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Local taxation, land use regulation, and land use: A survey of the evidence

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ABSTRACT/RÉSUMÉ

Local taxation, land use regulation, and land use: A survey of the evidence

This paper surveys the theoretical and empirical research on the relationship between local taxation, land use regulation and land use patterns. The findings can be summarized as follows: 1) In more fiscally decentralized settings, sub-national land use regulation and fiscal policies encourage urban sprawl. In contrast, in more centralized settings, restrictive urban containment policies and a lack of local fiscal incentives for land development tend to generate housing shortages. 2) Certain fiscal instruments affect the type and composition of land development, e.g. the share of residential versus commercial development. Removing local fiscal incentives for certain property types reduces the amount of land allocated for that type and increases its price. 3) In more decentralized settings, local land use policies aimed at containing or modifying urban growth are ineffective since mobile individuals can circumvent local restrictions by sorting into nearby jurisdictions that offer the preferred combination of land consumption and public services. 4) Expanding transportation networks enables households and firms to move to suburban areas, prompting the central city population to shrink and encouraging sprawl, particularly near major highways. 5) In fiscally decentralized settings, sub-urbanization is associated with a growing political power of homeowners. Homeowners tend to get fiscal zoning policies enacted – mainly via minimum lot size restrictions – that selectively attract well-off local taxpayers. Fiscal zoning thus imposes barriers to local development and raises property values, while at the same time facilitating sprawl. Overall, fiscal policy and land use regulation strongly interact, and governments must align those policies carefully to achieve land-use objectives effectively.

JEL classification codes: R3; R4; R5; H2; H3; H4; H7

Keywords: Land use regulation; fiscal instruments; fiscal competition; land use patterns; sprawl; urban density

Fiscalité locale, réglementation d'urbanisme et occupation des sols : Étude empirique

Ce document étudie les travaux de recherche théoriques et empiriques consacrés aux relations entre fiscalité locale, réglementation d'urbanisme et modes d'occupation des sols. Les résultats peuvent être résumés comme suit : 1) Dans les pays qui pratiquent la décentralisation budgétaire, la réglementation d'urbanisme et les politiques budgétaires au niveau infranational encouragent l'étalement urbain. À l'inverse, dans les pays plus centralisés, des politiques restrictives de maîtrise de l'étalement des villes et le manque d'incitations budgétaires locales en faveur de l'aménagement du territoire ont tendance à entraîner une pénurie de logements. 2) Certains instruments budgétaires influent sur le type et la composition de l'aménagement du territoire, par exemple l'importance de la construction de logements par rapport à celle de bâtiments à usage commercial. La suppression des incitations budgétaires locales en faveur de certains types de biens réduit la surface des sols qui leur sont affectés et augmente leurs prix. 3) Dans les pays à structure plus décentralisée, les politiques locales d'occupation des sols visant à limiter ou à modifier la croissance urbaine sont inefficaces car les individus mobiles peuvent contourner les restrictions locales en s'établissant dans les juridictions voisines qui offrent l'équilibre recherché entre occupation des sols et services publics. 4) Le développement des réseaux de transport permet aux ménages et aux entreprises de s'établir en zones périphériques, ce qui accélère la désertification des centres villes et favorise l'étalement urbain, surtout le long des routes à grande circulation. 5) Dans les pays où la gestion budgétaire est décentralisée, le développement des banlieues est associé au pouvoir politique croissant des propriétaires fonciers. Ceux-ci font généralement pression pour que des mesures d'urbanisme obéissant à des considérations budgétaires soient prises – essentiellement en fixant une taille minimale des lots – qui favorisent les contribuables plus aisés. Aussi, les décisions d'urbanisme qui répondent à des objectifs budgétaires freinent le développement local et augmentent la valeur des biens, tout en favorisant l'étalement urbain. Globalement, la politique budgétaire et la réglementation d'urbanisme sont étroitement liées, et les pouvoirs publics doivent harmoniser ces politiques pour atteindre efficacement les objectifs d'occupation des sols.

Classification JEL : R3 ; R4 ; R5 ; H2 ; H3 ; H4 ; H7

Mots clés : Réglementation d'urbanisme ; instruments budgétaires ; concurrence budgétaire ; modes d'occupation des sols ; étalement ; densité urbaine

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LOCAL FISCAL POLICY, LAND USE REGULATION, AND LAND USE: A SURVEY OF THE EVIDENCE

By Hansjörg Blöchliger, Christian Hilber, Olivier Schöni, Maximilian von Ehrlich[1]

1. Introduction

1. Urban land use development – and in particular urban sprawl – is a major concern in many countries. The scale of conversion of open land for residential and commercial purposes and the emergence of scattered and low- density settlement patterns raises questions about the efficiency and sustainability of land use. Land use policies ought to address the negative effects of sprawl and help reduce the externalities arising from certain forms of land use. Moreover, land use policies can enhance welfare by mixing land uses, thereby generating positive externalities, and they may help preserve open land, public parks and natural amenities. More generally, land use policy can be seen as a "planners triangle", which is about to find a balance between economic competitiveness, environmental stability and social inclusion (OECD, 2017).

2. However, fiscal and land use policies are not determined by a welfare maximizing central government with perfect information. Instead, the policies are the outcome of a political process that is influenced by particular interests across government levels. Moreover, policies often have unintended consequences not foreseen by policy makers. This paper reviews and summarizes the related theoretical and empirical literature and underlying empirical challenges to document how fiscal and land use policies determine land use patterns. It aims to provide a comprehensive framework that helps policy makers at various government levels and practitioners in the planning sector to understand the direct and indirect consequences of specific fiscal policies and planning regulations for land use.

3. This paper stresses the role of intergovernmental frameworks for land use and the interaction between fiscal and land use policy. As will be shown, decentralized systems tend to provide more incentives for low density development and sprawl. More centralized systems tend to facilitate urban containment policies, but they often lack sufficient fiscal incentives for local governments to build and develop, thereby making housing supply price inelastic and, ultimately, causing housing shortages. The report also emphasizes the role of sorting of individuals across political borders, as sorting can undermine urban containment policies. Finally, land use patterns must be seen in the context of the improvements in

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transportation technologies. The widespread use of the automobile has allowed households to live further away from city centers, and it allowed firms to settle farther away from railways and ports. In conjunction with rising incomes – which has also considerably increased the demand for suburban land (Margo, 1992; Deng et al., 2008) – it has caused sprawl at the edge of major agglomerations.

4. The paper is organized as follows: The second section illustrates how land use and fiscal policies rely on a country's inter-governmental frameworks and how, in turn, this may affect land use patterns. The third section discusses various fiscal and regulatory instruments such as minimum lot size restrictions, growth controls, height restrictions, and property and income taxation, and their impact on households and firms. The fourth section deals with sorting and how it may shape local government's strategic fiscal and land use policies. In particular, local governments may combine land use and fiscal policies to foster specific development patterns. The section is complemented with a comparison of development patterns in the United Kingdom – a highly centralized country with a restrictive planning system and few local fiscal incentives – with those in Switzerland, which is one of the most decentralized countries worldwide with a flexible planning system and strong local income-tax induced incentives for local development. The fifth section explores how government spending in transportation networks affects land use patterns. The sixth and final section concludes.

