



Experimental evidence on the resilience of a cap & trade system for land consumption in Germany



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ABSTRACT

The German government has committed to substantially limiting future land consumption. Among the most prominently discussed policy instruments is the implementation of a cap & trade system for land consumption, in which a limited amount of certificates is allocated to and traded by municipalities. Since these certificates would be a prerequisite for conducting building projects, this system is expected to reduce urban sprawl and foster the efficient allocation of land consumption projects. While previous empirical studies have supported these projections, the potential fragility of a cap & trade system in the case of macroeconomic shocks has not been considered. In three laboratory experiments, we simulate the impact of economic and budgetary crises within a cap & trade scheme for land consumption. We find that a market-based system succeeds in compensating macroeconomic disturbances with only minor welfare losses. Certificate prices in auctions and trading are somewhat more volatile before shocks, yet normalize afterwards. Trading volumes and the specifics of project realizations remain largely unaffected. Unrelated to the macroeconomic shocks, auction and market prices persistently diverge, leading to income redistributions to the state. Overall, our evidence supports the introduction of a market-based certificate scheme to reduce land consumption in Germany due to its resilience against potential shocks.

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1. Introduction

Policy options for reducing land consumption to preserve natural resources and biodiversity have been broadly discussed in recent years. Accordingly, a large number of different urban containment strategies have been proposed, implemented and evaluated, particularly in developed countries (see e.g. Anthony, 2004; Bengston et al., 2004; Millward, 2006; Gennaio et al., 2009; Menghini et al., 2015). Within the scientific and regulatory debate, environmental economists frequently point to the advantages of market-based instruments in reconciling the reduction of urban sprawl with economic growth (Nuisl and Schroeter-Schlaack, 2009). In Germany, one of the most prominently discussed instruments among environmental economists and legislators is the implementation of tradable certificates for land consumption, i.e. a cap & trade system for land consumption (Henger and Bizer, 2010). While previous market-based schemes for preserving open spaces have been

confined to particular communities or regions, e.g. tradable development rights (TDR) in the United States (Johnston and Madison, 1997; Bengston et al., 2004), proponents of a cap & trade system in Germany call for a nationwide implementation controlled by the federal state. German economists and government agencies argue that this system could substantially reduce land consumption, while at the same time market forces would lead to certificates being allocated to the communities that could conduct the most valuable building projects. Thus, the economically most valuable building projects would continue to be realized despite the overall cap on land consumption (Henger and Bizer, 2010).

The discussion in Germany has been driven by numerous studies issued by governmental agencies following the 2002 federal government's commitment to reducing the land consumption to 30 ha per day by 2020 (Federal Government, 2002), which has been renewed in 2013 (Coalition Treaty, 2013). These studies present theoretical evidence and weigh different policy options of implementing a cap & trade system for land consumption. The scientific discussion has evolved similarly, having considered a number of relevant institutional, political and judicial factors for an implementation in Germany, for which Henger (2010) provides

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a comprehensive literature review with Davy (2009) and Fischer et al. (2013) contributing critical assessments.

However, a shortcoming of the discussion is a lack of empirical evidence analyzing the feasibility and potential shortcomings of a cap & trade system for land consumption. A large theoretical literature has evolved discussing the advantages and potential restrictions to a system of tradable certificates for land consumption. The core arguments include the superior efficiency of a reduction on land consumption; the precision of a system that uses a fix quantity of land and variable prices, which is unattainable within a direct regulation of prices; the argument that a cap & trade system on land stimulates more efficient land consumption by decision-makers and fosters inner city development; and it is assumed that the necessity of taking part in the trading scheme will increase policy-makers' awareness of the ecological problems associated with land consumption (Henger, 2010).

However, only two field experiments have been conducted with officials from German municipalities to date, who are responsible for planning and approving building projects in Germany, as reported in Henger (2013). The field experiments implement a cap & trade system for land consumption considered as an attainable and realistic policy option. Both studies find that the system realizes an externally fixed cap on land consumption, while providing a satisfactorily efficient reallocation of excess certificates to the most valuable projects. Transferring the field experiments to the economic laboratory, Henger (2013) shows that student participants achieve more efficient allocations compared to municipal agents. In more recent experimental contributions, Meub et al. (2014) show the distortive influence of political business cycles to a cap & trade system for land consumption and Meub et al. (2015) investigate different allocative mechanisms.

