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Tax discrimination against inter-firm networks

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ABSTRACT

The purpose of this study is to investigate how local and central governments utilize inter-firm transaction network information for corporate tax discrimination. We assume a two-stage game with two asymmetric emerging regional markets and no prior investors. First, governments offer a different tax level to each firm. Next, firms embedded in a fixed transaction network choose a region in which to invest, prompted by the incentive of co-locating with their direct transaction partners. The game is played with incomplete information on the stand-alone payoffs of other firms. First, we find that when two competitive regional governments play the first stage to maximize their tax revenue, they both propose lower tax levels to firms with more direct partners. Second, when the central government plays the game to maximize social welfare, it offers a tax incentive to concentrate firms in the advantageous region. In addition, this tax incentive is greater for firms that have a higher Katz–Bonacich centrality. Furthermore, when a uniform tax is the only practical option for the central government, the level of the uniform tax depends on the average value and variance of the Katz–Bonacich centrality of the network.

1. Introduction

Finding good sources for procurement of material and sales channels for products in the local market emerges as major challenges for a firm that establishes a new affiliate in a distant market. Companies starting new transaction with local companies sometime suffer from various kinds of frictions like mismatch in design and quality of products and delivery system of them (e.g. Reid, 1995). Hackett and Srinivasan (1998) point out that some firms choose to invest together with their trading partners for replicating the current transaction partnership in the new investment destination to do away with some uncertainties of operating in a distant market.

With regard to the incentive to replicate the current transaction pattern and co-locate with current trading partners, there is growing concern about the impact of the network structure of inter-firm transaction on location choice. A strand of empirical studies on the agglomeration effect or network externality of investment from the same home country (e.g., Chang and Park, 2005; Chung and Song, 2004) and influence of group companies (keiretsu) of Japanese firms (Belderbos and Carree, 2002) indicate such network effects on foreign direct investments (FDI). Recent empirical works use more detailed data on networks describing a firm's trade with other firms to investigate the influence of direct and indirect links with other firms on the FDI decision of each individual firm (Yamashita et al., 2014; Itoh and Nakajima, 2014).

The primary question investigated by this study is how local and central governments utilize inter-firm network information to formulate policies. When the location choices of firms interact, providing an incentive to a firm will lead its direct partners and, subsequently, even its indirect partners, as well as the targeted firm. Therefore, local governments may offer special tax incentives to key firms in the non-heterogeneous inter-firm network, because these firms influence others and hence attract investment and maximize tax revenue.[1] On the other hand, it is well known that such discriminatory tax competition can lead to an undesirable location of firms. In this case, the central governments or international authorities such as OECD must coordinate and harmonize the distorted interregional and international competition.[2] To this end, these governments would benefit from having detailed information on the network structure. Several governments are already aware of the importance of inter-firm networks. Our analysis aims to help these governments, as well as other governments that may not be as aware, by providing new perspectives for policymakers.

We describe the location choice of firms by using a brief incomplete information coordination game played on a fixed network. Our model assumes that there is a set of firms with the same home market and there are two asymmetric emerging regional markets with no prior

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[1] For example, Peugeot Citroen's investment in Ryton, U.K., is subsidized by 30 million euros with an aid intensity of 9.8%.

[2] For example, the European Union (EU) initiates codes, regulations, or coordination measures against harmful tax competition; "A package to tackle harmful tax competition in the European Union" was adopted by the European Council meeting in 1997.

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investors. The firms choose one of these regions to invest. We assume that the current transaction relationship of each of these firms with others in the home market is exogenously given and fixed, and that they have an incentive to co-locate with their transaction partners. In other words, there is network-externality of location choice. We further assume that the "network" as an aggregation of these domestic relationships is given and fixed. Since part of the profits of these firms is assumed to be unobservable, each firm makes decisions based on its probabilistic expectation about these profits. In this setting, we can describe diffusion and convergence of expectations in the entire network such that the expectation of a single firm affects all the indirectly linked firms through its influence on the strategies of its direct partners. Given a uniformly distributed random profit, such diffusion of expectation yields a unique strategic equilibrium characterized by the Katz–Bonacich centrality measure of a network such as those presented in existing network games like Ballester et al. (2006).[3]

Our primary focus is to consider how local and central governments intervene in the location choice of firms in an inter-firm network. We suppose that these governments do not have complete information on the random profit of each firm. However, they do have complete information on the network structure and therefore apply tax levels based on the position of firms within the network. First, we investigate the corporate tax competition between the two regional governments, both of which are trying to maximize total tax revenue. The tax competition game is played before the firms play the location choice game, and the information on the tax levels offered to all firms is known to both regional governments. Providing a tax incentive to a firm attracts that particular firm, but also attracts its direct and indirect partners via diffusion of expectation. Considering this tax advertisement effect, governments offer larger tax incentives to firms that are more influential within the network. Our results show that the competing governments offer firms with a large number of direct partners (i.e., firms with a high "degree") a lower tax level. Since the number of transactions completed by a firm generally increases as the size of the firm increases, our results imply that tax discrimination by firm size is a good approximation of network-based taxation when network information is unavailable to governments.

