Secession and distribution of natural resourcess

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1 Introduction

The purpose of this paper is to analyze the condition, in which any region has a incentive to make a secession from home country. This paper analyze the relationship a secession and the allocation interest of natural resources with a simple theoretical model. Integration and separation have been caused by many kinds of reasons, which are policy, culture, religion, and so on. When a secession and independence issues arise, it is sometime caused by the allocation of interests of natural resources. In fact, natural resources have always been one of the causes of conflict among countires. Thus, these regions consider to make a secession from home country, the right of natural resources like oil, gas, and so on have been a one of very important factors. We extend the model including natural resources as Ohno (2018) by combining with political economic model to take account of a secession.We find that the government of minor region does not consider a secession from home country when the interests of natural resources in minor region is not so large relatively.

2 The model

2.1 Integrated economy

We consider the country composed by two regions, which are region 1 and region 2. Here we assume that region 1 has more population than region 2. Thus, we define region 1 and region 2 as a major region and a minor region, respectively. There are two kinds of workers in this economy. One of them is a worker employed in service sector. The other is a peasant enployed in agricultural goods sector. Following Krugman(1991), the number of workers employed in service sector is are denoted by μL and $(1-\mu)L$, respectively. Moreover, the number of peasants in each region is fixed and given by $(1-\mu)L/2$. Since we assume that region 1 is a major region, the number of households in region 1 is larger than that in region 2. Let L_X^i represent the number of workers employed in service sector of region $i(=1,2)$. When we define θ as the ratio of workers in region 1 to total number of workers in a country denoted by L, that is, $L_X^1 = \theta\mu L$, $L_X^2 = (1-\theta)\mu L$, and $\theta > 1/2$.

We specify the utility function of household in a country as follows.

$$U_i = C_X^{\mu} C_Y^{1-\mu}, \quad (i=1,2), \tag{1}$$

where C_X is given by

$$C_X \equiv \left[\int_0^N s(m)^{(\sigma-1)/\sigma} dm \right]^{\sigma/(\sigma-1)}, \ \sigma > 1$$

where s_m and N denotes a variety of service and the number of variety, respectively. Each household has a unit of labor and supplies it inelastically. When we denote w_j^i as wage of sector $j(= X, Y)$ in region $m(= 1, 2)$, the budget constraint is given by

$$w_j^i + I = \int_0^N p(m)s(m)dm + C_Y, \tag{2}$$

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$$w_j^i + I = \int_0^N p(m)s(m)dm + C_Y, \tag{3}$$

where I, N, and $p(m)$ are redistribution, the number of service variety, and the price of variety m, respectively. they determine consumption of consumption goods and each vareity to maxmize utility function subject to (3). Moreover, substitute the demands of each variety and consumption goods for (1), we can obtain the following indirect utility function.

$$V = \mu^\mu (1-\mu)^{1-\mu} P^{-\mu} (w_i^j + I), \tag{4}$$

where P is price index of service market in an integrated economy.

$$P \equiv \left[\int_0^N p(m)^{1-\sigma} dm \right]^{\frac{1}{1-\sigma}} \tag{5}$$

We assume that the consumption goods market is perfectly competitive and one unit of consumption goods is produced with one unit of labor. Moreover, the equilibrium wages in an integrated economy is one because we assume that consumption goods incurs no transportation costs between regions. Therefore, w_Y is equal to one.

Next we describe the production structure of service sector. Services are differentiated each other and face the monopolistic competition. Following Dixit and Stiglitz[**?**], we describe the monopolistic competition market. Labor is only input factor to produce service variety as well as consumption goods. A service variety uses α unit of labor in its region as the marginal input to produce one unit of service. Moreover, he is required to pay a fixed input requirement that comprises β units of labor. Therefore, labor input of variety i is given by $\alpha s(m) + \beta$. Each variety maximizes its profit with respect to $p(m)$ under the monopolistic competition market. Each variety deal with the constant elasticity

substitution σ and has no effect on price index of service market denoted by P. Consequently, the price of each service is derived as follows.

$$p^*(m) = \left(\frac{\alpha\sigma}{\sigma - 1}\right) w_X \tag{6}$$

Moreover, zero profit condition is given by

$$\left(\frac{\alpha\sigma}{\sigma - 1}\right) w_X s^*(m) - w_X(\alpha s^*(m) + \beta) = 0. \tag{7}$$

Supposed that each variety in service sector has been symmetric, the equilibrium price and output are also symmetric. Therefore, we define p^* and s^* as the equilibrium price and output of variety in service sector in an integrated economy, that is,

$$p^* \equiv p^*(i),\ s^* \equiv s^*(i) \quad \in [0, N]$$

Although we deal with the number of variety of service sector as given, it is necessary to determine it endogenously. The labor demand of each variety in equilibrium are given by $\beta\sigma$. Since the number of workers in service sector in an integrated economy is given by μL, the labor market clear condition in this sector is as follows.

