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The Effects of the Macroeconomy on the Labor Supply and Mortality in Long-term Care Institutions in Japan

HANAOKA, Chie
Toyo University

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Abstract

The numbers and types of workers in long-term care facilities may affect the quality of care in these facilities. Recent research has demonstrated that the supply of workers in nursing homes changes in response to macroeconomic conditions. Our study examines how staffing rates and mortality in long-term care institutions are affected by unemployment rates using data from public long-term care institutions in Japan. We find that the supply of skilled nursing care workers is sensitive to the macroeconomy and that mortality in long-term care institutions varies with these cyclic variations. These findings imply that cyclic fluctuations in mortality in long-term care institutions depend partially on cyclic fluctuations in the number of skilled nursing care workers.

Keywords: Staffing, recessions, nursing homes, business cycles
JEL classification: E24, I11, J21

*This study is conducted as a part of the project "Economic Analysis of the Development of the Nursing Care Industry in China and Japan" undertaken at the Research Institute of Economy, Trade and Industry (RIETI). This study utilizes the data of the questionnaire information based on "the Survey of Institutions and Establishments for Long-term Care" which is conducted by the Ministry of Health, Labour and Welfare (MHLW). The author is grateful for helpful comments and suggestions by Yoko Ibuka and Discussion Paper seminar participants at RIETI.

1. Introduction

Most developed countries today are confronting a shortage in their long-term care workforce with such shortages expected to increase. This study investigates how changes in the macroeconomy, measured by unemployment rates, affect this labor supply and how the labor supply affects the mortality rate, using data on long-term care facilities for the elderly in Japan. A better understanding of how the labor supply is determined and the extent an increase in staff improves the quality of care is critically needed today to address these shortages.

Previous literature has examined the effects of specific policies on staffing and quality of long-term care such as the method of reimbursement (Konetzka et al., 2008), mandated minimum staffing requirements (Park and Stearns, 2009; Lin, 2014; Tong, 2011), and staffing subsidies (Foster and Lee, 2015). Recent research has highlighted the effects of changes in macroeconomic conditions on staffing and quality of care. The motivation for this research stream was the study by Ruhm (2000) who found that mortality declined during economic downturns. Related research has reported procyclical mortality for segments of the population including infants (Dehejia and Lleras-Muney, 2004) and the prime working age (Ruhm, 2003). Recent evidence using Japanese data suggests that procyclical mortality is strong among those older than 75 (Ibuka, 2019). Specifically, Stevens et al. (2015) propose that procyclical mortality is driven by the labor supply that fluctuates with economic conditions in nursing homes. Using US state–year panel data, they find that as unemployment rates increase, the number of workers in nursing homes in that state increases. In line with this research, Antwi and Bowblis (2018) focus on the factors affecting workers' turnover in nursing homes using administrative data for all nursing homes in California. They find that a higher unemployment rate lowers nursing home turnover. They also find that as county unemployment rates increase, mortality rates in nursing homes decrease. These studies imply that the quality of care in long-term care facilities improves during recessions because of higher staffing.

Our study contributes to this earlier literature in two ways. First, we examine the differential effects by type of worker, skilled and less skilled. A skilled worker is identified as a worker who has received national qualification as a Certified Care Worker in Japan. The term "Certified Care Worker" refers to educated and trained workers who have the skills and the knowledge to engage in providing care for persons with physical disabilities and mental disorders (The Japan Association of Certified Care Workers, 2019). Considering the heterogeneity among workers is important. Existing literature analyzing acute care hospitals shows that better skilled nursing staff is associated with better care (Aiken et al., 2002). Previous studies analyzing long-term care facilities in the US report similar findings (Lin, 2014; Tong, 2011). Second, we examine macroeconomic impacts in the context of a public long-term care insurance system. Previous studies using long-term care facility data in the US include private-

pay residents. In that context, macroeconomic conditions would be expected to affect residents' ability to pay for services, where not only the labor supply but also the demand for long-term care is fairly responsive to the macroeconomy. Therefore, it could be difficult to disentangle the effects from changes in demand or from those in supply. One prior study addresses this issue. Konetzka et al. (2018) report evidence using nursing home data from California. In an important distinction from the study by Stevens et al. (2015), Konetzka et al. (2018) examine the effects of macroeconomic conditions on demand for nurses by looking at the effects on nursing home revenues. They show that when the county-level unemployment rate increases, nursing homes substitute less expensive licensed practical nurses for more expensive registered nurses. When the unemployment rate rises, staffing by registered nurses drops, however, staffing by licensed practical nurses increases, and the overall staffing level does not change.

