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# Addressing water shortages by force of habit

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## Abstract

Water shortages worldwide are increasingly managed via supply diversification. Yet efforts to optimize diversification have thus far failed to account for important empirical evidence on habit-driven water demand. To resolve this disconnect, an intertemporal optimization model is developed to generate a supply portfolio that weights alternative sources of water according to the uncertainty of inflows, supply costs and habit formation. The model demonstrates that failure to account for habit-driven consumption leads to sup-optimal water infrastructure investments with too much emphasis on risky, weather-dependent sources, while weather-independent sources with guaranteed supply are underemphasised. Importantly, the optimal share of safe sources depends critically on how sensitive habit formation is to supply shocks. This implies that the benefits of policies targeting water saving behaviours and investments during periods of low supply extend beyond water conservation to more cost-effective supply portfolios. Empirical results demonstrate the importance of accommodating habit-driven demand within optimal diversification strategies.

**KEYWORDS:** stochastic habit formation; water consumption; portfolio optimization; model calibration

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