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On fiscal federalism under democracy¹²

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Abstract

In his seminal work on fiscal federalism, Oates (1972) addressed the so-called Decentralization Theorem, which states that, if such factors as scale economies and spillovers are left out of consideration, a decentralized system is always more efficient than a centralized system for the supply of local public goods. Based on his analytical framework, we contrarily show that a centralized system is at times more efficient than a decentralized system under a democratic decision rule (Proposition 2). The key to such a possibility is the interests of minorities that may be sacrificed in each lower district under decentralization. That is, when the majority adopts an extreme policy that is far from minorities' tastes in a lower district under decentralization, if instead a moderate policy which is closer to minorities' tastes were chosen under centralization, then the interests of minorities would be saved. As a result, centralization could attain higher social welfare than decentralization.

JEL classification numbers: D62, H42, L32

Key words: centralization, decentralization, local public goods and services, majority rule, interests of minorities

1 Introduction

In this paper, we construct a model of two-tier districts with intra- and inter-district heterogeneity and examine comparative efficiency between centralized and decentralized systems under a majority rule. Special attention is paid on the interests of minorities in each lower district, which may be ignored under decentralization but taken into account to some extent under centralization.

Comparative efficiency between centralized and decentralized systems has long been examined in the literature of fiscal federalism. Conventionally, goods and services supplied by a public enterprise are assumed uniform in the constituency. In particular, it is assumed that residents in different local districts are provided with the same level of local public goods by the central government.¹ Based on such uniformity assumption and benevolent governments, Oates (1972) addressed the well-known Decentralization Theorem, which states that local governments, which respectively choose the amount of public goods for their jurisdictions, are always more efficient than the central government, which provides a uniform amount of public goods to all local jurisdictions.

The study of fiscal federalism after the Decentralization Theorem has been developed by adding to the model some extra factors that are balanced with the effects of uniformity. For example, Oates (1972) himself

¹A critique of the uniformity assumption claims that the level of local public goods need not be uniform across local constituencies under centralization [*e.g.* Besley and Coate (1999)]. In some occasions, however, uniformity assumption seems quite reasonable to make. First, in reality, many public services are supplied uniformly across local constituencies by the central government because of limited information on individual tastes, abilities and physical constitutions, of administrative costs, and of the ethics of equality. Examples in some European nations and Japan include primary and secondary education, immunization for children, and basic sanitation programs, although the kinds and intensity of schooling or medical care may differ across children living in distinct local communities. Second, in a sense, it is theoretically biased to assume that the central government can supply different levels of local public goods to the residents living in different places in its district, but that a local government cannot do the same thing.

introduced into his model scale economies in the provision of local public goods. He also examined a tradeoff between uniformity under centralization and spillovers of the benefit from local public goods. Other sorts of tradeoffs include scale economies under centralization against district-tailored supply of public goods under decentralization [Alesina and Spolare (1997)], exogenously given benefit of centralization against an income tax schedule which is appropriately chosen according to the income inequality of the local district under decentralization [Bolton and Roland (1997)], internalization of spillovers under centralization against the interests of small districts which are saved under decentralization [Ellingsen (1998)], and internalization of spillovers under centralization against adaptation to heterogeneous tastes for public goods by decentralization [Besley and Coate (1999)].

Contrary to such trend of extension of the model, this paper retains the original setting of Oates with the uniformity assumption, leaving out of consideration such factors as scale economies, spillovers, and any other exogenously given benefit from centralization. We rather consider an implication of democracy in collective decision making to the efficiency of centralized and decentralized systems. We find from the study that, despite the Decentralization Theorem, centralized system, which applies a uniform intensity level to all lower districts, is at times more efficient than a decentralized system, which can apply distinct intensity levels to different lower districts (Proposition 2).

