

Optimization on the Multi-period Empty Container Repositioning Problem in Regional Port Cluster Based upon Inventory Control Strategies

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Research Article

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Abstract

Within the area of regional port clusters, this paper establishes a multi-period mixed integer programming model to optimize the empty container repositioning between public hinterlands and ports, comprehensively considering the quantitative and periodical inventory control strategy. By using Markov decision process combined with dynamic programming method, this paper dynamically optimizes the empty container inventory threshold (D;U) under quantitative strategy and S under periodical strategy at each port within the regional port clusters. On this basis, this paper optimizes the empty container repositioning scheme between public hinterlands and ports. Meanwhile, Liaoning coastal regional port cluster and its northeast hinterland are selected as the objects to solve this model and the results show that the total cost of shipping company can be saved by 14.16% and 11.92% respectively by the quantitative and periodical inventory control strategy. Selecting the quantity of public hinterland terminals, the empty container demand of public hinterland terminals and ports, the inventory threshold of empty containers and other factors, this paper carries on the sensitivity analysis. This paper validates inventory control strategy can weaken the shipping company in the influence of the external environment changes. And the quantitative inventory control strategy can reduce the total cost value to a greater extent and more effective in cost control than periodical strategy.

Full Text

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Figures

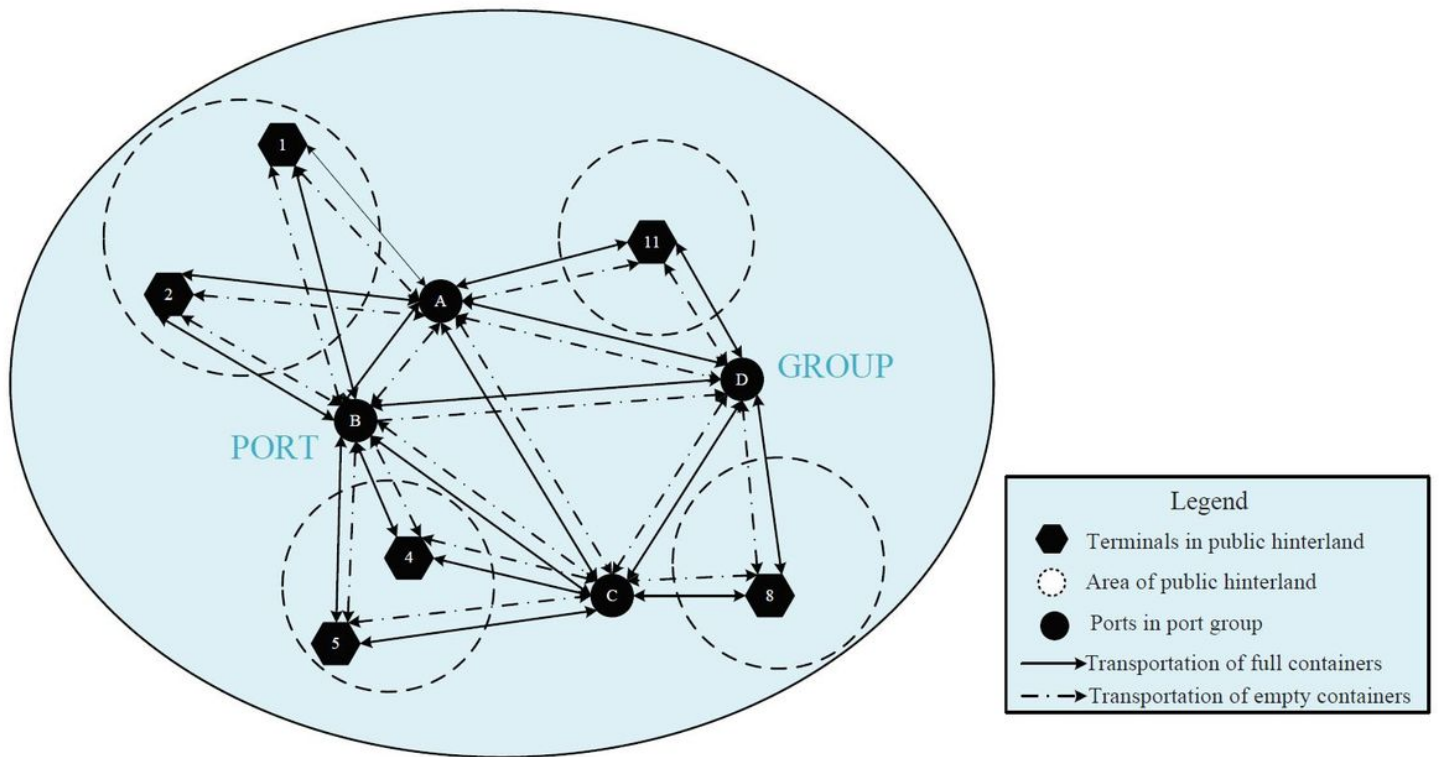


Figure 1

Empty container transportation mode within regional port cluster

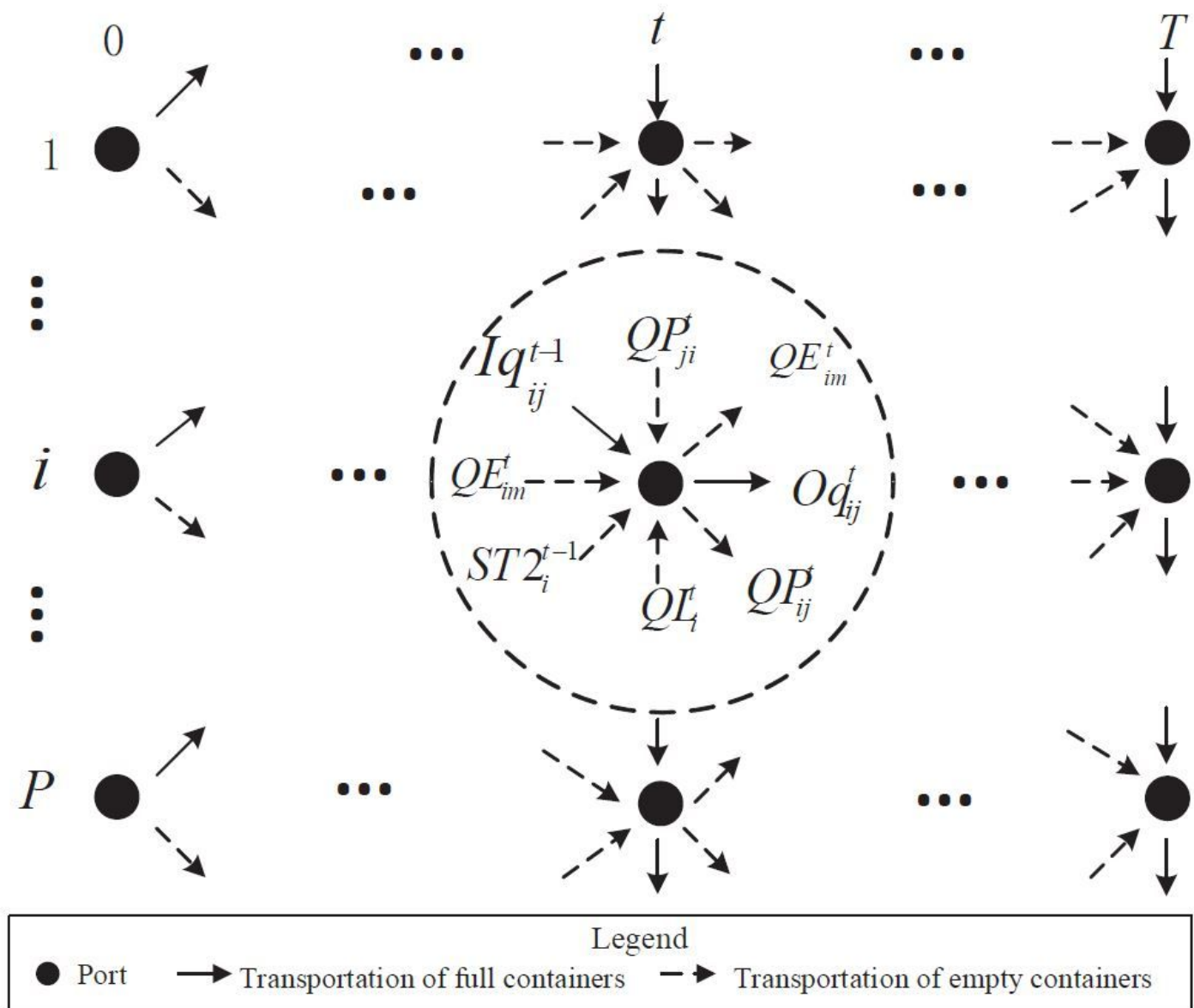


Figure 2

Schematic diagram of empty container inflow and outflow at port nodes

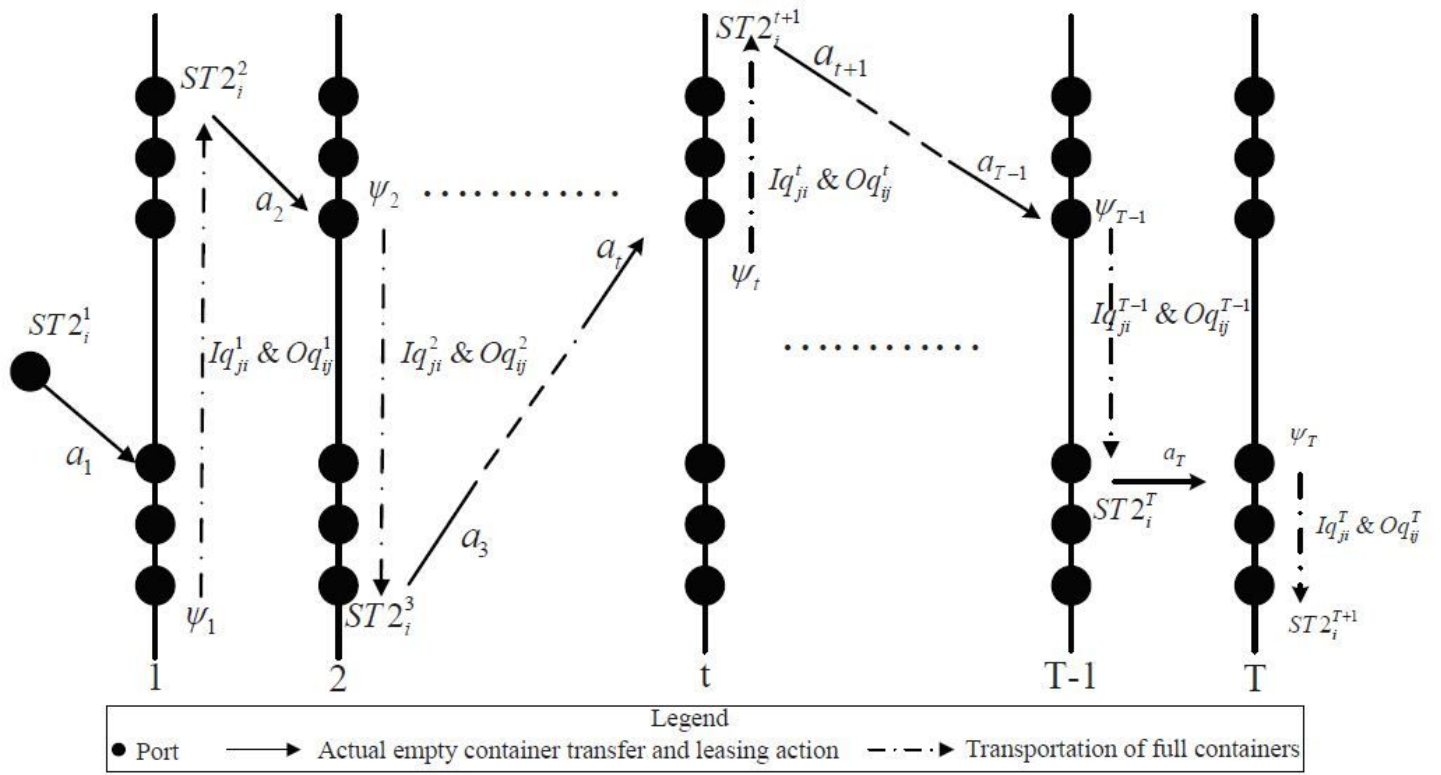


Figure 3

Markov dynamic decision process of empty container inventory

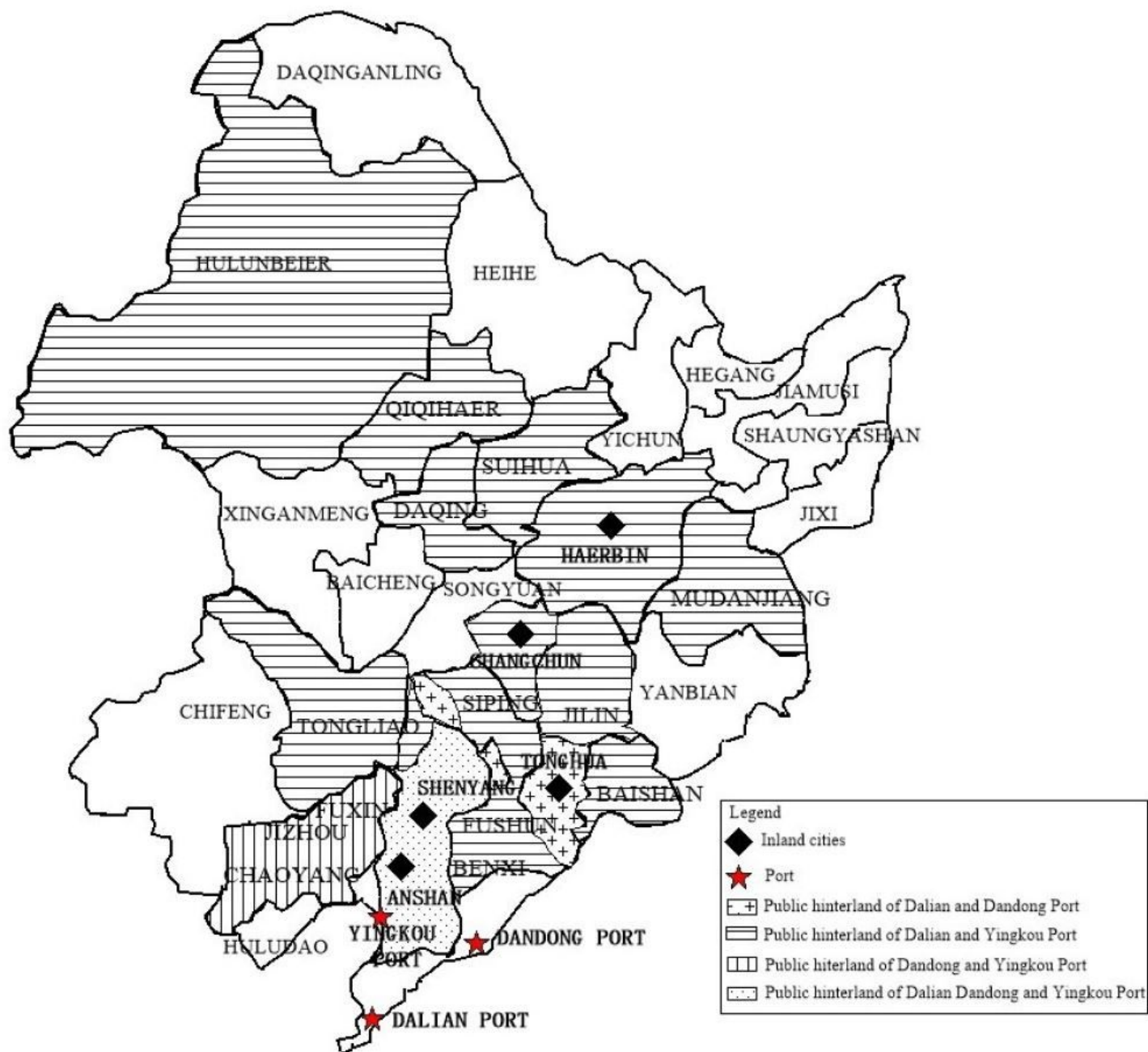


Figure 4

Sketch map of Liaoning coastal regional port cluster - northeast hinterland Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.

