Review Article

Relative Prices and the Macroeconomy: A Literature Review

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Abstract: This paper provides a review of the literature on the importance of relative prices in economic dynamics, focusing on three such prices: the relative price of one good/service to another, the terms of trade, and the real exchange rate. The narrative encompassed the theoretical, methodological and empirical spheres. The influential roles of relative prices in restoring internal and external equilibria were underscored and these attributes were deemed to be unparalleled in economic analysis. The terms of trade were particularly noted to be fundamental to economic growth, balance of payments, and, the real exchange rate.

Keywords: relative prices, real exchange rate, terms-of-trade, open economy macroeconomics

JEL Codes: E31, F30, F32, F41

1. Introduction

Relative prices play important roles in economic dynamics, helping to restore short-run equilibrium in the factor and product markets. They relay information about the availability or scarcity of certain goods and services in the economy, hence, they facilitate economic readjustments following disturbances and also generate deeper insights into the mechanisms of internal and external equilibria. They contribute greatly to short-run growth and in an instant, long-run growth as well. A vast literature has been devoted to understanding them, especially for developing countries, in matters of adjustment lags, adjustment costs, and output responses.

In order to help our understanding of their importance and roles in the growth process in particular and economic adjustment in general, a synthesis of the relevant literature is undertaken in this article. The emerging review presented below focuses sequentially on the theoretical, methodological, and empirical contributions with respect to three such prices: the relative price of one good or service to another, terms-of-trade (TOT), and real exchange rate (RER). What factors/disturbances impact the level and volatility of the prices and what are the consequences? To what extent do relative prices' structures as well as their fundamentals compare between the developed and the developing countries? These are some of the crucial questions to which answers were sought in the review.

2. Theoretical review

2.1 *Relative price of a good or service to another*

One particular area of relative prices, that is, the price of one good/service relative to another good or service that had attracted much attention in the literature in the past was the direction of causation between relative prices and inflation Fischer (1981) provided a detailed discussion of the various theoretical approaches and empirical findings. Indeed as Cukrowski and Kavelashvili (2002) pointed out, while there was agreement in the literature that relative price variability correlates with inflation, it was less so for the direction of causality.

Ball's and Mankiw's (1994, 1995) supply-side theory made a case for the influence of relative prices on the short-run dynamics of inflation and argued that changes in relative prices were inflationary in the short-run. The 1994 study showed that although shocks were symmetric, asymmetry in price adjustment was endogenous in the presence of menu costs and raised aggregate price levels. Further, they submitted that, with trend inflation, sectoral shocks led to some firms' desired nominal prices to rise while those of others fell. The increased prices produced greater price level adjustments than the decreased prices. Consequently, when there was a large dispersion in the changes in relative prices, inflation rose above trend with a decline in output. With aggregate demand assumed constant, this implied that large changes in relative prices were adverse supply shocks. In this case, inflation was related to the variability of relative prices.

In their 1995 study, however, they pointed out that the variance (first and second moments) of relative prices had no independent effect on inflation, rather it depended largely on the skewness (third moment) of price changes. Hence, the larger variance was more inflationary when the distribution of shocks was skewed to the right and deflationary when shocks were skewed to the left. Therefore, in Ball and Mankiw (1995), shocks were asymmetric in distribution. According to the authors, with menu costs, firms responded more quickly to large exogenous shocks to desired prices than small shocks and had a range where shocks to the desired price did not elicit a response. Hence, when the distribution of desired changes in relative prices was skewed to the right, the number of firms that desired large price increases was few and balanced by the most firms that desired small decreases. Thus, desired increases occurred faster than the desired decreases. Consequently, the average price level rose in the short run. The opposite was the case when the distribution of desired price changes was skewed to the left.

Balke and Wynne (2000) questioned the nominal rigidities assumption in individual price adjustment, to which they attributed the recorded positive relationship. They argued that such a positive relationship was generated by technological shocks driven by stochastic processes as shown in their general equilibrium model with multiple sectors and flexible prices. In a flexible price model, a positive technology shock (supply shock) that affected enough sectors simultaneously would result in a decline in inflation and if some sectors were affected by the shocks more than others, prices in those sectors would fall proportionately more and negative skewness in the distribution of price changes emerged.