2. The role of the institutional framework for land use patterns

2.1. Land use planning in decentralized settings

5. This section discusses how the institutional framework of a country is reflected in its land use planning system and how this, in turn, affects land use patterns. Land use regulation under more decentralized intergovernmental frameworks tends to induce sprawl, in some cases contradicting stated national land use objectives. The term ‘sprawl’, which is often used with a negative connotation, has been the subject of much controversy. Box 1 contains a brief summary of the empirical measures used in the literature to quantify sprawl. For this paper, sprawl is broadly understood as a land use pattern that is scattered and low-density.

Box 1. Sprawl: An elusive concept

Sprawl is an elusive concept and a variety of measures have been used in the literature, depending on both theoretical and practical considerations. Wassmer (2000), Galster et al. (2001), and Song and Knaap (2004) offer an overview of alternative sprawl measures. Theoretical work tends to identify sprawl with population density gradients (Glaeser and Kahn, 2004, Song and Zenou, 2006) and the urban spatial extent (Brueckner and Sridhar, 2012). In line with theoretical work, early empirical analyses measured sprawl with population density and urban extent (Brueckner and Fansler, 1983). There is, however, a recent trend to rely on Geographical Information System (GIS) data to measure sprawl patterns. The measures proposed by Galster et al. (2001) go indeed in that direction, although they may be of limited use due to computational considerations. A major contribution to the measurement and understanding of sprawl patterns is offered by Burchfield et al. (2006), who rely on satellite images mapping the US surface in square cells of 30x30 meters. Burchfield et al. (2006) define a sprawl index for US metropolitan areas by computing for each individual developed cell the share of undeveloped land surrounding that cell within a square kilometer, and then averaging across all developed cells in the urban area. The index corresponds to the share of open land surrounding an average developed cell within a square kilometer, thus providing insights on the spatial dispersion of development that may not be captured by a simple density measure.

6. Sprawl is more likely to happen in a decentralized setting mainly for two reasons. First, as argued by Glaeser and Kahn (2004), a system of local governments in which each government takes autonomous decisions with regard to land supply and land use may exacerbate the sprawl problem. Land developers and households can easily avoid growth control restrictions in a given jurisdiction by simply moving to another

one, creating so-called 'leapfrog' patterns. The mobility of households is the main driving factor allowing developers to undertake such a strategy. Although sound from a theoretical point of view, the empirical evidence is ambiguous. For example, Glaeser and Kahn (2004) point out that the number of jurisdictions is only weakly correlated with sub-urbanization, and that jurisdictional sorting is likely not the main force driving sprawl.

7. Second, while local residents might have first-hand knowledge of local market failures – such as incorrect pricing of incompatible land uses and open land preservation – and local authorities might implement land use policies to correct them, recent empirical research rejects this idea in favor of the hypothesis that special interests guide land use policy. The main instrument in more decentralized settings is fiscal zoning. Fiscal zoning describes the process by which local residents (and homeowners in particular) get land use policies enacted in the attempt to create exclusive clubs in which only individuals with similar income and social background will live, inducing low-density development. As illustrated in Box 2, fiscal zoning mainly benefits homeowners and hurts owners of undeveloped land and lower-income renters, thus creating a wedge between those groups (Hilber and Robert-Nicoud, 2013). The social consequences of fiscal zoning have been widely explored in the literature. See Nechyba and Walsh (2004) for a review of the literature linking land use patterns to peer externalities and segregation.

Box 2. Land use policies and capitalization mechanisms

The empirical literature provides strong evidence in support of the hypothesis that local land use constraints are capitalized into housing prices (for recent rigorous evidence see e.g. Saiz (2010) for the US or Hilber and Vermeulen (2016) for the United Kingdom). Fischel (1990) and Quigley and Rosenthal (2005) provide a literature review linking growth control with land and housing prices. The main message is that tighter land use constraints tend to benefit owners of developed land (e.g. homeowners) and hurt the owners of undeveloped land (landowners) (see the early work of Engle-Carson (1989) or more recently Hilber and Robert-Nicoud (2013)). The price of developed land is higher because zoning restrictions create a positive amenity effect, thus increasing the willingness to pay of would-be residents. At the same time they reduce the amount of land available for development and increase its price, thus capitalizing land and housing demand into higher equilibrium prices. In contrast, the price of undeveloped land falls, as new development is more difficult and costlier, thus decreasing demand from land developers. Recent evidence (Cheshire and Sheppard (2002), Brueckner and Sridhar (2012) or Turner et al. (2014)) suggests that the increased cost associated with more stringent land use regulation does not compensate its benefits.

8. Fiscal zoning is related to the so called 'homevoter' literature. Fischel's (2001a, b) homevoter hypothesis states that homeowners support certain local policies to maximize housing values. As land use regulation mainly benefits homeowners, owners of undeveloped land have an incentive to organize politically in the early formation of a local municipality – when still in numerical superiority – and oppose stringent regulation. As the municipality physically develops, and owners of developed land acquire political influence, homevoters will start to oppose new development via elected local planning boards. Hilber and Robert-Nicoud (2013) extend Fischel's work by explicitly modelling local zoning restrictions as the result of a voting and lobbying game played between owners of developed land (homeowners and absentee landlords who rent out their properties) and owners of undeveloped land (landowners).[2] By providing both theoretical and empirical evidence, they argue that more attractive places are more developed and, as a result of the political forces, also more regulated. Fiscal zoning can be interpreted as a particular means of homeowners maximizing their property values.

2. In Hilber and Robert-Nicoud's (2013) framework, absentee landlords (who favour tighter control) and owners of undeveloped land (who favor more relaxed planning) can influence planning boards through lobbying contributions. In addition, homeowners (who favour tighter control) and renters (who benefit from relaxed planning) can vote to elect local planning boards.

9. Fiscal zoning also relates to the literature sparked by Tiebout's (1956) seminal contribution on "voting with the feet". Tiebout argues that households with similar tastes sort into the same municipality according to their preferred combination of fiscal burden and public services, thus leading to the creation of 'homogenous' jurisdictions. In particular, in more decentralized settings local governments provide public goods that better fit the preferences of each individual. As long as there are as many governments as groups of individuals and relocation costs are low, mobile households can sort across jurisdictions to maximize their net fiscal benefit, and an efficient level of local public services results.[3] Although not explicitly taking land markets into account, Tiebout's approach to local public finance is important to understand recent land use patterns in decentralized countries. Over the past century individuals have become both wealthier and more mobile. They have started to bid in land markets located at the outskirts of major urbanized areas, arguably choosing to live in those places with the preferred combination of land consumption and corresponding fiscal packages. In this respect, fiscal zoning is much more likely to happen in more decentralized settings, where local governments enjoy some fiscal autonomy and the power to shape land use regulations. As such, the literature analysing the role of fiscal decentralization for inter-jurisdictional competition (e.g. Besley and Case, 2001) can also be applied to decentralization of land use policy and its interaction with the local tax system.