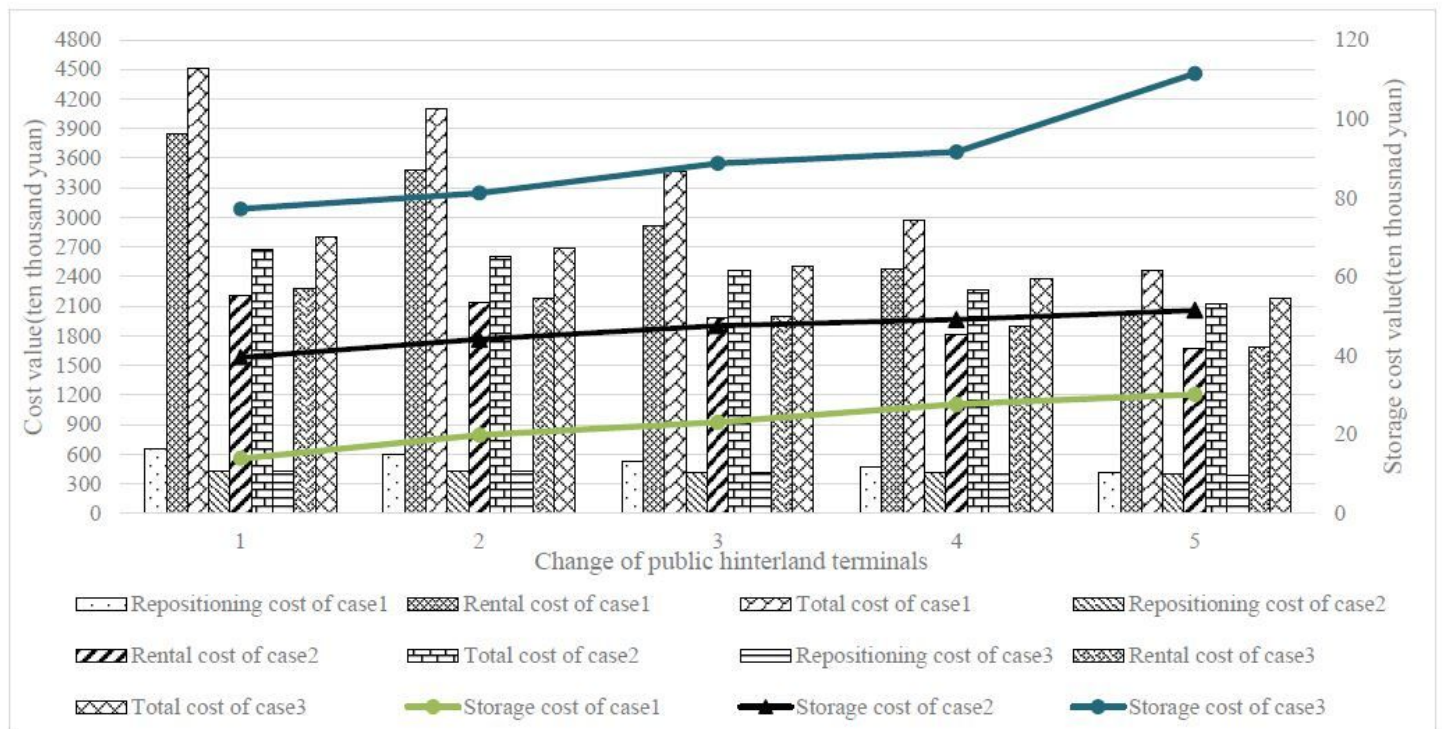


Figure 5

The influence of changes of public hinterland terminals on costs

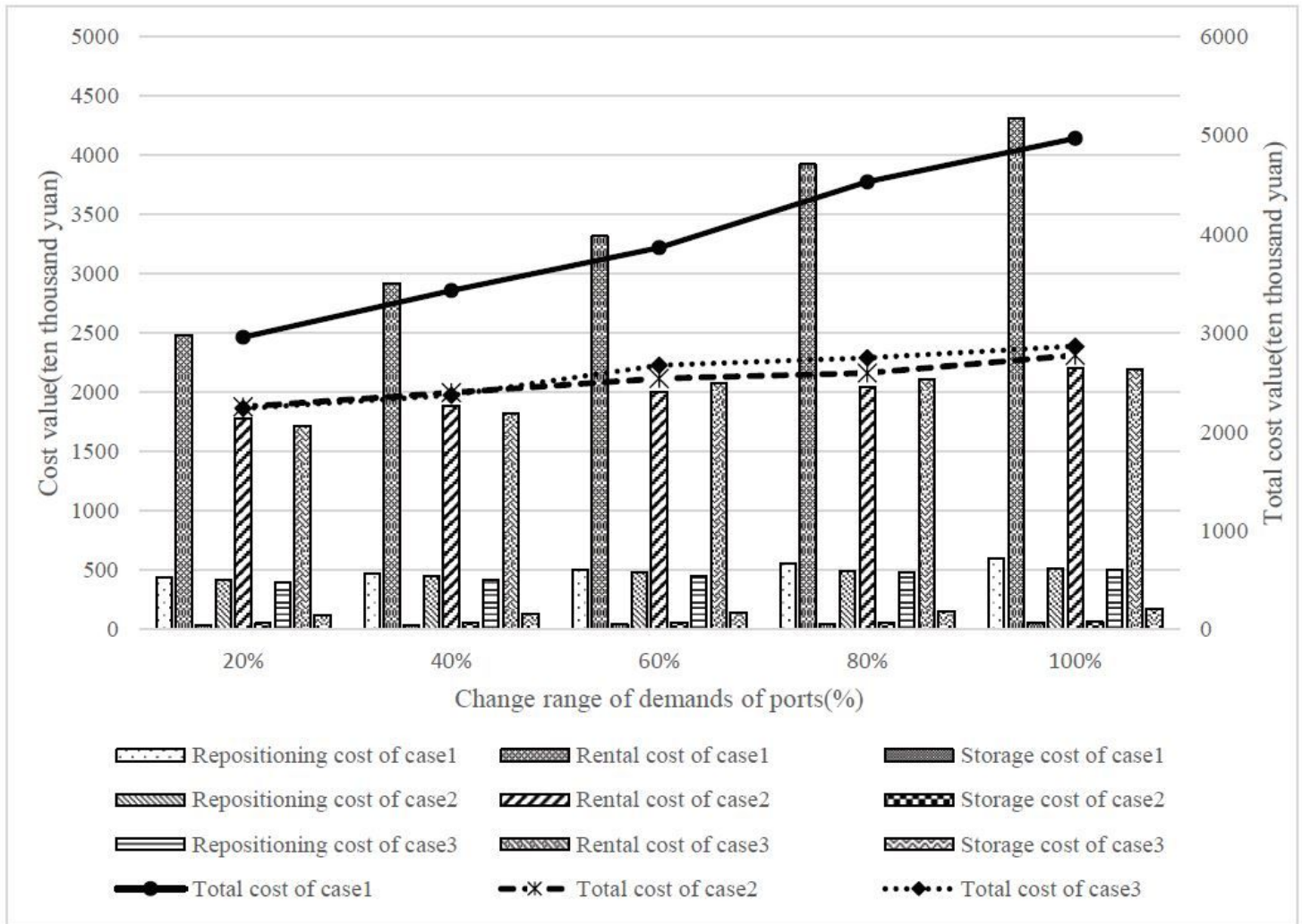


Figure 6

