

Do Farmers Live Longer?: Empirical Evidence from City-Level Data in Japan

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1. Introduction

PRIMAFF is undertaking a project on the non-economic benefits of agriculture. As a part of the project, this report presents a summary of the major findings on the impact of agriculture on workers' health. The purpose of this research is to clarify whether farmers are long-lived compared to non-farmers. Specifically, we investigate the causal relationship between farm population and overall mortality using city-level data in Japan.

2. Previous research

There is some evidence of whether or not farmers are in good health. For example, according to demographic statistics in 2000, the mortality rate among Japanese farmers aged 20 to 64 is slightly higher than national average. A similar pattern has been found by medical research focused on men aged 30-59 during the period 1980-2005 ⁽¹⁾.

However, simple comparison of mortality rate could be misleading as it ignores various factors other than occupation (known as "omitted variable bias" or "confounding"). For instance, the higher mortality rate among farmers may not be caused by occupation itself, but rather, caused by their low income or the scarcity of hospitals in rural regions. Further, in light of the fact that 85% of the total deceased, and roughly half of farmers, were 65 years or older, the elderly should not be ignored in the analysis ⁽²⁾.

3. Method and data

We analyze the relationship between the share of each occupation in the population (dividing the number of workers in each occupation by the total population) and the overall mortality rate (The ratio of deaths to the total population. This variable is defined for overall population, not by each occupation). The share of each occupation and mortality rate are calculated for 1,700 cities across Japan, by gender, and by 5-year age groups ⁽³⁾.

The data on population by occupation and mortality count are obtained from the census and demographic statistics respectively. The definition of "farmer" in the census is a person engaged mainly in agricultural works, and thus those who earn more from non-farm sources are excluded. In order to reduce omitted variable bias, a number of variables are also collected (e.g. education, income, number of hospitals, number of doctors, total road length, land use).

4. Results

Regression analysis reveals the impact of each occupation on mortality. Here, the "impact" represents the percent change in mortality caused by 1% increase in the population ratio of a given occupation. In the following figures, the results are summarized as the difference between agriculture and non-agriculture. Impact of non-agriculture is a weighted average of about 20 non-agricultural occupations (including unemployment). If the difference is negative, it means that higher share of farm population (and lower share of non-farms) decreases overall mortality, even if other conditions such as income and local environment are the same.

Figure 1 shows the estimation results for all age groups (over 20 years old). The results are negative and statistically significant in most cases, suggesting that the city's mortality rate decreases as farm population share increases. From these aggregated (city-level) patterns, we could infer that even at the individual-level, farmers live longer than non-farmers ⁽⁴⁾.

Next, looking at the results by age group (Figure 2), the difference between agriculture and non-agriculture is not statistical significant from age 20 to 59, but for ages 60 and over, the difference is significantly negative. Agriculture is especially beneficial for the elderly's health ⁽⁵⁾.

Finally, similar analysis is performed by cause of death for ages over 60 (Figure 3). We observe that agriculture decreases the mortality due to senility and cardiovascular disease (e.g. heart stroke). For ease of

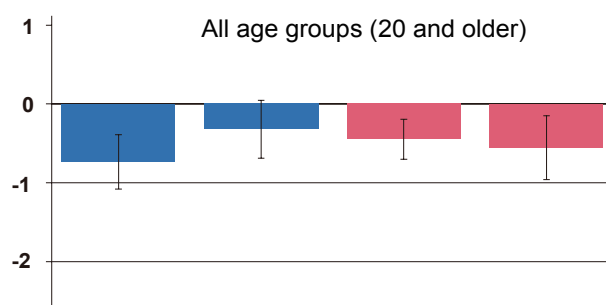


Figure 1. All age groups

Notes: The vertical axis is "Impact of Agriculture - Impact of Non-Agriculture". For instance, if this value is -0.5, it means that when the farmers' share in the total population increases by 1% point (and non-farmer decreases by the same amount), then the regional mortality rate decreases by 0.5% (not 0.5% points). Vertical lines are 90% confidence intervals, and if they do not overlap with 0, it means they are statistically significant. Four patterns were estimated by sex and age group.