2.2. Local land use instruments and their impact on sprawl

10. Empirical evidence suggests that more extensive regulation slows down new development and decreases the responsiveness - or supply price elasticity - of local housing markets. Mayer and Somerville (2000) find that tighter land use regulation reduces new construction up to 45% in U.S. metropolitan areas, causing the price responsiveness in such areas to be about 20% lower with respect to less regulated ones.[4] Quigley and Raphael (2005) also document a negative impact of stringent regulation in the form of both growth controls and fiscal zoning on the construction of new housing in California. They demonstrate that low construction activity in regulated places is not due to low housing demand. On the contrary, those areas that had experienced the strongest increases in housing demand were those that displayed the lowest increases in housing supply. Glaeser and Ward (2006) investigate barriers to new development in Greater Boston. They find that minimum lot size restrictions are among the most important factors hindering new development. In contrast to most of the capitalization literature, however, they observe only a moderate effect of such constraints on housing prices, likely due to the presence of similar jurisdictions in which households may sort into. Caldera Sánchez and Johansson (2011) analyze long-run housing supply elasticities across 21 OECD countries. They document that long-run housing supply is less responsive in places with more stringent land use and planning regulations. Dempsey and Platinga (2013) investigate how urban growth boundaries affect the probability of development of cities in Oregon. They find that, for most cities, urban containment indeed reduces the probability of new development. Hilber and Vermeulen (2016) show that regulatory and geographical constraints in the United Kingdom reduce the responsiveness of housing supply, leading to greater capitalization of local income and labor demand shocks into housing prices. Jackson (2016) shows that zoning controls are among the strongest land use policies lowering housing supply and new development in Californian cities. Their results suggest that a new land use regulation reduces, on average, the number of multifamily and single-family construction permits by around 6% and 3%, respectively.

11. By limiting the supply of land in certain places, land use instruments could entail sprawling land use patterns. As mentioned above, developers can easily circumvent the policies of an individual local government by moving into a nearby jurisdiction, provided it is less restrictive. In more centralized settings, in which land use policies are coordinated or even applied homogenously throughout the country

3. The formal conditions for such efficient allocation have been stated by Bewley (1981).

4. Mayer and Somerville (2000) broadly define 'regulation' as any policy rule that increases costs, adds uncertainty, or delays the development process.

or a metropolitan area, such behavior is less possible. In this line, Cunningham (2007) finds that by imposing an urban growth boundary around the greater Seattle area, development in rural areas indeed declined, whereas in urban areas it increased.[5] This is not surprising, as implementing land use regulation at the regional rather than local level leaves households with no other choice but to comply or move away from the region altogether. Interestingly, Brueckner and Sridhar (2012) illustrate what happens when land use regulation is implemented locally. In particular, they show that by imposing height restrictions – by setting maximum Floor to Area Ratios (FAR) – on Indian cities, their spatial size has increased to accommodate the increasing population. Additionally, building heights in non-restricted areas are higher than would have been in the absence of any restriction. In a similar vein, Geshkov and De Salvo (2012) analyze the impact of different land use regulation policies on US urbanized areas and find, among other things, that minimum lot size restrictions and maximum FAR increase their spatial extent.

12. Another strand of the literature argues that stricter land use regulation in the form of minimum lot size restrictions and open land preservation may spur sprawl even within the local area where they are implemented (Fischel, 2000). Moss (1977) and Pasha (1996) provide two alternative theoretical frameworks that help understand the conditions under which this may occur. Irwin and Bockstael (2004) argue that land use regulations produce not only a direct effect via increasing development costs of undeveloped land, but also create a land use externality on adjacent parcels. In particular, they suggest that land use regulations that preserve open space create a positive amenity effect on nearby developable land. Looking at development patterns in Calvert County, Maryland, they find that parcels surrounded by preserved land have higher development rates, whereas those parcels in proximity of industrial development showed lower development rates. They conclude that land use controls that preserve open land may have the effect of i) draining development from central high-density areas, and ii) attracting new development towards areas that have protected open space. As a consequence, leapfrog or sprawling development may happen. McConnell et al. (2006) also consider land use patterns in Calvert County, and find that land use patterns surrounding an individual parcel affect its development intensity and that zoning regulation in the form of minimum lot size restrictions encourage low-density sprawling residential development. Finally, Turner et al. (2014) isolate the value of regulatory constraints for the imposing jurisdiction as well as for the neighboring jurisdictions. Based on this composition they estimate the aggregate welfare effect of land use regulation, which they find to be negative.

2.3. Summing up

13. Intergovernmental frameworks affect land use and in particular the extent of urban sprawl. Decentralised settings are more prone to sprawl for two reasons:

- Territorial and political fragmentation in more decentralized settings allows mobile households to circumvent restrictive local fiscal and regulatory policies and consume the preferred combination of land and public services, thereby causing sprawl. Sprawl is less likely in more centralized settings, when a similar tax and regulatory framework is imposed on all jurisdictions.

- In decentralized settings, homeowners get fiscal zoning policies enacted to attract well off taxpayers. Fiscal zoning imposes barriers to new development and increases property values. These barriers, which may take the form of minimum lot size restrictions or open land preservation, could lead to sprawl.

5. Interestingly, Cunningham (2007) demonstrates that limiting density reduces the uncertainty related to the optimal future use of undeveloped land, a main obstacle to investment. The option value of regulated developable land in urban areas is thus lower, encouraging developers to build in the short run.

3. Individual fiscal and land use instruments

3.1. The interaction between fiscal and land use instruments

14. This section reviews the impact of fiscal instruments on land use patterns and their composition - essentially residential and commercial use - and the extent to which countries apply them. In more decentralized settings local governments finance public services mainly by levying local taxes, allowing them to set fiscal incentives to attract residents and firms and expand the tax base. Because local jurisdictions can autonomously decide which fiscal instruments to use and to what extent – and households react to these incentives – land use varies across jurisdictions. Such heterogeneity in land use patterns is less likely in more centralized settings, since taxes are levied centrally and redistributed to local governments in the form of transfers. In this case, unless fiscal redistribution favors specific places that allocate more land for development, the fiscal system does not add variation to land use patterns, as there are no positive fiscal incentives at the local level.[6]

15. A wide range of empirical literature shows that households and firms react to local fiscal incentives. Households choose to locate in jurisdictions that they deem offer the largest net fiscal benefit, i.e. the best tax-public services combination. Considering multistate metropolitan areas, Coomes and Hoyt (2008) document that location decisions of households are indeed influenced by tax rate differentials and differences in public spending. Similarly, Rohlin et al. (2014) find that firms sort across state boundaries to avoid adverse tax effects. Importantly, both the results of Coomes and Hoyt (2008) and Rohlin et al. (2014) depend in an important way on the reciprocal agreements between the two jurisdictions: If two jurisdictions adhere to reciprocal agreements, workers pay income tax where their residence is located and not where they work.

16. The relevant question for the analysis of land use patterns is whether land and housing consumption of new entrants is affected by local fiscal incentives. Importantly, land and housing consumption also depend on the quantity and quality of public services provided by the jurisdiction for a given level of taxation, and how public services are capitalized into local housing prices. Box 3 briefly explains the capitalization mechanism of local taxes and public services into local housing prices.

