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Small Benefit from Country Size

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Abstract

Furceri and Karras(2007, 2008) insisted that smaller countries are subject to more volatile business cycles than larger countries and country size really matters using international data from 1960 to 2000. In this paper, we calculate welfare benefit from doubled country size in Japan, US and OECD average on 2007. For calculating welfare benefit, we use welfare cost of business cycle approach following Obstfeld(1994), and we examine the welfare consequences of their conclusion. Our simple calculations shows that even if Fuerci and Karras(2007, 2008) is right, welfare benefit from country size is small, less than 1% in terms of consumption. Our conclusion suggests that, as long as focusing on only business cycle, population size is not important in terms of welfare, contrary to Furceri and Karras(2007, 2008). However, for example, note that we focus only on the effect of population size on business cycle and we neglect the effect of population size on growth rate of macroeconomy, though some studies recognize it. In other words, our conclusion in this paper is only one suggestion about welfare consequence of population size, particularly focused on and limited to the effect of severity of business cycle. Further researches about welfare consequence of population size (country size) are needed.

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1. Introduction

The "size of nation" is the often-discussed topic in economics (for example, see Alesina and Spolaore[2003]). To be more precise, whether a country size matters for economic success is one of traditional questions in economics. Country size is measured by GDP, population size, and so on.

There are some studies to measure effects of country size on macroeconomy. For example, Rose(2006) suggested that country size does not matter for several economic outcomes, and on the other hand, Alesina and Spolaore (2003) and some other studies suggest that country size is important for some basic economic outcomes such growth rate, inflation and so on. Among them, Furceri and Karras(2007, 2008) does find the negative relationship between business cycle and population size with international data. They defined population size as country size and insisted that smaller countries are subject to more volatile business cycles than larger countries and country size really matters at least for the severity of cyclical fluctuations, i.e. business cycle, using annual and quarterly data from 1960 to 2000. But they do not measure the welfare impact of this population size concretely.

In this paper, we calculate welfare benefit from doubled population growth (that is, doubled growth rate of country size) and doubled population size in Japan, US and OECD average. For calculating welfare benefit, we use the "Welfare Cost of Business Cycle" approach following Obstfeld(1994), and we examine the welfare consequences of Furceri and Karras(2007, 2008)'s conclusion: "country size really matters, at least in terms of cyclical fluctuations."

This paper is organized as follows. In section 2, we explain our theoretical measure for welfare benefit from population size. In section 3, we show our empirical result and in section 4, we summarize our conclusion.

2. Theoretical Measure of Welfare Benefit from Population Size

Let $(\mu, \sigma_\varepsilon^2)$ be the combination of growth rate and variance of consumption under actual business cycle and $(\mu', \sigma_\varepsilon^{2'})$ be that under some new idealistic path. Then, Obstfeld(1994) shows that welfare cost of business cycle, $\kappa[(\mu, \sigma_\varepsilon^2), (\mu', \sigma_\varepsilon^{2'}) : \gamma, \phi, \theta]$, which is the compensation ratio of initial consumption level moving from the path $(\mu, \sigma_\varepsilon^2)$ to new path $(\mu', \sigma_\varepsilon^{2'})$ is represented as

$\kappa[(\mu,\sigma_\varepsilon^2),(\mu',\sigma_\varepsilon^{2'})] = [\exp\{\mu'-\mu-\frac{1}{2}(\sigma_\varepsilon^{2'}-\sigma_\varepsilon^2)\}]^{\frac{\beta}{1-\beta}}-1$ under the assumption about standard expected utility $U_0 = E_0\left\{\sum_{t=0}^{\infty}\beta^t c_t\right\}$, $0<\beta<1$, and consumption process $c_t = c_{t-1}+\mu-\frac{1}{2}\sigma_\varepsilon^2+\varepsilon_t$ where β : discount factor, c_t : natural logarithm of consumption, $\varepsilon_t \sim i.i.d.N(0,\sigma_\varepsilon^2)$. This is the standard definition of "Welfare Cost of Business Cycle."

Now consider "Welfare Cost of Consumption Instability" proposed by Obstfeld(1994) and modify it for our analysis. "Welfare Cost of Consumption Instability" is a kind of "Welfare Cost of Business Cycle" and focuses on measuring the pure benefit from consumption "stability" which means that business cycle variance is zero, assuming other things being equal.

Then, let $(\mu',\sigma_\varepsilon^{2'})$ be the pair of parameters under some assumed population size which is different from actual population size and assume $\mu'=\mu$. The assumption of $\mu'=\mu$ is set to measure the pure cost or effect of severity of cyclical fluctuations, i.e. consumption instability, which Furceri and Karras(2008) suggested[1]. Now, we can calculate welfare benefit from population size using only information about population size. The resulted formula is simplified and shown as follows;

$$\kappa[(\mu,\sigma_\varepsilon^2),(\mu,\sigma_\varepsilon^{2'})] = [\exp(-\frac{1}{2}\Delta\sigma_\varepsilon^2)]^{\frac{\beta}{1-\beta}}-1 \quad \text{where} \quad \Delta\sigma_\varepsilon^2 = \sigma_\varepsilon^{2'}-\sigma_\varepsilon^2.$$

3. Calculation

In this section, we calculate the welfare benefit from population size, following the result of section 2 and with empirical data.