The intuitive logic behind this result is as follows. In a lower district, the interests of minorities may be ignored under a majority rule.² In particular, when there is wide divergence of tastes for public services among residents in a lower district, an extreme policy can be chosen in it which is best preferred

²In the model of local public goods with inter-regional spillovers, Ellingsen (1998) pointed out this aspect on a *inter*-regional basis; when two districts form an upper district, the interests of the smaller district will be ignored under a majority rule. This paper considers the problem of neglected interests of minorities on a *intra*-regional basis, where the tastes for a public service vary within a lower district.

by the majority but not desired by the minority. In some cases, efficiency loss caused by the ignored interests of the minority could be considerably large. As the law of large numbers suggests, extreme policies taken in each lower district may be leveled down and up if these small districts are integrated into a large district. When indeed a moderate policy is chosen under centralization, the interests of the minority will be saved to some extent without terribly harming the interests of the majority, and as a result the social welfare may be improved.

The remainder of the paper is constructed as follows. The next section presents a model of two-tier governments which supply a local public service. Section 3 qualitatively examines comparative efficiency between centralized and decentralized systems, while section 4 tackles the problem quantitatively. Section 5 concludes the paper with the discussion on the implications of our theory to the reality.

2 The model

Assume that there are two levels of districts: m lower districts (*e.g.* states, provinces, prefectures/cities, towns) constitute a higher district (*e.g.* a nation/a state, province, prefecture). There are n_i residents in lower district $i = 1, \dots, m$, so that there are $\sum_i n_i$ residents in the higher district. We exclude the possibility that the residents move across the border of the lower districts.

Let x be the intensity of a public service, and $c(x)$ be its cost *per capita*. We assume that $c(0) = 0$, $c'(0) = 0$, $c'(x) > 0$ for $x > 0$, and $c''(x) > 0$.³ The total cost for the public service, which is $c(x)$ multiplied by the number of residents in the district, is assumed to be financed by a poll tax. Hence, each resident pays $c(x)$. The intensity x is assumed uniform to all residents in the district with which the government is charged. Therefore, x is uniform

³Single primes indicate first derivatives, and double primes indicate second derivatives.

only within a lower district under decentralization, but it is uniform in all lower districts under centralization.

We assume that individuals have a quasi-linear utility function (so that we can ignore the effects of the initial wealth). The utility function of an individual is thus written as

$$u = bx - c(x)$$

where $b \geq 0$ is his taste parameter for the public service. He then best prefers the intensity x with

$$b = c'(x). \tag{1}$$

Since $c'' > 0$, (1) yields the demand function for the intensity of the public service, $x = \tilde{x}(b)$, where $\tilde{x} := (c')^{-1}$. Notice that $\tilde{x}'(b) > 0$; *i.e.*, residents with greater b prefer a more intensive service.

In this model, comparative efficiency between centralized and decentralized systems rests solely on the distribution of taste parameter b in each lower district, $g_i(b)$, and its distribution in the higher district, $g(b)$.

3 A qualitative analysis

In this section, we assume that there are two types of residents in each lower district. In lower district $i = 1, \dots, m$, n_i^H residents value the public service high at $b = b_i^H$, and n_i^L residents value it low at $b = b_i^L$, where $n_i^H + n_i^L = n_i$ and $b_i^H > b_i^L$. (Therefore, $g_i(b) = n_i^H/n_i$ if $b = b_i^H$, $g_i(b) = n_i^L/n_i$ if $b = b_i^L$, and $g_i(b) = 0$ otherwise.) Let $x_i^H := \tilde{x}(b_i^H)$ and $x_i^L := \tilde{x}(b_i^L)$.