2.2 *Terms-of-trade*

Since the early 1950s, the literature on the effects of TOT on the macroeconomy had followed two sets of thoughts: the "Singer-Prebisch hypothesis" in relation to Singer (1950) and Prebisch (1950) on the effect of the level and volatility of TOT on national income and development, and, the "Harberger-Laursen-Metzler (HLM) effect" concerning the outcome of Harberger (1950), and Laursen and Metzler (1950) on the impact of TOT shock on the current account.

Singer (1950) first alluded to the impact of TOT volatility on national development when he noted in his theoretical discussion that "fluctuations in the volume and value of foreign trade tend to be much higher in underdeveloped countries …. in relation to that small margin of income over subsistence needs which forms the source of capital formation, for which they often depend on export surpluses over consumption goods required from abroad". Embedded in this argument was the idea that improvement in TOT could provide a surplus for capital accumulation and growth. Unrelated to the above but similar to Prebisch (1950), Singer (1950) hypothesized that primary product prices declined relative to the prices of manufacturers. The argument was that technical progress or increased productivity led to higher income in the manufacturing industries through increased efficiency and, consequently, higher wages, which translated into higher demand for the manufacturers. For the primary products, technical progress resulted in low relative prices,

and low demand from the manufacturing industries due to increased efficiency while it also suffered from low price elasticity. This was referred to as the "Singer-Prebisch hypothesis". This could result in asymmetry in growth if TOT induced more industrialization in the Core and less industrialization in the Periphery by reinforcing comparative advantage (Blattman & Williamson, 2003).

Harberger (1950) and Laursen's and Metzler's (1950) proposition using a one-good (exportables) Keynesian open economy framework with no domestic investment but a marginal propensity to consume that was assumed to be less than unity was that deterioration (improvement) in TOT was expected to decrease (increase) saving and net exports as real income declined (improved) because of fall (rise) in the purchasing power of exports. This had been extended into a two-good (exportables and importables) framework by Obstfeld (1982) and Svensson and Razin (1983) using an intertemporal optimizing approach with perfect international capital mobility. They criticized the Keynesian premise on which the Harberger-Laursen-Metzler effect was based: the household's consumption-smoothing path required a reduction in saving and spending as the TOT deteriorated. Obstfeld (1982) argued that when an adverse shock to TOT was unanticipated and permanent, it induced a surplus in the current account because households acquire interest-bearing claims on foreigners to restore their stationary-state utility to its original level, hence increasing savings and current account surplus, rather than deficit. This implied that a current account surplus required a decline in the export value of expenditure when initial net claims were zero.

Edwards' (1989) extension of the Svensson and Razin's (1983) model into a three-good, two-period intertemporal optimization model included an examination of the indirect effect of TOT on the current account through the RER channel. He also examined the effect of TOT via the temporal changes in the internal TOT (generated by imposing import tariffs) and external TOT. Cashin and McDermott (2002) summarized the three channels of effect in Edwards (1989) as (i) the consumption-smoothing or HLM effect, operating through lower current national income relative to future national income; (ii) the consumption-tilting effect due to an increase in the current price of imports relative to the future price of imports; (iii) and the RER effect as a result of an increase in the price of imports relative to the price of non-traded goods.

In the model, the indirect effect through RER was ambiguous and depended on whether the exchange rate appreciated or depreciated. Raising import tariff temporarily in period 1 caused the price of imports in that period to rise, making present total consumption relatively more expensive. As a result, intertemporal substitution moved consumption spending from period 1 to period 2, increasing demand for all goods (including, non-traded) in period 2, and RER appreciated in period 2. Also at play were intratemporal cross-effects that depended on whether imported goods and non-traded goods were complements or substitutes in consumption. Higher prices for imported goods reduced their consumption, if imported goods and non-traded goods were complements, prices of non-traded goods fell via demand, and RER depreciated in period 1, if they were substitutes, then the relative price of non-traded goods rose in both periods and RER appreciated similarly.

Mendoza (1995) incorporated the real business cycle into the analysis of the Obstfeld-Svensson-Razin framework and extended it to a three-good intertemporal general equilibrium model with international capital mobility to examine the relationship between TOT and business cycles. The transmission mechanisms of TOT shocks to the economy were through international capital mobility, the cost of imported inputs, and the overall purchasing power of exports.

