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Pricing and hedging GDP-linked bonds in incomplete markets

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Abstract

We model the super-replication of payoffs linked to a country's GDP as a stochastic linear program on a discrete time and state-space scenario tree to price GDP-linked bonds. As a byproduct of the model we obtain a hedging portfolio. Using linear programming duality we also compute the risk premium. The model applies to coupon-indexed and principal-indexed bonds, and allows the analysis of bonds with different design parameters (coupon, target GDP growth rate, and maturity). We calibrate for UK and US instruments, and carry out sensitivity analysis of prices and risk premia to the risk factors and bond design parameters. We also compare coupon-indexed and principal-indexed bonds.

Results shed light on the policy question whether the risk premia of these bonds make them beneficial for sovereigns. The findings from UK and US data affirm that both coupon-indexed and principal-indexed bonds can benefit a sovereign, with an advantage for coupon-indexed bonds. This finding is robust, but a nuanced reading is needed due to the many inter-related risk factors and design parameters that affect prices and premia.

Keywords: contingent bonds; debt restructuring; asset pricing; incomplete markets; risk premium; stochastic programming; super-replication.

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