



## Exchange rate undervaluation and R&D activity<sup>☆</sup>



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### ABSTRACT

We examine how real exchange rate undervaluation policy affects research and development (R&D) activity. Using a panel data set comprising 49 developed and developing countries covering 1996–2011, we show that undervaluing the exchange rate retards technological innovation. Such a negative impact is particularly prominent for developed countries. This paper provides new insights into the real effects of undervaluation policy on the economy. An implication of our work is that countries implementing exchange rate undervaluation policy should be mindful of its potential negative effects on research and development activity.

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### 1. Introduction

In this paper, we examine the relationship between expenditure on research and development (R&D) and real undervaluation of the exchange rate. We find that currency undervaluation significantly reduces R&D expenditure. As R&D is an important source of technological progress and economic growth, we thus identify an R&D channel through which currency undervaluation may lower economic growth.

Not only does R&D activity play a significant role in standard endogenous growth models, it is empirically important for economic growth and development. Griffith et al. (2004) find that R&D enhances technology transfer, and helps industries lagging behind the productivity frontier to catch up. Aw et al. (2011) provide evidence that investment in R&D raises firms' future productivity. Bloom et al. (2013) show that technology spillovers quantitatively dominate business stealing effects, which suggests that the gross social returns to R&D are greater than the private returns.

R&D activity has long been examined from a global point of view; in particular, there is much research on international R&D spillovers (see, e.g., Coe and Helpman, 1995; Keller, 1998; Bernstein and Mohnen, 1998; Frantzen, 2000; Funk, 2001; Frantzen, 2002; Lumenga-Neso et al., 2005; Le, 2008; Coe et al., 2009; Wang and Sunny Wong, 2012; Ang and Madsen, 2013). Recently, the focus has moved to investigating the impacts on R&D activity of global factors such as international trade and international financial development. Examining the effect of international financial development on R&D intensities, Maskus et al. (2012) find that only foreign direct investment is significant among alternative measures of international financial development. Bandick et al. (2014) provide evidence that foreign acquisitions lead to increasing R&D intensity in acquired domestic firms. A recent noteworthy study by Boler et al. (2015) shows that firms' incentives to invest in R&D depend on their access to imported inputs. They argue that cheaper intermediate imports stimulate R&D investment. Accordingly, their finding is related to the so-called *exchange rate undervaluation policy*, which raises the cost of importing machinery and other inputs for domestic firms, thereby negatively affecting R&D activity.

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Some countries attempt to gain an advantage in trade and thus accelerate their economic growth by intervening in foreign exchange markets to limit their currency appreciation. Such a mercantilist exchange rate policy is referred to as “fear of appreciation” (see [Levy-Yeyati et al., 2013](#)), or simply, as an exchange rate undervaluation policy. Such a mercantilist exchange rate policy has been a hot issue for international policy makers. For example, just before the G20 meeting in Seoul in September 2010, Brazilian finance minister Guido Mantega spoke of an “international currency war” where devaluing currencies artificially had become a global strategy. Moreover, [Bernanke \(2010\)](#) argues that “increasingly over time, the strategy of currency undervaluation has demonstrated important drawbacks, both for the world system and for the countries using that strategy.”