While the limited empirical evidence emphasizes that the trading system envisioned by federal agencies is an efficient allocative and redistributive mechanism, we argue that many potential influences on the effectiveness of such a system have not been considered. In particular, the system's resilience against exogenous shocks has not been analyzed to date. Consequently, the theoretical arguments only hold for the (fairly unlikely) case of long periods of macroeconomic stability. We thus argue that the cap & trade system's resilience should be a central empirical research goal, understood as its ability to uphold the efficiency and applicability when confronted with sudden exogenous changes to its core parameters. In our experimental setting, we chose to implement a recent issue that is likely to have a substantial impact on the stability of a cap & trade system for land use in Europe, namely the issue of economic crises and critical public budget deficits. Firstly, abrupt firm bankruptcies and the ensuing movement of labor are likely to reduce the value of potential building projects as the demand for land consumption decreases in areas of rapidly shrinking populations. Secondly, we investigate the issue of imminent budget restrictions, which may limit municipalities' ability to buy certificates when considered optimal from a cost-benefit perspective, which is a necessary condition for the system's overall efficiency. Both issues can happen within short periods of time so municipalities are faced with abrupt changes in land values and budgetary restrictions. For instance, consider the case of an economic crisis that could lead to a rapid reduction in local tax revenues or massive emigrations due to the loss of industrial jobs following company bankruptcies. Particularly in smaller and medium-sized municipalities, the loss of a single larger company or government institution, e.g. military installations, could dramatically reduce tax revenues and lead to the emigration of employees, whereby the value of all building sites is substantially reduced over a short period. These – largely unpredictable – exogenous shocks reduce municipalities' ability to rationally plan the costs and benefits of buying and selling certificates for land consumption. We therefore aim at investigat-

ing this potential disturbance to the efficient working of a cap & trade system for land consumption.

To address our research agenda, we pursue the methodology of experimental economics, which enables us to empirically answer counterfactual questions that are inaccessible through empirical studies based on field data. This approach allows us to simulate how subjects in a system of tradable planning permits act when confronted with an environment of potentially severe macroeconomic disturbances. While the use of student subjects in experimental studies leads to certain issues in terms of external validity, the resulting empirical evidence provides behavioral insights that theoretical and classical empirical analyses cannot generate. We build our analysis of a cap & trade system's resilience under an uncertain macroeconomic environment upon an experimental design that implements the core features of the cap & trade system planned within the German administration and tested in field experiments (Henger, 2013), whose details are described in section two.

Our investigation broadly builds on two strands of literature. Firstly, our experimental design, as well as the previous studies on tradable planning permits, is motivated by the empirical literature on various aspects of CO₂ emission certificates (see Wrake et al., 2012) for a comprehensive literature review), which has been accompanied by experimental studies early on (see e.g. Grimm and Ilieva, 2013; Goeree et al., 2010; Benz and Ehrhart, 2007; Fischer and Fox, 2007). Our experimental setting loosely implements these previous considerations and experimental parameters. However, we necessarily deviate to account for the specifics of land consumption rather than emissions.

Secondly, our motivation to pursue the consequences of macroeconomic disturbances within a system of tradable planning permits is based upon the discussion of the debt crisis faced by municipalities across Europe, which is connected to the broader economic crisis, both of which calls the successful implementation of a cap & trade system into question. Thus, the financing of certificates for land consumption could become problematic for many heavily indebted municipalities. Further, the decline of regional firms and the shutdown of government programs could lead to a substantially decreasing demand for potential building sites and thus substantially decrease the value of potential building projects. Potential problems caused by budgetary and economic crises within a cap & trade system would universally apply to all European states. We can thus base our study on a broad strand of contributions that discuss the effects of fiscal crises on the municipal level across European states. Comprehensive overviews regarding the reactions of federal states and municipal governments to the most recent fiscal crises following the financial- and the euro crisis are provided by Silva (2014) and Cottarelli and Guerguil (2014). A more detailed look into fiscal rules and deficits across Europe is provided by Foremny (2014), who empirically investigates the pre-crisis years and the fiscal performance of local governments; an institutional perspective on local government reform with a focus on the post-2008 crisis years in Europe is offered by Hlepas (2015). Glumac et al. (2014) discuss the reactions of Dutch municipalities to the financial crisis and the ensuing financial problems with a special focus on land use decisions.

Consequently, our study builds upon the previous, mostly theoretical work on tradable planning permits in Germany, implements experimental settings from studies of emissions certificates and is motivated by the discussions on the economic and budgetary crises in Germany and Europe. Combining these aspects, we are able to provide novel, policy-relevant evidence on the stability of a cap & trade system for land consumption given an uncertain macroeconomic environment. The remainder of this paper is structured as follows. Section 2 introduces our experimental design and Section

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