to deny re-election to incumbents who raise taxes while their colleagues in neighbouring jurisdictions do not, while they tend to accept tax raises when neighbouring governments also raise taxes.[4]

The problem is, however, that while yardstick competition functions for the tax rate, it fails for other issues of economic policy: for regionally differing income levels and unemployment rates, Besley and Case find no significant influence on the individuals' voting decisions. This is a somewhat puzzling result: if voters learn from the comparison of regionally differing tax policies, and a lone tax raise is deciphered as a sign for inefficiency, then why does the same mechanism not work for other fields of policy? A possible explanation would be that a rise of unemployment in one jurisdiction alone can be the result of an asymmetric shock that is beyond the control of the incumbent, so that punishing him would be irrational. The same, however, may be true for tax rates, whose rise may simply be the result of a declining tax base following the same type of shock. There is no fundamental difference between the two variables in this respect, and it may be more reasonable to look at the theory market for reasons of differing learning processes. The discussion in the preceding subsection has shown that once the theory market within one jurisdiction is out of equilibrium due to rising nonconformism, some collective learning initiated by the losers of this transition can be expected. But the underlying problem is if and under which conditions decentralised policy can be expected to disturb the peace of local theory markets.

The evidence from Besley and Case cited in the above subsection is clearly to be categorised as learning from differential signals. Yardstick competition implies that only the fact that policies and results in one jurisdiction are different from those in another jurisdiction is used to learn about the rela-

[4]The presumption that yardstick competition plays a role in determining tax rates is also supported by evidence for tax mimicking in other countries than the United States, as for instance Revelli (2001, 2002) shows for the United Kingdom, Heyndels and Vuchelen (1997) show for Belgium and Feld and Reulier (2003) for Switzerland.

tive usefulness of economic policies – information flows across borders, while productive factors not necessarily do so. In our model, these streams of information about the relative efficiency of different policies meet a population that is mostly characterised by a rather limited propensity to care for such information. Considering themselves to be immobile, loyal individuals have principally no interest at all to invest into gathering information from other jurisdictions: being reluctant to migrate, they have no private benefits to gain from monitoring policy in other jurisdictions. And being part of a social network that stabilises their given majority conjectures Ω^*, they are most likely also reluctant to critically compare Ω^* to the theories that underlie policies in other jurisdictions.

By assumption, there is, however, always also a share of illoyal, yet immobile individuals in every jurisdiction. These are individuals who do not feel attached to the jurisdiction they live in as such, who oppose the given Ω^*, but who for some reason are not able or willing to migrate to another jurisdiction. This opposition, if it manages to organise in parties or interest groups, may serve as a channel to diffuse information about the policies in other jurisdictions within the own population, in order to weaken the popular support for Ω^*. The aim is to raise the level of nonconformism, μ, possibly above the critical mark where the stable equilibrium at w_3^* in *Figure 1* disappears. Thus, internal heterogeneity of jurisdictions can be seen as an important prerequisite to initiate collective learning processes. In the Tiebout world, which consists of jurisdictions with internally homogeneous populations, this inlet for information from outside is missing. If there were internally completely homogeneous populations in the model presented here, differential signals would most probably be blinded out in order to stabilise a given consensus theory.

Nevertheless, even in a heterogeneous community learning from differential signals involves barriers that prevent the collective learning processes from being perfect mimicking mechanisms capable of finding the most efficient policy and implementing it wherever this would be reasonable. With social networks that are working to stabilise their respective conjectures, it is unlikely that all the differential signals from outside that are available and contradict the majority theory do indeed lead to a destabilisation of the equilibrium on the theory market. If the signal that $l_B > l_A$ is received in A, the underlying differences of Ω_A^* and Ω_B^* still have to be brought to public attention, which is usually scarce. Moreover, it is often possible to "explain" such a differen-

tial signal and at the same time maintain the relatively inefficient Ω_A^* if one accepts convenient auxiliary hypotheses, which may for example hint at principal differences between jurisdictions A and B, so that they are perceived as uncomparable.

Furthermore, it may be the case that some issues are easier to bring to public attention than other issues. Some issues, such as tax policy, may be more salient in the public discourse because observing and comparing tax rates is a matter of relatively low complexity while, for example, comparing technologies of public good production or expenditure structures in budgets is a matter that is much more costly to communicate and, more importantly, costly to learn about. To sum up, learning from differential signals alone in a decentralised setting is a highly imperfect mechanism of collective learning about the relative efficiency of policies. It is, however, easy to see that it should still be superior to a completely centralised framework. There, the differential signal does not even exist. There is only one laboratory where policy experiments can be conducted. But such an experiment is much less likely to happen in a centralised setting, because instability on the theory market is less likely to be induced without signals from outside. With every step of centralisation, policy experiments occur less often in time and in a fewer number of jurisdictions.

