Do Agency Costs Affect the Optimal Matching Grant Rate in a Model of Tax Competition with Labor Market Imperfections?

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Abstract: We examine the effect horizontal fiscal externalities and labor market imperfections have on the optimal matching grant rate in a model where agency costs are inevitable. Since we take agency costs into account, the main results would be quite different from the standard conclusions of tax competition literature. We find that the degree of agency costs will determine the relationship between tax competition and the optimal matching grant rate and the relationship between unemployment rate and the optimal matching grant rate.

1. Introduction

Agency problems arise in any environment involving principal-agent relationship. Following the theory of agency, if the principal hope to make sure that the agent will make those decisions which would be optimal for the principal, agency costs are inevitable due to the differences between their objectives. This issue not only applies to the ownership structure of the firm, but also to the political agency process. There exist a number of recent studies analyzing agency problems. Jensen and Meckling (1976) explain that agency costs arise in any environment without cooperative effort between agent and principal. Besley and Case (1995) demonstrate that the incumbent will improve his welfare by putting in less effort, which is opposite to the objectives of voters. The marginal disutility of effort incurring agency costs can be resolved by the threats to the governments' re-election (see e.g. Seabright 1996). Belleflamme and Hindriks (2005) observe that yardstick competition between jurisdictions have both discipline effect and sorting effect within political agency framework. Voters can mitigate agency costs below the Leviathan level by a successful voting strategy (as pointed out by Wrede 2001).

For the case of fiscal externalities, this question has been analyzed by Dahlby (1996). Direct and indirect fiscal externalities are both able to be corrected by matching revenue, matching expenditure or equalization grants devised by the state and federal governments. Within vertical fiscal externalities framework, Dahlby and Wilson (2003) show that the jurisdictional government will underprovide or overprovide a local public good, which depends on the assumptions we follow. Following Zodrow and Mieszkowski (1986), the local public goods provided by the jurisdictional governments are underprovided through interregional property tax competition. Therefore, if the lump-sum tax cannot be operated by the jurisdictional government, the under-provision of the local public goods financed by the distortionary tax is inevitable in a standard model of tax competition. In order to solve this issue, it is often argued that intergovernmental matching grant devised by the federal government can be introduced to ease the exorbitant marginal cost of local public funds deriving from the downward pressure on tax rates, assuming that the federal government is a benevolent and omniscient entity (see e.g. Dahlby 1996).

A number of studies analyzing tax competition and the optimal capital tax have assumed a perfect labor market. Within this environment, the economy has a fixed labor supply, which can simplify the analysis. However, there is a widespread belief that unemployment is a universal problem for both developing countries and developed countries. Therefore, an imperfect labor market has been considered in more detail in a model involving tax competition. Richter and Schneider (2001) show that taxing capital can be seen as a third-best policy in an imperfect labor market when the head tax is not available for the jurisdictional government to finance a local public good. When this world is extended by assigning a fixed-wage leading to unemployment to the

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capital tax competition model, Ogawa and Sato and Tamai (2006) observe that the local public good, which is only financed by capital tax, is under-provided by jurisdictional government when capital and labor are complementary. This model is further developed by Eichner and Upmann (2012). As Eichner and Upmann (2012) explain, even when the fixed –wage assumption is relaxed and the wage rate and the employment level are determined on the imperfect labor market, the local public good, which cannot be funded by the head tax, is underprovided by the jurisdictional government assuming that overemployment is not feasible, since overprovision is considered as an unrealistic case. Following this claim, a matching grant from the federal government to the jurisdictional governments for local public goods is a strong instrument to solve the problem.

The literature (see e.g. Belleflamme and Hindriks 2005; Besley and Case 1995) pays great attention to agency problems and confirms that agency costs can raise the marginal cost of the local public goods provided in the jurisdictions. As a consequence, it will incur the undersupply of the local public goods in the jurisdictions if the marginal benefit of the local public funds is unaffected by that issue. However, they don't deal with agency problems in any situation involving horizontal tax externalities and labor market imperfections. In doing so, we find that the under-provision of a local public good by jurisdictional governments will be mitigated by tax competition and imperfect labor market if agency costs are large enough. Accordingly, the optimal matching grant rate devised by the federal government should decrease with the intensiveness of tax competition and the unemployment rate, considering the large agency costs.