$$\mu L = N\beta\sigma$$

Consequently, we derive the number of variety in a service sector under an integrated economy as follows.

$$N^* = \frac{\mu L}{\beta\sigma} \tag{8}$$

2.1.1 Natural resources

Although natural resources are located in region 2, it is owned by the central government including both regions. Therefore, the central government gets the benefit from this natural resources and redistribute it to households. Taking into account that the number of households is denoted by L, the redistribution for each household is $I = \bar{R}/L$.

Since the indirect utility function and the equilibrium wage of service sector are given by (4) and P^*, respectively, we derive the equilibrium utility function of workers and peasants as follows.

$$V_X^* = \mu^\mu (1-\mu)^{1-\mu} P^{-\mu} \left(w_X^* + \frac{\bar{R}}{L}\right) \tag{9}$$

and

$$V_Y^* = \mu^\mu (1-\mu)^{1-\mu} P^{-\mu} \left(1 + \frac{\bar{R}}{L}\right) \tag{10}$$

Proposition 1
In the integrated economy, the increase in poplation increases(decreases) utility in equilibrium when the effect of population increase on the number of variety of service is larger(smaller) than the effect of it on income redistribution.

Taking account of (9) and (10), the weighted indirect utility function defined by V^* is given by

$$\begin{aligned} V^* &= \mu V_X^* + (1-\mu)V_Y^* \\ &= \Omega\left[\left(\frac{\alpha\sigma}{\sigma-1}\right)\left(\frac{\mu L}{\beta\sigma}\right)^{\frac{1}{1-\sigma}}\left(\frac{(1-\mu)L+I}{(1-\mu)L}\right)\right]^{-\mu} \\ &\times \left\{\mu\left(\frac{(1-\mu)+I}{(1-\mu)L}\right)+1-\mu+I\right\}, \end{aligned} \tag{11}$$

where Ω denotes $\mu^\mu(1-\mu)^{1-\mu}$. When the government of minor region consider whether it secedes or not, it needs to compare the weighted indirect utility function after secession with (11). As we know from (11), the weighted utility function under integrated economy depends on L and I, which are the number of population in the economy and the amounts of natural resources. In the next section, we consider the case, where the minor region seceded.

3 Secession

In the previous section we consider the economy composed by two regions. Since we assume that the central government have the ownership of natural resources located in region 2 and redistributes the benefit from it to each households in the integrated economy, there is no difference between major region (region 1) and minor region (region 2). Smilar to section 1, we derive the equilibrium under secesion. Afrer secession, the population in region 1 and region 2 are given by θL and $(1-\theta)L$, respectively. Moreover, since because the ratio of workers is given by μ, the numbers of workers in region i are given by $\mu\theta L$ and $\mu(1-\theta)L$, respectively. On the other hand, the number of peasants in region 1 and region 2 are also given by $\theta(1-\mu)L$ and $(1-\theta)(1-\mu)L$, respectively.

$$V_X^{1*} = \mu^\mu(1-\mu)^{1-\mu}\left(P_1^*\right)^{-\mu}\left\{1+\frac{[1+(1-\mu)\theta L](1-\phi)\bar{R}}{(1-\mu)(\theta L)^2}\right\}, \tag{12}$$

$$V_Y^{1*} = \mu^\mu(1-\mu)^{1-\mu}(P_1^*)^{-\mu}\left(1+\frac{(1-\phi)\bar{R}}{\theta L}\right), \tag{13}$$

$$V_X^{2*} = \mu^\mu(1-\mu)^{1-\mu}\left(P_2^*\right)^{-\mu}\left\{1+\frac{[1+(1-\mu)(1-\theta)L]\phi\bar{R}}{(1-\mu)((1-\theta)L)^2}\right\}, \tag{14}$$

and

$$V_Y^{2*} = \mu^\mu(1-\mu)^{1-\mu}(P_2^*)^{-\mu}\left(1+\frac{\phi\bar{R}}{(1-\theta)L}\right) \tag{15}$$

