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Summary: Energy Efficiency and Commercial-Mortgage Valuation

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The net operating income of a commercial building is usually calculated by summing rental income, subtracting operation expenses, and adding back reimbursements. While this takes energy risk exposure into account, it is not able to estimate the level or volatility of a commercial building's energy costs. Higher energy efficiency can affect the mortgage underwriting process by either persuading developers that investments will lower building operation costs, or that default risks from energy costs can be reduced. The paper develops a commercial-mortgage valuation accounting for energy risks.

Traditional commercial mortgage lending focuses on the loan-to-value ratio and the debt-service coverage ratio. These are monitored by bank regulators because they are important indicators of the quality of commercial bank underwriting and the degree of mortgage-related default risk exposure. Such mortgage underwriting has focused exclusively on building prices and interest rates to establish the risk of the mortgage, and because of this, lenders cannot distinguish between efficient and inefficient real estate buildings, impeding energy retrofit financing.

Lacking a national market, electricity prices vary by region. While the natural gas market can be benchmarked via the Henry Hub in Louisiana, prices still fluctuate. These variations are important for mortgage prices because energy costs account for 12% of base rents and 30% of total costs.

Unfortunately, there is no existing method of precisely measuring energy efficiency in office buildings. Most commercial buildings do require engineering reports, but the lack of standardization makes it difficult to utilize. Benchmark data can be used to estimate expected energy consumption. Several data can be used, such as the Commercial Buildings Energy Consumption Survey. It is important to note, however, that this has limits, since it does not account for relative energy efficiency, or differences in climate within a geographical region.

When taking energy risk into account for mortgage valuation, building prices must be decomposed into market rents minus total costs including the costs of energy expenses. It is important to note that now the mortgage valuation must account for: interest rates, electricity forward prices, gas futures prices, and office market rents. These four factors are modeled accordingly. During this process, cross-sectional differences in the risk of electricity exposure should be considered.

Energy prices could induce volatility into cash flows and thus building prices over time, and volatility could even be greater than the cost of other building maintenances. For reliable mortgage values, the valuation model must be consistent with the individual building's current price. The data is thus adjusted accordingly, also taking into account other building characteristics such as number of tenants, location, etc. The estimation can explain about 68% of the observed variance in building prices.

Valuation of a specific loan requires data for the market term structure of interest rates and volatility, the market energy and natural gas forward curves and their volatility, and the calibrated market rent process for the building. Different simulations were exercised for different types of loans. The results indicate that not explicitly accounting for energy volatility leads to mortgage mispricing. Saving energy costs especially benefits higher loan-to-value ratio mortgages and larger buildings.

The model described in the paper accounts for energy risk when assessing mortgages. This inclusion reduces commercial mortgage mispricing by 8.5%, and will also assist in estimating the benefits of energy retrofits. Benchmarks for energy consumption for office buildings determined by its size and location are enough to differentiate the relative energy risk of commercial mortgages. Development of relative efficiency measurement and refinement in the mortgage valuation framework can further assist mortgage underwriting to be more precise.