Box 3. Fiscal instruments and capitalization mechanisms

Capitalization of local taxes into housing prices largely depends on households' willingness to pay for the public services obtained in return. If a given public service is underprovided by the local government, raising tax rates will increase the households' willingness to pay to live in the jurisdiction. This is because households benefit from higher public spending (assuming that local jurisdictions are not leviathans and do not waste money). In this case, capitalization of the tax increase into higher housing prices can be expected. However, if the additional tax is used to fund a public service that is overprovided, households are not willing to pay more to live in the jurisdiction and housing prices should negatively capitalize the local tax increase. To reach 'efficiency' in the sense of Samuelson, local governments should set taxes such that the total expenditure for the public services equals the aggregate willingness to pay for it. See Hilber (2015c) for an in depth discussion of the capitalization of local public goods and taxes into house prices.

6. Of course, variation in land use patterns is still possible in more centralized settings, as local jurisdictions differ in amenities, proximity to major urban areas, labor markets, etc.

3.2. Property taxation

17. Property taxes are the most widespread tax instrument available to local governments. The effect of property taxation on land use patterns has been the subject of much controversy.[7] Brandt (2014) offers a comprehensive analysis on how property taxation may internalize negative externalities arising from new development. One related question is who really bears the increase in cost caused by the tax, which in turn affects land use patterns. As summarized by Brueckner and Kim (2003), two countervailing effects of the property tax are relevant to estimate its impact on land use patterns. On the one hand, since it taxes both land and capital, the tax makes it costlier for land developers to invest in land improvements, thus lowering the capital/land ratio.[8] This view of property taxation suggests that part of the tax is shifted back to the factors of housing production, causing land developers to build lower buildings with less housing surface per unit of land. This results in lower density development, forcing the urban area to expand horizontally to accommodate its population. On the other hand, the property tax may simply be an excise tax on housing consumption. As the tax makes housing floor space more expensive, households will adjust their housing consumption downwards. This leads to smaller dwellings being occupied and – assuming the capital/land ratio is not affected – raises population density.

18. The literature does not provide a clear cut answer on which of the two effects prevails. Brueckner and Kim (2003) provide a theoretical framework stating the conditions under which one or the other effect dominates. Haurin (1980) provides an urban model with taxation that combines the two effects discussed above and suggests that property taxation decreases the quantity of housing consumed and increases the land-capital ratio, while the effect on population density is somewhat ambiguous. Ihlanfeldt (1984) is among the first to provide empirical evidence on the negative effect of the property tax on housing consumption in a city. He also finds, however, that, if anything, in sub-urban areas higher property tax rates are associated with more housing consumption, hinting at the fact that (richer) suburban residents may consider the tax as a payment for local public services. Song and Zenou (2006) develop a theoretical model that incorporates two countervailing effects of the property tax: (i) it suppresses improvements thus reducing population density and (ii) it reduces dwelling size, which raises population density. Empirically, using cross-sectional data from the 2000 US census, they demonstrate that the latter effect dominates, that is, a higher property tax is associated with a lower spatial extent of urbanized areas, implying less urban sprawl.

19. This finding by Song and Zenou (2006) however is in contrast to the findings of Banzhaf and Lavery (2010). By considering land use patterns in Pennsylvania, they implicitly demonstrate the prevalence of the improvement effect. They investigate the impact of a split rate on land use patterns, and find that taxing capital improvements at a lower rate than land results in more housing units, and not bigger ones, being built, suggesting adopting a split-rate tax may prevent sprawl. An alternative framework in which property taxation may lead to sprawl is provided by Song and Zenou (2009), who consider how property tax rate differentials between urban and suburban areas affect land use development. In line with their theoretical framework, they estimate that lower tax rates in sub-urban areas increase outward development, thus expanding the urban area. Overall, while the literature does not provide clear-cut answers, it appears that property taxes can facilitate sustainable land use policies if they are well designed. For example, a pure land-value tax helps contain urban sprawl and fosters the densification of developed land rather than greenfield development (Blöchliger, 2015).

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7. See Ihlanfeldt (1984) for an early review of the different theories describing the effects of property taxation.

8. The reader may want to refer to Brueckner and Kim (2003) for a detailed review of the literature investigating the impact of property taxation on capital/land ratios.

3.3. Income taxes and development fees

20. A few OECD countries only feature local income taxes, hence the literature that relates local income taxes to land use patterns is scarce.[9] Haurin (1981) models the effect of increasing income taxation in an urban-suburban setting, numerically showing that rich households tend to avoid the increased tax burden of the central city by migrating into the sub-urban area, causing the metropolitan area to expand. Using an alternative theoretical approach Wildasin (1985) also supports the proposition that higher sub-national income taxes lead to more dispersed land use patterns. He argues that in a setting in which individuals must allocate their time between work, commuting, and leisure, a tax on income decreases the implicit cost of time people spend commuting. He illustrates that, under certain conditions, this can result in more dispersed cities. Typically, income taxes are progressive which generates sorting of high income households into low tax jurisdictions and vice versa (see Schmidheiny, 2006; Basten et al., 2015). To the extent that housing and more generally land use preferences vary with income, a correlation between local income taxes and local land use regulation seems likely.

21. There is a recent tendency, especially in the United States, to shift the financing costs of incremental spending to new entrants through so-called impact or development fees. Impact fees cover the costs of newly arriving residents and are usually paid by real estate developers, who in exchange obtain the permission to develop. By forcing developers to bear the full cost of new construction, current residents aim to internalize the negative environmental externalities, like traffic congestion and open land destruction, associated with new development. As development becomes more expensive than under the cost sharing approach, urban growth should be lower. Indeed, Brueckner (1997) proposes a model in which, under certain conditions, when a jurisdiction switches from a cost sharing approach to an impact fee scheme, where the cost of new construction is paid up front by developers, short-term growth temporarily stops and only resumes (at a lower rate) when the population level rises enough.[10]

22. Gyourko (1991) explores the effect of impact fees on land use patterns. He theorizes that impact fees may actually make fiscal zoning less appealing to local jurisdictions, as they can flexibly set the price for entering the municipality. The resulting density of new development should thus increase following the introduction of development fees. Despite mainly focusing on the role played by land use regulation in US metropolitan areas, Mayer and Somerville (2000) find that impact fees do not significantly affect new construction. Gyourko's (1991) proposition that impact fees may lessen fiscal zoning is consistent with empirical evidence for Florida's counties. Burge and Ihlanfeldt (2006a) show that impact fees spur the development of smaller homes in inner sub-urban areas and of medium and large homes throughout all the suburban areas. Burge and Ihlanfeldt (2006b) attribute the increased construction in inner sub-urban areas to new multifamily houses being built. In contrast to Mayer and Somerville (2000), however, Burge and Ihlanfeldt (2006b) find that impact fees levied to finance water/sewer services lower new development

9. This may be partly because the urban economics and local public finance literatures are somewhat US centric and in the majority of US states, property taxation is the main source of local tax revenue. According to Brühlhart et al. (2015), 73% of local tax revenue is based on immovable property, whereas 5% has a personal income base, with the rest relying on corporate income or consumption. It is worth pointing out, however, that in 14 US states plus Washington D.C. cities, counties, or school districts tax residents' earnings. Local income taxation is also an important feature in many European countries (Denmark, Finland, Iceland, Latvia, Lithuania, Slovenia, Sweden and Switzerland) or in Russia, although in the wake of tax sharing or equalisation mechanisms actual tax autonomy is often low.