According to Furceri and Karras(2007), their estimate of population size on business cycle volatility is as follows,

$\sigma_{it} = 0.064 - 0.003\ln(pop_{it})$,

where σ_{it} : output volatility of country i at time t (measured by the standard error of the HP6.25 cyclical component of log of real GDP),

[1] Note that, for example, Barlevy(2006) argues that economic fluctuations remarkably reduce welfare by affecting the growth rate of consumption. At the same time, a growing empirical literature starting with Ramey and Ramey (1995) has showed that cyclical volatility negatively affects growth and investment. Our assumption is only for simplification and for the purpose of drawing clear welfare consequences of Furceri and Karras(2007, 2008).

pop_{it} : population of country i at time t.

Estimation is based on Penn World Table 6.2., annual data. Estimation period is 1960-2000 and data consists of 167 countries. This bivariate equation shows the negative and statistically significant relationship, proposed by Furceri and Karras(2007,2008).

Using the above equation, we estimate the effect of population size and calculate the welfare benefit from population size concretely. For population size, we use the population in the Penn World Table 6.3. As the benchmark, when calculating benefit, we assume that (i) "population growth size" is doubled, (ii) "population size" is doubled and $\beta = 0.95$, following Obstfeld(1994). Though Furceri and Karras(2007) reports some different estimates about coefficient of population size on business cycle (it varies from –0.001 to –0.022, see table 1 in their paper), the estimate -0.003 is moderate in their estimates. Rather, since we do not know the constant terms under other coefficients from their table 1, we must use –0.003 case in which we can only know the constant term. Thus, the constant term is important as we see in the following equation. However, we do not have to be too nervous about this limited coefficient selection problem. Recall that Obstfeld(1994) calculated "Welfare Cost of Consumption Instability." His calculation is limited to US case, but shows the upper bound of our calculation: "Welfare Cost of Consumption Instability" in US is less than 1% of initial consumption level, and is small. Because his assumption in his calculation is that the variance under new path is zero and the upper limit of effect of population size on variance is at most equal to or less than his assumption, even if we take the largest coefficient from table 1 in Furceri and Karras(2007).

Following Furceri and Karras(2007), the effect of population size on variance of business cycle is calculated as follows:

$$\Delta\sigma_{it}^2 = \Delta\sigma_{\varepsilon}^2 = [0.064 - 0.003\ln(pop_{it}')]^2 - [0.064 - 0.003\ln(pop_{it})]^2,$$

where pop_{it}': our alternative population size of country i at time t.

Then, our calculation is shown in the next table.

Table

Welfare Benefit from Population Size

	Japan	USA	OECD Average
Population Size (in thousands)*	126,729	282,158	30,955
Population Growth (in thousands)**	329	3,165	285
Benefit(%) if Population Growth Rate is doubled.	0.0004	0.0017	0.0017
Benefit(%) if Population Size is doubled.	0.11	0.10	0.13

* Value at 2000.

** Average from 1990 to 2000.

"Population size" is the value of each country at year 2000, and when we calculate "Benefit(%) if Population Growth Rate is doubled.", we simply add "Population Growth" to "Population Size" for calculating the variance. Therefore, our estimate of "Benefit(%) if Population Growth Rate is doubled." should be interpreted as the value of increased temporal population growth, i.e. the short run effect of population size.

Our result shows that the highest benefit from doubled population size is 0.13% of consumption (OECD average case[2]), and the lowest benefit is 0.10% (US case). And benefit from increased temporal population growth, "Benefit(%) if Population Growth Rate is doubled." is quite small. Therefore, our simple calculations shows that even if Fuerci and Karras(2007, 2008) is right (population size affects business cycle), welfare benefit from country size, that is population size, is small, less than 1% in terms of level of consumption. Particularly, considering that the population size of US is the third biggest in the world and its resulted small benefit (0.10% of consumption), we conclude that practically, population size does not bring a significant effect on welfare both in a short run and a long run.

Note that consumption variance is smaller than GDP variance in general because of larger variance of investment. Therefore, our estimate shows the upper limit of effect of population size, since the coefficient -0.003 we choose is estimated from not consumption data but GDP data.

4. Conclusion

Our conclusion suggests that, as long as focusing on only business cycle, population size is not important in terms of welfare, contrary to Furceri and Karras(2007, 2008). However, note that we focus only on the effect of population size on business cycle. To be more precise, in this paper, we neglect the effect of population size on growth rate of macroeconomy. But some studies suggest that there exists the effect of population size on growth rate (for example, see Alesina and Spolaore[2003]), and including this growth effect into our analysis is important (remember that "Welfare Cost of Business Cycle" approach admit the importance of the effect of growth rate on welfare).

Also, when calculating welfare benefit from population size, we limit our interest to the case of expected utility and that relative risk aversion and elasticity of intertemporal substitution is 1 (see Obstfeld[1994] for implications of these

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[2] OECD countries are Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary Iceland, Ireland, Italy, Japan, Republic of Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.

assumptions). Relaxing these assumptions may bring some interesting conclusions, partly as shown by Obstfeld(1994).

But for them, we need further information such as quantitative effects of population size on growth rate of macroeconomy, correlation among business cycle and growth, and so on. Considering the limitation of such necessary information, we believe that our method in this paper is best at present.

In other words, our conclusion in this paper is only one suggestion about welfare consequence of population size, particularly focused on and limited to the effect of severity of business cycle. Further researches about welfare consequence of population size (country size) are needed.

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