Whether an undervaluation policy helps promote economic growth remains an ongoing debate among economists. There are several reasons why managed real undervaluation might facilitate growth. The first and most natural channel is through exports: an undervalued currency boosts exports by making them more competitive, which stimulates growth. Second, real exchange rate undervaluation provides an incentive to shift resources into the modern high-productivity manufacturing sector, which generates positive externalities in the form of learning-by-doing and technology spillovers. Third, an undervalued exchange rate encourages savings and thereby stimulates investment; it can do this by reducing real wages, which transfers income from labor to firms or to higher-income households who save more (see [Glüzmann et al., 2012](#)). However, exchange rate undervaluation can have deleterious effects. First, undervaluation may cause an excessive accumulation of low-yield foreign reserves, which may be inefficient and raise the opportunity cost of holding foreign reserves. Second, because of the impossible trinity, currency undervaluation may constrain domestic monetary policy to be too lax, and thereby generate asset price booms such as housing market bubbles. Third, pursuing an undervaluation policy is similar to subsidizing exporters. Because this is mainly financed by taxation, the purchasing power of taxpayers may fall, which reduces aggregate demand. Fourth, and most importantly, undervaluing the currency might lower long-term economic growth by raising domestic firms’ costs of importing machinery and other inputs. It is because that raising the cost of importing machinery and other inputs by undervaluing the currency may eventually inflate the cost of R&D investment (see e.g., [Boler et al., 2015](#)). As R&D is an important source of economic growth, it is worth investigating whether currency undervaluation harms economic growth by reducing firms’ incentives to engage in R&D activity. However, to the best of our knowledge, there has been no study of the relationship between real undervaluation and R&D expenditure. This paper aims to fill this gap.

Our study contributes to the literature in two ways. First, our work relates to the literature on the relationship between exchange rates and R&D investment. Studies such as [Zietz and Fayissa \(1994\)](#), [Funk \(2003\)](#), [Becker and Pain \(2008\)](#) and [Tabrizy \(2016\)](#) conduct country-specific investigations using firm-level data, and find mixed evidence on the direction of changes in R&D expenditures in response to changes in exchange rates. Moreover, some studies move the focus from the changes in exchange rates to changes in exchange rate volatility. For example, [Becker et al. \(2009\)](#) show that exchange rate uncertainty affects foreign direct investment in R&D. [Santacreu and Gavazzoni \(2015\)](#) present evidence that pairs of countries that share more R&D exhibit less volatile exchange rates. In this paper, we further examine the relationship between exchange rate misalignment and R&D using country-level panel data. In particular, we investigate whether undervaluation negatively affects R&D activity by depreciating the currency.

Second, our work relates to the empirical literature on the relationship between undervalued real exchange rates and economic growth. Early studies show that undervaluing the real exchange rate is the most effective way of spurring industrialization and hence growth, particularly for developing countries that rely on export-led growth (see, e.g., [Rodrik, 2008](#); [Berg and Miao, 2010](#); [MacDonald and Vieira, 2010](#)). By contrast, more recent studies present no convincing support that depreciating the real exchange rate promotes economic growth (see, e.g., [Nouira and Sekkat, 2012](#); [Magud and Sosa, 2013](#)). R&D activity provides a potentially important channel for linking undervaluation policy and (reduced) economic growth. In this paper, we examine such an R&D channel through which currency undervaluation lowers economic growth.

We first construct an undervaluation index that accounts for the Balassa–Samuelson effect. Then, using a panel data set comprising 49 developed and developing countries, we examine whether currency undervaluation negatively affects R&D activity. We find that pursuing an undervaluation policy reduces R&D activity. This finding is robust to different model specifications, different measures of R&D activity, and different real exchange rate measures.

The rest of the paper is structured as follows. In Section 2, we discuss various economic mechanisms and empirical findings linking exchange rate movements and innovation activity to motivate the empirical investigation. In Section 3, we describe our empirical approach. In Section 4, we describe the data. In Sections 5 and 6, respectively, we report the main empirical results and robustness checks. Concluding remarks are presented in Section 7.

## 2. Exchange rate movements and innovation activity

There are various mechanisms to link exchange rate changes and expenditures on R&D. First of all, it is worth noting that a currency depreciation (appreciation) serves much like a combination of an export subsidy (tax) and import tax (subsidy). Therefore, movements in exchange rates affect the product market competitive environment, and can be used as a good measure of competitive pressure (see e.g., [Marin, 1986](#); [Zietz and Fayissa, 1994](#)). A currency depreciation (appreciation) indicates a weak (intensified) market competitive pressure. Product market competition may have distinct impacts on R&D activity. Facing stronger market competition, companies may increase their R&D expenditures to defend their market share. However, it is also possible that increasing competitive pressure will blunt their incentives to invest in R&D if rivalry

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