10. Brueckner (1997) also shows that if impact fees are introduced during the early stage of the community creation – when the per capita cost of providing public services is decreasing – urban growth may actually be stimulated. However, since during the early stages of a community creation, incentives to introduce impact fees are likely not present, this case seems unlikely.

across the whole metropolitan area. Finally, Geshkov and De Salvo (2012) provide empirical evidence that impact fees reduce the spatial extent of US urbanized areas.

3.4. Residential versus commercial land use

23. The discussion so far focused on explaining how local fiscal policy may affect the rate and patterns of new construction. A related question is whether and to what extent specific fiscal instruments may affect the composition, mostly residential versus commercial, of new development. Solid evidence is limited to a handful of studies, discussed below. To begin with, Quigley and Raphael (2005) point out how California's tax policies create fiscal disincentives to build new, mid-priced housing in favor of expensive housing and retail buildings. In fact, jurisdictions in California can benefit from sales tax revenues, whereas property taxes are limited to 1% of the last transaction price. A case study on Israel points at the distortions when different types of land use are taxed at different property tax rates (Box 4).

Box 4. The distortive effect of differentiated property tax rates: The case of Israel

An example of a fiscal system that provides incentives to prefer one type of development over another is Israel (OECD, 2017). Property taxes are the main source of own revenues for local governments in Israel. They are free to choose tax rates for different types of properties within bands set by the central government. As the allowed rate for commercial property is up to 10 times higher than for residential units, local authorities prioritise the development of commercial and office space. Residential developments are typically associated with a net loss in local government revenues, since the cost for service provision exceeds the revenue from residential property taxes and fees. In contrast, commercial developments result in higher revenue from property taxes and are less service intensive, typically creating net gains for the local budget. Residential developments are, however, greatly needed in order to accommodate population growth, but local governments do not have incentives to provide them.

24. Cheshire and Hilber (2008) investigate the effects of the Uniform Business Rate adopted in the United Kingdom in 1990, which shifted tax revenue levied on commercial real estate from local authorities to the central government. Cheshire and Hilber (2008) document persuasively that such fiscal centralisation implied a strong disincentive for local authorities to allow new commercial development, making the supply of office space more inelastic and capitalizing demand for such space into higher market prices. Although Cheshire and Hilber did not explore this, a corollary of their main finding is that by making development of commercial real estate comparably less attractive, local authorities might have been comparably more willing to allocate scarce local sites for residential purposes.[11] It is worth noting that the United Kingdom is set to reverse the reform of 1990, allowing local authorities to retain the revenue arising from taxation of commercial property. The unintended consequence of this may thus be that local authorities may have even fewer incentives to permit land for residential purposes, potentially worsening the housing affordability crisis that plagues the country since at least the late 1990s (Hilber, 2016).

25. Burnes et al. (2012) document that those jurisdictions in Florida that have higher sales tax rates prefer to attract large shopping malls over manufacturing firms. Jacob and McMillen (2015) find that higher sales tax rates give jurisdictions an incentive to attract commercial and industrial firms. Studying Cook County suburbs of Chicago, they provide evidence that firms create a negative externality for residents: they find that commercial and industrial parcels and low-priced residences are usually situated near to municipality boundaries, likely far from attractive neighborhoods. Finally, focusing on German municipalities, Buettner (2016) provides a theoretical approach investigating the trade-off between

11. This conjecture is consistent with the stylized fact that planning refusal rates decreased during the early 1990s. However, it is difficult to disentangle this effect from the general property bust during the early 1990s.

increasing the land available for commercial use – the main source of revenue of German municipalities is a business tax – and quality of life in the jurisdiction. He argues that making too much land available for commercial development may actually hurt mobile households. Overall, these findings provide strong support for the proposition that differential fiscal incentives by property type, affect land use composition.

3.5. Summing up

26. Four main lessons can be drawn from the literature on the link between fiscal instruments and land use patterns:

- Households react to local fiscal incentives and sort into jurisdictions that offer the best net fiscal benefit, or tax-public service relationship. A similar argument applies for firms.

- Local fiscal instruments used to finance public spending – property and personal income taxes – appear to encourage sprawl under certain conditions. This effect could be stronger for income taxes than for property taxes.

- Shifting the cost of development to new residents appears to imply less sprawl, and it spurs construction of smaller houses.

- The tax mix affects the type of land use. Local income taxes encourage residential development and minimum-lot-size-restrictions, whereas high local sales taxes foster commercial development. The impact of property taxation on land use depends on the split between capital and land tax. A pure land tax tends to restrain sprawl.

4. The strategic implementation of fiscal policy and land use regulation

27. If local governments own fiscal incentives to attract new residents and businesses, they are likely to compete with each other to attract them. This is documented by a growing literature on how local governments use tax competition to attract residents and businesses. The strategic behaviour of jurisdictions is likely multidimensional (Blöchliger and Pinero Campos, 2011) and not limited to fiscal instruments, as assumed by most researchers. Indeed, land use policies may also be implemented strategically to attract residents or businesses, and they often respond to land use decisions by neighbouring jurisdictions. Thus, competitive behaviour of local governments in both policy areas is likely to have important consequences for land use patterns.

4.1. Competition between local governments is multi-dimensional

28. Competition between local governments varies in its intensity and its scope. It is less pronounced in highly centralised countries where local governments have little scope to set their own tax and land use policies and do not draw a fiscal benefit from them. However, even in those countries, local governments are likely to compete with each other, for example by trying to attract businesses that provide well-paying jobs for their residents. Competition between local governments is likely to be most intense in highly decentralised countries, where local governments have considerable control over both land use and tax policies and benefit from attracting specific groups of residents and businesses. In all cases, the ways in which local governments compete depends on the incentives that they face and the instruments that they control.

29. Blöchliger and Pinero-Campos (2011) survey the literature on sub-national fiscal competition in OECD countries. Heyndels and Vuchelen (1998) investigate the potential strategic interactions among Belgian municipalities in setting property taxes. They find that local jurisdictions do indeed mimic tax rates of neighboring municipalities, but this interdependency decreases with geographical distance.

Brueckner and Saavedra (2001) do a similar analysis for 70 cities of the Boston metropolitan area. They point out how, in their theoretical framework, the sign of the slope of the reaction-function–which describes how the tax rate in a given municipality changes according to the tax rate of neighboring municipalities–is ambiguous. This suggests that establishing whether property-tax competition is present is an empirical question. Consistent with Heyndels and Vuchelen (1998), they also find an upward-sloping reaction function.

30. Most of the fiscal competition literature is limited to the analysis of one instrument whereas local jurisdictions usually have control over several policy instruments. In particular, theoretical models show that the uncooperative equilibrium may not only be characterized by inefficiently low taxes on mobile factors but also by an overprovision of public inputs that benefit the mobile factor (Bucovetsky, 2005; Fenge et al., 2009). Consistent with this proposition, Hauptmeier et al. (2012) suggest that local governments do in fact use both tax rates and public inputs to compete for mobile tax bases.

