



Social infrastructure and the preservation of physical capital: Equilibria and transitional dynamics



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ABSTRACT

We study the mechanisms according to which social infrastructure influences the preservation of physical capital and, consequently, economic growth. The model considers that social infrastructure is a specific type of human capital, which acts in order to preserve already existing physical capital, by, e.g., reducing the incentive for rent seeking or corruption. Using an innovative methodology in economics, the Gröbner bases, we study the equilibrium of our model and conclude for the existence of two feasible steady-states or of unicity according to different combinations of parameters, highlighting a trade-off between consumption and production on one hand and social infrastructure and physical capital accumulation, on the other. We also present sufficient conditions for saddle-path stability. Finally, we describe transitional dynamics and calculate welfare effects from which we show that strengthening social infrastructure increases welfare.

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1. Introduction

We explore the effects of social infrastructure on the preservation of physical capital and, consequently, on economic growth. This is an unexplored link in the theory of economic growth, even within the literature that relates institutions to growth. In fact, social infrastructure can be associated with the existence of institutions, formal and/or informal in nature, that may help to decrease corruption, rent seeking, and cheating while improving transparency and trust in the economic environment of a country, facilitating the preservation of the existing physical capital stock, and enhancing economic growth.

The role of institutions on the economic performance of countries acquired such a relevance that it gave rise to a new branch in economics, designated by “institutional economics”, which was born with the seminal work of North [32], among others. Empirical work has emphasized the important contribution of good institutions to economic growth and development, and there is an important consensus on this conclusion, as we can see in the work of Acemoglu et al. [1,2], Dollar

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and Kraay [20], Easterly and Levine [21], Hall and Jones [24] and Rodrik et al. [34]. In this study, we follow this consensual view and assume that good institutions contribute to economic growth. However, we go further and consider that the channel is through the protection of physical capital or investment. In fact, empirical literature has found a negative relation between corruption levels and capital accumulation (Campos et al. [15]), corruption and productivity (Salinas-Jiménez and énez [35] and Salinas-Jiménez and énez [35]), social barriers and capital accumulation (Grafton et al. [23]), and social capital and corruption (Bjørnskov [10]); it also found a positive relationship between governance institutions and investment (Aysan et al. [5]), responsibility and capital accumulation (Breuer and Mcdermott [13]), and trust and capital accumulation (Yamamura and Inyong [41]). Closer to our work, Bu [14] presented evidence according to which depreciation rates are higher in developing countries than in developed ones. According to the author and references therein, some of the explanations may be related to greater risk of expropriation, higher uncertainty on future returns from investments, lower maintenance expenditures in those countries, associated with greater corruption, e.g. factors linked with institutions. For instance, Tanzi and Davoodi [38] showed that higher corruption is associated with lower expenditures on operations and maintenance of physical capital, which calls for a relationship between institutions and the depreciation of physical capital, exactly the link that we uncover.

There is a related extensive literature on the importance of institutions in the realm of evolutionary game theory. A very detailed and recent survey is Perc et al. [33]. In this literature, the interaction behaviour of different individuals is analyzed within game theoretical framework (other examples are Hilbe and Trausen [26] and Szolnoki and Perc [36]). Because different possibilities emerge from different behaviours (e.g. free-riding, cooperative), then multiple states may arise. In this sense there is a parallel between that literature and our contribution, although we place ours in more aggregated terms.

We define institutions as being associated with the concept of social infrastructure as in the work of Hall and Jones [24] (pp.84). For these authors social infrastructure is composed by "...institutions and government policies that determine the economic environment within which individuals accumulate skills, and firms accumulate capital and produce output". We use this definition of institutions in a broad sense, including both formal and informal institutions. While formal institutions include constitutional constraints, statutory rules, property rights, rule of law, and other political and legal constraints; informal institutions arise from norms, culture, and customs, emerging spontaneously (Williamson [40]). But formal institutions can contribute to economic growth only if they incorporate some of the principles established and agreed upon by informal institutions. This definition of informal institutions proposed by Williamson [40] is closely related to the concept of social capital, as well as the notions of social infrastructure and trustworthy institutions.¹ The notions of social capital and its most commonly used empirical proxy, trust, are related, and work as a substitute for the notion of property rights (Aharonovitz et al. [3]). There is a growing empirical literature relating institutions, social capital, and economic growth, namely Beugelsdijk and van Schaik [8], Bjørnskov [12], Cuesta [18], Knack and Keefer [27] among others, pointing to a positive association between the mentioned variables, but still presenting diffuse results. In a model of endogenous growth, Strulik [37] studies how social fractionalization and aggressiveness affect economic growth and show that civil conflict deters it.

In our work we focus on the positive role of institutions (social infrastructure) in preventing the depreciation of physical capital, a role that earlier empirical studies have uncovered, but that theory has so far neglected. We build an endogenous growth model with both physical and human capital accumulation in which we incorporate the important role of social infrastructure in facilitating physical capital preservation. Our main goal is to study an economic environment in which this feature is incorporated, focusing on the steady-state features and the transition path of the economy to the steady-state. The model will also allow us to access the consequences of increasing this preservation effect both in transition and in equilibrium. The precise mechanisms according to which social infrastructure influences output (and hence economic growth) are underexplored in the literature.²

We fill this gap, proposing specific mechanisms according to which social infrastructure influences output by its direct effect on physical capital preservation. In the model, social infrastructure is modelled as a particular type of human capital allocation consisting of hours spent in several activities such as: petitions, influence groups, participation in informal networks that spread information, etc., i.e., activities of civic and community participation, which help to improve the level of civic rights, property rights, law and order, and ultimately the social infrastructure of a country. Through these effects social infrastructure reduces the incentive for rent seeking, corruption, predation, and cheating, and thus helps to preserve the existing physical capital stock of the economy. We analyze the economic consequences of such mechanisms.

To this end and given the structure of the model, involving four variables, four equations and seven parameters, we use an innovative method of algebraic geometry in the economics field, recently proposed by Kubler and Schmedders [29,30], to study the existence and multiplicity of steady-states' solutions and equilibria – the Gröbner bases. The solution of economic growth models is often characterized as a set of multivariate parameterized polynomial equations, resulting from setting growth rates of stationary variables to zero. Finding all steady-states of the model is thus equivalent to being able to solve the corresponding polynomial system. In many cases, as referred by Kubler and Schmedders [29], standard numerical

¹ North [32] and Knowles [28] also emphasized the importance of informal institutions. Knowles [28] relates the concepts of informal institutions and social capital, claiming that they are very similar. Berggren and Jordahl [7] find an empirical positive relationship between the existence of a good legal structure and property rights (formal institutions in our definition) and the level of trust in economies (informal institutions in our definition).

² Chin and Chou [16] also model social infrastructure in a growth model, but in their model this variable affects the division of time between productive and non-productive activities. In our model it affects physical capital accumulation.

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