In sharp contrast to existing studies, our study demonstrates the effects under the public long-term care insurance, where fees are set by the government and revised every three years, and are unrelated to the fluctuations in the macroeconomy. In addition, fees are the major source of wages for workers in the long-term care industry; thus, wages in the industry would be unresponsive to economic conditions. Moreover, eligibility is universal after age 40. Hence, in this study, the demand for formal long-term care is unrelated to the macroeconomy[1].

We address two empirical research questions. First, how do macroeconomic conditions affect the quantity and composition of the labor supply in long-term care facilities? Second, how does a change in staffing affect the mortality of the residents? To answer these, we analyze the variation in the unemployment rate across 47 prefectures and triennial data covering 2004 and 2016.

We show that the macroeconomic conditions have different effects on staffing and mortality among different types of workers. Our results show that as unemployment rates increase, staffing by national Certified Care Workers increases, while staffing by workers without such qualification decreases. These results suggest that during economic downturns, the competency among nursing care workers is higher. We also show evidence that suggests that an increase in staff with higher skills is associated with a decrease in mortality. Our contribution to the literature is to examine how the macroeconomy affects the quality of workers in long-term care.

2. Background: public long-term care in Japan

We analyze healthcare facilities in the context of public long-term care in Japan.

[1] The economic condition may affect the demand for formal long-term care services through changes in the availability of informal care. This possibility is tested in the robustness checks.

Healthcare facilities mainly provide rehabilitative care for residents who need long-term care to return home. These facilities are not-for-profit with most run by hospitals. As shown in Figure 1, the mortality rate in healthcare facilities declines as the unemployment rate rises. The figure displays the correlation between total mortality in healthcare facilities and the unemployment rate using Japanese prefecture–year panel data from the Survey of Institutions and Establishments for Long-term Care conducted by Japan's Ministry of Health, Labour and Welfare (MHLW) and unemployment rate from the Labour Force Survey conducted by the Statistics Bureau between 1997 and 2017. The variables are detrended, using a linear trend, and normalized by subtracting the mean of the detrended variable and dividing by its standard deviation. This illustrates a strong correlation between unemployment and mortality.

Facilities in Japan are regulated and must maintain minimum ratios and minimum staff presence. For healthcare facilities, the doctor-to-patient ratio is 1:100, while the nurse and nursing care worker-to-patient ratio is 1:3. In the case of healthcare facilities, nursing care workers are the primary care givers who support the daily lives of the care recipients, accounting for 53% of all workers, whereas nurses account for 19% (MHLW, 2017). Since nursing care workers provide the majority of direct care to residents, our focus is on the supply of nursing care workers. Generally, about 40% of nursing care workers are part-time workers in long-term care facilities (MHLW, 2014). In our analysis, we divide workers into two groups, those working full time and those working part time. Although nursing care workers do not require formal training, 67% in the nursing care industry are nationally Certified Care Workers (MHLW, 2017). A Certified Care Worker has worked in nursing care for at least three years and has received specialized nursing-care education for more than six months. Individuals can become Certified Care Workers after passing a national examination. Reports indicate that the number of people with this national qualification is about 640,000; however, 35% do not work in the long-term care industry (MHLW, 2010). One of the most important issues in the public long-term care insurance system is how to attract and retain trained and qualified persons in the long-term care industry (MHLW, 2018).