31. Strategic behavior of jurisdictions is not limited to fiscal instruments. Land use regulation as well may be implemented strategically. Brueckner (1995) and Helsley and Strange (1995) are among the first to analyse such interactions, pointing out how local land use regulation–in the form of growth control policies–may be strongly intertwined: the adoption of a growth control policy restricting the supply of new land for development in a given jurisdiction creates spillovers that influence land use policies of nearby jurisdictions. Brueckner (1998) provides empirical evidence by investigating strategic interactions of growth-control restrictions implemented by Californian cities. In line with the results obtained for property tax competition, local jurisdictions seem to mimic the growth control policies of nearby jurisdictions. Put differently, a given jurisdiction is likely to adopt stringent growth control restrictions when nearby jurisdictions implement tight growth controls as well. Brueckner's (1998) theoretical framework suggests that this interdependency arises because growth control policies in a given municipality depend on the regional housing market supply-responsiveness, which results from growth control policies in other jurisdictions.

4.2. The interaction between land use regulation and fiscal policy

32. Local governments might affect land use patterns by interacting land use and fiscal policies–that is, local authorities may implement the two instruments simultaneously when competing to attract new residents and firms.[12] From a theoretical perspective, the joint effect of these two channels on land use patterns is not obvious. Moss (1977) conceptualizes an interaction between minimum lot size restriction and property taxes. In his model, minimum lot size requirements may increase the conversion rate of rural into urban land, thus increasing the size of an urban area. However, this conversion is slowed down when property taxes on developed land increase faster than those on agricultural property. Voith and Gyourko (2002) adopt a theoretical framework in which a public policy that subsidizes homeownership according to income, thereby favoring higher income households, may lead to greater income segregation when lot size restrictions are binding. Even in a setting where poor and rich households have the same preferences for city versus suburban living, there is residential sorting by income. This implies that the observed migration of richer households towards suburban areas–and the subsequent low density development–could have occurred, in part, due to a combination of land use policies and fiscal incentives. A study by Basten et al. (2015) supports this conclusion as it documents that high-income households systematically sort into low tax jurisdictions which tend to be low density places, where the provision of local public goods and services is more expensive.

12. The authors of this report currently investigate this proposition in a larger scale research project funded by the Swiss National Science Foundation. In particular, the project explores whether the bundle of policy instruments local jurisdictions compete upon also includes various aspects of land use restrictiveness, i.e., whether municipalities in Switzerland implement a form of minimum-lot-size or height restrictions.

33. Finally, several other factors – besides land use and fiscal policies – may influence residential location, and thus competition between local governments. Banzhaf and Walsh (2008) show that local amenities – such as clean air – affect residential location choices, with higher income and lower income households leaving/entering more polluted places. Blöchliger and Pinero Campos (2011) argue that both capitalization of fiscal policies into housing prices and agglomeration economies reduce inter-jurisdictional competition. Hilber and Mayer (2004) provide empirical evidence that equalization grants also reduce competition. Specifically, they investigate the effect of school funding equalization reforms–which reduce differences in the local public good provision by equalizing school finances–in the United States. They find that more equalization is associated with less sorting. In other words, the competition in education investments has been strongly reduced by the reforms. We speculate that by imposing some degree of coordination in land use planning, central governments may hinder land use competition as well.

4.3. The role of intergovernmental frameworks for tax and land use policies

34. Given the interaction between fiscal policy and land use regulation and their effect on land use, it seems likely that more decentralized governments are more prone to sprawl than more centralized ones. In a centralized setting government imposes fiscal and land use regulations homogenously across the country, which means that sub-national jurisdictions can no longer use them strategically.[13] In such a case, the only item that allows local jurisdictions to sort households along income is the value of land, which varies across locations due to factors unrelated to fiscal or land use regulatory variables. In a setting where local jurisdictions have little political autonomy, local jurisdictions may not be able to engage in fiscal or land use competition. While in such a setting the central government will be able to impose policies, such as urban containment, that cannot easily be circumvented via sorting of households and firms, it comes at a significant cost. Indiscriminately imposing fiscal policies and regulatory policies can have negative effects on land use development and housing markets and especially on housing prices. Box 5 illustrates this point by comparing two countries that–in accordance with their governmental structure–feature diametrically opposed fiscal and land use planning policies, namely the United Kingdom and Switzerland.

35. Recent research shows that binding housing supply constraints–such as tight land use regulation–and tax differentials may be responsible for misallocating households across space. In a headline-grabbing study, Hsieh and Moretti (2015) argue that housing supply constraints are responsible for misallocation of the labor force across the United States: As mobile workers were increasingly unable to live in more productive cities due to regulatory supply constraints, wage dispersion across 220 US metropolitan areas doubled from 1964 to 2009, lowering production output and welfare of the whole country. Hsieh and Moretti (2015) estimate this effect to be substantial. They calculate that lowering regulatory constraints in high productivity cities like New York, San Francisco or San Joes to the level of the median US city would increase US GDP by 9.5%. Similarly, Fajgelbaum et al. (2015) argue that US state taxes may be responsible for the spatial misallocation of individuals and firms, thus reducing workers' welfare. As illustrated in Boxes 2 and 3, capitalization effects may prevent mobile workers to move to larger, more productive agglomerations. In this respect, the UK development control system presented in Box 5 may have negative externalities that go well beyond housing affordability issues, but have implications for productivity and growth as well (Barker, 2006).

13. Even in quite centralized countries such as the United Kingdom, land use policies are partially assigned to local authorities though and they can to some extent choose local regulatory restrictiveness. Moreover, even if the constraints were applied homogenously throughout the country, identical regulatory constraints (e.g. height restrictions) would be more binding in a high-demand compared to a low-demand place. To illustrate: A 100 meter height restriction in the wilderness or in a desert will not be binding at all, while it is extremely binding in places such as Hong Kong or Manhattan, NY.

Box 5. Fiscal and planning systems: The United Kingdom versus Switzerland[14]

The government structure of the United Kingdom and Switzerland are at opposite poles in the centralization-decentralization spectrum. While the UK's land use planning system is one of the most rigid in the world - although it leaves local governments some discretion - and its fiscal system is heavily centralized, Switzerland is an extremely decentralized country, with strong fiscal and regulatory powers allocated to the local level.

The Anglo-Saxon (British) planning system–which has been adopted 'in spirit' by most of the Commonwealth countries, such as Australia or New Zealand–differs starkly from continental European planning systems. Two main features distinguish the British 'development control' system from the continental European 'rule-based zoning' system. First, development control is highly centralized and imposes stringent land use restrictions to contain urban growth throughout the country ('green belts' that are largely sacrosanct for development for example surround all major urban centers in England). Second, development control is discretionary rather than rule based. This means that every single planning application is subject to review and political opposition by local 'not in my backyard' (NIMBY) residents, making new development extremely difficult and–due to the planning process related costs–costly and creating a significant degree of uncertainty for would-be developers often making development projects unviable. In contrast, in a rule-based zoning system, as long as a plot of land is within a residential zone and developers follow the rules, they have the automatic right to develop the land for residential purposes.

