Note S1. Discussion of "siphon effect" and "radiation effect"

The siphon effect likely represents the early phase of the Changchun Economic Circle strategy, during which resources are initially concentrated in the core city, benefiting its residents [29,50]. While this process has contributed significantly to Changchun's development and improved well-being, it may also temporarily widen disparities with surrounding areas. The absence of a clearly observable radiation effect in the study area does not necessarily imply its nonexistence. Rather, as the economic circle matures, the radiation effect is expected to become more pronounced, potentially generating positive spillovers to neighboring regions [29,52]. It should be noted, however, that our current data do not directly quantify these effects. Given the limitations of the existing dataset, these interpretations remain speculative and should be treated with caution.