Second, there exists the well-known problem that tax competition can lead to location distortion. Therefore, we investigate the socially optimal policies of central governments that aim to adjust the externality of firms to maximize social welfare (i.e., the aggregated profit of all firms). The less advantageous region always becomes a tax haven as a result of tax competition. However, this is harmful, since firms should be relatively concentrated in the advantageous region because of the externality of location choice. Our analysis suggests that the tax incentive to concentrate firms in the advantageous region should be relatively larger for firms with a higher Katz–Bonacich centrality. Furthermore, we investigate optimal uniform taxation as a more practical second-best measure of central government or international authorities facing much restriction in harmonizing tax. In this case, the tax rate does not vary according to a firm's position within the network, but the network information is still useful to central governments because the average and variance of the Katz–Bonacich centrality of the entire network help determine the optimal uniform tax rate.

There are two strands of literature related to this study. The first refers to recent studies on tax competition that consider the heterogeneity of firms. Most of the initial work on tax competition, such as that of Wilson (1986) and Zodrow and Mieszkowski (1986), focuses on how countries and regions differ when setting corporate tax levels. More recent studies present the incentive for tax discrimination as being based on footlooseness (Hong and Smart, 2010) and productivity (Baldwin and Okubo, 2009; Haulfer and Stahler, 2013). However, to the best of our knowledge, no existing study has examined tax competition by considering inter-firm networks. Therefore, this study aims to contribute to this gap in the literature.

The second strand of literature deals with the issue of price setting by supplier(s) in the market of network goods with consumption externalities. In this case, the relationship between consumers and suppliers is very similar to that between firms and governments, as considered here. Candogan et al. (2012) consider that consumers choose continuous volumes of consumption under complete information, while Bloch and Quérou (2013) find that consumers decide whether to purchase one unit of the indivisible good under incomplete information. Despite these differences, the decisions made by consumers and firms in these studies are described by the Katz–Bonacich centrality and are hence mathematically identical. One critical difference between our model and those of other studies is the competition between two price-setting governments.[4] The assumption of two competing governments brings more severe tax competition with which to influence firms, which leads to tax discrimination. This differs from the behavior of the single suppliers in Bloch and Quérou (2013) and Candogan et al. (2012) who do not discriminate price in reciprocal consumer networks, although such a strategy is feasible.[5] Furthermore, we present entirely original research findings pertaining to the analysis of socially optimal policies that maximize the total profit of firms (i.e., consumers of related models) and show how a welfare-maximizer should use the network information.

The rest of the paper is organized as follows. The model is presented in Section 2. Section 3 investigates stage 2 of the game where firms choose their location based on corporate tax, and Section 4 investigates stage 1 of the game where the two local governments set tax levels. Section 5 considers socially optimal policies of the central government, and Section 6 concludes.

2. Model

2.1. Firms

Set $N = \{1,2,\ldots,n\}$ is a finite set of risk-neutral firms from the home country (e.g., Japan) embedded in a given $n \times n$ transaction network, denoted by G. The (i,j) component of G, denoted as $\phi_{ij} \geq 0$, represents the strength of the transaction between firms i and j. In other words, a higher ϕ_{ij} means the firms are trading either a large amount or a less substitutable product. We assume that the network is symmetric, in which case $\phi_{ij} = \phi_{ji}$. Furthermore, $\phi_{ii} = 0$ holds for the diagonal components of the transaction network.

There are two emerging foreign regional markets, X and Y (e.g., China and Vietnam), with no prior investors, and each firm simultaneously chooses one of these markets in which to establish affiliates (i.e., interpreted as a greenfield investment). For this location choice decision, we assume that the colocation of affiliates among the trading firms in the home country yields a profit by replicating their transactions. When missing this replication of transactions, caused by a mismatch of locations, both sides of the trade suffer a loss of profit. The buyer suffers from a mismatch of the quality of the product with that from an alternative supplier, while the supplier loses sales. Suppose that the total profit of two trading firms by colocation depends on the strength of their transaction.

Then, considering some Nash-bargaining on the total profit, with equivalent bargaining power and disagreement on the profit on both

[3] Since this measure was first proposed by Katz (1953) and generalized by Bonacich (1987), Ballester and Calvó-Armengol (2010) named the index after them.

[4] Although Banerji and Dutta (2009) examine price competition between two suppliers, only uniform pricing is feasible for their suppliers.

[5] Note that Candogan et al. (2012) also consider the case of directed networks in which the monopolist chooses price discrimination.