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研究課題名(和文) Simulations of Municipal Mergers

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研究成果の概要(和文)：How should patterns of municipal mergers be decided? The recent Heisei mergers were determined voluntarily by municipalities. However, the earlier Meiji mergers were decided by central officials. How does the merger pattern differ when decision-making is centralized rather than decentralized?

研究成果の概要(英文)：How should patterns of municipal mergers be decided? The recent Heisei mergers were determined voluntarily by municipalities, based on incentives offered by the national government. However, the earlier Meiji mergers were decided by central government officials. How does the merger pattern differ when decision-making is centralized rather than decentralized? We examine the Meiji municipal mergers as they actually occurred, and assume that the central planners were attempting to choose patterns of mergers that would benefit local residents. Some areas were richer than others, however, and thus some of the centrally decided mergers resulted in richer areas having to share resources with poorer areas. Using computer simulations, we then show that if municipalities had been allowed to choose their own merger partners, the result would have been a large number of geographically bizarre mergers, as municipalities avoided poorer neighbours and merged instead with more distant partners.

研究分野：Political economy

キーワード：Municipal mergers Coalition formation Integer programming Hedonic game

1. 研究開始当初の背景

To prepare for this research, we had obtained the GKCR dataset, which described a large number of variables for villages in Gifu prefecture, before the imposition of the Meiji municipal mergers. Previous research on the Heisei municipal mergers suggested that a major problem would be performing computational simulations that describe how municipalities would want to merge. We thus obtained access to the high performance computing system at Nagoya University.

2. 研究の目的

When there are changes in the arrangement of jurisdictions, there are basically two ways of carrying out these changes. First, the new jurisdictions could be imposed from above. Alternatively, the new jurisdictions could be decided on from below. The “bottom up” approach is seen at the international level in the form of independence referenda. This decentralized approach is also seen at the sub-national level in the form of decentralized municipal mergers, such as those carried out recently during the *Heisei* mergers. These sorts of mergers, which emphasize the “right to self-determination” of the residents in the target jurisdictions, are attractive from a philosophical perspective.

When the *Heisei* municipal mergers actually occurred, however, several problems were identified. First, a smaller number of mergers actually occurred than was targeted by the Japanese government. Second, some of the mergers that did occur had geographically bizarre patterns, where municipalities did not merge with their neighbours, but rather merged with more distant partners with whom there was supposedly a better “fit”. Anecdotally, these *tobichi* mergers frequently occurred when some municipalities were heavily indebted. Neighbours did not want to be forced to assume a share of those debts via a municipal merger, and thus chose different merger partners.

Can these features of the *Heisei* municipal mergers be explained by the fact that the mergers were conducted in a decentralized fashion? Which of the two identified problems with the *Heisei* mergers is more

severe: the fact that there were not as many municipal mergers as the central government was hoping for, or the fact that the mergers that did occur had geographically bizarre shapes?

3. 研究の方法

We answer these questions by using a structural model of the municipal merger process. A structural model is necessary because the question is counterfactual: if a *different* merger procedure (centralized vs. decentralized) had been used, how would the mergers that resulted have changed. It is not enough to simply compare two sets of municipal mergers, one of which was centralized and the other one of which was decentralized. For example, the Meiji mergers were not only centralized, but also marked the introduction of modern local government in Japan. Very few *tobichi* mergers were observed in the Meiji municipal mergers, but this may be due to the fact that travel was more difficult during this period, compared over a hundred years later during the *Heisei* municipal mergers.

Our approach is thus to estimate the preferences for various sorts of merger configurations, and then predict (via simulation) what would have happened, had a different municipal merger method been employed. To do this, we first need to develop a structural model that explains why the actually observed mergers occurred, and then use this model to predict what would have happened had a different method of deciding municipal mergers been employed.

An important choice at this point is whether we should construct a model using the *Heisei* mergers and then simulate a counterfactual for what a central planner would have done, or alternatively construct a model using the Meiji municipal mergers and simulate a counterfactual for what would have occurred had the mergers been decentralized. The former approach is perhaps intuitively more appealing, but turns out to have a serious problem: data on the outcome of a decentralized set of municipal mergers only leads to a set-identified estimate of preferences over mergers, which creates difficulties when then trying to consider what a social planner would do. In contrast, data on a set of centralized municipal mergers leads

to point identified estimator of preferences over mergers (assuming that the central planner is utilitarian), and can be relatively easily used to simulate what would have happened in the decentralized case. We thus use data from the Meiji municipal mergers, which were centralized, rather than from the more recent Heisei municipal mergers.

With the Meiji data we assume that the government officials that planned the mergers were utilitarian social planners, although ones that placed somewhat more weight on the elite than regular farmers. Using data on village characteristics, we can thus estimate the payoff for various sorts of mergers: for example, some villages might be more geographically distant, but produce the same sorts of agricultural products. If these types of villages are systematically merged this shows that agricultural similarities are more important than geographic distance. Estimates are produced using a variety of methods, including versions of probit, maximum score, minimum distance, and moment inequality estimators.