Chia et al. (2005) questioned the findings of Obstfeld (1982), and Svensson and Razin (1983) against the Harberger-Laursen-Metzler effect arguing that the results of their permanent deterioration in TOT were because their models assumed perfect price flexibility and perfect competition. They also extended the model to three goods by incorporating the non-traded sector in an intertemporal optimizing model with imperfect competition and nominal price rigidities. Chia and Alba then proved that the Harberger-Laursen-Metzler effect held for a temporary TOT shock both in an economy captured by Obstfeld-Svensson-Razin's (OSR) framework as well as in an economy with nominal price rigidities and imperfectly competitive markets. Besides, the model showed that permanent TOT deterioration might have a positive or negative effect on the current account depending on the intertemporal and intratemporal elasticities of substitution in consumption.

2.3 *Real exchange rate*

Theoretically, the effect of RER on some macroeconomic variables is still under debate, especially as it relates to national income growth. While it is generally accepted that RER changes induce expenditure switching (substitution

effect) and expenditure reduction (income effect) according to Meade (1951), its role and effectiveness in achieving internal and external balances were (and, are) still generating debate.

Early studies on macroeconomic adjustment for developing countries were divided into outcomes. Devaluation elicited a decline in aggregate demand via expenditure reduction, arising from the redistribution of income from workers to firms, which was greater than the increase in output generated from expenditure switching to non-traded (home) goods from traded (foreign) goods (Alejandro, 1965). Consequently, aggregate output and employment fell. In addition, from a position of trade deficit, real devaluation reduced national income as expenditure on imports rose more than the earnings from exports, reducing aggregate demand, hence, output and employment (Krugman & Taylor, 1978). Also, in Krugman and Taylor (1978), ad valorem taxes on exports and imports that had their values raised by devaluation redistributed income from the private to the public sector following the decline in aggregate demand due to the lower propensity to consume by the public sector. On the supply side, in van Wijnbergen (1986), a rise in the domestic cost of non-competitive imported intermediate input increased working capital as variable production costs rose. Assuming gradual adjustment in final goods prices, the rise in production costs would overwhelm the increased competitiveness in traded goods resulting in a fall in output. Also, with the indexation of real wage on domestic prices, the increase in domestic prices from devaluation raised the cost of production, hence, a decline in output. These theoretical studies predicted a decline in output from devaluation either through a fall in aggregate demand or a rise in costs of production.

However, according to Guitian (1976), devaluation, by inducing a decline in the real supply price of factor services in the domestic sector relative to the external sector drew productive resources into the latter from the former until equilibrium was restored in the market for inputs at the previous real factor price. Substitution effects on consumption in addition to a fall in supply raised the price of non-traded goods resulting in an increase in domestic inflation. At the same time, the trade balance improved as a consequence of the increase in output and lower demand in the traded goods sector. Khan and Knight (1982) showed that under certain conditions, real devaluation in the short run temporarily raised domestic currency prices of output relative to factor income, stimulating profit in the productive sector. This, therefore, temporarily increased aggregate real supply, and thus the gains from the real devaluation increased with persistence in RER change. Consequently, absorption declined resulting in a balance of payments surplus since domestic output was assumed to have infinitely elastic foreign demand at the new price. These last two theoretical models postulated supply-side effects that raised aggregate output.

More recently, Rodrik (2008) formulated a growth model for a small open economy in which traded and non-traded sectors both suffered from economic distortions. However, the traded goods sector suffered disproportionately relative to the non-traded goods sector "from the institutional weakness and inability to completely specify contracts that characterize lower-income environments" and "from the market failures (information and coordination externalities) that blocked structural transformation and economic diversification". In the intertemporal model, consumers consumed a single final good produced using a combination of traded and non-traded inputs. "Taxes" on both the traded and the non-traded goods sectors created conflict between the private and the social marginal benefits. Therefore, when the "tax" on traded goods was larger (in ad valorem terms) than that on non-traded goods, it elicited misallocation of resources which consequently shrank the traded goods sector such that growth became suboptimal. Under these conditions, a real depreciation could promote growth, via expenditure-switching. In this case, "the relative price of tradable acted as a second-best mechanism to partly alleviate the relevant distortion, fostered desirable structural change, and spurred growth". In the model, RER acted as a policy variable only in complement with other policies. Part of the "tax" was that developing economies devoted too few of their resources to the traded goods sector, and thus experienced slower growth than they should.