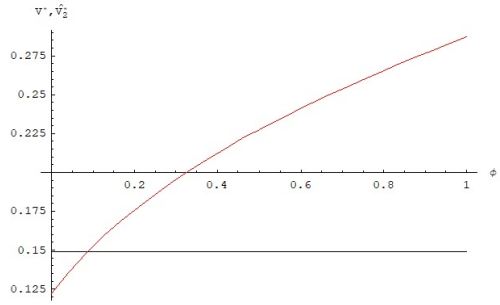

Figure 1: Indirect utility before and after secession

From (12) to (15), we know that the equliribrum indirect utility function under secession are described by some parameters, which are α, β, σ, μ, θ, ϕ, L, and $\bar{R}$. We assume that each government take account of the weighted indirect utility function of workers and peasants and compare it with the indirect utility function before secession when their own region make a secession or not. Here we define $\hat{V}_i$ as the weighted indirect utility function of workers and peasants in region $i(=1,2)$ after secession. Since we assume that the weight ratio is equal to the ratio of workers and peasants, $\hat{V}_i$ is given by

$$\hat{V}_i^* = \mu V_X^{i*} + (1-\mu)V_Y^{i*}, \qquad (i=1,2) \tag{16}$$

Substituting (12), (13), (14), and (15) for (16), $\hat{V}_1$ and $\hat{V}_2$ are given as follows.

$$\hat{V}_1^* = \Omega\left(P_1^*\right)^{-\mu}\left[1+\frac{\left[\mu+(1-\mu)L\theta\right](1-\phi)\bar{R}}{(1-\mu)\theta^2L^2}\right] \tag{17}$$

$$\hat{V}_2^* = \Omega\left(P_2^*\right)^{-\mu}\left[1+\frac{\left[\mu+(1-\mu)(1-\theta)L\right]\phi\bar{R}}{(1-\mu)((1-\theta)L)^2}\right] \tag{18}$$

4 Remaining or secession

4.1 Numerical example

Since the average indirect utility functions before and after secession are given by (11) and (18), the government in region 2 has an incentive to decide a secession from home country when the followin relationship is held.

$$\hat{V}_2^* \geq V^* \tag{19}$$

Figure 1 describes the level of average indirect utility in region 2 before and after secession. Black line and red line denotes the average indirect utility in

region 2 before and after secession, respectively. [1]

Proposition 2:

Supposed that the interest rights of natural resources of minor region (region 2) is not so large relatively, the government in minor region has no incentive to make a secession from home country.

5 Concluding remarks

We construct the model, which the natural resources are unevenly distributed and analyze the effect of interest rate of natural resources on regional secession. We extend the core-periphery model by introducing unevenly distributed resources. There are two kinds of effect in our model. One of them is income effect with the origin of natural resources. Since the natural resources are unevenly distributed in minor region (region 2), the interest rate of them brings an incentives to make a secession to minor region. The other is the decreasing effect of economy of agglomeration caused by the declining population. Consequently, whether local governments are independent or not depends on the trade-off between these two effects. Since we assume that total population of both regions is constant and they are immobile between regions after secession, the decrease in population leads to decrease the number of variety of service there and decrease the utility level. On the other hands, supposed that the minor region can keep the interest rate of natural resources the minor region has kept the interest rate of natural resources after secession and it has been enough large, the government of minor region has an incentive to make a secession from home country. In other words, the home country containing the major region can reduce the incentive to make a secession of the minor region by ensuring the interests of the unevenly distributed natural resources adequately. The most of previous studies as to secession introduce public goods into the model because the disadvantage of secession is given by it. Although our model does not include public goods, we have derived the same result similar to Ohno (2018).

References

[1] Alesina, A., and Spolaore, E. (1997). "On the number and size of nations," *The Quarterly Journal of Economics*, 112(4), 1027-1056.

[2] Krugman, P. (1991). "Increasing returns and economic geography," *Journal of Political Economy*, 99(3), 483-499.

[3] Ohno T. (2018). "Secession, economies of scale, and fiscal policy," *mimeo.*

[1] In Figure 1, we adopt the following parameters, which are $\sigma = 4,\ \mu = 0.6, \alpha = 3,\ \beta = 2,\ \bar{R} = 3,\ L = 10,\ \phi = 0.5$, and $\theta = 0.9$.

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Abstract

This paper analyze the relationship a secession and the distribution interest of natural resources with a simple theoretical model. First of all. one of most serious disadvantages is the decreasing effect of population. As Krugman[2], Ottaviano, Tabuchi, and Thisse[**?**], other core-periphery models show, the decrease in population brings to some disadvantages in terms of love of variety, economy of scale, home market effect. Thus, the decrease in population of minor region suppresses incentives for minor areas to be independent from home country. Similar to minor region, major region may also suffer damage due to population decline with any secession. Secondary, supposed that minor region can get the interest like natural resources which non-uniformly locates in particular regions, minor region has an incentive to make a secession from home country. As we know easily, these effects has a trade-off relationship each other. Therefore, minor region will determine whether its region make a secession from home country or not after taking account of this trade-off relationship.

Local public finance, Natural resources, Products differentiation