The influence of the change of empty container demand of ports on costs

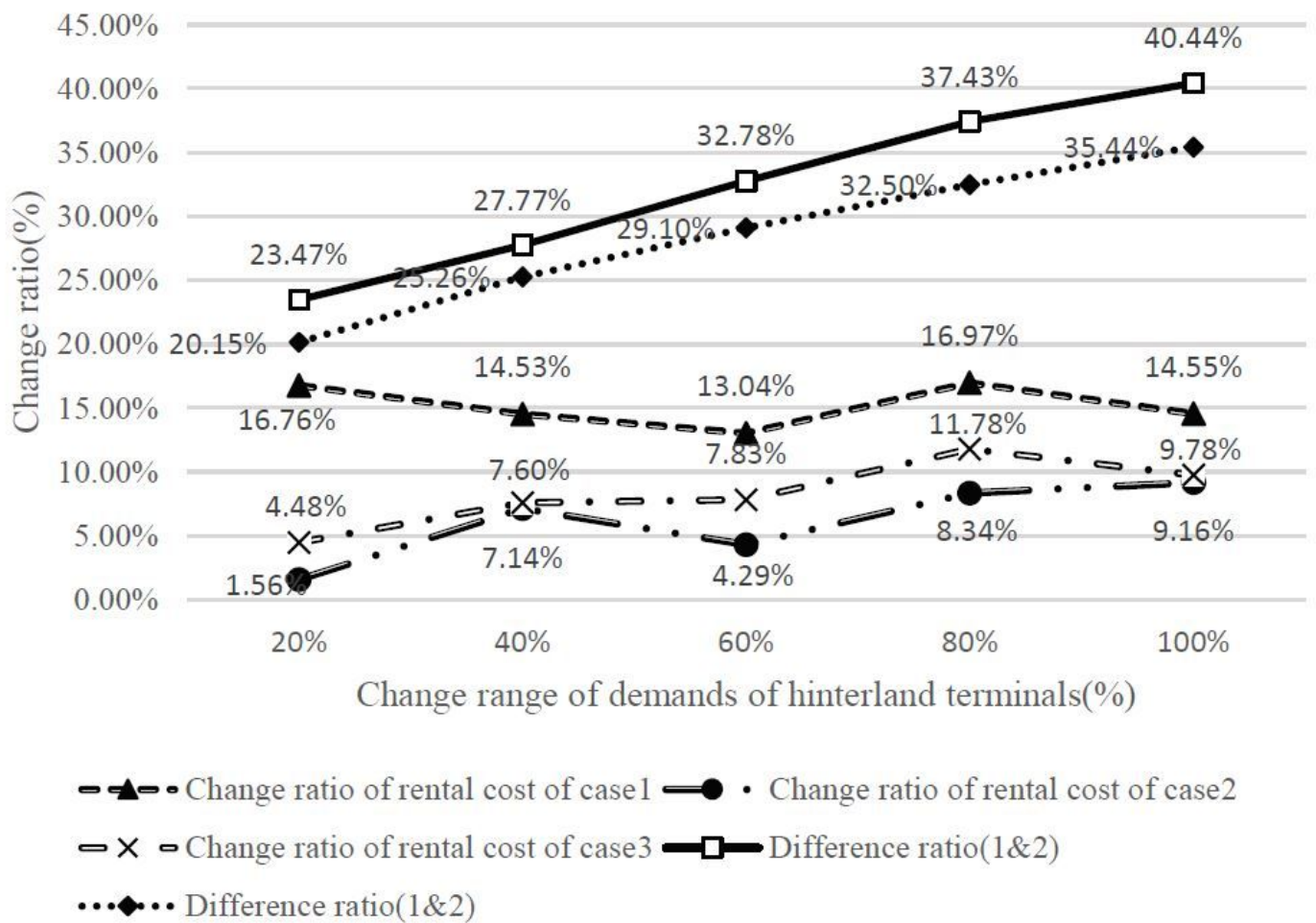


Figure 7

The influence of the change of terminal demand on the cost of rental and total cost