Aizenman and Lee (2008) also presented a mercantilist view of the condition under which RER undervaluation could promote export-led growth, precisely the influence of learning-by-doing externality. In their two-good model, agents consumed non-traded and traded goods. The non-traded good was produced only by labor, while the traded (manufacturing) good was produced using capital and labor, and was subjected to the learning-by-doing externality: the productivity of each firm in the traded good sector was determined by the "stock" of experience gained from past aggregate production of the traded good.

Ribeiro et al. (2019) provided a theoretical framework in which they made an elaborate and extensive discussion on the relationship between the RER changes and output growth. They hypothesized that RER affected output growth through two opposing partial effects: (i) undervaluation engineers growth-enhancing changes in the productive structure

of the economy by stimulating technological progress and knowledge spillovers, thereby increasing output growth; (ii) undervaluation promotes income inequality and thus harmful to output growth. This was tested empirically.

3. Methodological review

3.1 *Relative price of a good or service to another*

One of the earliest works that sought to examine the effects of relative prices, especially its variability on the macroeconomy was Blejer and Leiderman (1980). Using the United States annual time series data from 1949-79, a variance measure of relative price variability was computed. Three different formulations of price variability were used: (i) the initial measure computed, (ii) the sum of (i) and lagged value, and (iii) the sum of (ii) and the second lag of (i). In each of these formulations, real output or unemployment was the dependent variable and against this was regressed (by ordinary least squares (OLS)), the time trend and a lag of either real output or unemployment as the explanatory variable. The reason for using (ii) and (iii) was to account for possible "delay in real effects of the higher uncertainty and unpredictability caused by larger variability". Thereafter, a measure of unanticipated inflation was included in the model in order to obtain an independent effect of relative price variability.

Assarsson and Riksbank (2003) examined the effects of the variance and skewness of relative prices of 71 consumer goods items in Swedish consumer price index (CPI) as well as the interaction between them (to ascertain the strength of their joint effect) on the inflation rate from 1980 to 2002 and the sub-periods of high and low inflation with different monetary regimes, using both monthly and quarterly data. The study first employed graphical analysis before applying unrestricted regression as well as restricted regression which included only the skewness of price changes. Also included in the regressions was the lag of the inflation rate.

Rátfai (2004) examined the relationship between relative price asymmetry and inflation rate to help improve the understanding of short-run dynamics of inflation, precisely to ascertain the contribution of idiosyncratic pricing shocks to aggregate price changes. The study employed first, a baseline OLS regression in a univariate analysis and then, a bivariate, Structural ector autoregression (SVAR) in order to control for their dynamic and simultaneous determination with data comprising monthly store-level price quotations for twenty-seven homogenous food products and services in Hungary over 55 months. Ratfai criticized the use of cross-sector standard deviation of the change in sector-level price indices and cross-sector price level for computing relative price variability arguing that it did not reflect the theory behind inflation and relative price variability.

Tripathi and Goyal (2011) investigated the effect of relative price shocks on the price level and then inflation in India. The study used the monthly wholesale price index (WPI) of 90 products from M4 1971 to M4 2010. First, the product-specific frequency of price changes and duration of a single price spell were computed alongside the size of price increases and decreases. Second, the inflationary effects of the variance and skewness of each of the components of the WPI were examined using the OLS, because all variables were stationary. The aggregate inflation rate was computed as the year-on-year change in the log of the WPI. Both weighted and unweighted moments of the relative price changes were used. The weight was based on the relative importance of the industry. The baseline regression included oil price shock as a supply shock, monetary policy variable expected to affect demand, and lagged inflation, to capture persistence, then standard deviation, skewness, and their interactive term were systematically introduced.

3.2 *Terms-of-trade*

Mendoza (1995) simulated his model to examine the effects of TOT variability on the business cycle for groups of G-7 and 23 developing countries. The sample varied, from 1955 to 1990 for G-7 countries and 1960 to 1990 for the developing countries. The business cycle variables included GDP, RER, and trade balance.

Blattman et al. (2003) carried out a historical study on the effects of TOT, both its secular change and volatility on economic growth for 35 countries - the 16 Periphery (less developed countries with a large dependence on primary product exports) and 19 Core (more developed countries but with less dependence on primary product exports) countries from 1870 to 1938 as well as the sub-period of 1890-1938. The Panel regression included 10-year average GDP per capita growth rates as a dependent variable against 10-year average TOT growth and the 10-year standard deviation

of TOT while controlling for initial income per capita, export shares in GDP, primary products export shares in total exports, interactions between TOT (growth and volatility) and primary products share of export and exports share of GDP. Other variables were also included as controls. The study also evaluated the asymmetry hypothesis of TOT on the two regions. To examine the total effects of TOT, the study calculated what it called the marginal impact (the impact of a one-unit increase) and actual impact (the full impact) of TOT secular change and volatility on income growth in the regions.