We examine the effect horizontal fiscal externalities and labor market imperfections have on the optimal matching grant rate in a model where the agency costs are inevitable.

The remainder of the paper is organized as follows. Section 2 describes the basic model and derives the optimal matching grant rate which the central government should choose when the labor market is imperfect. Agency costs play a decisive role in our analysis. Section 3 shows the intriguing results of comparative statics. Section 4 presents some concluding remarks.

2. Basic Model

We start with the basic model herein. There are *n* identical jurisdictions, and in each jurisdiction *i* (=1, 2,…, *n*), there are two types of immobile residents: the employed and unemployed workers of size 1, with preferences defined by a strictly quasi-concave utility function $u(x_i,\ T_i,\ g_i)= x_i + W(T_i) + v_i(g_i)$, where x_i is the consumption of a private numeraire good, T_i is the leisure time and g_i is the local public good. Only if $\omega+W(T_{max}-1) > W(T_{max})$, residents are willing to work, where T_{max} denotes the maximal leisure time and $T_{max}-1$ is the leisure time facing the employed worker. When $W(T_{max}-1)=0$ and $W(T_{max}) = U_R = \bar{\omega}$, with $\bar{\omega}$ represents the reservation wage rate as Eichner and Upmann (2012), residents are indifferent between employment and unemployment.

We assume the aggregate production function in jurisdiction i is $f_i(l_i, k_i)$, where l_i is labor employment, and k_i is the amount of capital employed in the jurisdiction. Under constant returns to scale, $f_i(l_i, k_i)$ is assumed to be strictly concave, where$f_{lli} < 0$, $f_{kki} < 0$ according to the second order condition. There is perfect private capital mobility. In equilibrium, therefore, the after-tax return to capital is equalized across jurisdictions

$$f_{ki}(l_i, k_i) - t_{1i} = f_{kj}(l_j, k_j) - t_{1j} = r \qquad (\ j \neq i\ ) \tag{1}$$

for all i(=1,2,…,*n*), t_{1i} is the tax rate per unit of capital in jurisdiction i and r is the after tax return to private capital in the country.

The total supply of private capital in the country is fixed at $\bar{K}$ such that

$$\bar{K} = \sum_{i=1}^{n} k_i. \tag{2}$$

The jurisdictional governments impose a distortional tax on capital and a distortional tax on labor as the source of revenue for the local public good provision, and the central government imposes lump-sum taxes on the resident as the source of revenue for the matching grant.

As Ogawa and Sato and Tamai (2006), we assume that each resident in jurisdiction *i* owns the fraction p_i ($\sum_{i=1}^{n} p_i = 1$) of capital stock in the country. The employed workers are paid wage at a rate ω_i. The capital income rk_i and the firm's profit $\pi = f_i(l_i, k_i) - (\omega_i + t_{2i})l_i - (r + t_{1i})k_i$ are distributed to the two types of residents. According to the firm's profit maximization condition, using the Cramer's rule, we define the differential of labor and capital with respect to capital tax rate with

$$\frac{\partial l_i}{\partial t_{1i}} = -\frac{f_{lki}}{f_{lli}f_{kki} - f_{lki}^2}, \tag{3-1}$$

$$\frac{\partial l_i}{\partial t_{2i}} = \frac{f_{kki}}{f_{lli}f_{kki} - f_{lki}^2}, \tag{3-2}$$

$$\frac{\partial k_i}{\partial t_{1i}} = \frac{f_{lli}}{f_{lli}f_{kki} - f_{lki}^2}, \tag{4-1}$$

$$\frac{\partial k_i}{\partial t_{2i}} = -\frac{f_{lki}}{f_{lli}f_{kki} - f_{lki}^2}, \tag{4-2}$$

respectively. As the concavity of the aggregate production function, the denominator of (3-1), (3-2), (4-1) and (4-2) is positive. In addition, for the sake of simplicity, we assume that capital and labor are complementary in production, that is $f_{lki} > 0$.