Let x_i denote the intensity of the public service selected in lower district i . For two lower districts i and j , x_i must equal x_j under centralization, and x_i can differ from x_j under decentralization. The sum of utility of the residents in lower district i when the intensity of the public service is x_i is given by

$$U_i(x_i) := n_i^H (b_i^H x_i - c(x_i)) + n_i^L (b_i^L x_i - c(x_i)).$$

The social welfare, which is the sum of utility of all residents in the higher district, is then given by $\sum_i U_i(x_i)$. Maximizing the social welfare with respect to (x_1, \dots, x_m) , the social optimum is characterized by

$$\bar{b}_i = c'(x_i) \quad i = 1, \dots, m \quad (2)$$

where $\bar{b}_i := (n_i^H/n_i)b_i^H + (n_i^L/n_i)b_i^L$. Let $\bar{x}_i := \tilde{x}(\bar{b}_i)$. That is, $(\bar{x}_1, \dots, \bar{x}_n)$ constitute the social optimum intensity levels.

Let \hat{b}_i be the taste parameter of the median voter in lower district i . Then, $\hat{x}_i := x(\hat{b}_i)$ is chosen by the simple majority rule in lower district i under decentralization. Notice that $\hat{x}_i = x_i^H > \bar{x}_i$ (oversupply) if $n_i^H > n_i^L$, and $\hat{x}_i = x_i^L < \bar{x}_i$ (undersupply) if $n_i^L > n_i^H$. Similarly, let \hat{b} be the taste parameter of the median voter in the higher district. Then, $\hat{x} := x(\hat{b})$ is chosen by the simple majority rule under centralization.

In general, social optimum is not attained by a majority rule. We will thus examine relative efficiency between centralized and decentralized systems by comparing $\sum_i U_i(\hat{x})$ and $\sum_i U_i(\hat{x}_i)$.

Property 1:

If $\hat{b}_i \leq \hat{b} \leq \bar{b}_i$ or $\bar{b}_i \leq \hat{b} \leq \hat{b}_i$, then $U_i(\hat{x}) \geq U_i(\hat{x}_i)$. Conversely, if $\hat{b} \leq \hat{b}_i \leq \bar{b}_i$ or $\bar{b}_i \leq \hat{b}_i \leq \hat{b}$, then $U_i(\hat{x}_i) \geq U_i(\hat{x})$.

Proof:

Since $c'' > 0$, U_i is strictly concave with respect to x_i with its peak at $x_i = \bar{x}_i$. Then, for any x_i^1 and x_i^2 , if $x_i^1 < x_i^2 < \bar{x}_i$ or $\bar{x}_i < x_i^2 < x_i^1$, then it holds that $U_i(x_i^2) > U_i(x_i^1)$. By replacing x_i^1 and x_i^2 with \hat{x} and \hat{x}_i accordingly and using $\tilde{x}'(b) > 0$, we obtain the property. ||

If all the lower districts are *similar* in the sense that $b_i^H = b_j^H$, $b_i^L = b_j^L$, and $n_i^H : n_i^L = n_j^H : n_j^L$ for $i \neq j$, then it does not matter which of the central government or local governments supplies the public service, as far as economic efficiency is concerned.

Proposition 1 [Oates (1972)]:

Suppose that $b_i^H = b_i^L = b_i$ for all $i = 1, \dots, m$. Then, decentralization is always more efficient than, or at least as efficient as, centralization.

Proof:

Since $b_i^H = b_i^L = b_i$, $\hat{b}_i = b_i = \bar{b}_i$ for all $i = 1, \dots, m$. Therefore, decentralization attains the social optimum. Under centralization, on the other hand, since $\hat{b} = b_j$ for some j , $\hat{b} = b_j = \hat{b}_j$ so that \hat{b} is optimal for lower district j . However, unless $b_i = b_j$ for all $i \neq j$, it holds that $\hat{b} = b_j \neq b_i = \hat{b}_i$ for some $i \neq j$, so that \hat{b} is not optimal for lower district i . Therefore, centralization does not attain the social optimum unless $b_i = b_j$ for all $i, j = 1, \dots, m$. \parallel

The condition $b_i^H = b_i^L = b_i$ for all $i = 1, \dots, m$ in Proposition 1 implies that there is no intra-district heterogeneity in each lower district. Indeed, inter-district heterogeneity ($b_i \neq b_j$ for some $i \neq j$) is the cause of superiority of decentralization over centralization in this case.