Moreover, the UK fiscal system provides very few fiscal incentives to local authorities to permit new development: Local authorities bear most of the cost of providing public services to new entrants but cannot reap the benefits in the form of local tax revenue, as most taxes are levied by the central government. Moreover, increases in the local (council) tax revenue are, in the medium run, equalized away through a central government grant system. Thus, because there are so few fiscal incentives to permit local development, local planning authorities have strong incentives to cater to NIMBY residents, who in turn have strong incentives to oppose new development in order to protect their asset values. Put differently: the development control system facilitates NIMBY-behavior. Successful opposition to new development via NIMBY-residents in this context is strongest near green belts as homeowners, in accordance with Fischel's (2001a, b) homevoter hypothesis, have particularly strong incentives to protect their nice views and open space. As a consequence, land use patterns in the UK are not sprawling. New development is compact, although at a lower density than in the absence of height restrictions. This, however, comes at a staggering cost. The combination of lack of fiscal incentives and development control has created a vicious circle leading to an unprecedented housing shortage and severe housing affordability crisis. To provide an order of magnitude of the effects of the development control system on housing markets, Hilber and Vermeulen (2016) estimate that housing prices would have increased 100% less between 1974 and 2008 in the absence of any regulatory constraints.

In contrast to the United Kingdom, Switzerland–a highly decentralized country with fiscal competition both at regional and local level–has a rule or code-based planning system, where construction projects are automatically approved as long as they comply with the requirements of the respective code. These requirements usually consist in attributing land use type (residential, commercial, industrial, or mixed) to plots of land zoned for new construction and in defining the development intensity (in the form, for example, of floor to area ratios). This makes it extremely difficult for local NIMBY residents to successfully oppose new development. Moreover, the Swiss fiscal system provides strong incentives to local municipalities to allocate land for new residential development: local public good provision is financed by levying progressive income taxes and municipalities can choose tax rate levels. Local municipalities thus have strong fiscal incentives to allocate large plots of land at the outskirts of their municipalities in an attempt to attract high-income tax payers. The combination of a flexible planning system with local fiscal incentives makes the housing supply in Switzerland fairly elastic. As a consequence, housing affordability is considered less of an issue in Switzerland, except in major agglomerations–mainly Zurich and Geneva–where physical and geographical supply constraints (lakes, mountains) are quite binding. The main policy concern in Switzerland is thus urban sprawl and preservation of the touristic countryside: Swiss voters are increasingly concerned about urban sprawl as new development in suburban areas is typically quite scattered and low density. Moreover they are concerned about blighting the most beautiful and touristic Alpine areas. This has recently led Swiss voters to approve an initiative that imposed a ban on the construction of new second homes in tourist areas, with adverse consequences for local residents.[15]

14. This comparison is based on Hilber (2015a, b), Hilber (2016) and Hilber and Schöni (2016a).

15. Hilber and Schöni (2016b) show that the ban on new second home construction reduced transaction prices in the affected tourist areas by about 12%. Their finding suggests that the negative effect of the ban on local economies dominated the positive landscape preservation effect. Primary homeowners and local workers in touristic areas may thus be the most adversely affected by the policy.

4.4. Summing up

36. Three main lessons can be learned from the strategic behavior of jurisdictions when adopting and implementing fiscal and land use policies and the combination of the two.

- Jurisdictions compete along several dimensions to attract new residents. This is true for both fiscal and land use policies, as jurisdictions tend to mimic fiscal and planning decisions of neighboring governments.
- The interaction of fiscal policy and land use policy likely alters land use patterns, potentially reinforcing sprawl in decentralized settings, and independently so of households' preferences for living in urban versus suburban areas. More research in this area, however, is needed.
- In more centralized settings, where fiscal and yardstick competition are less relevant, urban containment policies are easier to enforce. However, without fiscal autonomy local governments enjoy fewer incentives to develop land, even when planning is local and especially when combined with a local development control planning system. This in turn may induce housing shortages.

5. Government spending and transportation networks

5.1. The role of transport infrastructure for sprawl

37. This section considers how investment in transportation networks affects land use. The section focuses on transportation infrastructure, leaving out other aspects–such as the relative price of public versus private transportation or the tax treatment of transport – that may affect land use patterns. It also leaves out the role of intergovernmental frameworks and metropolitan governance, which has a considerable role for investment in transport infrastructure, productivity, and ultimately land use (Ahrend et al, 2014). The results presented in this section can be interpreted causally (and not as simple correlations) as the studies we consider in this section have taken great care to handle reverse causality and other endogeneity issues.

38. As argued by many researchers, and Glaeser and Kahn (2004) in particular, the sprawling patterns observed during the last century can be largely attributed to the rise of the automobile. Indeed, when considering a sample of 70 international cities Glaeser and Kahn (2004) find strong evidence that car ownership encourages sprawl.[16] An important point in this context is that advances in transportation technology would not have increased peoples' mobility without governments' transportation investments.[17] Baum-Snow (2007) investigates the relationship between the observed population decline in US central cities between 1950 and 1990 and the construction of new highways. His estimates suggest that inner city population decreases by about 18% due to the construction of a new highway passing through the city. Interestingly, Baum-Snow (2007) points out that this population dispersal does not seem to be affected by jurisdictions' boundaries, suggesting that space–rather than political boundaries–is the crucial factor influencing land use patterns. Duranton and Turner (2012) tackle a complementary question, namely the impact of highway construction on the distribution of employment across–rather than within–U.S. cities between 1983 and 2003. Their key finding is that a 10% increase in a city's highway stock increases its

16. In contrast, Burchfield et al. (2006) find that the density of major roads in the urban fringe does not significantly influence sprawl patterns. As they point out, however, the estimated impact may be biased due to reverse causality: a denser road network may lead to low density development but low density development may encourage a more dispersed road network.

17. These investments are, of course, endogenous to the development of transportation technologies. The proposition that the car shaped development patterns remains thus true.

employment by about 1.5% over the considered period. Additionally, they find that adding a kilometer of highway to a random city would lead to a stronger increase in population (or employment) than allocating it according to the choices observed. Their findings hold two important lessons. First, policy makers planning new highway construction ought to take into account the increase in the demand of public services resulting from the increase in population. Second, highways appear to be spatially misallocated: new highways tend to be built where negative population shocks occurred and where labour and land are relatively cheaper.

5.2. Transport infrastructure investment, local fiscal policy and land use regulation

39. Garcia-López (2012) extends Baum-Snow's (2007) work by empirically investigating the effects of improving the transportation infrastructure–both roads and railways–on land use patterns. By analyzing transportation and land use data from the Barcelona metropolitan area between 1991 and 2006, he finds that transportation improvements not only cause suburbanization, but also affect residential choices of individuals living in the inner city. These two distinct effects occur because by improving the accessibility to the highway system, suburban areas are able to attract new residents, and, because (inner) city inhabitants tend to live near railroad stations. Garcia-López et al. (2015a) provide evidence on the impact of highways on land use patterns of Spanish cities between 1960 and 2011. Focusing on population changes in both central cities and suburban areas, they find that i) highways emanating from central cities reduced central city population by about 8-9%, ii) suburban areas located in the proximity of highway ramps were subject to a 20% population growth over the considered period, iii) the population growth of suburban areas is more pronounced in municipalities that are more distant to the central city, and iv) population density of suburban municipalities grew by 8% for each additional kilometer of being closer to the nearest highway ramp. Similar development patterns resulting from the structure of the transportation network are observed for Chinese cities. Baum-Snow et al. (2015) find that since 1990 about 4% of the population of Chinese cities has been displaced to surrounding regions for each single radial highway passing through the city. The displacement effect is even bigger for ring roads around the city, which are found to displace an additional 20%. Interestingly, Baum-Snow et al. (2015) also consider the effect of both highway and railroad networks on the location decisions of the service and industrial sectors. They conclude that the effect of the transportation network is to spread employment. Finally, Deng et al. (2008) provide empirical evidence suggesting that highway density led Chinese cities to expand spatially between the late 1980s and 2000s.