The budget constraints of the employed and unemployed workers are given by

$$x_i^e = \omega_i + f_i(l_i, k_i) - (\omega_i + t_{2i})l_i - f_{ki}(l_i, k_i)k_i + rp_i\overline{K} - h, \tag{5}$$

$$x_i^u = U_R + f_i(l_i, k_i) - (\omega_i + t_{2i})l_i - f_{ki}(l_i, k_i)k_i + rp_i\overline{K} - h, \tag{6}$$

respectively. The budget constraint of the jurisdictional government *i* can be given by

$$t_{1i}k_i + t_{2i}l_i + s_i = g_i, \tag{7}$$

where s_i is the matching grant the jurisdictional government *i* receives from the central government. Hence, the matching grant s_i can be given by

$$s_i = mg_i, \tag{8}$$

where *m* is the rate of the uniform matching grant. Fiscal revenue serves to finance the provision of local public goods. *h* in (5) and (6) should satisfy the central government's budget constraint, which is given by

$$\sum_{i=1}^{n} s_i = nh = \sum_{i=1}^{n} mg_i. \tag{9}$$

In this model there are two stages:

In stage 1, the central government chooses the national tax *h* and the matching grant rate *m*.

In stage 2, the jurisdictional government *i* chooses the capital tax rate t_{1i}, the labor tax rate t_{2i}, and the local public goods g_i, taking *h* and *m* as given.

The central government cares about all individuals in the country, but can neither choose the private goods x_i *nor* g_i directly, but it wants to determine *m* and *h* which lead to an efficient provision of local public goods by the jurisdictional governments in a non-cooperative equilibrium, according to Pareto-optimal condition derived below.

Considering the proportion of employed and unemployed workers, the jurisdictional government *i* wishes to maximize the utilitarian form of welfare considering agency costs in its jurisdiction subject to (3-1), (3-2), (4-1), (4-2), (5), (6), (7), (8), taking the tax rates t_j and the provision of local public goods of other jurisdictions as given. Then, the maximization problem is defined as

$$\max_{t_i, g_i} W_i = V_i[X_i(g_i)] + (1 - l_i)u_i^u + l_i u_i^e,$$

$$\text{s.t. } \frac{\partial l_i}{\partial t_{1i}} = -\frac{f_{lki}}{f_{lli}f_{kki} - f_{lki}^2},$$

$$\frac{\partial l_i}{\partial t_{2i}} = \frac{f_{kki}}{f_{lli}f_{kki} - f_{lki}^2},$$

$$\frac{\partial k_i}{\partial t_{1i}} = \frac{f_{lli}}{f_{lli}f_{kki} - f_{lki}^2},$$

$$\frac{\partial k_i}{\partial t_{2i}} = -\frac{f_{lki}}{f_{lli}f_{kki} - f_{lki}^2},$$

$$x_i^e = \omega_i + f_i(l_i, k_i) - (\omega_i + t_{2i})l_i - f_{ki}(l_i, k_i)k_i + rp_i\overline{K} - h,$$

$$x_i^u = U_R + f_i(l_i, k_i) - (\omega_i + t_{2i})l_i - f_{ki}(l_i, k_i)k_i + rp_i\overline{K} - h,$$

$$t_{1i}k_i + t_{2i}l_i + s_i = g_i,$$

$$s_i = mg_i,$$

where $u_i^u = x_i^u + U_R + v_i(g_i)$ and $u_i^e = x_i^e + v_i(g_i)$. We assume that $V_i[X_i(g_i)]$ are the agency costs, with $V_i[X_i(g_i)] > 0$, $V_i^{'}[X_i(g_i)] < 0$, $V_i^{''}[X_i(g_i)] < 0$. In addition, $X_i(g_i)$ denotes the variation in effort which reflects differences in incumbents' types, with $X_i(g_i) > 0$, $X_i^{'}(g_i) > 0$, $X_i^{''}(g_i) > 0$. l_i is the proportion of employed workers, say employment rate in jurisdiction i, $1 - l_i$ is the proportion of unemployed workers, say unemployment rate in jurisdiction *i*.