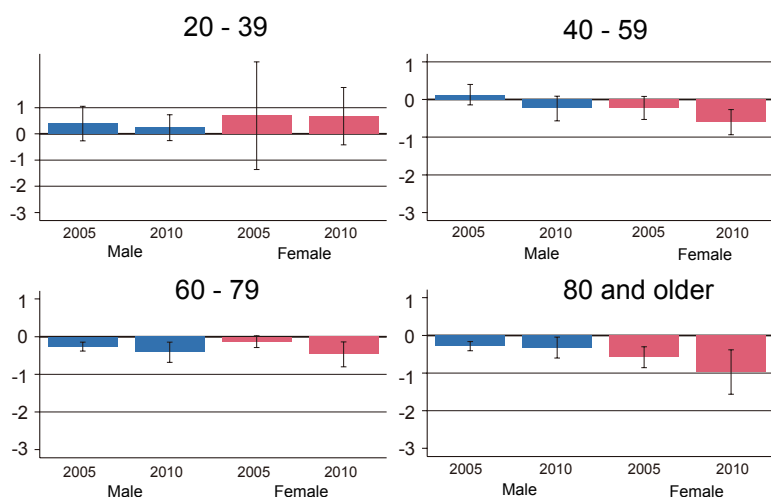


Figure 2. By age group

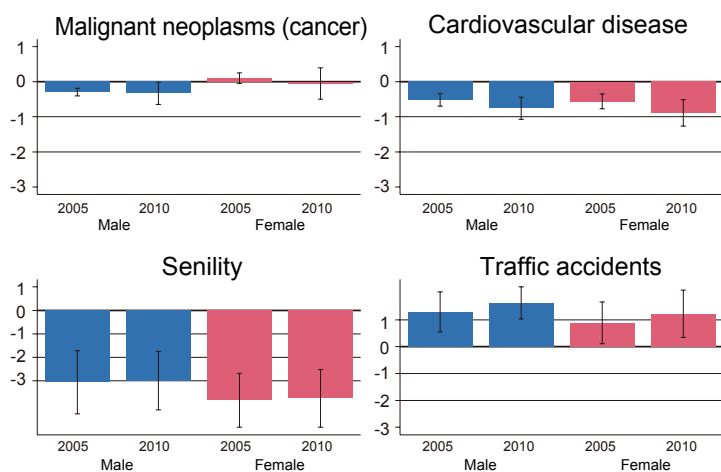


Figure 3. By cause of death

understanding, suppose that there are 10,000 farmers and 10,000 non-farmers at the beginning of year. Our results mean that the total number of deaths due to senility or cardiovascular disease by the end of year among farmers, is fewer than those among non-farmers. However, agriculture increases deaths by traffic accidents (including tractor accidents). The mortalities due to respiratory disease and renal disease were significantly negative only among men, while liver disease and suicide were not significant for either gender (figures omitted).

5. Conclusion

We found that among people 60 years or older, regional mortality rate decreases as farm share in population increases, all other things held constant. This result implies that farmers are longer-lived than non-farmers. In particular, farmers' mortality due to senility and cardiovascular disease are significantly lower than non-farmers. Conversely, mortality rate due to traffic accidents are higher, though the total deaths is not so large. Clarifying the mechanism of why farmers live longer, whether it is because of their exercise habits, their diet, or psychological stress, is an important direction for future research.

Notes(1) Wada, K. et al. (2012). Trends in cause specific mortality across occupations in Japanese men of working age during period of economic stagnation, 1980-2005: retrospective cohort study. *BMJ*, 344.

(2) In Europe and the U.S., it has been found in various studies that farmers have a lower mortality rate than non-farmers, that they suffer less from cancer and cardiovascular disease, that they have a lower probability of hospitalization, and that farmers generally tend to be healthier than non-farmers.

(3) Estimation results using regionally aggregated data could be biased (known as "aggregation bias" or "ecological fallacy"). In order to reduce biases, it is recommended to stratify data as finely as possible, and to control spatial correlation. In this study, the data are compiled by city, sex, and 5-year age group, and the spatial correlation are controlled by clustered standard error at the prefecture level.

(4) A similar result has been observed in Sokejima and Kagamimori (2005) "Occupation and Average Life Span", *Japan Medical Journal* (4247), p. 129-131.

(5) Note that these results may merely show the reverse causality: Healthier individuals are more likely to engage in farming than sicker or more sensitive individuals. In order to avoid this bias (known as "selection bias" or "healthy worker effect"), I conducted several robustness checks, and confirmed that the qualitative conclusion does not change.