Proposition 2:

Suppose that $\max\{\bar{b}_1, \dots, \bar{b}_m\} \leq \min\{b_1^H, \dots, b_m^H\}$. If $n_i^H > n_i^L$ for all $i = 1, \dots, m$ and $\hat{b} = \min\{b_1^H, \dots, b_m^H\}$, then centralization is more efficient than, or at least as efficient as, decentralization.

Proof:

First, since $\hat{b} = \min\{b_1^H, \dots, b_m^H\}$ and $\min\{b_1^H, \dots, b_m^H\} \geq \max\{\bar{b}_1, \dots, \bar{b}_m\}$, we have

$$\hat{b} \geq \bar{b}_i \quad i = 1, \dots, m. \quad (3)$$

Next, since $n_i^H > n_i^L$, we have $\hat{b}_i = b_i^H$ for all i . Also, since $\hat{b} \leq b_i^H$ for all i by assumption, it holds that

$$\hat{b} \leq \hat{b}_i \quad i = 1, \dots, m. \quad (4)$$

By (3) and (4), we have $\bar{b}_i \leq \hat{b} \leq \hat{b}_i$ for all i . Then, by Property 1, we have

$U_i(\hat{x}) \geq U_i(\hat{x}_i)$ for all $i = 1, \dots, m$, so that the social welfare is no less under centralization than under decentralization. \parallel

There are intra-district heterogeneity in the case of Proposition 2, which may cause superiority of centralization over decentralization. Existence of minorities, which is represented by $n_i^L > 0$ in this case, is crucial for this result. Seeing \bar{b}_i as a function of n_i^L , the conditions of the proposition require that $\bar{b}_i(n_i^L) \leq \beta$ for some $\beta := \min\{b_1^H, \dots, b_m^H\}$. Notice that $\bar{b}_i(n_i^L = 0) = b_i^H$, $\bar{b}_i(n_i^L = n_i) = b_i^L$, and $\bar{b}_i'(n_i^L) < 0$. Therefore, as long as $n_i^H > n_i^L$, the greater the volume of the minority n_i^L is, the more likely the requirement is satisfied and the superiority of centralization over decentralization holds.

Corollary 1:

Suppose that $\min\{\bar{b}_1, \dots, \bar{b}_m\} \geq \max\{b_1^L, \dots, b_m^L\}$. If $n_i^L > n_i^H$ for all $i = 1, \dots, m$ and $\hat{b} = \max\{b_1^L, \dots, b_m^L\}$, then centralization is more efficient than, or at least as efficient as, decentralization.

Proof:

The proof is symmetrical to that of Proposition 2, and is omitted. \parallel

Notice that Proposition 2 (as well as Corollary 1) provides a set of *sufficient* conditions with which centralization is more desirable than decentralization. Slight divergence from the conditions is still likely to retain the result. For example, when \hat{b} equals either of the first few minimum elements in $\{b_1^H, \dots, b_m^H\}$, it holds that $U_j(\hat{x}) < U_j(\hat{x}_j)$ for a few lower districts j but $U_k(\hat{x}) > U_k(\hat{x}_k)$ for all the other lower districts k . Therefore, it is still quite possible that $\sum_i U_i(\hat{x}) > \sum_i U_i(\hat{x}_i)$ holds.

4 A quantitative analysis

This section presents a numerical example with two lower districts of equal size which have symmetrically different distribution of the preference for the public service.

