International Journal of Finance & Economics

WILEY

RESEARCH ARTICLE OPEN ACCESS

The Impact of Changes in Real Income and the Real Effective Exchange Rate on Trade in Goods and Services

Tjeerd M. Boonman[1] | Ioannis Litsios[2] | Keith Pilbeam[3]

[1]Leon Hess Business School, Monmouth University, West Long Branch, New Jersey, USA | [2]Plymouth Business School, University of Plymouth, Plymouth, Devon, UK | [3]Department of Economics, City St George's, University of London, London, UK

Correspondence: Ioannis Litsios (ioannis.litsios@plymouth.ac.uk)

Received: 6 October 2024 | **Revised:** 12 August 2025 | **Accepted:** 9 October 2025

Keywords: income elasticity of demand for imports and exports | international trade | price elasticity of demand for imports and exports | real effective exchange rate

ABSTRACT

We use foreign trade data on both imports and exports of goods and services among a group of 15 advanced economies to determine the incomes and price elasticities of demand for exports and imports of goods, services and goods and services combined in the long run. We find that changes in foreign and domestic income have, as expected, a positive long-run impact on the demand for exports and imports, respectively, with the impact of income changes being typically greater on the demand for services than on the demand for goods. We also confirm that a depreciation in the real effective exchange rate leads to an increase in exports for most of the economies, while the impact on the demand for imports is mixed. Finally, we find a large degree of heterogeneity in the income and price elasticities of demand for trade in goods and services among the 15 economies.

JEL Classification: F14, F41

1 | Introduction

The trade balance deals with exports and imports of goods, but given the growth in trade in services, the current account balance is now increasingly the focus of policymakers' attention. The current account balance of goods and services is influenced by several factors, in particular changes in the exchange rate and income. There is no consensus on the impact of a change in the exchange rate on the current account balance—in either theoretical or empirical studies. The role of changes in domestic and foreign income in influencing the trade balance has been extensively studied, but the differential impact on trade in both goods and services has been neglected. Traditionally, the literature has focused on goods trade, as the literature developed in an age when trade was predominantly trade in merchandise, see Eichengreen and Gupta (2013). Marquez (2006) and Cheng (2020) point out that services and goods are different in nature, and that the income and exchange rate impacts on the trade in goods do not necessarily apply to the trade in services.

The literature has found that (i) the export demand price elasticities are still too heterogeneous to yield consensus benchmark estimates, (ii) the evidence on import demand price elasticities is more limited than that on exports, with often counterintuitive results, and (iii) the joint analysis of imports and exports income and price elasticities has been largely absent using the analytical framework of panel data with the notable exception of Aiello et al. (2015). In this study, we estimate and analyse the effects from the exchange rate and income on international trade for a group of 15 advanced economies, during the period 1999Q1–2019Q4. Our study ends in 2019Q4 to avoid incorporating the disruption to trade caused by the Covid-19 pandemic. The 15 economies under study cover more than 60% of the world GDP. We first analyse the full panel, then disaggregate our analysis to examine different regional clusters. Finally, we perform the analysis at the individual country level. Through this approach we are able to detect the overall trend and possible heterogeneity at the country level. While other studies have mainly focused on goods, we concentrate on both goods and services as well as goods and services combined.

We contribute to the literature in several ways. First, we construct and use time-varying, trade-weighted foreign income, based on multilateral data rather than simple aggregates of bilateral data. Second, we estimate long-run income and price elasticities by focusing separately on goods, services, and goods and services. Most studies focus on either goods or services, or on goods and services combined, but not all three together as we do. This is the first paper to estimate these long-run elasticities simultaneously within a unified framework. Third, we report our results for both individual economies and panels whereas the literature focuses on either individual economies or panels, but not both. Fourth, unlike the vast majority of studies that focus on bilateral trade patterns, we use the real effective exchange rate (REX); this is helpful as it means we can include currencies with fixed and floating exchange rate regimes, and it enables us to use the total imports and exports of goods and services, not just bilateral trade between two economies.[1] Finally, we concentrate not only on calculating the long-run income and price elasticities for goods but also for services and combined goods and services, and this is the first paper to look at all three simultaneously within a unified framework.