Wages in the long-term care industry compared with other industries is one of the key drivers of the labor supply. Wages in the nursing care industry may be slow to respond to macroeconomic changes because long-term care fees for Japanese institutional care services are publicly fixed and only revised every three years. Accordingly, during an economic upturn, wages at long-term care facilities may be lower than in other industries. Suzuki (2011) points out that during an economic upturn, job opportunities that pay higher wages compared with the nursing care industry become more available and this may encourage workers in the long-term care industry to seek outside options. Suzuki (2011) finds that workers switch jobs from the long-term care industry to other industries when wage rates in other industries increase. This

implies that it may harder for long-term care facilities to fill job vacancies during economic upturns and may be required to hire less skilled care workers. In contrast, during economic downturns workers who lose jobs, face a cut back in hours, or a reduction in wage rates may seek available jobs in the nursing industry where the jobs are seen as less vulnerable to economic fluctuation. A person with a Certified Care Worker qualification has a great advantage during economic downturns compared with a person without this qualification. Overall, we expect that during recessions, less skilled care workers may decrease, while more skilled care workers may increase. This suggests that economic conditions may indirectly affect mortality at long-term care facilities through changes in staff composition among nursing care workers. Although data on wages are not available in our study, we attempt to examine these effects by focusing on the supply of workers by type of occupation.

3. Methods and Data

3.1. Long-term care facility data

We use panel data of licensed long-term care providers from the Survey of Institutions and Establishments for Long-term Care conducted by Japan's MHLW in 2004, 2007, 2010, 2013, and 2016. These years represent the second year of each fee revision that occurs every three years. Since labor shortages in the long-term care industry first appeared in early 2006, the data are used to encompass the periods before and after this. We analyze two types of questionnaires. The first targets all the facilities in the public long-term care insurance system and investigates status as of October 1 of every year. This questionnaire covers staff allocation and details of services provided to residents. The second questionnaire targets residents of the facilities covered by public long-term care insurance, issued once every three years. To implement the resident questionnaire, about a quarter of all facilities are randomly selected nationwide and two types of residents are chosen as subjects: all residents discharged (including due to death) from the facility during September, and half their residents as of the end of September. The questionnaire covers residents' nursing care level between one and five based on assessment of care requirements and health status. Unfortunately, the facility identification numbers are only available in 2013 and 2016, so we test the second research question using only 2013 and 2016 data. Response rates for the survey are usually approximately 90% for long-term care facilities.

To examine how economic conditions affect staffing in long-term care facilities, we use facility-level data. We construct a facility-level panel dataset. The initial sample includes 3,131, 3,435, 3,382, 3,683, and 3,901 facilities in 2004, 2007, 2010, 2013 and 2016, respectively. We merge these datasets and obtain 19,542 facility–year observations of 4,980 unique facilities.

To examine how changes in staffing levels affect mortality, we merge facility data and resident data. Owing to the survey design where a quarter of all facilities are randomly selected

in implementing the resident questionnaire, we are unable to construct facility-level panel data. Instead, we construct facility-level repeated-cross sectional data. We merge facility data and resident data and obtain 2,464 facility-year observations.

To test the effect of unemployment rates on staffing, the dependent variables are number of workers divided by the number of residents by the types of staff. The key explanatory variable, the prefecture-level unemployment rate, has a wide variation from 1.7 to 7.6, which is measured annually using data obtained from the Labour Force Survey conducted by the Statistics Bureau.

To test the effects of staffing on mortality, the dependent variables are number of deaths during September divided by the number of residents as of October 1 in 2013 and 2016. The key explanatory variable is the fraction of workers by type of healthcare occupation, as described. Summary statistics are reported in Table 1.

3.2. Testing the effect of unemployment rates on staffing

To test the effect of unemployment rates on staffing by type of staff, we use a facility-level fixed-effects strategy to examine how changes in the macroeconomy affect staffing levels in nursing homes and healthcare facilities using facility-level panel data. We estimate the following ordinary least squares regression following Konetzka et al (2018):

$$\text{Worker}_{jkt} = \beta \text{Unemployment}_{kt} + \tau_t + \gamma_j + \delta_k T + e_{jkt} \qquad (1)$$

where the outcome of interest is the number of workers per total number of residents for facility *j*, located in prefecture *k*, in year *t*. We control the time fixed-effects and facility fixed effects. Prefecture-specific time trends are also included. The error term is e_{jkt}. The coefficient estimate of interest is β, which measures the effect of the macroeconomy on staffing.