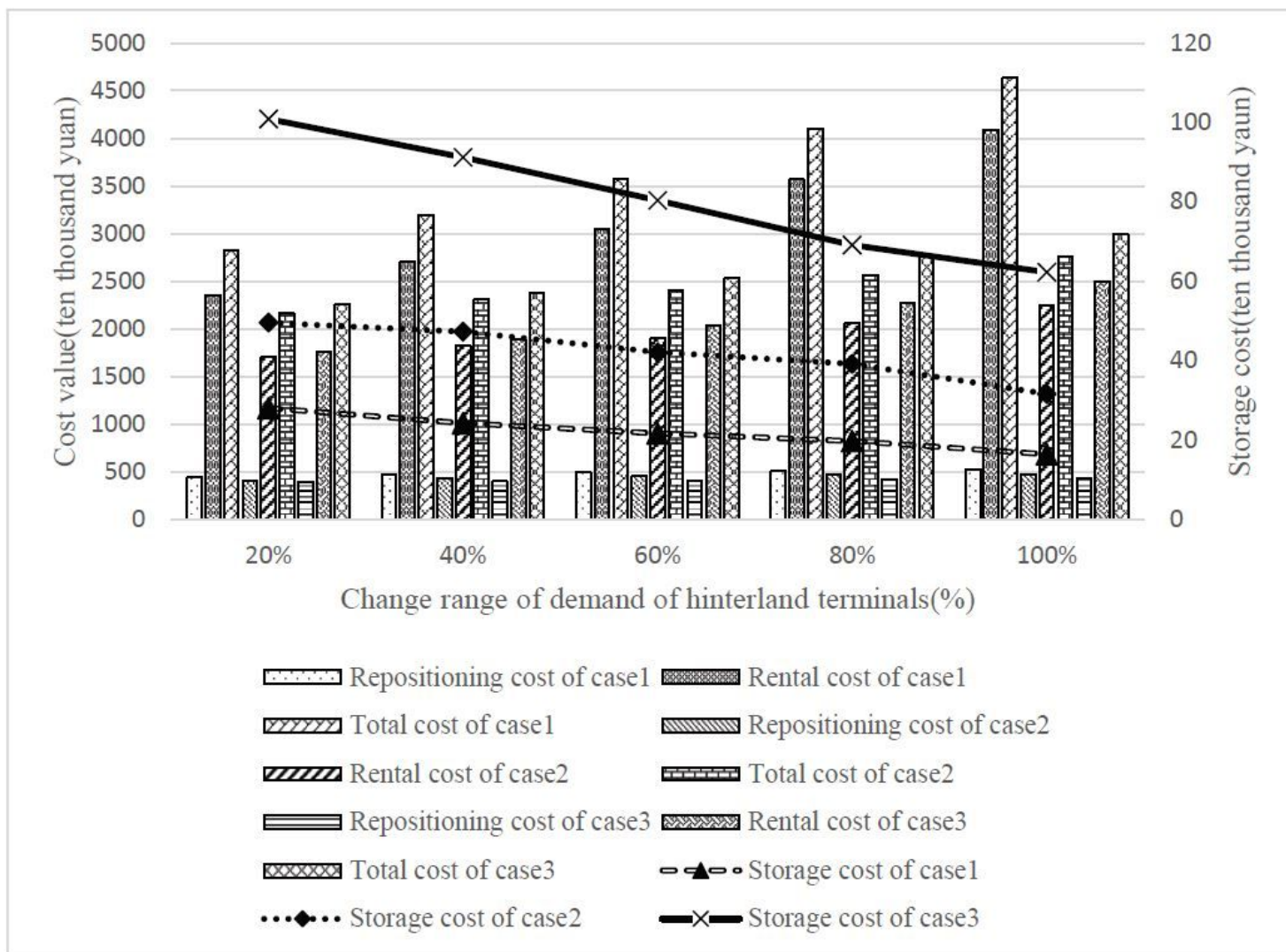


Figure 8

The influence of demand change of public hinterland terminal on costs

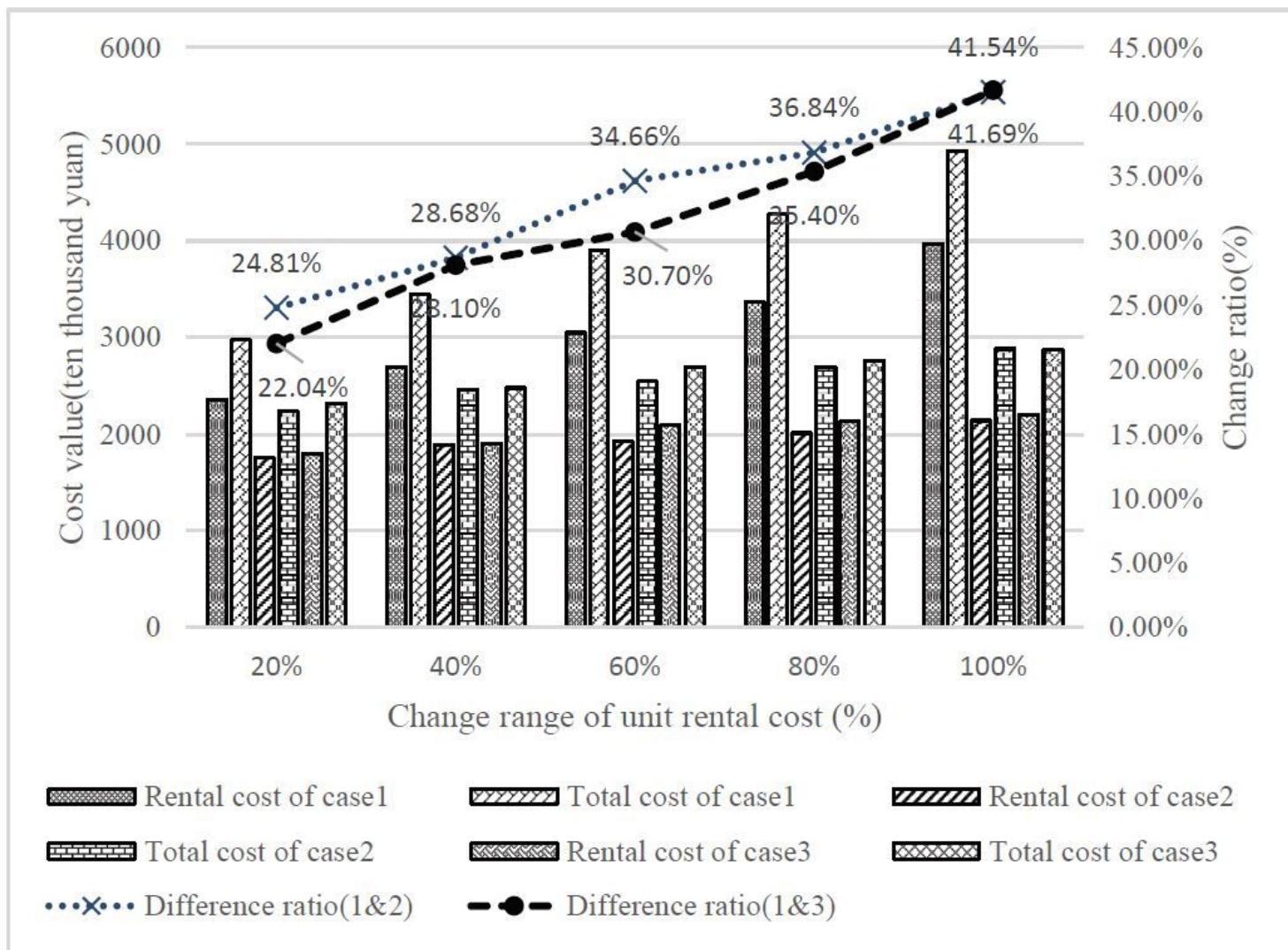


Figure 9

