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journal homepage: www.elsevier.com/locate/ecotraDecentralization and spillovers: A new role for transportation infrastructure[☆]Christophe Feder^{*}

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ABSTRACT

Inter-regional spillovers of local public goods are the main cause of decentralization failure. Assuming that the quality of transportation infrastructure policy affects the strength of inter-regional spillovers, we compare a one-step scheduling design, in which all policies are chosen simultaneously, with a two-step scheduling design, in which transportation infrastructure policy is used to influence local public goods policies. We show that decentralization failure could be partially solved with scheduling design. When regional governments correctly schedule their policies, citizens benefit from the same level of public goods but with lower taxes. Moreover, the two-step scheduling design results in a lower quality of transportation infrastructure and a higher intensity of local public goods. However, the overproduction of local public goods with positive externalities cannot be excluded.

1. Introduction

The regional economic literature has extensively discussed the link between the quality of transportation infrastructure and welfare (Krugman, 1991; Fujita et al., 1999). Despite different views and opinions, scholars have both theoretically and empirically demonstrated that the quality of transportation infrastructure has a positive impact on both inter-regional trade and regional growth (Martin and Rogers, 1995; Martin and Ottaviano, 1999; Melo et al., 2013). However, less attention has been paid to the impact of transportation infrastructure on inter-regional spillovers, especially those related to the provision of local public goods. In this paper we describe the impact of transportation infrastructure on inter-regional spillovers of local public goods.

Since institutional design affects both the intensity of local public goods and the quality of transportation infrastructure (Qian and Roland, 1998; Lizzeri and Persico, 2001; Boadway and Shah, 2009; Proost et al., 2011), it is important to study both policies within the same framework, and within the current debate on decentralization. The understanding that decentralization is optimal only in the absence of inter-regional spillovers is a milestone in the literature on public economics (Oates,

1972; Besley and Coate, 2003). Decentralization fails when regional governments only consider the local effects of internal policies in their own region, and several scholars have shown that the centralization of power is able to solve the problem of inter-regional spillovers efficiently.¹

In this paper we assume a set of public transportation infrastructure that links two (homogeneous) regions. People living in one region can use the transportation infrastructure to benefit from the local public good of the other region. This implies that there are inter-regional spillovers of local public good, but that the strength of the spillovers is affected by the quality of the transportation infrastructure. We assume that welfare has a private and a public component, as will become clear below. To improve welfare, regional governments could invest in either their own local public good or the quality of transportation infrastructure.

We principally compare one- and two-step scheduling designs. In the former, the quality of the transportation infrastructure and the provision of local public goods are determined simultaneously. In the latter, the quality of the transportation infrastructure is determined in the first step, and the provision of local public goods in the second step.

By comparing the two scheduling designs both a lower quality of transportation infrastructure and a higher intensity of local public goods

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¹ Given the focus on externalities, centralization failures are not discussed in this paper.

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emerge in the two-step scheduling design. Moreover, we show that the scheduling design does not affect the public component of welfare but only impacts on the private component of welfare. Finally, assuming positive externalities, overproduction cannot be excluded when the quality of the transportation infrastructure affects the inter-regional spillovers of local public goods.

The paper is structured as follows. Section 2 reviews the literature. Section 3 develops the model and derives the public-sector decisions for various institutional designs. Section 4 shows the main results on efficiency and provides a numerical illustration of the policy mix. Some extensions of the model are presented in section 5, and conclusions are drawn in section 6.

2. Literature

This paper adds to the literature on transportation infrastructure and decentralization (for a survey, see [De Borger and Proost, 2012a, 2012b, 2015](#)). Scholars focus on transportation infrastructure mainly because it has specific features and various kinds of spillovers (e.g. traffic congestion and smog) that are unlike other goods.² Most authors would solve decentralization failure with a centralization of the transportation infrastructure. For example, [Bjørner \(1996\)](#) shows that the low quality of transportation infrastructure with environmental spillovers could be eliminated with centralization. [De Borger and Proost \(2016a\)](#) use a two-region framework with inter-regional spillovers and transportation congestion to find that the federal legislature may adopt more efficient transportation infrastructure through regional referenda. Moreover, they show that with regional homogeneity the regional governments voluntarily delegate power to the central level when most voters are also drivers, and uniform pricing is a binding promise.

[Ferguson \(2015\)](#) considers two levels of government that influence the quality of the transportation infrastructure in a country where poor citizens live in the center and rich citizens live in the periphery. He finds that, as citizens regularly travel to the center, decentralization creates more traffic congestion than centralization. Indeed, with centralization, both communities obtain a medium level of transportation; and, with decentralization, the periphery obtains a higher quality of transportation infrastructure than the center. Vice versa, in a country where poor citizens live in the periphery and rich citizens live in the center, decentralization becomes more efficient than centralization. This heterogeneity of results also emerges in [Van der Loo and Proost \(2013\)](#). They assume that there are two levels of government: a regional level that does not internalize inter-regional spillovers but has regional information; and a national level that internalizes spillovers but could only use financial transfers to obtain regional information. The results differ by the type of spillovers: with air pollution, the national government can always use the mechanism of financial compensation to incentivize regional governments to correctly inform the national government; with traffic congestion, this mechanism can be used only with citizens' intra-regional travel and if the level of inter-regional travel is not too high.

