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Consistent Testing for an Implication of Supermodular Dominance with an Application to Verifying the Effect of Geographic Knowledge Spillover

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Abstract : Supermodularity, or complementarity, is a popular concept in economics which can characterize many objective functions such as utility, social welfare, and production functions. Further, supermodular dominance captures a preference for greater interdependence among inputs of those functions, and it can be applied to examine which input set would produce higher expected utility, social welfare, or production. Therefore, we propose and justify a consistent testing for a useful implication of supermodular dominance. We also conduct Monte Carlo simulations to explore the finite sample performance of our test, with critical values obtained from the recentered bootstrap method, with and without the selective recentering, and the subsampling method. Under various parameter settings, we confirmed that our test has reasonably good size and power performance. Finally, we apply our test to compare the geographic and distant knowledge spillover in terms of their effects on social welfare using the National Bureau of Economic Research (NBER) patent data. We expect localized citing to supermodularly dominate distant citing if the geographic knowledge spillover engenders greater social welfare than distant knowledge spillover. Taking subgroups based on firm and patent characteristics, we found that there is industry-wise and patent subclass-wise difference in the pattern of supermodular dominance between localized and distant citing. We also compare the results from analyzing different time periods to see if the development of Internet and communication technology has changed the pattern of the dominance. In addition, to appropriately deal with the sparse nature of the data, we apply high-dimensional methods to efficiently select relevant data.

Keywords : supermodularity, supermodular dominance, stochastic dominance, Monte Carlo simulation, bootstrap, subsampling
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