We use the substitution method and differentiate W_i with respect to t_{1i} and t_{2i}, the first-order condition can be written as

$$V'X'\left(\frac{1}{1-m}\right)\left(k + t_1\frac{\partial k}{\partial t_1} + t_2\frac{\partial l}{\partial t_1}\right) + (f_l - t_2 - U_R)\frac{\partial l}{\partial t_1} - k + v'\left(\frac{1}{1-m}\right)\left(k + t_1\frac{\partial k}{\partial t_1} + t_2\frac{\partial l}{\partial t_1}\right) = 0,$$

$$V'X'\left(\frac{1}{1-m}\right)\left(l + t_1\frac{\partial k}{\partial t_2} + t_2\frac{\partial l}{\partial t_2}\right) + (f_l - t_2 - U_R)\frac{\partial l}{\partial t_2} - l + v'\left(\frac{1}{1-m}\right)\left(l + t_1\frac{\partial k}{\partial t_2} + t_2\frac{\partial l}{\partial t_2}\right) = 0, \quad (10)$$

where the jurisdiction-specific subscript *i* is omitted.

The Pareto-optimal condition, however, is derived by

$$\max_{x_i^u, x_i^e, g_i} \sum_{i=1}^n [(1 - l_i)u_i^u + l_i u_i^e] \quad (i=1,2,\ldots,n)$$

$$\text{s.t. } \sum_{i=1}^n (1 - l_i)x_i^u + \sum_{i=1}^n l_i x_i^e + \sum_{i=1}^n g_i = \sum_{i=1}^n f_i(l_i, k_i).$$

The Lagrange function is given by

$$L(g_i, x_i^u, x_i^e) = \sum_{i=1}^n [(1 - l_i)u_i^u + l_i u_i^e] + \lambda[\sum_{i=1}^n (1 - l_i)x_i^u + \sum_{i=1}^n l_i x_i^e + \sum_{i=1}^n g_i - \sum_{i=1}^n f_i(l_i, k_i)].$$

Differentiating $L(g_i, x_i)$ with respect to g_i, x_i^u, x_i^e, gives us

$$\frac{\partial L}{\partial g_i} = v_i^{'} + \lambda = 0,$$

$$\frac{\partial L}{\partial x_i^u} = (1 - l_i) + (1 - l_i)\lambda = 0,$$

$$\frac{\partial L}{\partial x_i^e} = l_i + l_i\lambda = 0,$$

which can be rewritten as

$$v_i^{'} = 1. \quad (11)$$

We have considered that all jurisdictions are identical. Therefore, (11) at the symmetric equilibrium can be rewritten as

$$v' = 1, \quad (12)$$

where the jurisdiction-specific subscripts *i* and *j* are omitted.

Comparison of (10) and (12) shows the optimal matching grant rate which the central

government should choose is given by

$$\mathrm{m} = \frac{1}{1-\frac{1}{k}(f_l-t_2-U_R)\frac{\partial l}{\partial t_1}}\left[-\frac{t_1}{k}\frac{\partial k}{\partial t_1}-\frac{t_2}{k}\frac{\partial l}{\partial t_1}-V^{'}X^{'}\left(1+\frac{t_1}{k}\frac{\partial k}{\partial t_1}+\frac{t_2}{k}\frac{\partial l}{\partial t_1}\right)-\frac{1}{k}(f_l-t_2-U_R)\frac{\partial l}{\partial t_1}\right] = \frac{1}{1-\frac{1}{l}(f_l-t_2-U_R)\frac{\partial l}{\partial t_2}}\left[-\frac{t_2}{l}\frac{\partial l}{\partial t_2}-\frac{t_1}{l}\frac{\partial k}{\partial t_2}-V^{'}X^{'}\left(1+\frac{t_2}{l}\frac{\partial l}{\partial t_2}+\frac{t_1}{l}\frac{\partial k}{\partial t_2}\right)-\frac{1}{l}(f_l-t_2-U_R)\frac{\partial l}{\partial t_2}\right] \quad (13)$$