Bleaney and Greenaway (2001) investigated the impact of the TOT and the real effective exchange rate on investment and growth for a panel of 14 sub-Saharan African countries that were heavily dependent on the export of primary commodities over the period of 1980 to 1995. The fixed effects panel regressions were estimated with instrumental variables for investment and OLS for economic growth. The study specifically examined the impacts of the volatility of the TOT, the RER, and the levels of the TOT and RER misalignments in the current and the previous two periods. The volatilities were estimated from a GARCH (1, 1) model. The independent variables were investment as a percentage of GDP and GDP growth rate.

Cashin and McDermott (2002) examined the importance of TOT shocks in current account imbalances in five OECD countries by comparing two commodity-exporting countries with relatively small non-tradable sectors (Australia and New Zealand) with three major industrial countries (the United States, the United Kingdom, and Canada, which was also an important commodity exporter). The study applied the SVAR model to quarterly data over the period 1970 to 1997. Three different shocks were identified: an external shock identified by innovations to the TOT, a permanent 'supply' shock measured by innovations to the growth of real output, and a temporary 'demand' shock produced as innovations to the current account balance as a share of GDP. Median unbiased estimation of TOT was carried out to identify persistence and, the size of the temporary component of TOT measured.

Di Pace et al. (2021) constructed country-specific export and import price indices using commodity prices and manufacturing price (US Producer Price Index (PPI)) data with their respective trade shares as weights and used them separately to examine the impact of shocks to TOT on a business cycle, using sign and narrative restrictions. Shocks to the individual prices are expected to reflect the effects of shocks to the TOT. The study focused on emerging and low-income countries over the period, 1980-2016, for 38 countries using annual data. A positive shock to export price implied an increase in the TOT and a positive shock to import price was a decline in the TOT. The study was carried out using structural VAR to estimate country-by-country time series data. However, the mean values weighted by each country's size proxy by their GDP (Purchasing Power Parity (PPP)) were reported and explained in the paper.

3.3 *Real exchange rate*

Rodrik (2008) used a measure of undervaluation adjusted for the Balassa-Samuelson effect, to make it comparable across the country and over time, to assess the role of RER in spurring the economy back to growth after initial distortions. The data used covered 188 countries from 1950 to 2000 over five-year periods and sub-periods of 1950-1979 and 1980-2004. Also included in the panel equation were initial income per capita as well as country and time dummies. GDP per capita was the dependent variable. In another regression, five-year-average sectoral shares (in real terms) were regressed on income, a complete set of fixed effects, and the measure of undervaluation.

Glüzmann et al. (2012) examined the mercantilist hypothesis captured in Rodrik (2008) for the same sample but a new and corrected Penn World Table up to 2007. Using a similar undervaluation measure of Rodrik, they estimated the influence of an undervalued currency on output growth for 1-year ($T = 1$) and 5-year ($T = 5$) panels for all whole samples and for different countries subsamples (developing, developed, and emerging). The same regression for $T = 1$ to $T = 5$ was conducted for the individual components' share of output: consumption, savings, investment, exports, and imports, and for employees to understand the possible channels of the undervaluation-growth effect, especially, the presence of the export growth-import substitution channel that is usually invoked by the mercantilist. A similar analysis was carried out for sectoral shares: agriculture, industry, and services for the emerging countries. In all regressions, the undervaluation measure was regressed along with initial per capita GDP, and a set of country and time period dummies as controls to capture other exogenous time-varying global factors and country-specific characteristics.

Soukiazis et al. (2014) questioned the assumption of constant relative prices in the long-run as documented as occurring through international trade. They, therefore, extended the Thirlwall (1979) growth model in which a country's long run growth rate was consistent with the balance-of-payments equilibrium by incorporating internal (arising from

the public deficit and debt) and external (captured through current account deficits) imbalances and non-neutral relative price by introducing RER directly into the growth model. The model also separated the import components of domestic income. They performed the system equations for Italy from 1983 to 2010, using annual data, with the 3-stage least squares to control the endogeneity of regressors and cross-equation error correlation and obtained the elasticities. The import demand equation, the export demand equation, and the private consumption and investment equations were estimated simultaneously to obtain the elasticities from which the reduced form of domestic income growth was computed. They compared their growth estimates with those of Thirlwall (1979), their earlier extension of Thirlwall's model with neutral relative prices in Soukiazis et al. (2013), and the actual average growth rate for Italy over the study period.