The influence of the change of unit rental cost on costs

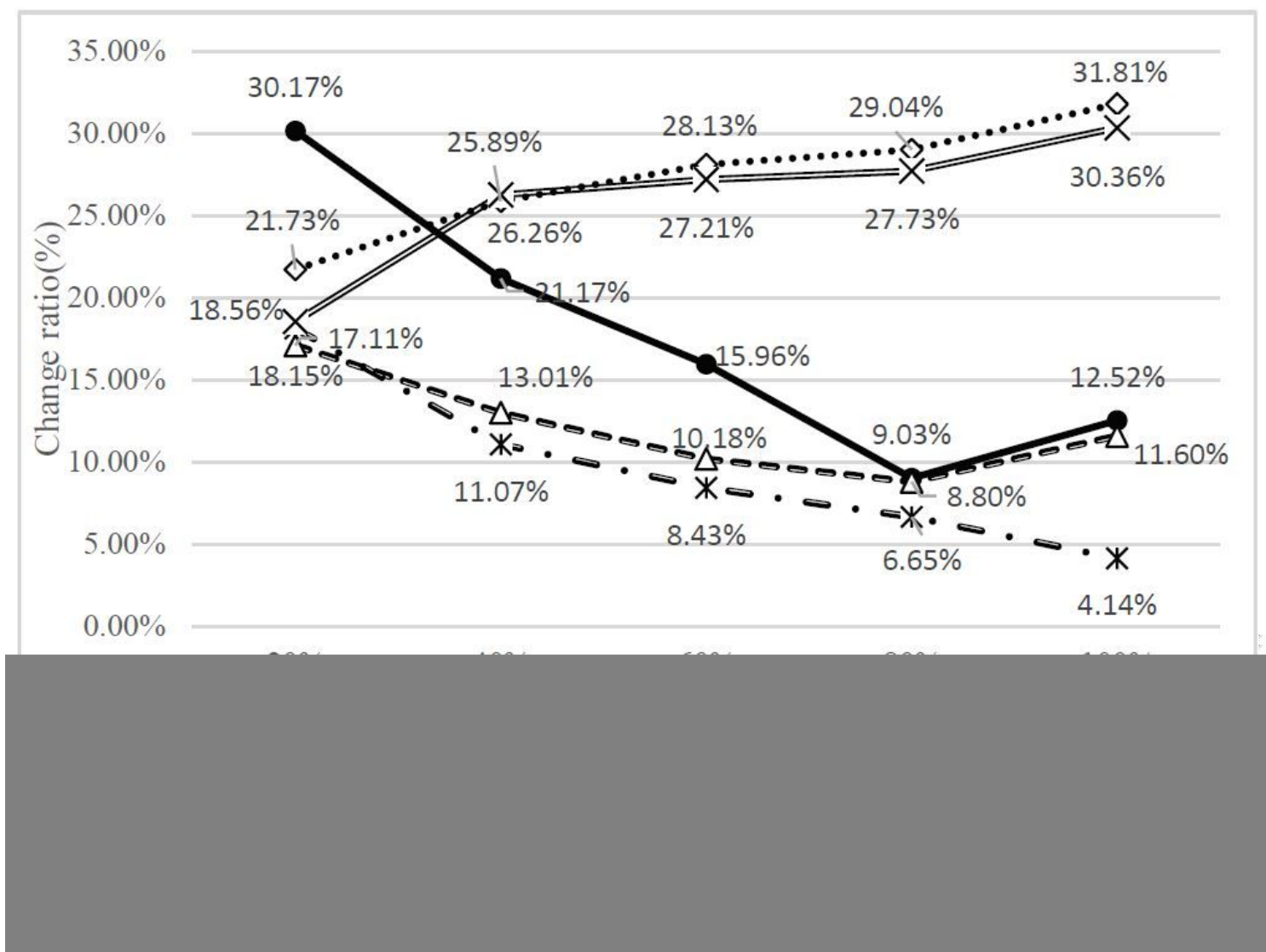


Figure 10

The change ratio of storage cost on costs

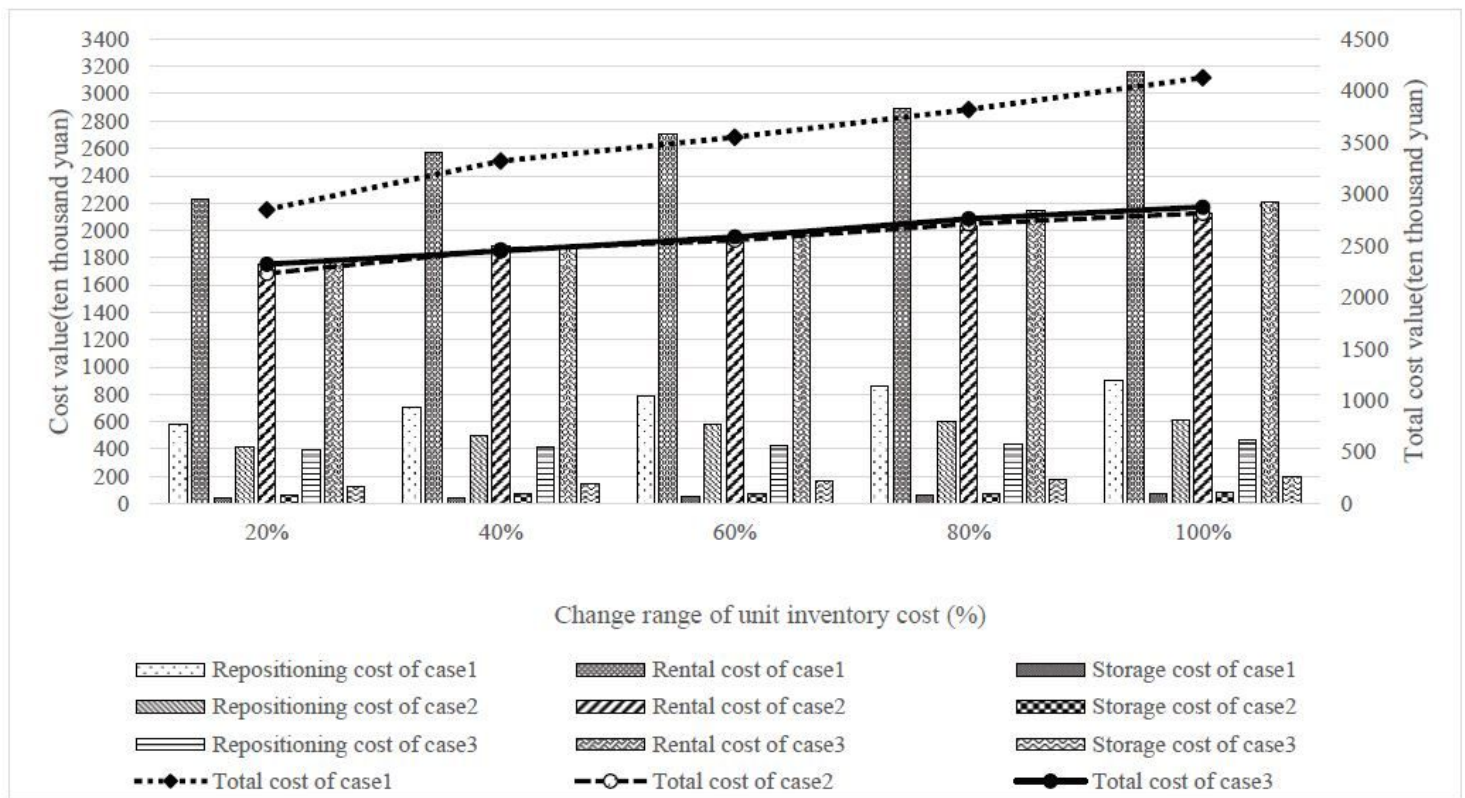


Figure 11