3. Results of Comparative Statics

3.1 The Unemployment Rate and the Optimal Matching Grant Rate

Differentiating (13) with respect to $f_l - t_2 - U_R$, we obtain the relationships of between *m* and $f_l - t_2 - U_R$:

$$\frac{\partial m}{\partial(f_l-t_2-U_R)} = \frac{1}{\left[1-\frac{1}{k}(f_l-t_2-U_R)\frac{\partial l}{\partial t_1}\right]^2}\left[-\frac{1}{k}\frac{\partial l}{\partial t_1}\left(1+\frac{t_1}{k}\frac{\partial k}{\partial t_1}+\frac{t_2}{k}\frac{\partial l}{\partial t_1}\right)\left(1+\mathrm{V}^{'}\ \mathrm{X}^{'}\ \right)\right] \quad (14)$$

$$= \frac{1}{\left[1-\frac{1}{l}(f_l-t_2-U_R)\frac{\partial l}{\partial t_2}\right]^2}\left[-\frac{1}{l}\frac{\partial l}{\partial t_2}\left(1+\frac{t_2}{l}\frac{\partial l}{\partial t_2}+\frac{t_1}{l}\frac{\partial k}{\partial t_2}\right)\left(1+\mathrm{V}^{'}\ \mathrm{X}^{'}\ \right)\right],$$

where $f_l - t_2 - U_R$ denotes the net marginal benefit of labor, which reflects the distortion on the labor market. Accordingly, suppose the unemployment rate increase with the distortion on the labor market caused by the high wage rate, the unemployment rate can be denoted by $f_l - t_2 - U_R$.

We follow Eichner and Upmann (2012) in assuming that we are on the left side of the Laffer curve, $1+\frac{t_1}{k}\frac{\partial k}{\partial t_1}+\frac{t_2}{k}\frac{\partial l}{\partial t_1}>0$ and $1+\frac{t_2}{l}\frac{\partial l}{\partial t_2}+\frac{t_1}{l}\frac{\partial k}{\partial t_2}>0$. Reminding of the complementarity between capital and labor in production and the concavity of the aggregate production function, which implies $\frac{\partial l}{\partial t_1}<0$ and $\frac{\partial l}{\partial t_2}<0$ according to (3-1) and (3-2), respectively, the following result may be stated:

Proposition1: If agency costs are relatively small or there are no agency costs, that is $1+\mathrm{V}^{'}\ \mathrm{X}^{'}>0$, the optimal matching grant rate should increase with the unemployment rate. In contrast, if agency costs are sufficiently large, that is $1+\mathrm{V}^{'}\ \mathrm{X}^{'}<0$, the optimal matching grant rate should decrease with the unemployment rate. Especially, if $1+\mathrm{V}^{'}\ \mathrm{X}^{'}=0$, the unemployment rate has no effect on the optimal matching grant rate.

To understand why, consider the following: if the unemployment rates increase in a short period due to the increased wage rates in some jurisdictions, which means labor demand decreases. According to the complementarity between capital and labor in production and the concavity of the aggregate production function, capital demand will also decrease shortly. The unemployment capital may escape to the other jurisdictions, even to the foreign countries. Without loss of generality, we assume that the labor tax rates and the capital tax rates cannot change in the short run or only can change in a pretty long period. For that reason, this results in the decrease of the tax revenues financed by the distortionary taxes in these jurisdictions facing increased unemployment rates. Therefore, the local public goods provided by these jurisdictional governments will be decreased due to the adjustment of budget constraint. Consequently, agency costs will be decreased since $V_i^{'}[X_i(g_i)]<0$ and $X_i^{'}(g_i)>0$. However, the welfare of residents will also be decreased due to the less provision of local public goods. This means that the utilitarian form of welfare considering agency costs in each jurisdiction significantly depends on the two effects working in the opposite direction. For example, if agency costs are small, the decrease of agency costs is smaller than the decrease of the welfare of residents. The net effect is that the utilitarian form of welfare considering agency costs in each jurisdiction is decreased. In other words, the inefficiency of each jurisdiction is more severe. For that reason, the matching grant rate from the central government should be increased to eliminate the inefficiency resulting from the increase of unemployment rates. On the contrary, if agency costs are large enough, the decrease of agency costs is larger than the decrease of

the welfare of residents. The net effect is that the utilitarian form of welfare considering agency costs in each jurisdiction is increased. Namely, the inefficiency of each jurisdiction is mitigated. Accordingly, the matching grant rate from the central government should be decreased.