With these estimates of the payoffs of villages over mergers, we then consider what merger partners these villages would have chosen, had the Meiji mergers been conducted in the decentralized manner of the later *Heisei* mergers. Here there is a computational difficulty, because the number of potential merger patterns grows very quickly with the number of villages, and it is not possible to enumerate all potential mergers – let alone all potential partitions of villages into mergers – in all but the smallest cases. However, for the particular form of payoff functions that we have chosen, the coalition formation game we are considering has the form of a fractional hedonic game, and we show that a stable partition for fractional hedonic games can be found by an iterated myopic method. This method is empirically motivated: it is theoretically possible that there is no stable partition, and thus our method could not possibly return one. However, in over a million simulations we never encounter such a situation, and thus conclude that our method works in practice, even though it is not guaranteed to work in theory.

4. 研究成果

We first verify that our model accurately describes the government officials' objectives. In particular, the number of municipal mergers that a central planner should choose is predicted to be very close to the actually observed number, and patterns of predicted mergers match actually observed patterns. This indicates that the estimators used indeed work as expected.

We then consider what would have happened in the Meiji period had municipal mergers been decided by a decentralized process instead of by government officials. Here we find that there are fewer mergers than the central planner would have chosen, and that these mergers mainly involve rich villages choosing other rich villages as their partners, even if there are poorer villages that are closer.

An important feature of the *Heisei* municipal mergers was the financial incentives that were offered in order to convince municipalities to participate in mergers. These financial incentives had effectively both a “carrot” and a “stick” component. The “carrot” consisted of additional payments (mostly in the form of subsidized debt issuance) to municipalities that did participate in mergers. The “stick” consisted of cuts in transfer payments, particularly to municipalities that did not participate in mergers. We take this set of incentives, and now suppose that these specific incentives had been provided to villages during the Meiji period as part of a system of decentralized mergers.

What we find is that with this particular set of incentives, the distortion in the pattern of mergers becomes much more severe. This is because the main purpose of municipal mergers is to reduce the cost of public goods, and thus if the individual municipalities do not bear this cost they do not choose efficient patterns of mergers. The merger incentives provided during the *Heisei* period, however, were built on top of an existing transfer system that served to subsidize smaller municipalities, leading to them ignoring the potential benefits of merging.

A major conclusion of our research is that, while there is some inefficiency introduced

simply by allowing municipal mergers to be decided by a decentralized process, severe inefficiency results only when this decentralized process interacts with a transfer scheme that distorts the incentives of individual municipalities.

An open question in the history of Japanese local public finance is the precise nature of the Showa municipal mergers. Some researchers believe that these mergers were effectively centralized, while other researchers hold that government pronouncements were actually truthful, and the mergers truly were decentralized and voluntary. As in the Heisei period, a large transfer system was in place during the Showa period, providing different transfers to different municipalities based on municipal characteristics. A major difference, however, was that the Showa transfer system did not provide special benefits for smaller municipalities: the transfer scheme was effectively an across-the-board per capita grant to all municipalities, adjusted for municipal tax base.

Using our simulation approach, we show that, had the transfer scheme in place during the Showa period been used with our Meiji municipal merger data, the decentralized set of mergers that would have resulted is almost indistinguishable from the set of mergers that would have been selected by a social planner. This result shows that it is not the existence of a transfer system per se that causes problems for decentralized municipal mergers. Instead, it is the particular form of the transfer system in place during the *Heisei* period: by providing subsidies particularly to smaller municipalities, the transfer system eliminated a large part of the incentive for municipalities to merge and enjoy efficiencies of scale.

An additional result from our examination of the Showa transfer system is that we can explain why there has been no conclusion regarding the nature of the Showa municipal mergers. These mergers have been studied fairly extensively, and thus it is surprising that researchers do not agree on whether the mergers were centralized or decentralized in nature. Our simulations, however, show that decentralized mergers in the presence of a Showa-style transfer scheme result in almost identical mergers to those

chosen by a central planner. That is, with this particular type of transfer scheme, there is no conflict between the individual municipalities' desired mergers and the merger pattern that would be chosen by the central government. It thus makes sense that there is no agreement about whether the mergers were centralized or decentralized: the distinction is irrelevant, because the preferences of the individual municipalities are effectively the same as the objective of the central planner. This result is in sharp contrast to our simulation results for *Heisei*-style transfer schemes, which show a divergence between the desired partners of individuals municipalities and the types of patterns that would be selected by a central planner.

5. 主な発表論文等

(研究代表者、研究分担者及び連携研究者には下線)

[雑誌論文] (計 1 件)

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6. 研究組織

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