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Half the Capital Stock, One Premise

Japan's ¥1 Quadrillion of Implicit Power-System Credit

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KEY MESSAGE

Capital accumulation rests on the expectation that electricity will remain reliably available at economically viable prices throughout the service lives of long-lived assets. A bottom-up classification of more than 170 asset categories estimates Japan's electricity-dependent capital at about ¥1 quadrillion in 2019—roughly half of the measured stock of fixed assets, inventories, and household durables, and 1.8 times its annual GDP. This accumulated stock represents an "implicit power-system credit" embodied in the investment decisions of firms and households.

WHY THIS MATTERS

A wide range of assets is designed on the premise that electricity will remain reliably available at adequate quality and economically viable prices. Without electricity, machine tools and precision instruments in factories, medical equipment in hospitals, air-conditioning systems and elevators in buildings, and traffic signals and electrified transport networks cannot provide their intended services. Software, although intangible, likewise cannot deliver productive services without powered computers, data centers, and communications networks. Electricity is therefore more than an intermediate input: it is an operating platform for much of the installed capital stock.

When firms and households acquire such assets, they convert that confidence into long-lived commitments, thereby extending implicit credit to the power system. Nomura (2023) documented that electrification progressed alongside capital deepening during Japan's postwar productivity growth. It also documented a sharp decline after the two oil shocks, from 1980 to 1995, in the share of electricity imported indirectly through traded goods—a change plausibly associated with lower domestic electricity prices and greater supply reliability as LNG and nuclear generation expanded. The present note turns from these flow-side relationships to the stock side: how much existing capital embodies that confidence?

EVIDENCE: JAPAN'S ELECTRICITY-DEPENDENT CAPITAL STOCK

As a pilot estimate for a pre-pandemic year, I update the net capital stock matrices developed in Nomura (2004) through 2019. The stock covers fixed assets, inventories, and household durables. For depreciable assets, investment histories are accumulated under geometric depreciation using asset-specific rates measured from Japanese data. More than 170 asset categories are classified as fully dependent, strongly dependent, partly dependent, or not materially dependent on electricity. The strict case counts only fully dependent assets; the baseline weights the four groups at 100, 80, 30, and zero percent; and the broad case counts all three dependent groups in full.

Applied to the measured 2019 asset stocks, these assumptions yield ¥403.4 trillion in the strict case, ¥1,000.8 trillion in the baseline, and ¥1,830.7 trillion in the broad case. Under the baseline, service industries form the largest component, followed by manufacturing and infrastructure systems. Together, fixed assets, inventories, and household durables total ¥2,009.2 trillion, making the baseline estimate 49.8 percent of the measured stock.

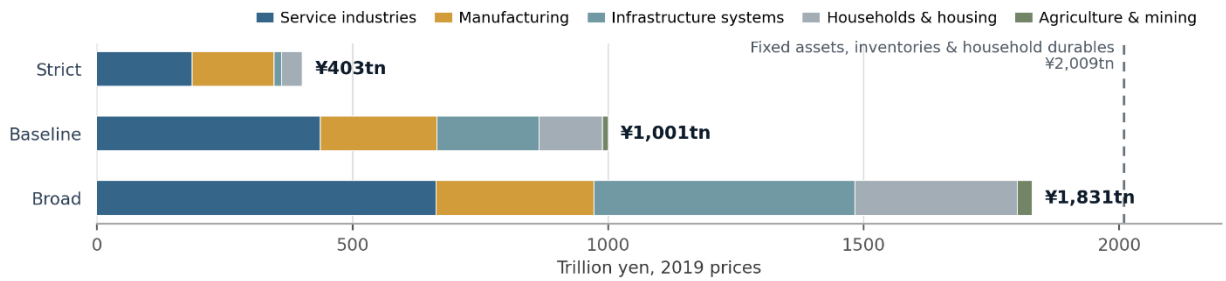

Figure 1. Japan's electricity-dependent capital stock under alternative assumptions, 2019
Source: Author's estimates.

INTERPRETATION

The ¥1 quadrillion estimate is not a measure of blackout losses or physical damage. It is the weighted value of installed capital whose services depend on a functioning power system. Outage-cost studies measure the flow of output lost during an interruption; this measure identifies the stock of capital accumulated in the expectation of continued electricity supply. "Credit" denotes that long-lived, partly irreversible commitment by capital owners—not a legal claim on utilities or an estimate of replacement cost.

That service industries form the largest exposure shows that electricity dependence extends well beyond manufacturing, while the dependence of infrastructure networks allows disruptions to propagate across complementary systems. Since the 2010s, weaker confidence in the future reliability and affordability of Japan's electricity supply may have lowered expected returns on electricity-dependent assets, contributing to Japan's weak capital accumulation and, through it, to sluggish labor-productivity growth. The single-year estimate does not identify this channel, but the scale of exposure shows that it could be macroeconomically important.

MEASUREMENT CONSIDERATIONS

The classification is granular but necessarily judgmental. Asset-type weights are held constant across users and do not capture differences in utilization, location, backup capacity, self-generation, storage, substitution, or outage duration. The three cases are sensitivity scenarios, not statistical confidence bounds; despite their range, all indicate macroeconomically large exposure.

IMPLICATIONS

01
Electricity reliability supports a stock of capital as well as a flow of output. Conventional outage-loss measures capture the latter, not the accumulated dependence.

02
Classification changes the point estimate, not the conclusion: even the strict case identifies more than ¥400 trillion of electricity-dependent capital.

03
Weaker confidence in reliable and affordable electricity may help explain Japan's weak capital accumulation and sluggish labor-productivity growth since the 2010s.

REFERENCES

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