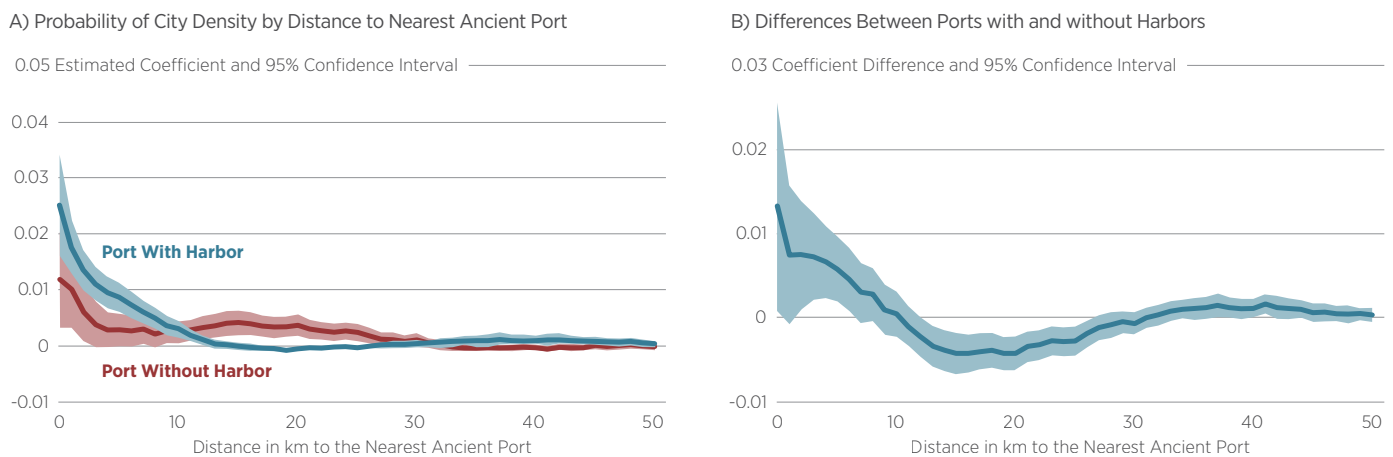


# Identifying Agglomeration Shadows: Long-run Evidence from Ancient Ports

Based on BFI Working Paper No. 2024-80, “[Identifying Agglomeration Shadows: Long-run Evidence from Ancient Ports](#),”  
by Richard Hornbeck, University of Chicago; Guy Michaels, London School of Economics; and Ferdinand Rauch, University of Heidelberg

The locations of ancient ports near the Mediterranean reveal that large cities cast “agglomeration shadows” that discourage economic activity in nearby areas.

**Figure 1** • Impacts on Probability of City Density



Note: Panel A shows how the likelihood of having city population density changes with distance from ancient ports, for ports with and without natural harbors. Density is highest at the ancient port locations themselves (0 km), with a noticeable decline as you move away from ancient port locations. There is a distinctive dip in city density at intermediate distances (around 20 km), followed by an increase at distances up to 40 km. Panel B shows the differences between these estimates for ports with and without natural harbors, and is constructed by subtracting the estimates for ports without harbors from the estimates for ports with harbors.

Prior research shows that businesses are more productive when they are clustered together, due to agglomeration spillovers. The resulting concentration of economic activity may also cause agglomeration shadows, which discourage

growth in the areas surrounding large cities. Identifying these shadows is complicated, however, because cities affect each other in both directions and because of “wave interference” that arises when averaging across different areas.

## BFI Blackboard

**Agglomeration spillover:** Economic benefits that firms gain from being close to each other, resulting in increased productivity.

**Agglomeration shadow:** The negative impact on economic activity and city formation in areas surrounding large cities, where the concentration of businesses discourages growth in nearby locations.

**Wave interference:** The overlapping and interacting effects of economic activity in different regions, which makes it difficult to isolate the role of agglomeration shadows.

To overcome these challenges and identify agglomeration shadows, the authors develop simulations that build on a model from Fujita, Krugman, and Mori (1999). They then use the locations of ancient ports near the Mediterranean, which they show seeded modern cities. They collect data on population density in 2015 across 2.3 million 1km by 1km grid cells within 50km of the coast and within 200km of their nearest ancient port (detailed in their [working paper](#)) to estimate the impacts of ancient ports on modern conditions in these areas. They find the following:

- Ancient port locations cast agglomeration shadows on surrounding areas, in ways consistent with the model simulations. Ancient port locations exhibit a distinct “wave” effect, where population density declines markedly out to 20km and then increases up to 40km. This estimated agglomeration shadow, roughly 10-30km from ancient port locations, is similar to the distance of a typical day’s travel for pack animals or carts in the ancient world. This wave pattern is more obscured around ancient ports that lost their harbors by the modern era, suggesting that the loss of a geographic advantage leads to more diffuse agglomeration shadows.

- Agglomeration shadows reflect general economic competition between cities rather than competition between port activities. The loss of a natural harbor in neighboring ancient port locations decreases the likelihood of modern port structures in a location, but increases that location’s city activity.
- The authors also find evidence of agglomeration shadows in modern city locations more generally. Across all the modern cities in the authors’ sample, they show that there are fewer large cities (> 500,000 people) whose nearest large city is within 40km, and more large cities from 40km to 60km.

The upshot is that encouraging growth in particular places can discourage growth in nearby areas. Prior research shows that the same can be true of concentration of [medical services](#), as providers benefit from geographically concentrated production. This research has implications for the design of place-based policies that emphasize investment in a specific location, as it suggests potential negative consequences for surrounding areas.

## READ THE WORKING PAPER

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