3.3. Testing the effect of staffing on mortality among residents in long-term care facilities

We use a prefecture-level fixed-effects strategy to examine how changes in staffing levels in long-term care facilities affect mortality using facility-level repeated cross-sectional data. We estimate the following ordinary least squares (OLS) regression controlling the prefecture-level fixed effect:

$$\text{Mortality}_{jkt} = \theta \text{Worker}_{jkt} + \pi X_{jkt} + \tau_t + \delta_k + \delta_k T + e_{jkt} \qquad (2)$$

where the outcome is mortality for long-term care facility j in prefecture k in year t. X_{jkt} is facility characteristics such as average age, fraction of female, and average nursing care level. We also control the time fixed-effects and prefecture-specific time trends. The parameter θ captures the effect of staffing on mortality.

One concern with estimating equation (2) is that the supply of workers is likely to be correlated with unobserved time-varying factors; and the quality of nursing care and the supply of workers are simultaneously determined. As Konetzka et al. (2008) note, sicker residents tend to choose facilities with more staff and, therefore, endogeneity bias could underestimate the effect of staffing on mortality. To tackle this problem, we estimate the instrumental variable (IV) model that uses the unemployment rate as an instrument for staffing level[2]. We follow Antwi and Bowblis (2018) when choosing the IV, as they use the unemployment rate as the IV for turnover of staff on quality of care and find that OLS underestimates the effect of staffing level on mortality in nursing homes in California. Unreported results show that our specification does not pass the Staiger-Stock criteria for a weak exclusion restriction by having an F-statistic over 10; the F-statistic in our first-stage regression is 5.8. Hence, in this study the estimated effect on mortality failing to consider time-varying factors due to the lack of a valid IV could be considered a lower bound on the true effect of staffing on mortality.

4. Results

4.1. Effect of the unemployment rates on staffing

We begin by examining how economic conditions affect the staffing of nursing care of both full-time and part-time workers. In addition, we divide nursing care workers into two groups, those with national qualification as Certified Care Workers and those without to examine whether there are any differential effects by skill. We construct measures of the numbers of each healthcare occupation per resident.

Table 2 show results for nursing care workers. There is a statistically significant effect of the unemployment rate on the ratio of total nursing care workers, as shown in the first column. However, the effect of unemployment differs between the types of qualification. We find evidence that unemployment rates have significant positive effects on the fraction working as Certified Care Workers. In contrast, unemployment rates have negative but insignificant effects on the fraction working as non-certified care workers. A one percentage point increase in the unemployment rate raises the fraction working as full-time Certified Care Workers by 0.004 per resident but decreases the fraction working as full-time non-certified care workers by 0.001 per

[2] When using the IV, we estimate the equation (1) as the first stage model to obtain the predicted values of staffing level for each long-term care facility by type of staff. To implement the IV estimation, we use the predicted values rather than the original values of the supply of workers in the second stage.

resident. These effects reflect a 2.2% increase in the sample average for full-time Certified Care Workers and a 0.7% decrease in the sample average for full-time non-certified care workers.

4.2. Effect of staffing on mortality among residents in long-term care facilities

Next, we examine how changes in staffing affect mortality among long-term care residents. The results in Section 4.1 imply that the competency among nursing care workers may be higher during economic downturns. We estimate a prefecture-level fixed effects model to control the time-invariant unobserved factors. Again, since we use facility-level repeated cross-sectional data, we are unable to control the facility-level fixed effects. Table 3 reports the results of the prefecture-level fixed effects model. The results show that when the fraction working as full-time Certified Care Workers increases, mortality decreases, shown in Panel (a). We find no statistically significant relationship for part-time Certified Care Workers and non-certified care workers shown in Panels (b) to (d).

The results imply that more staffing with higher skilled nursing care workers may be associated with better care management. Lin (2014) shows that quality of care differs among types of workers; registered nurse staffing has a large impact on quality, whereas nurse aide staffing does not have any significant effect on quality using nursing home data in the US. Previous literature shows that an increase in nursing staff reduces the use of restraints and the number of deficiencies (Park and Stearns, 2009) and an increase in registered nurses is associated with a decrease in pressure sores and urinary tract infections (Konetzka et al., 2008), which may subsequently reduce mortality rates. Unfortunately, the available data do not allow for the examination of the effects on these outcomes.

4.3. Robustness checks

One concern with our results is whether changes in the supply of informal care from family caregivers could be a factor. The rate of unemployment is closely related to the supply of informal care, since the decision to provide informal care primarily depends on the opportunity cost of time. Costa-Font et al. (2016) find that after the Great Recession in Europe, the availability of informal care increased, and the use of formal care decreased. To check this possibility, we estimate equation (1), where the outcome is replaced by the fraction of residents who returned home. As the first column of Table 4 shows, we do not observe any significant change in response to changes in unemployment rates. Thus, the results do not support the idea that the supply of informal care from family caregivers is behind the cyclicality in transitions out of long-term care facilities.