4.3 Learning from shift signals

For price signals following from a shift of productive factors from the relatively inefficient to the relatively efficient region, generally the same statement holds as for the differential signals: they are unreliable if one expects them to induce efficient learning processes. Table 1 shows that, if one does not enforce restrictive assumptions, the sign of the effect of migration out of the relatively inefficient region on net wages is not fully determined. A larger tax base allowing to finance more productive infrastructure may overcompensate the direct effect on marginal labour productivity, or it may not. In the relatively inefficient region, net incomes may rise as a result of out-migration if the public goods effect does not overcompensate the direct effect on marginal productivity.

If there are barriers to migration at the outset and if these are lifted, migration out of the relatively inefficient and into the relatively efficient region may therefore lead to perverse incentives for collective learning. If scenarios

III or IV occur, the remaining individuals in the relatively inefficient region experience a raise of their incomes after labour mobility is implemented. This signal, on its own, is certainly not the right incentive to revise the relatively inefficient Ω_A^*. A satisficer, who benefits from his income rising above his aspiration level, there is little reason to increase his scepticism and nonconformism in such a scenario.

In scenarios II and IV, perverse incentives are also present for individuals in the relatively efficient region B, as they experience a decline of their net incomes as a result of incoming migration from A. In this case, the trend of net incomes as a result of migration is unsettling for the wrong individuals, namely those who hold the relatively more efficient conjectures. Only in scenario I are the effects of migration on net incomes suitable to set incentives for efficient collective learning processes.

These problems may be reduced if individuals learn from both type of signals considered here. To also reckon that the level of incomes is higher in B than it is in A is certainly an improvement compared to an exclusive reliance on the shift signals. Especially in scenarios that imply a further divergence of income levels, the additional information would enforce justified scepticism in A. If there is no divergence, though, then a convergence of income levels can easily serve as an argument to defend Ω_A^*: if the income level in B is decreasing, then this can be easily interpreted as an indicator that, for instance, circumstances have changed and Ω_B^* is out of time.

Thus, there is even more information necessary to ensure that individuals have the correct incentives. They have to know the differential signal, the shift signal *and* they have to reckon that the shift signal follows from migration and that migration out of A is a sign of relative inefficiency of Ω_A^*. This may be trivial for an economist – but for an individual who defends his set of conjectures behind a veil of insignificance and within a stabilising social network, a willingness to face the facts cannot be simply presupposed.

Nevertheless, from a knowledge-producing perspective, decentralisation is still preferred to centralisation. Decentralisation delivers a systematic tendency to destabilise equilibria on the theory market. Even if this does not necessarily occur in the correct (the inefficient) jurisdiction, a change of Ω_B^* would also produce new knowledge about the efficacy of economic policies. A unitary system is missing this inherent instability that comes with the signals discussed here and is thus bound to produce less knowledge.

5 Conclusion and outlook

It has been argued that under decentralised economic policy-making, more knowledge about the relative efficacy of different theories underlying policies is produced compared to unitary systems. The problem is only that incentives to revise a given set of conjectures and thus to experiment with new policies are not necessarily to be found in the relatively inefficient region. While more knowledge is produced in decentralised systems, it cannot be ensured that there is a frictionless diffusion process where the relatively efficient policy is adopted by all jurisdictions.

Somewhat surprisingly, this result has also an encouraging facet, because diversity of policies is likely to be sustained. There is no ex post harmonisation towards one efficient policy, but rather an ongoing process where distorted equilibria on the theory market lead to a continuing revision of theories, which in turn leads to experiments with new policies. In this process, an abrupt disappearance of theories in unlikely, and a syncretic change in which small, seemingly successful elements of policies in other jurisdictions are incorporated into one's own theories are more probable.

As far as future research is concerned, the discussion hints at the fact that decentralisation as a knowledge-generating process may be made more efficient if it comes with supporting institutions that set incentives for the electorate to gather more information than it is assumed in the present paper. For example, it may be worthwhile to augment the model with non-economic incentives to invest into collecting information about the relative efficacy of different economic policies and the relative usefulness of theories underlying these policies. Empirical research suggests that such incentives may be associated with a feeling of civic duty that is present when decisions on public goods and taxes are made within a direct democratic framework (Benz and Stutzer, 2004). It was the purpose of the present paper, however, to show that with strictly rational and self-interested voters, perverse incentives to learn from decentralised policy may exist under reasonable assumptions.

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