Ribeiro et al. (2019) examined their theoretical argument for a sample of 54 developing countries with the belief in the literature that the exchange rate had little effect on growth in developed countries, over the period 1990 to 2010. They first estimated a baseline empirical model in which the GDP per capita growth rate was regressed against the initial output per capita, an index of misalignment (undervaluation based on Rodrik, 2008), and a set of control variables that included government spending (%GDP), the TOT and population. Thereafter, the relative level of technological capabilities of each country and the wage share of income were included. The estimation method was the Generalized Methods of Moment.

4. Empirical review

4.1 *Relative price of a good or service to another*

Blejer's and Leiderman's (1980) findings revealed that relative price variability reduced output and increased unemployment. All but the contemporaneous measure were significant indicating that it was the cumulative measure of the current and past periods or the persistence of relative price variability that was more disruptive. Besides, the addition of the unanticipated inflation did not change the results rather the effects were more significant, including the contemporaneous measure.

In Assarsson and Riksbank (2003), the graphical analysis revealed that the skewness of monthly data was positive in the long run as shown by its filtered series. The recursive mean also showed that it was monthly data that had long-run positive skewness. This, the authors attributed to trend inflation. They explained that the difference in the findings between monthly and quarterly data was possibly due to 'the higher the frequency of the data, the lesser the importance of nominal rigidities in price adjustment' or that, at very low inflation rates, most price adjustments were done on a quarterly basis. The regression results suggested that, for both monthly and quarterly data, the variance and skewness of relative prices significantly explained the inflation rate over the different periods, especially during the period of low inflation, implying that nominal rigidities became more vital in periods of low inflation, according to the authors. However, results with quarterly data were weaker compared to those of the monthly data, and the interactive term was no longer significant in all the periods.

Rátfai (2004) found via the univariate results that relative price asymmetry (consistent with alternative measures) affected inflation positively, suggesting a positive contemporaneous relationship, both in the sector and store-level data. The SVAR results show that after the initial disturbance, idiosyncratic pricing shocks resulted in a large increase in inflation after two to five months. Idiosyncratic shocks were found to account for 25 to 30 percent of the forecast error variance in inflation at the 12-month horizon. There was no significant long-run effect of idiosyncratic shocks on inflation. These findings, as in the univariate case, were robust to different definitions of the relative price and alternative measures of asymmetry.

Tripathi and Goyal (2011) discovered that over time, price increases exceeded price decreases suggesting that the inflation rate might have been driven by higher price increases, according to the authors. Also, product prices in India were changed about once a year, implying real and nominal rigidities. The regression results showed that aggregate inflation was driven by the distribution of relative price changes, that is, inflation rose when the distribution of relative price changes was skewed to the right. The introduction of the moments of relative prices decreased the coefficient of the monetary policy variable, thereby reflecting some effects of a supply shock. The findings, in addition, revealed that the distribution-based measures of supply shocks performed better than conventional measures of prices of energy and

food.

4.2 *Terms-of-trade*

Mendoza's (1995) simulations showed that TOT disturbances accounted for around 1/2 of the observed variability of GDP and RERs, although the outcome was too large to be attributed to TOT alone and according to the author, productivity shocks might have played a role. Specifically, the findings observed that about 45 percent of Group of 7 - highly industrialized economies' business cycles could be accounted for by TOT shocks, using GDP at import prices while it explained 1/3 of the GDP variability at domestic prices. For developing countries, 37 percent and 56 percent of the volatility of GDP at import prices and domestic prices respectively, were attributed to TOT shock. Findings from simulation using the CPI-based real effective exchange rate (REER) suggested that TOT variability accounted for 40 and 49 percent of RER variability observed in G7 and developing countries, respectively. In addition, benchmark simulation for the G7 and developing countries showed, ceteris paribus, a stronger relation between trade balance and TOT coincided with lower TOT persistence. On the contrary, the correlation was stronger for the developing countries when the persistence of the TOT shocks rose. However, the negative correlation between productivity and TOT shocks negated the effects of TOT shocks on net exports.