Another concern is that the business cycle may simply relocate elderly residents. If low unemployment rates are associated with an increase in the admissions of the frail elderly into

long-term care facilities, it may be possible that the deaths increase because of changes in the composition of the residents in long-term care facilities. We explore this possibility by running a regression equation (1), where the outcome is replaced by the average nursing care level in a facility. We find that unemployment rates do not have a significant effect on the composition of residents, shown in the second column of Table 4.

Another concern is that changes in other health occupations associated with the macroeconomy, such as doctors and nurses, affect mortality. The evidence does not support this possibility. Table 5 shows the results for the fraction of doctors and nurses working in healthcare facilities. The estimates provide evidence that unemployment rates do not have significant effects on the number of workers in these more skilled occupations. The results show that workers in healthcare occupations with higher education or training compared with nursing care workers may be less responsive to macroeconomic fluctuation. This is similar to the finding of Baughman and Smith (2012) who indicate that direct care workers in nursing homes are more affected by the macroeconomy compared with registered nurses.

5. Conclusion

This study examines how economic conditions affect staffing rates and how staffing rates affect mortality in long-term care facilities. We find evidence that a higher unemployment rate is associated with a statistically significant increase in Certified Care Workers and a decrease in non-certified care workers in healthcare facilities. Furthermore, we find that as the number of Certified Care Workers increases, mortality among healthcare facility residents decreases. Taken together, these results imply that staffing difficulties among relatively high-skilled nursing care workers during an economic upturn may be an important factor in managing mortality in healthcare facilities.

Our study has some limitations. First, while we use the 2013 and 2016 surveys to answer our second research question, data availability does not permit us to examine whether the results are robust using longer survey panels. Second, we fail to examine other quality measures than mortality. Third, data limitations prevent us from parsing out the effect of the macroeconomy on the hours of workers in long-term care facilities, as shown in previous studies. These questions remain for future studies to address.

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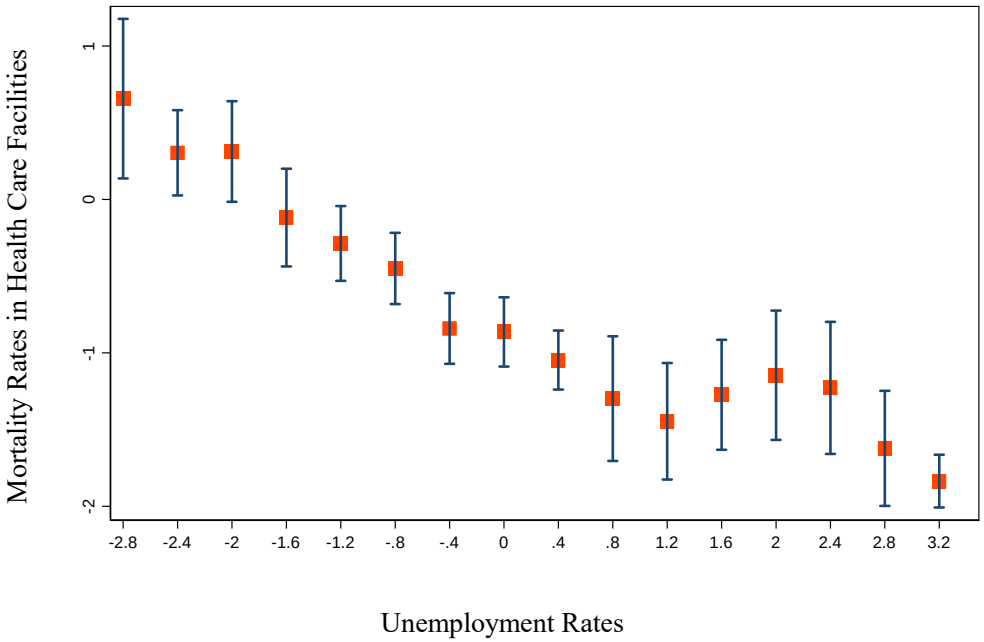
Figure 1. Mortality Rates in Health Care Facilities and Unemployment Rates



Notes: The figure plots the mean and 95% confidence intervals of mortality rates in healthcare facilities for various unemployment rates using the 1997-2017 prefecture-year panel. Both variables are detrended and normalized.