We first specify the distribution of the taste parameter b . Let $f(b; p)$ be a binominal density, where $b \in \{0, 1, 2, \dots, 10\}$ is a random variable and $p \in (0, 1)$ is the parameter of the density function.⁴ Let

$$g_1(b) := wf(b; p) + (1 - w)f(b; 1 - p)$$

and

$$g_2(b) := (1 - w)f(b; p) + wf(b; 1 - p)$$

where $w \in [0, 1]$ is the weight for the two symmetric density functions, $f(b; p)$ and $f(b; 1 - p)$. The density function g_1 is illustrated in Figure 1 for $w = 0.3$ and various values of p .⁵ We assume that b is distributed according to g_1 and g_2 in lower districts 1 and 2, respectively. Since the two lower districts are assumed to have an equal population size, the distribution of b in the higher district is given by

$$g(b) := \frac{1}{2}g_1(b) + \frac{1}{2}g_2(b).$$

In what follows, since g_1 and g_2 are symmetric to each other, it suffices to pay our attention to the region of (p, w) with $0 < p \leq 0.5$ and $0 \leq w \leq 0.5$.

For the economic context, p implies divergence of residents' preferences for the public service in a lower district. The divergence is wide when p is close to 0 (the two hills are remote to each other), whereas it is narrow when

⁴We exclude the case of $p = 0$ and $p = 1$ in the simulation, in which the votes for $\tilde{x}(b = 0)$ and $\tilde{x}(b = 10)$ tie under centralization.

⁵ g_1 and g_2 may or may not have two hills, according to the values of p and w . When they have two hills, p determines the horizontal difference between the two peaks (which is wide when p is close to 0 or 1, and narrow when it is close to 0.5), and w determines the vertical difference between them (which is wide when w is close to 0 or 1, and narrow when it is close to 0.5).

p is close to 0.5 (the two hills are close to each other, or they merge into one hill). In this sense, p indicates the degree of intra-district heterogeneity of residents' preferences in a lower district.

On the other hand, w shows how different the two lower districts are. The two districts are very different when w is close to 0, whereas they are exactly the same when $w = 0.5$. In this sense, w implies the degree of inter-district heterogeneity of residents' preferences. At the same time, w also determines the relative importance of minorities in each lower district. Minorities are negligible when w is close to 0 (the smaller hill is very short), whereas they are significant when w is close to 0.5 (the smaller hill is almost as tall as the larger hill).

Specifying the cost function as $c(x) = x^2/2$, we can calculate an equilibrium intensity level under centralization and decentralization for given (p, w) . By substituting the intensity level so derived back into individual utility functions and adding them up, we obtain the social welfare under the two regimes. We can then determine which of centralized and decentralized systems is more efficient than the other for that (p, w) . Such results are summarized in Figure 2.

When $p \approx 0$ and $w \approx 0.5$, intra-district heterogeneity is wide and minorities are numerous. As Proposition 2 suggests, centralization works better than decentralization in this case, since the former better saves the interests of minorities in each lower district. Indeed, in Figure 2, centralization surpasses decentralization in efficiency at such points as $(p, w) = (0.1, 0.4)$ and $(p, w) = (0.1, 0.3)$. As p approaches 0.5, intra-district heterogeneity shrinks, and the benefit of minorities from centralization diminishes. For example, at $(p, w) = (0.1, 0.3)$, if p increases from 0.1 to 0.2 with w being kept at 0.3, decentralization comes to surpass centralization. On the other hand, as w approaches 0, minorities get fewer, and again the benefit of minorities from centralization diminishes. At $(p, w) = (0.1, 0.3)$, for example, if w decreases from 0.3 to 0.2 with p being kept at 0.1, decentralization comes to surpass

centralization.

An opposite argument holds when $p \approx 0.5$ and $w \approx 0$. In that case, intra-district heterogeneity is narrow and minorities are few. Therefore, as Proposition 1 suggests, decentralization works better than centralization, since the losses of minorities' interests from decentralization are limited. In Figure 2, decentralization works better than centralization at such points as $(p, w) = (0.4, 0.1)$, $(p, w) = (0.3, 0.2)$, and $(p, w) = (0.2, 0.3)$. As p approaches 0, intra-district heterogeneity widens, and the losses of minorities' interests from decentralization increase. At $(p, w) = (0.2, 0.3)$, if p decreases from 0.2 to 0.1 with w being kept at 0.3, centralization comes to surpass decentralization. On the other hand, as w approaches 0.5, minorities get more numerous, and again the losses of minorities' interests from decentralization increase. At $(p, w) = (0.2, 0.3)$, if w increases from 0.3 to 0.4 with p being kept at 0.2, centralization comes to surpass decentralization.