Blattman et al.'s (2003) findings revealed that TOT improved growth but only significantly for the Periphery while its volatility generated adverse effects on growth for both the Periphery and the Core, though only significantly for the former. Primary product share was found to be associated with poor growth, although, this was only significant for the Periphery. This, the authors referred to as the resource 'curse'. The export share of primary products had a negative effect on growth, this caused a reduction in the TOT gains (which was negative on growth) as shown by the negative sign of the interacted term between export share and TOT. The results showed that the interaction between TOT and the share of exports was positive but only significant for the periphery. The interaction of TOT volatility and share of exports was found to be negative for the Core and positive for the Periphery, although, only significant between 1890 and 1938 for the Periphery.

According to Bleaney and Greenaway (2001), growth was negatively affected by TOT instability but investment by RER instability. Both growth and investment increased when the TOT improved and RER overvaluation was eliminated. On investment, the contemporaneous TOT was insignificant, but the lag of TOT had a significant positive effect. The TOT volatility had no significant impact on investment. However, RER had stronger effects on investment with its misalignment exerting a significantly negative coefficient, likewise the past level, but the second lag had a positive coefficient of approximately equal magnitude. The study, therefore, combined the first and second lags as the lagged change in the regression. The overall effect was a decline in investment. Finally, the volatility of RER strongly diminished investment. With respect to economic growth, GDP growth was positively associated with the current level of the TOT but negatively with the lagged change. Growth was negatively and significantly affected by lagged misalignment, while, the current level of misalignment had no impact. Volatility was negative but only significant for TOT.

Cashin and McDermott (2002) found that shocks to the TOT were very persistent in all countries except the United States and that TOT was composed largely of transitory shocks. The results of the study suggested that the TOT shocks had no impact on the current account balance in the highly industrialized countries of the United States, Canada, and the United Kingdom. Contrarily, TOT shocks accounted strongly for the variations in current account balances in Australia and New Zealand. Here, the HLM effect seemed to play an important or dominant role in the dynamics of the current account balance because they have relatively limited opportunity to switch between tradable and nontradable in response to a TOT shock. On the impact of TOT shock in explaining changes in real output, the variance decomposition accounted for less than 10 percent of the variations in all countries.

Di Pace et al. (2021) found that TOT was highly volatile and persistent using standard deviation and first-order autocorrelation, respectively as measures. A higher commodity export share and higher export concentration were found to be correlated with higher volatility of export prices. Energy exporting countries had, on average, higher volatility of export prices than agriculture exporting countries. Similarly, the higher the commodity imports' share, the higher the import price volatility. Di Pace et al. (2021) findings from the impulse response function showed that a one standard deviation positive shock to export and import prices affected the economy differently. The findings indicated that a positive shock (improvement) to export prices led to a rise in domestic GDP, private consumption, and investment.

The positive shock to export price improved the TOT by about 3 percent on impact while the RER appreciated by about 3 percent. The response to the trade balance was insignificant in the study. This was explained away as the ambiguity noted in the theory, suggesting that while some countries experienced the HLM effect, others had the Obstfeld, Svensson and Razin (OSR) effect dominating. For import prices, one standard deviation induced a much smaller effect on GDP, declining by about 0.4 percent while the impacts on consumption, investment, and the trade balance were quite insignificant. The RER was observed to exhibit a short-lived small appreciation, depreciating by about 1 percent thereafter. The TOT's response was negative by about 1.9 percent on impact.

4.3 *Real exchange rate*

Rodrik's (2008) empirical findings from the whole sample showed that undervaluation significantly increased growth. Further analysis indicated that the effect was only strong for developing countries. The developed countries returned an insignificant coefficient. This is consistent with various robustness checks. The inclusion of the interacted term between the measure of undervaluation and initial income was significantly negative for all countries and the full sample indicating that the growth effect of undervaluation depended on the level of development. Also, the growth effect is reduced with higher per capita income. The growth-inducing effect of RER in developing countries was not affected by the time period as indicated by the results from the sub-periods. The reallocation of resources was most pronounced in the industries. The regression in sectoral share revealed that industrial sectors depended heavily and positively on undervaluation for growth while agriculture was negatively associated with undervaluation. Hence, countries whose share of traded goods was dominated by industrial production grew faster. Rodrik explained that the difference in results might reflect the prevalence of quantitative restrictions in agricultural trade, which usually turned many agricultural products into non-traded goods at the margin.