Our main findings on income elasticities are threefold. First, changes in foreign and domestic income have the expected, positive long-term impact on the demand for both exports and imports. Second, for the majority of the economies, the impact of income on the demand for trade in services is greater than that for goods. Third, we find regional differences in the disparities between income elasticities of imports and income elasticities of exports for the Western hemisphere as opposed to the Asia-Pacific economies and the non-euro group of European economies. Specifically, the evidence suggests that the United Kingdom, United States and Canada should consider policies towards reducing their income elasticity of demand for imports, relative to exports, to tackle their trade deficits in goods. Lastly, the main finding on price elasticities is that a depreciation in the REX leads to an increase in exports for almost all of the economies that we examine, while the impact on imports is mixed. For more than half of the economies in our sample, the imports increase in the long run after a REX depreciation, which is at odds with the traditional economic theory. Possible explanations are that imports are "sticky" due to the existence of long-term contracts, the absence of viable domestic substitutes, or being part of the global supply chain through multinational corporations with increased exports requiring increased imported inputs. This highlights the importance of further investigating the import dependency of exports in future research. Another possible explanation is the growing role of China as an exporting nation since its entrance into the WTO in 2001. We report a large degree of heterogeneity in the impact of changes in both the REX and real income on international trade of goods and services among the fifteen economies, which confirms that a panel analysis should be complemented by a country-by-country analysis.

The remainder of this paper is structured as follows. In Section 2 we review the literature on the principal factors that impact the demand for exports and imports of goods and services, namely, changes in the REX and domestic and foreign income. In Section 3 we provide an overview of the model and methodology that we employ. Section 4 presents the data and Section 5 presents the empirical results to estimate the impact of changes in the REX and changes in income on the demand for exports and imports. Section 6 concludes.

2 | Literature review

The main framework in literature is the imperfect substitutes model, initiated by Orcutt (1950) and Houthakker and Magee (1969), and formalised by Goldstein and Khan (1985). The major assumption of this model is that neither imports nor exports are perfect substitutes for domestic goods. This approach is motivated by the traditional partial equilibrium view of trade, where trade flows are a function of prices and income. Indeed, its main characteristics are based on the conventional demand theory, predicting that consumers maximise their utility subject to a budget constraint, see Aiello et al. (2015). Exports are determined by foreign income and their relative price compared to foreign goods and services, while imports depend on domestic income and their relative price compared to domestic goods and services.

$$lnX_{it} = \alpha_i + \beta_1 lnREX_{it} + \beta_2 lnY_{ft} + u_{it} \tag{1}$$

$$lnM_{it} = \alpha_i + \beta_3 lnREX_{it} + \beta_4 lnY_{it} + u_{it} \tag{2}$$

where X_{it} (M_{it}) refers to the total volume of national exports (imports) of country i at time t (be they goods, services or combined goods and services), REX_{it} is the REX of country i at time t (defined as domestic currency per unit of foreign currency, so that a rise represents a real depreciation and a fall a real appreciation),[2] Y_f is the real foreign income, and Y_i the real domestic income. Based on the theory, it is expected that β_1 (export elasticity with respect to the real exchange rate) is positive as a real depreciation results in higher competitiveness leading to an increase in the volume of exports. Similarly, β_3 (import elasticity with respect to the real exchange rate) is expected to be negative as real depreciation causes an increase of import prices leading to a decrease in import volumes. The parameters β_2 and β_4 (exports and imports elasticity with respect to real foreign and domestic income respectively) are expected to be positive, indicating that export and import volumes rise with foreign and domestic income respectively, see Aiello et al. (2015).

The focus of the early literature was long on the impact of a depreciation of the real exchange rate on the trade balance and the existence of a J-curve effect on the trade balance, which is described in Section 2.1.[3] Starting with Johnson (1958) and Houthakker and Magee (1969), the literature has given more prominence to the role of income elasticities of demand for imports and exports, which is described in Section 2.2. We build on the literature of export models as well as international trade models. We pay particular attention to the growing literature on the dynamics of exports and imports of services.

2.1 | The effect of the real exchange rate on foreign trade

The real exchange rate is an important constituent of the relative price of exports, and relative prices matter for allocation, including the allocation of resources to the export sector, see Eichengreen and Gupta (2013). The idea of improving the trade position through a so-called 'competitive devaluation' has been an attractive concept for policy makers and goes back to the standard theory of international trade. If a country's currency is devalued or depreciates in real terms, then foreign products become more expensive (and thus domestic products relatively cheaper) for domestic consumers and domestically produced products become cheaper for foreigners. As a consequence, domestic households purchase fewer imports and more domestic goods, while demand from foreign households will increase, thus increasing the demand for exports.