The influence of the change of unit storage cost on costs

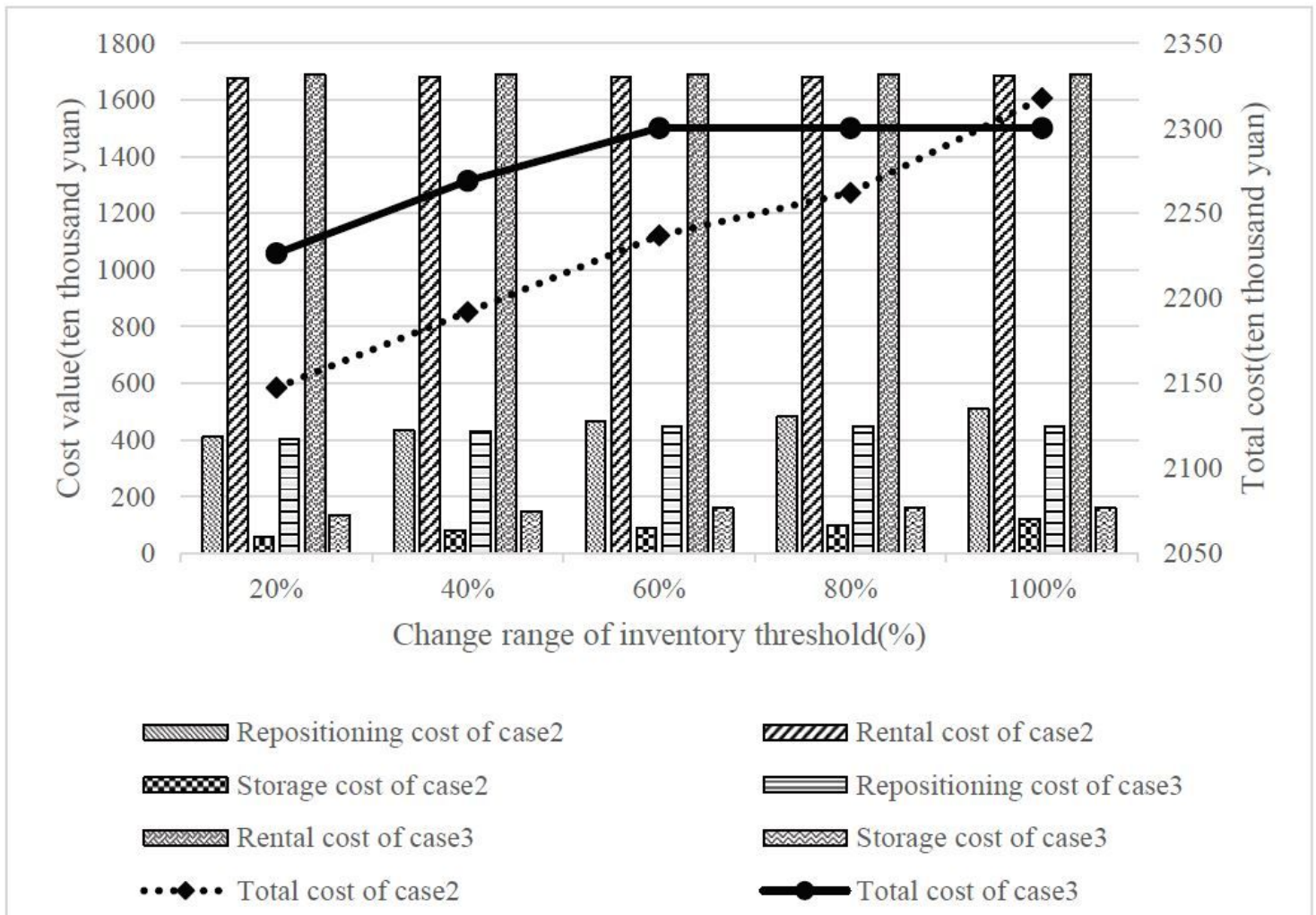


Figure 12

The influence of change of inventory threshold on all costs

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