5 Conclusion

In this paper, we examined comparative efficiency between centralized and decentralized systems in a conventional model of fiscal federalism under democracy, where the provision of local public goods and services is restricted to be uniformly across lower districts under centralization. Without incorporating into the model such additional factors as scale economies and spillovers, we obtained a result which is contrary to Oates' (1972) Decentralization Theorem; *i.e.*, centralization is at times more efficient than decentralization. The key to this result is the existence of minorities whose interests may be sacrificed under a majority rule in a local constituency. Suppose that an extreme policy that is preferred by the majority prevails in a lower district and the interests of the minority are being ignored under decentralization. If the system were centralized and a milder policy were chosen, the welfare of the minority would improve. As a result, a higher level of social welfare

could be attained under centralization than under decentralization.

In the rest of this section, we discuss some implications of our theoretical results to the reality.

Difference in age structure between urban and rural areas

The age structure often differs between urban and rural areas. Typically, upon graduation from high school or college, young people move from rural to urban areas for higher education or jobs. Then, they return to their hometown after retirement. By this reason or the other, urban areas are relatively thickly populated with working age people, whereas rural areas are with old people. Consequently, the interests of old people in urban areas, and those of young and middle-aged people in rural areas, may not be well reflected in the decision of local public expenditure. For example, welfare programs for the aged might be undersupplied in urban areas but rather oversupplied in rural areas under decentralization. If a moderate level of the programs (which is more intensive than those in urban areas but less intensive than those in rural areas under decentralization) were chosen under centralization, then the interests of the old in urban areas, and those of the young and middle-aged in rural areas, would be saved. Thus, a higher level of social welfare might be attained under a centralized than a decentralized system.

Difference in wealth level among adjacent local districts

We commonly observe that people of a similar income level reside in the same area and dominate the community. Upper East Side of Manhattan in New York, Hampstead in London, and Denen Chofu in Tokyo are well-known sites for wealthy residents. Indeed, it is not unusual that the preferences for public goods and services well differ among adjacent local districts. For example, municipal bus transportation, playgrounds and public halls may be undersupplied in districts where high-income households hold the majority,

but oversupplied in districts where low-income households hold the majority. The society as a whole thus sacrifices the interests of low-income households (who need more of those goods and services) in the former districts and the interests of high-income households (who in fact do not need much of those goods and services) in the latter districts. ⁶ If the decision were made at a higher level of district that encompasses these lower districts, then a moderate amount of the goods and services would be selected and the interests of minorities could be saved. As the result, the society might attain a higher level of welfare by centralizing the system.

Difference in enthusiasm for environmental protection among countries

Our theory may be applied not only to local problems as discussed in the previous two subsections, but also to international affairs such as global environmental protection programs. As for the emission of carbon dioxide which causes global warming effects, for example, Europe is determined, and the United States is passive. If the decisions are made separately, a very strict emission standard will be enforced in EU whereas a loose standard will be applied in the US. This may harm the interests of EU industrialists and US environmentalists. With the coordination by the United Nations, a moderate standard would be adopted and the interests of minorities in both areas would be saved. Consequently, the outcome might be more efficient under UN coordination than under separate decisions.

⁶On the contrary, cultural facilities such as museums and music halls may be oversupplied in the former type of districts, sacrificing the low-income households, and undersupplied in the latter type of districts, sacrificing the high-income households.

