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Impact of natural disasters on industrial agglomeration: The case of the Great Kantō Earthquake in 1923

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Abstract

The Great Kantō Earthquake in 1923 did enormous damage to industries in Tokyo Prefecture. Around 40% of the buildings in Tokyo Prefecture were completely burnt or destroyed. In this paper, we investigate whether this temporary shock had a persistent impact on the spatial distribution of industries in Tokyo, using ward- and county-level panel data for industrial workers. It was found that while the earthquake caused mean shifts in the shares and numbers of workers, these mean shifts disappeared by the early 1930s. On the other hand, the earthquake caused shifts in the trends in the share and number of workers. The combined effects of these mean shifts and trend shifts were persistent for both the shares and the numbers of workers. The earthquake caused especially serious damage to the old industrial clusters in the southeast of Tokyo, and provided an opportunity for newly developing industrial clusters in non-damaged areas to take over the market. Further, the people and the local governments in non-damaged areas made an effort to take advantage of this opportunity to attract factories. Arguably, these forces made the impact of the earthquake on the spatial distribution of industry persistent.
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1. Introduction

This paper investigates the impact of a large natural disaster on the spatial distribution of industries, focusing on the Great Kantō Earthquake that hit the areas around Tokyo in 1923. The Great Kantō Earthquake, in which more than one hundred thousand people died, was the worst natural disaster in the history of Japan. This disaster also caused enormous damage to industries in certain areas in Tokyo, at least temporarily. We focus on how persistent the impact of the earthquake was.

This paper is related to the broad literature on the persistence of impacts of historical events. The possibility of path dependence has been widely accepted by economic historians and economists since the influential work of David (1985). Further, a number of models with multiple equilibria provide a theoretical

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basis for the possibility of path dependence (Nunn 2014). These models include those in spatial economics (Krugman 1991; Fujita et al. 1999). It is remarkable that formal empirical tests on multiple equilibria and path dependence have been conducted on spatial issues. One of the reasons for this is that there are appropriate opportunities for natural experiments. Those studies include Davis and Weinstein (2002, 2008), Brakman et al. (2004), Miguel and Roland (2006), Bosker et al. (2007), Redding and Strum (2008), and Redding et al. (2011). The results of these studies on multiple equilibria and path dependence are mixed. That is, whereas Davis and Weinstein (2002, 2008), Brakman et al. (2004), and Miguel and Roland (2006) did not find evidence supporting the persistence of temporary shocks, Bosker et al. (2007), Redding and Strum (2008), and Redding, et al. (2011) found supportive evidence.

This paper aims to contribute to this strand of literature in two ways. First, the focus is on the effects of a temporary shock caused by a natural disaster rather than by a war or a political event. The damage caused by the earthquake was exogenous, and, as shown below, the shock provided by the Great Kantō Earthquake was extremely large. Second, ward- and county-level data from Tokyo Prefecture are used. Previous studies that focused on temporary shocks rejected the possibility of a long-run impact of a temporary shock, based on nationwide, city-level, or district-level data. However, even if the nationwide spatial distribution of the population and economic activities is determined by the fundamental conditions and, hence, a temporary shock has no long-run impact, it is possible that a temporary shock has a long-run impact within a more limited area. In such a case, the variations in fundamental conditions, such as proximity to the coast and river, are supposed to be smaller; hence, the existing equilibrium of spatial distribution of economic activities within the area is less stable. In addition, the case of the Great Kantō Earthquake is useful in identifying the shift in equilibrium, because not only did those fundamental natural conditions not change due to the earthquake, but the physical infrastructure, including public transportation, also recovered swiftly after the earthquake.[1]

In the context of Japanese economic history, the period that includes the Great Kantō Earthquake was the period when the spatial distribution of industries in the Tokyo metropolitan area changed substantially, as shown below. In this period, new industrial clusters developed rapidly in some counties, including Ebara County, which came to be the largest cluster of the machinery industry in Japan. Investigating the impact of the Great Kantō Earthquake on the spatial distribution of industries contributes to understanding the spatial aspects of the development of the Japanese economy (Whittaker 1997, pp. 63–6; Kantō Bureau of International Trade and Industry 1996, pp. 137–8).

The remainder of the paper is organized as follows. Section 2 describes the damage caused by the Great Kantō Earthquake, and the subsequent reconstruction plan. Section 3 describes the changes seen over time in the spatial of industries in Tokyo Prefecture and econometrically analyzes the long-run impact of the earthquake. Section 4 discusses the descriptive and anecdotal evidence on the impact of the earthquake. Section 5 concludes the paper.

2. The Great Kantō Earthquake and reconstruction

At 11:58 am on September 1, 1923, a huge earthquake with a magnitude of M 7.9 hit the southern area of the Kantō district in Japan. This earthquake, the Great Kantō Earthquake, was the worst natural disaster in the history of Japan. The damage extended over seven prefectures, Tokyo, Kanagawa, Saitama, Chiba, Ibaraki, Shizuoka, and Yamanashi. The total number of deaths and missing persons was more than 100,000,[2] which was 16.3 times larger than the losses from the 1995 Kobe Earthquake and 5.4 times larger than those from the 2011 Great East Japan Earthquake.[3] In addition, more than 460,000 buildings were completely burnt or destroyed.[4] The human and physical damage was concentrated in the prefectures of Tokyo and Kanagawa (see Table 1 and Figs. 1 and 2). The main reason why the damage was so serious was the

[1] Railways were seriously damaged by the earthquake, but by October 1923, most of the major railway lines had been reconstructed by the activities of the engineer brigade (Social Affairs Bureau, Ministry of Home Affairs, 1926, pp. 439–441). Yokohama Port, the largest international port in Japan at the time, had also been reconstructed by 1925 (Society for Research on the Recovery, 1930, p. 2123).

[2] The number of deaths and missing persons include those who died from the earthquake itself and those who died from the fire caused by the earthquake.

[3] The losses from the 1995 Kobe Earthquake and the 2011 Great East Japan Earthquake were 6,437 and 19,386, respectively (see the Web page of the Fire and Disaster Management Agency, http://www.fdma.go.jp/data/010604191452374961.pdf, and the Web page of the National Police Agency, http://www.npa.go.jp/archive/keibi/biki/higaijokyo.pdf).

[4] “Destroyed” means “directly destroyed by the quake,” while “burnt” means “burnt by the fire caused by the earthquake.”

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