The impact of changes in the real exchange rate on the trade balance depends on the price elasticity of the demand for imports and exports, which is central in the elasticities approach, as laid out by Bickerdike (1920). When domestic demand is elastic, a depreciation of the real exchange rate will lead to lower imports, and when foreign demand is elastic, exports will surge after a depreciation. The Balance of Payments Constrained Growth (BPCG) theory, see Thirlwall (1979), has traditionally emphasised that price competition and a real exchange rate depreciation are ineffective for export performance and economic growth in the long run. Instead, qualitative superiority and technological advantages matter most for export performance, see Blecker (2021). Amiti et al. (2014) present a model where exporting firms that have high import shares and high market shares have a low exchange rate pass-through. This mechanism can also work on the aggregate country level, since some countries, for example, Hong Kong, Singapore, and the Netherlands, have both high exports and imports.

The empirical literature has found heterogeneous results for the impact of the REX on trade; see Bahmani et al. (2013); Aiello et al. (2015) and Bussiere et al. (2020). Bottega and Romero (2021) state that 'non-price and technological competitiveness are more relevant for the export performance of high-tech products, while price competitiveness is a more determinant factor for the exports of low-tech products'. The Covid-19 pandemic showed the potential influence of the highly globalised supply chain in determining international trade flows. In a globalised world, a depreciation of the REX does not automatically lead to lower imports, because imports may be needed to sustain the increased production of exports. This applies to energy and other raw materials imports, but also to semi-manufactured products such as microchips and outsourced services (e.g., information, communication and technology, administration). When domestic substitutes do not exist or are still more expensive than imports after a REX depreciation, then countries continue to import despite the relatively higher prices.

Marquez (2006) points out that services and goods are different in nature and the exchange rate and income impacts on the trade in goods do not necessarily apply to trade in services. Exports of services have grown faster than exports of goods between 2001 and 2010, as observed by Eichengreen and Gupta (2013) who note that the effect of the real exchange rate is even stronger for exports of services than for exports of goods, and that it is especially strong for exports of modern services such as engineering, health, legal, accounting and management services—more than traditional services such as transport, tourism, financial services and insurance. Trofimov (2023) examines the relationship between the real exchange rate and the trade in services balance in the United Kingdom using the quarterly data for the 2005Q1–2019Q4 period and finds little evidence of a long-term improvement in the services balance following depreciation.

The empirical literature has used several methods to analyse the impact of the real exchange rate on the trade balance and output. The cointegration analysis introduced by Engle and Granger (1987) provides a strong empirical toolkit, as non-stationary variables may have a linear combination that is stationary (Rose 1991; Andersen 1993). The Johansen method can be used to test for the significance of the cointegration of exports and imports caused by relative income and prices. Another popular methodology is the autoregressive distributed lag (ARDL) approach of Pesaran et al. (2001). The ARDL approach places lagged levels of each variable separately into a short-run error correction model, see Bahmani et al. (2013) and is robust for small samples, see Narayan and Narayan (2005). Another advantage of the ARDL approach is that it does not require the same order of integration of underlying variables. Specifically, a mixed series of integration of order zero I(0) and integration of order one I(1) can be used in the estimated model. This implies that it can include all types of exchange rates in the model (Bahmani-Oskooee and Hegerty 2010). Boyd et al. (2001) use a Vector ARDL model for eight OECD countries and find that output and the real exchange rate can be treated as weakly exogenous for the parameters of the balance of payment equation.

2.2 | The effect of income on foreign trade

A change of the real exchange rate is not the only determinant of exports and imports. Changes in foreign and domestic income also have an impact on the foreign trade of goods and services. According to the imperfect substitutes model, higher domestic income leads to more imports through an increase in the consumption component of the aggregate demand. Similarly, higher foreign income leads to a higher demand for exports.

Houthakker and Magee (1969) build on Johnson (1958) by giving more prominence to the role of income elasticities of demand for imports and exports. If trade is initially balanced in a two-country model, if prices are constant and if income growth is the same in both countries, then the trade balance between them can still change over time if their respective income elasticities of demand for the other's exports differ. For example, the country with a higher income elasticity of demand for its imports than the foreign income elasticity of demand for its exports will experience more rapid import growth than export growth, leading to a deterioration in its trade balance; see Houthakker and Magee (1969).

In empirical works, the impact from foreign income on the trade balance has been analysed too. The traditional export demand function is a log-linear function of the real exchange rate and the economic activity rate of the trade partners, where the latter is usually measured by a trade-weighted average of the trade partners' Gross Domestic Product (GDP), see Senhadji and Montenegro (1999). An increase in foreign income boosts demand for export products due to positive income effects, as long as the exported goods are not inferior goods. The coefficient of the foreign income variable is positive and significant in nearly all studies (Bayar 2018). Cheng (2020) finds that most categories of services trade are income elastic and economic growth plays a key role in determining the imports and exports of services trade.