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Figure 1: Density function g_1 for $w=0.3$ and various values of p

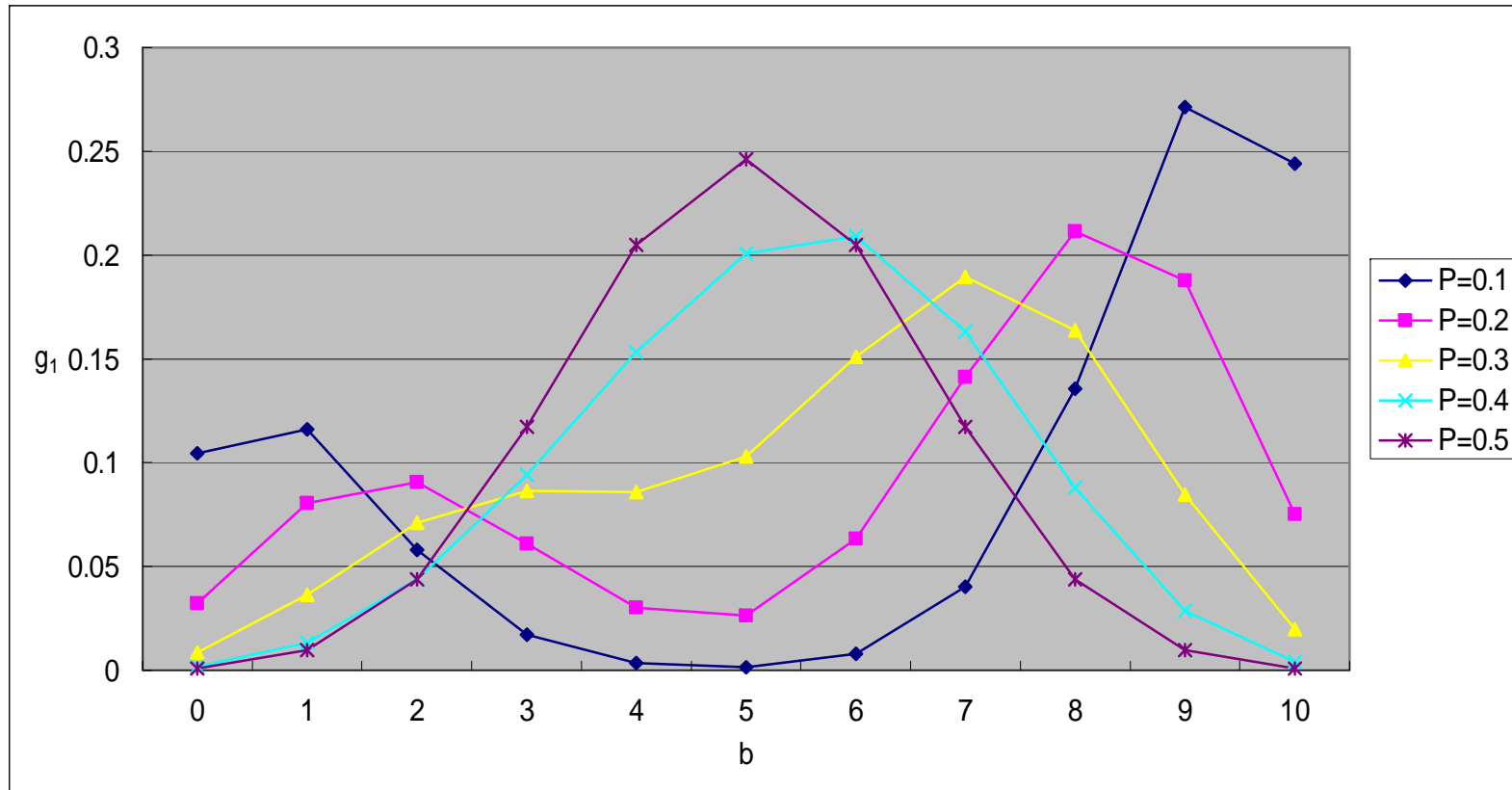


Figure 2: Comparative efficiency between centralization and decentralization