40. The literature suggests that transportation networks play a major role in location decisions of households. There is, however, little research that links transportation networks to local fiscal and land use policies, and to development patterns beyond simple density. Two exceptions are Garcia-López et al. (2015b) and Garcia-López (2016). Garcia-López et al. (2015b) investigate Spanish municipalities that gained access to a new highway between 1995 and 2007. Their results indicate that municipalities did substantially increase the amount of land zoned for development and that this increase was larger in high-demand places, not subject to major geographical constraints, and where new development was aligned with the interests of the municipality. They conclude that zoning follows market forces, which is in line with earlier findings for the United States (Wallace, 1988; Evenson and Wheaton, 2003). A closer look at the link between highway construction and development patterns is provided by Garcia-López (2016), who investigates the impact of the stock of highways on urban sprawl. By measuring sprawl according to the Burchfield et al. (2006) index, he analyses development patterns of European cities between 1990 and 2012. He finds that a 10% increase in the highway stock leads to a 0.4-0.8% increase in residential land area and a 0.7-1.2% growth in the share of undeveloped land surrounding a residential parcel.

5.3. Summing up

41. Three main lessons can be learned concerning the impact of investments in transportation networks–and highways in particular–on land use patterns.

- By investing in transportation networks, governments reduce transportation costs of people and goods. This pushes both households and firms to spread into suburban areas, lowering the central city and increasing the suburban population, although well-designed transport networks may help create mixed neighborhoods and polycentric cities.

- Development in suburban areas–residential in particular–appears to be sprawling in proximity of major highways. The observed increase in the density of suburban municipalities located near highways may simply be due to an increase in the conversion rate from farmland into residential/urban surface. However, more research is needed in this area.

- There is some evidence that jurisdictions that become connected to the transportation network implement local land use and fiscal policies to attract new residents, such as zoning new land for development.

6. Summary and outlook

42. This paper reviewed the literature linking land use policies and fiscal instruments to land use patterns. In particular, the paper surveyed policies and their impact in centralized versus decentralized fiscal and regulatory frameworks. The paper examined four main topics related to land use: 1) the role played by land use regulation, 2) the impact of fiscal instruments, 3) the strategic use of planning and fiscal policies and their interaction, and 4) the effects of investing in transportation networks.

43. The literature review offers several important findings. Although land use patterns are largely shaped by transportation technologies–and in particular by road transportation–there is evidence that intergovernmental frameworks influence land use patterns in important ways. In more decentralized settings, fiscal and land use policies encourage sprawl for two main reasons.

- *First*, in decentralized settings local governments compete to attract high income/wealthy residents without internalising the impact of their policies on the greater urban area. With a local income tax and - to a lesser extent–a property tax at their disposal, local jurisdictions have strong local fiscal incentives for (residential) development, especially at the outskirts of the localities where land is more readily available. Local residents have incentives to enact 'fiscal zoning' policies such as minimum-lot-size-restrictions or–to a lesser extent–height restrictions. The empirical literature also suggests that local jurisdictions in more decentralized settings tend to mimic strategies of nearby governments.

- *Second*, households and firms are mobile. Sprawl is driven by households and firms who can respond to local planning policies and local fiscal incentives by selecting where to locate and how much land/housing/commercial space to consume (Tiebout sorting). Thus, local urban containment policies, unless they are strictly coordinated and enforced, are likely to be circumvented by mobile households and firms. On the other hand, making new residents pay for the incremental cost of providing public services via impact or development fees appears to reduce scattered development, consistent with theoretical considerations.

44. Mimicking strategies documented in the fiscal competition literature appear to apply for land use policies as well: a local government surrounded by jurisdictions with tight land use policies is more likely

to implement stringent land use regulation. This suggests that sprawl may be reinforced by mimicking strategies.

45. Overall, sprawl seems to be less pronounced in more centralized settings. This is in part because urban containment policies are easier to enforce in a setting where land use policies are applied homogenously across space and, in which sorting does not provide a way to circumvent the policies. In part it is because in centralized settings local governments have little fiscal autonomy, implying that they have few tax-induced incentives to permit development at the outskirts of the localities. Moreover, fiscal redistribution from the central government to lower level authorities virtually eliminates fiscal competition between jurisdictions. If a local jurisdiction permits new development, the additional tax revenue quickly disappears due to redistribution via central government grant systems. To support the idea that intergovernmental frameworks indeed affect land use patterns as predicted, the paper briefly compares two countries–the United Kingdom and Switzerland–that are at opposite poles in the centralization-decentralization spectrum.

46. The paper also considered how investment in the transportation network affects land use patterns. This is particularly relevant for central (or federal) governments as such investments are typically carried out at the national/regional level. Empirical findings suggest that highways that connect major urban areas usually decrease the inner city population and increase the suburban population, thus extending the overall urban surface area. The development occurring at the fringe of the urbanized area usually displays low density patterns. Importantly, the urban expansion due to transportation network enlargement appears to be independent of political boundaries and mainly depends on geographic distance. Again, sprawl as a result of investment in the transportation network is much more likely in more decentralized settings: local jurisdictions that become linked to the transportation network tend to follow market forces and convert more open land to satisfy the positive demand shock coming from inner city inhabitants who move further out.

47. Apart from the aforementioned lessons, there are many unanswered questions. The following gaps in the relevant literature can be identified:

1. Despite being theoretically sound, the proposition that jurisdictional fragmentation increases sprawl and leapfrog development is not (yet) supported by empirical evidence. This is arguably because across-government comparisons in decentralized countries are difficult to conduct due to, for example, a lack of data harmonization across regional statistical authorities.
2. The effect of the widely used property tax on land use patterns is not clear. This is perhaps because the tax is combined with a variety of local land use policies that make it difficult to isolate the effect of a tax change from all other policies.
3. Theoretical and empirical research that explores the linkages between land use and fiscal policies and how these policies interact to affect land use patterns is virtually non-existent. This is likely due to the econometric difficulties of handling numerous endogenous variables in the same regression and a lack of quasi-natural experiments.
4. There is little knowledge of the compatibility of different land uses, e.g. residential versus commercial, and the consequences for land use patterns.
5. The shape of urban development caused by transportation networks has not been fully explored yet. There is a potential dis-amenity effect of living near highways, air and noise pollution, for example, that might have an impact on land use patterns, but has not been considered in the literature so far.

48. Finally, more research is needed to understand how transportation networks interact with local land use and fiscal policies. These questions are left for future research.

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