Marquez (1990) finds that the aggregate foreign income elasticities for exports for a panel of developed and developing countries are consistent with the literature: they are positive, range between 1 and 2, and have small standard errors. Senhadji and Montenegro (1999) estimate export demand elasticities for a large number of developed and developing economies. The long-run price and income elasticities have the expected signs and are significant in most cases. On average, these elasticities are −1 and 1.5, respectively.

One of the causes of the widening of the US current account deficit is the higher elasticity of US imports with respect to income than that of US exports with respect to foreign income, known as the Houthakker-Magee effect, see, Gruber and Kamin (2007). The income asymmetry is quite pronounced for US trade in goods, but nearly absent or even reversed in certain categories of US trade in services (Mann 2002; Wren-Lewis and Driver 1998). Crane et al. (2007) find that the US export elasticity for services with respect to foreign income exceeds the US import elasticity for services with respect to domestic income over the period 1988–2006. This means that if the US were to grow at the same rate as its trading partners and prices remained constant, over time the US trade balance in services would move towards larger and larger surpluses. Wren-Lewis and Driver (1998) find that the elasticity of US exports of services to foreign income of 1.95 is much higher than that of manufactured goods (1.21), and they find that the elasticity of US imports of services with respect to US income (1.72) is much lower than that of manufactured goods (2.36). In other words, the Houthakker–Magee asymmetry is reversed for US trade in services. As the world's economies mature and spend more on services, which are becoming increasingly tradable, and less on manufactured goods, the income asymmetry is expected to reduce.

3 | Model and methodology

Following the elasticity approach,[4] the long-run relationships for import and export demand (in logarithms) are given by Equations (3) and (4)

$$X_t = \alpha_x + \beta^* y_t^* + \eta_x q_t \tag{3}$$

$$M_t = \alpha_m + \beta\ y_t + \eta_m q_t \tag{4}$$

where X_t and M_t are the natural log of volume of exports and imports respectively, y_t^* and y_t are the natural log of the foreign and the domestic real income, and q_t the natural log of the REX with an increase indicating a REX depreciation. The expected sign of the coefficients is positive, except for η_m that is expected to be negative, as a depreciation (rise in the exchange rate) is expected to reduce import volumes.

Initially we perform panel analysis based on FM-OLS after dividing the sample into different groups.[5] To estimate the model for each economy separately, we then use the ARDL cointegration methodology with bounds testing, see Pesaran et al. (2001).[6] We reformulate Equations (3) and (4) into a conditional (unrestricted) error-correction format:

Export model Equation (5):

$$\Delta X_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i} \Delta X_{t-i} + \sum_{j=0}^{p} \alpha_{2j} \Delta \mathrm{q}_{t-j} + \sum_{k=0}^{p} \alpha_{3k} \Delta \mathrm{y}^*_{t-k} + \theta_1 X_{t-1} + \theta_2 q_{t-1} + \theta_3 y^*_{t-1} + v_t \tag{5}$$

Import model Equation (6):

$$\Delta M_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta \mathrm{M}_{t-i} + \sum_{j=0}^{p} \beta_{2j} \Delta \mathrm{q}_{t-j} + \sum_{k=0}^{p} \beta_{3k} \Delta y_{t-k} + \phi_1 M_{t-1} + \phi_2 q_{t-1} + \phi_3 y_{t-1} + \omega_t \tag{6}$$

The lag structure is selected based on the Akaike information criterion (AIC). The appropriate lag structure of the model is obtained based on the smallest value of AIC. We use AIC and let the software determine the optimal lag structure.

A bounds testing procedure using the F-test is employed to examine the existence of a long-run relationship among the variables. The F-test aims to test the joint significance of the coefficients on the one period lagged level of the variables in Equations (5) and (6). Specifically, it is a test on the null hypotheses $H_0\colon \theta_1 = \theta_2 = \theta_3 = 0$ and $H_0\colon \phi_1 = \phi_2 = \phi_3 = 0$ respectively. For our sample, a bound test has been performed for all regressions and there was strong evidence of co-integration.

The diagnostic test provided for the estimated models is the AR (1) test on the residuals. We have performed the following tests for model misspecification: (i) Breusch-Godfrey serial correlation LM test, (ii) Breusch-Pagan-Godfrey heteroscedasticity, (iii) Jarque-Bera normality test. In addition, we also employ cumulative sums (CUSUM) test to check the stability of parameters, and for our sample, we find strong evidence in favor of the long-run structural stability.