Some papers describe how the decentralization of transportation infrastructure policy could directly solve externality failure. [Russo \(2013\)](#) assumes that there are two levels of non-coordinating government, each of which control a tax that affects the transport layer – the city uses parking fees, and the region uses the toll road – so then the policymaker must control both taxes to reduce spillovers (arising from traffic congestion). Similarly, [De Borger and Proost \(2016b\)](#) compare centralization, where governments make individual decisions, with decentralization, where governments bargain with other governments to make a

decision at the national level. Through the bargaining process, decentralization solves traffic congestion better than centralization. Neither [De Borger and Proost \(2016b\)](#) nor [Russo \(2013\)](#) use the standard Oates' definition of decentralization to solve externality failure, which means their results are not perfectly comparable with those of this paper.

Other papers use the standard definition but find heterogeneous results. [Brueckner \(2015\)](#) assumes three regions connected by a road (or a bridge), for where the governments require citizens to pay a toll for all access to the road. With standard traffic congestion it is possible to achieve efficient transportation infrastructure not only with uniform centralization but also with decentralization. [Fung and Proost \(2017\)](#) consider a country with spillovers between a not-congested rural region and a congested urban region. Assuming a central level of government that uses the gasoline tax and a regional level that uses either flat or fine tolls, they found that the introduction of regional taxation on top of central taxation gives a better result both in the urban region and, if spillovers are sufficiently small, in the rural region. Moreover, they show that when both pricing and capacity decisions are decentralized, the externality failure is larger than when only a single decision is made at the regional level.

Another strand of the literature starts from the seminal contribution of [Tiebout \(1956\)](#). He affirms that decentralization improves the allocation of local public goods when citizens freely change residence between regions. The large literature that has arisen from Tiebout's paper is principally focused on: local fiscal competition ([Mieszkowski and Zodrow, 1989](#); [Brueckner, 2000, 2004](#)); horizontal expenditure competition ([Hochman et al., 1995](#); [Hoxby, 2000](#); [Nechyba, 2000](#); [Epple et al., 2004](#)); growth ([Henderson, 1985](#); [Brueckner, 2006](#)); and the size of the union ([Alesina et al., 2000](#); [Stiglitz, 2015](#)). However, the core assumption that local policies are the main driver of citizens' residence has been strongly criticized by scholars ([Rhode and Strumpf, 2003](#); [Kobayashi, 2011](#)).

Since the intensity of local public goods and the quality of transportation infrastructure are chosen by governments, the public decision-making process is relevant to our paper. In the following, we use [Lin \(2003\)](#)'s definition where the decision-making process is a series of actions undertaken to make public decisions.³ Political decision-making is influenced by socio-cultural factors, historical experience and institutional framework ([Zhao, 2009](#); [Kuehnhanss et al., 2015](#)). Timing is relevant to efficient decision-making, and dynamic scheduling is usually better than static scheduling. However, we show that this conclusion does not necessarily hold when it comes to public failures. At present, research is mostly focused on national decision-making but regional decision-making has important unique characteristics ([Pape et al., 2016](#); [Christopherson et al., 2010](#)). Indeed, regional decision-making is more reactive to social needs and pressures, but also has more institutional constraints than national decision-making ([Welch, 2002](#); [Jessop, 2008](#); [Klijn and Koppenjan, 2012](#); [Morgan, 2014](#)).

The degree of decentralization failure could be affected by institutional design ([Lijphart, 2012](#); [Lockwood, 2002, 2005](#)). The scholarly debate is focused on voting rules ([Redoano and Scharf, 2004](#); [Lorz and Willmann, 2005](#); [Rota Graziosi, 2009](#)), or on the level of government that should allocate the political power ([Crémer and Palfrey, 1996](#); [Lockwood, 2004](#); [Alderighi and Feder, 2014](#)). The main conclusion of this literature is that, with high spillovers, both federal legislature and federal referenda are more efficient than their respective unitary systems because they lead to more centralization. Vice versa, with low spillovers, unitary legislature and unitary referenda become the most efficient institutional designs.

In our paper, the scheduling design of policies becomes an additional factor in the degree of decentralization failure. Scholars generally focus on selecting the best policy instrument, or on setting the most efficient level of investment. However, the timing of the implementation of any policy is

² There is a strand of literature that studies the link between institutional design and transport policy ([De Borger et al., 2005, 2007](#); [Ubbels and Verhoef, 2008](#); [Grah-Voorneveld, 2013](#); [Mandell and Proost, 2016](#)). Other papers have analyzed the relationship between transportation and private goods, especially for inter-regional trade ([Bond, 2006](#); [Mun and Nakagawa, 2010](#)) or tourism ([Levinson, 2000](#)).

³ We then assume that the cognitive psychology process is concluded, and the optimal policymaker's choice is implemented.

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