3.2 Tax Competition and Labor Market Imperfections

Differentiating (13) with respect to $-\frac{t_2}{k}\frac{\partial l}{\partial t_1}$ and $-\frac{t_2}{l}\frac{\partial l}{\partial t_2}$ respectively, recalling $\frac{\partial l}{\partial t_1} = -\frac{f_{lk}}{f_{ll}f_{kk}-f_{lk}^2}$, and $\frac{\partial l}{\partial t_1}$ is decreasing in f_{lk}, we obtain the equations (15) and (16):

$$\frac{\partial m}{\partial f_{lk}} = \frac{t_2}{k}\frac{1}{(f_{ll}f_{kk}-f_{lk}^2)}\frac{1}{\left[1-\frac{1}{k}(f_l-t_2-U_R)\frac{\partial l}{\partial t_1}\right]^2}\left[1-\frac{1}{t_2}(f_l-t_2-U_R)\left(-\frac{t_1}{k}\frac{\partial k}{\partial t_1}-1\right)\right]\left(1+\mathrm{V}'\ \mathrm{X}'\right) \quad (15)$$

$$\frac{\partial m}{\partial\left(-\frac{t_2}{l}\frac{\partial l}{\partial t_2}\right)} = \frac{1}{\left[1-\frac{1}{l}(f_l-t_2-U_R)\frac{\partial l}{\partial t_2}\right]^2}\left[1-\frac{1}{t_2}(f_l-t_2-U_R)\left(-\frac{t_1}{l}\frac{\partial k}{\partial t_2}-1\right)\right]\left(1+\mathrm{V}'\ \mathrm{X}'\right) \quad (16)$$

Differentiating (13) with respect to $-\frac{t_1}{k}\frac{\partial k}{\partial t_1}$ and $-\frac{t_1}{l}\frac{\partial k}{\partial t_2}$ respectively, recalling $\frac{\partial k}{\partial t_2} = -\frac{f_{lk}}{f_{ll}f_{kk}-f_{lk}^2}$, and $\frac{\partial k}{\partial t_2}$ is decreasing in f_{lk}, we obtain the equations (17) and (18):

$$\frac{\partial m}{\partial\left(-\frac{t_1}{k}\frac{\partial k}{\partial t_1}\right)} = \frac{1}{1-\frac{1}{k}(f_l-t_2-U_R)\frac{\partial l}{\partial t_1}}\left(1+\mathrm{V}'\ \mathrm{X}'\right) \quad (17)$$

$$\frac{\partial m}{\partial f_{lk}} = \frac{t_1}{l}\frac{1}{(f_{ll}f_{kk}-f_{lk}^2)}\frac{1}{1-\frac{1}{l}(f_l-t_2-U_R)\frac{\partial l}{\partial t_2}}\left(1+\mathrm{V}'\ \mathrm{X}'\right) \quad (18)$$

To study the effects tax competition and labor market imperfections on the optimal matching grant rate, we put forth the basic rationale as follows: As a general rule, the factors of production demand elasticities with respect to the factor tax rates are larger, tax competition is more intense or labor market is more imperfect. It is widely considered that the marginal cost of public funds is larger for the jurisdictions facing this situation. Therefore, the jurisdictional governments are inclined to provide less local public goods in the symmetric equilibrium. Consequently, agency costs will be decreased since $V_i'\ [X_i(g_i)] < 0$ and $X_i'\ (g_i) > 0$. However, the welfare of residents will also be decreased due to the less provision of local public goods. This means that the utilitarian form of welfare considering agency costs in each jurisdiction significantly depends on the two effects working in the opposite direction. For example, if agency costs are small, the decrease of agency costs is smaller than the decrease of the welfare of residents. The net effect is that the utilitarian form of welfare considering agency costs in each jurisdiction is decreased. In other words, the inefficiency of each jurisdiction is more severe. For that reason, the matching grant rate from the central government should be increased to eliminate the inefficiency resulting from tax competition and labor market imperfections. On the contrary, if agency costs are large enough, the decrease of agency costs is larger than the decrease of the welfare of residents. The net effect is that the utilitarian form of welfare considering agency costs in each jurisdiction is increased. Namely, the inefficiency of each jurisdiction is mitigated. Accordingly, the matching grant rate from the central government should be decreased.