Glüzmann et al. (2012) first replicated the result of Rodrik that undervaluation had a significant and positive contemporaneous association with growth, including for developed countries. Precisely, a 10% undervaluation was associated with between 0.1% and 0.2% rise in growth rates. Accounting for endogeneity by replacing the measure with its lag, widened the coefficients from 0.05 to 0.22 for a 10% depreciation. Specifically, the results became insignificant for developed countries for both the 1-year and 5-year periods and for developing countries for the 5-year period. The results for the components of output failed to establish a significant and consistent positive effect on exports and imports (both current and constant shares) for the overall sample and for the developing and emerging countries, the effects on savings and investment, as well as on employment were positive and significant, especially for the emerging countries. The findings for the developed countries were insignificant.

Likewise, the sectoral analysis indicated undervaluation was insignificant for industry, negative for agriculture, and positive for services. The results suggested that undervaluation operates through an increase in savings and investment, as well as an increase in employment, but not through the external sector. Glüzmann et al. (2012) explained that devaluations operated through a labor market-enhancing effect reminiscent of the channels identified in classical models of economies with an unlimited supply of labor, in which workers move from unproductive subsistence agricultural jobs into high-productivity industrial jobs. This effect was particularly strong for developing countries where a 10% depreciation led to a 0.07% change in the employment rate (and a 0.14% rise in employment). The second channel related to the positive effect of lower labor costs on the availability of internal funds for financially constrained enterprises, which had been found to be a source of rapid recovery in the aftermath of emerging market crises and as a source of growth in developing economies, as well. This channel had a strong effect on emerging countries.

In line with these findings, Glüzmann et al. (2012) explained that the contractionary findings of undervalued currency by Diaz Alejandro could be attributed to these. According to them, the savings and greater internal funds (due to an income transfer to high-income households or to firms, respectively) and financial constraints reconciled the findings of Diaz Alejandro with the new expansionary results. Diaz Alejandro's Keynesian framework revolved around the question of how the income transfer from a devaluation was ultimately spent but, because Diaz Alejandro did not see these increased savings as sources of domestic finance, rather going abroad in the form of foreign assets, aggregate demand hence, output was depressed.

Soukiazis et al.'s (2014) estimation showed that the relative price elasticity was positive and significant in the export equation but insignificant in the import demand equation, although it had a negative sign. The coefficients on the relative price elasticities were lower than those on the income elasticities, indicating that trade was more sensitive

to income than relative price changes. Their computation of growth rates revealed that the assumption of relative price neutrality in growth models underestimated growth rates and proved the importance of relative prices in economic growth. Specifically, their growth estimate was 3.393% compared to 2.205% from their earlier model (with constant relative price), 2.785% from Thirlwall's Law, and 1.493 - from the actual growth rate. Their findings showed that not only did Italy have the potential to grow faster without creating balance-of-payments problems but also that the other models with neutral relative prices or without relative prices underestimated the growth rate for Italy.

Ribeiro et al. (2019) baseline results suggested that real undervaluation was positively and significantly associated with economic growth in developing countries. The inclusion of both wage share (current and lagged) and the level of technological capabilities (current and lagged) in the baseline model render the growth effect of RER insignificant. The current term of technological capabilities was positive and significant while its lag term was negative and significant, with a positive net effect. The wage share had its current and lagged values negative and positive, respectively, and was statistically significant, likewise with a positive net effect. They concluded that RER only affected growth in developing countries indirectly through its impacts on functional income distribution and technological innovation. In fact, when the partial effects of these two variables were taken into account, the indirect impact of undervaluation on growth was small and negatively signed. A 10% real depreciation reduced long-run growth by 0.00036.

5. Concluding remark

The roles of relative prices in economic dynamics have been focused. Their remarkable contributions in the context of equilibrium restoration were stressed. Hardly in economic analysis is the relevance of relative prices replicated by other variables. Factors impacting their levels and volatility were identified as including, technology shocks, exogenous shocks, complementarity and substitutability in consumption, devaluation, market failures and explicit tax (in the case of developing countries). Further, fluctuations of relative prices tended to be much higher in underdeveloped countries, while, TOT shocks were generally found to be transmitted to the economy through international capital mobility, the cost of imported inputs and the purchasing power of exports. Overall, relative price variability or its persistence tended to reduce output and increase unemployment.

Conflict of interest

The author declares no conflict of interest with respect to the article.

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