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# Purchasing power parity: Granger causality tests for the yen–dollar exchange rate

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**Abstract**

The paper analyses the causality between the Japanese prices and the yen–dollar exchange rate. It explains the long-term appreciation trend of the Japanese yen and why the Japanese yen proved strong even during the economic slump of the 1990s. The paper suggests that the appreciation of the Japanese yen forced the Japanese enterprises into price reductions and productivity increases, which put a floor under the high level of the yen and, thus, initiated rounds of appreciation. This corresponds to the conjecture of a vicious (virtuous) circle of appreciation and price adaptation. Further, there is evidence that the yen-appreciation has been accommodated by the Bank of Japan's monetary policy. This corresponds to the conjecture that the recent Japanese deflation is imposed from outside via the exchange rate.
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## 1. Introduction

The 1990s have been a period of contradictory exchange rate development for the Japanese yen. Despite the deep and sustained recession in Japan, the yen proved extraordinarily strong. The combination of low interest rates, weak domestic activity and a strong currency has been regarded as a puzzle.

While the impact of international capital flows on exchange rates has recently earned attention, the impact of prices on the yen exchange rate has been neglected. Although, international capital flows doubtlessly drive exchange rates in the short run, a strong correlation between yen–dollar exchange rate and relative Japan–US tradable prices can also be observed.

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The fact that relative purchasing power parity (PPP) holds true for the Japanese yen in the case of traded goods does not say anything about causation, however. Do capital market-driven exchange rate movements influence the pricing behavior of export enterprises, or does the pricing behaviour on international markets influence the exchange rate?

This paper reconsiders the impact of prices on the exchange rate. It tests causality between yen–dollar exchange rate and Japanese prices on the basis of both aggregated and disaggregated Japanese export price data and wholesale prices.

The results provide evidence that the pricing of the Japanese export industry between 1973 and 2002 was influenced by the exchange rate. This corresponds to the pricing to market behavior of the Japanese export industry. International capital flows cause the yen to appreciate and the (export) industry to adapt prices and productivity. More generally, the deflation pressure in Japan is imposed from outside via the exchange rate.

Further, tests on the basis of disaggregated industry data show that Japanese industries have lowered their prices to adapt to the appreciation and thus put additional appreciation pressure on the yen exchange rate. Both results together give evidence for a vicious (virtuous) circle of yen appreciation and price adaptation.

Finally, there is evidence that the yen appreciation has been accommodated by the Japanese Central Bank, which explains how monetary policy has contributed to the strong yen.

The paper is divided into six sections. Section 2 discusses the general causality between prices and exchange rate. Section 3 reviews the respective research on the determinants of the Japanese yen exchange rate. After data description in Section 4, Granger tests estimate cause-and-effect relationship between Japanese export prices and the yen–dollar exchange rate in Section 5. Conclusions will be drawn in Section 6.

## 2. Cause-and-effect relationships between prices and exchange rate

The concept of PPP is widely attributed to Cassel (1916, p. 62), who suggested that the exchange rate of two currencies is determined by the price levels of the two countries (absolute PPP). Due to problems in specifying comparable price indices in two countries, the majority of the empirical literature tries to verify the relative version of PPP. This version says that a decrease (increase) in the domestic price level in comparison to that abroad is accompanied by a proportionate appreciation (depreciation) of the home currency.

Although, in their survey of PPP literature Froot and Rogoff (1995, p. 1648) conclude that "*[relative] PPP is not a short-run relationship*" and "*price level movements do not begin to offset exchange rate swings on a monthly or even annual basis*," there is evidence that relative PPP holds for the yen–dollar exchange rate on a quarterly basis if it is based on the price indices of exclusively traded goods (Schnabl, 2001). Pigou (1920) and Viner (1937) had already made this proposition.

Even if PPP holds true for the prices of traded goods, there is no indication of causality, however. Does relative price stability (inflation) cause an appreciation (depreciation) or does appreciation (depreciation) trigger price adjustments? For empirical OLS investigations question arises as to whether the exchange rate should be defined as an exogenous or endogenous variable.

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