When labor market is imperfect and agency costs are inevitable, we obtain the following two propositions:

Proposition2: We assume that $1+\frac{t_1}{k}\frac{\partial k}{\partial t_1} > 0$ and $1+\frac{t_1}{l}\frac{\partial k}{\partial t_2} > 0$. If agency costs are relatively small or there are no agency costs, that is $1+\mathrm{V}'\ \mathrm{X}' > 0$, the optimal matching grant rate should increase with the factors of production demand elasticities with respect to the factor tax rates. However, if agency costs are sufficiently large, that is $1+\mathrm{V}'\ \mathrm{X}' < 0$, the optimal matching grant rate should decrease with the factors of production demand elasticities with respect to the factor tax rates. Especially, if $1+\mathrm{V}'\ \mathrm{X}' = 0$, the factors of production demand elasticities with respect to

the factor tax rates have no effect on the optimal matching grant rate.

Proposition3: If agency costs are relatively small or there are no agency costs, that is $1 + V'X' > 0$, the optimal matching grant rate should increase with the complementarity between labor and capital. However, if agency costs are sufficiently large, that is $1 + V'X' < 0$, the optimal matching grant rate should decrease with the complementarity between labor and capital. Especially, if $1 + V'X' = 0$, the complementarity between labor and capital has no effect on the optimal matching grant rate.

Note that horizontal fiscal externalities originating from tax competition and labor market imperfections result in under-provision of local public goods (inefficiency). However, they also can ease the under-provision of local public goods resulting from the agency costs (inefficiency correction). The two effects simultaneously work in the opposite direction. If agency costs are small, the former effect is larger than the latter one, which means horizontal fiscal externalities and labor market imperfections aggravate under-provision of local public goods. Conversely, if agency costs are large enough, the former effect is smaller than the latter one, which means horizontal fiscal externalities and labor market imperfections ease the under-provision of local public goods.

4. Conclusion

This paper has focused on the effect that horizontal fiscal externalities and labor market imperfections have on the optimal matching grant rate in a model where agency costs are inevitable. The following results have been established.

(1) If agency costs are relatively small or there are no agency costs, the optimal matching grant rate should increase with the unemployment rate and vice versa. Especially, if agency costs equal to a special value, the unemployment rate has no effect on the optimal matching grant rate.

(2) If agency costs are relatively small or there are no agency costs, the optimal matching grant rate should increase with the factors of production demand elasticities with respect to the factor tax rates and vice versa. Especially, if agency costs equal to a special value, the factors of production demand elasticities with respect to the factor tax rates has no effect on the optimal matching grant rate. What this means is that the inefficiency arising from agency costs may be eased by tax competition only if the disutility of effort is so large that the benefits resulting from tax competition exceed its costs.

(3) If agency costs are relatively small or there are no agency costs, the optimal matching grant rate should increase with the complementarity between labor and capital and vice versa. Especially, if agency costs equal to a special value, the complementarity between labor and capital has no effect on the optimal matching grant rate.

It is evident that agency costs (the disutility of effort) in providing the local public goods should be set equal to the marginal increase in probability of re-election multiplied by the value of being re-elected. By ignoring the problems about re-election, we obtain some succinct results in our paper. Therefore, the robustness of the results should be analyzed by introducing incumbent politicians into the model. Especially, we choose a simple form of social welfare function to formulate the maximization problem. Therefore, employing a more general form of objective function and considering about re-election may provide an intriguing insight, which is left to future research.

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