Table 1. Summary statistics of selected variables for healthcare facilities

	Observations	Mean	Std. dev.
Staffing rates			
Nursing care workers	19,542	0.373	0.077
Certified Care Workers			
Full-time	19,542	0.183	0.071
Part-time	19,542	0.010	0.014
Non-certified care workers			
Full-time	19,542	0.131	0.070
Part-time	19,542	0.350	0.034
Doctor			
Full-time	19,542	0.005	0.004
Part-time	19,542	0.008	0.011
Nurses			
Full-time	19,542	0.045	0.028
Part-time	19,542	0.014	0.017
Assistant nurses			
Full-time	19,542	0.059	0.027
Part-time	19,542	0.013	0.014
Prefecture-level unemployment rate	19,542	3.986	0.106
Mortality	2,464	0.003	0.007
Facility characteristics			
Average age	2,464	86.08	8.046
Fraction of female	2,464	0.767	0.422
Average nursing care level	2,464	3.291	1.302
Discharge home	2,464	0.009	0.020

Table 2. Effect of unemployment rates on staffing rates in healthcare facilities

	Nursing care workers	Certified Care Workers		Non-certified care workers	
		Full-time	Part-time	Full-time	Part-time
	(1)	(2)	(3)	(4)	(5)
Key explanatory variable					
Unemployment rate	0.00458***	0.00404***	0.00131***	-0.00146	-0.00034
	(0.0015)	(0.0015)	(0.0004)	(0.0016)	(0.0008)
Facility fixed effects	×	×	×	×	×
Year effects	×	×	×	×	×
Time trends	×	×	×	×	×
N of facilities	4,980	4,980	4,980	4,980	4,980
N of observations	19,559	19,559	19,559	19,559	19,559

Notes: Robust standard errors are in parentheses. Significance levels are **p < 0.05 and ***p < 0.01.

Table 3. Effect of staffing rates on mortality in healthcare facilities

	Mortality Rates
Key explanatory variable	
Panel a: Full-time Certified Care Workers	-0.01548***
	(0.0052)
Panel b: Part-time Certified Care Workers	0.00927
	(0.0163)
Panel c: Full-time non-certified care workers	0.00545
	(0.0086)
Panel d: Part-time non-certified care workers	-0.00580
	(0.0048)
Facility characteristics	×
Prefecture fixed effects	×
Year effects	×
Time trends	×
N of facilities	2,446
N of observations	2,446

Notes: Robust standard errors are in parentheses. Significance levels are **p < 0.05 and ***p < 0.01.

Table 4. Robustness checks for healthcare facilities: Effect of unemployment rate on resident characteristics

	Discharge home	Average nursing care level
	(1)	(2)
Key explanatory variable		
Unemployment Rate	0.00069	0.00360
	(0.0066)	(0.3352)
Facility characteristics	×	×
Prefecture fixed effect	×	×
Year effect	×	×
Time trends	×	×
N of observations	2464	2464

Notes: Robust standard errors are in parentheses. Significance levels are **p < 0.05, and ***p < 0.01.

Table 5. Robustness checks for healthcare facilities: Effect of unemployment rate on doctors and nurses

	Doctor		Nurses		Assistant Nurses	
	Full-time	Part-time	Full-time	Part-time	Full-time	Part-time
	(1)	(2)	(3)	(4)	(5)	(6)
Key explanatory variable						
Unemployment rate	0.00002	0.00047	0.00003	-0.00039	0.00028	-0.00066
	(0.0001)	(0.0002)	(0.0006)	(0.0003)	(0.0006)	(0.0003)
Facility fixed effects	×	×	×	×	×	×
Year effects	×	×	×	×	×	×
Time trends	×	×	×	×	×	×
N of facilities	4,980	4,980	4,980	4,980	4,980	4,980
N of observations	19,559	19,559	19,559	19,559	19,559	19,559

Notes: Robust standard errors are in parentheses. Significance levels are **p < 0.05 and ***p < 0.01.