4 | Data

The quarterly trade of goods and services data is collected for 15 economies from the trade data for the period 1999Q1 to 2019Q4 using data from IMF's balance of payments and International Investment Position Statistics (BOP/IIP). All the selected economies are members of the OECD, except for Hong Kong, Singapore and Taiwan.[7]

Chinn (2006) acknowledges the challenge of using real-world variables for the theoretical concept of the REX. These challenges range from the choice of the deflation metric (CPI, PPI, export price index) to the way to integrate multi-country exchange rates. For the latter, it is common to use trade weights. There is wide variation in the empirical literature on how to calculate these. Should one use export weights, import weights, or both? And how does one account for time variation in trade weights? The selection of the REX measure depends upon the economic issue being analysed. Examples are the use of REX overvaluation to detect currency crises, using the REX as a measure for productivity, and estimating the impact of changes in the REX on international trade. For our analysis, we use the REX based on time-varying trade weights used by the Bank for International Settlements (BIS), which, given the slow-moving nature of trade flows, adjusts the trade weights every 3 years.

We collected the value of exports of goods and services and the value of imports of goods and services in dollars and then used the average dollar exchange rate for the year to convert into the local currency. To obtain the export volumes, we deflate the exports of goods and services (separately and aggregated) by the domestic consumer price index. To obtain the import volumes, we deflate the imports of goods, services, and the two combined by the domestic consumer price index. Our study ends in 2019Q4 to avoid incorporating the disruption to trade caused by the Covid-19 pandemic.

The vast majority of studies use bilateral exchange rates to measure the impact of changes in the exchange rate on international trade. For the purposes of our study, we have used the REX series calculated by the BIS using the narrow exchange rate definition of effective exchange rates, which uses 3-year moving average trade weights to calculate the real and nominal effective exchange rates of 16 economies.[8] We prefer this consistent series due to the use of moving average of trade weights over time.

To calculate the real foreign income of each country, we multiply the foreign incomes of each of the country's 14 trading partners by the trade weight used to calculate the REX and add the series. Since we are not able to distinguish the different trade weights that undoubtedly exist for trade in goods and services, we apply the same trade weights to both for the purposes of our study. We should, however, note that trade in goods is approximately four times that of trade in services, although there can be considerable variations in this ratio between countries. Overall, our procedure gives us a unique representation of the foreign national income facing each country based upon the trade weights of each of its trading partners.

5 | Empirical results

We present the results from general to more specific; that is, we firstly present the complete panel of 15 economies in Section 5.1, three regional clusters and individual economies in Section 5.2. Finally, we present our findings on export and import elasticities of demand with respect to changes in the REXs in Section 5.3.

5.1 | Panel Results for the Whole Group in the Sample (15 Economies)

For the whole group of our economies, the results are shown in Table 1. The evidence suggests that both imports and exports of services increase after a REX depreciation, with exports increasing more than imports. The increase in imports and exports for the whole group in the sample is also apparent for goods and for goods and services combined. For the whole group of the 15 economies, all income elasticities come with the expected positive sign and are all highly significant. The income elasticities for imports and exports of services with respect to both domestic and foreign income are higher than those for goods and goods and services combined.

5.2 | Regional clusters

For more insight, we first break our sample up into regional clusters and perform panel experiments for each cluster. The first cluster consists of large economies in the Western hemisphere, the Eurozone area, United Kingdom, United States and Canada (EUUC). These economies are characterised by high trade and capital flows among themselves. The second cluster consists of seven Asia-Pacific economies: Singapore, Hong Kong, Japan, South Korea, Taiwan, New Zealand and Australia (Asia-Pacific). The third cluster consists of four relatively small European countries that are not in the euro zone: Switzerland, Norway, Sweden and Denmark (SNSD).

To further investigate the empirical outcome, we also analyse the results for each individual economy per region, based on ARDL regressions. Overall, there is evidence of heterogeneity within each group related to the various effects on import and export volumes from a REX depreciation.

TABLE 1 | Panel (FM-OLS) results for 15 economies: Coefficients for domestic real income (y), foreign real income (y*) and real effective exchange rate (q).

	Panel-all 15 (Constant level-grouped)		
	y	**y***	**q**
M^S	1.94*** (0.00)	—	0.31*** (0.00)
X^S	—	2.64*** (0.00)	0.39*** (0.00)
M^G	1.66*** (0.00)	—	0.39*** (0.00)
X^G	—	1.86*** (0.00)	0.36*** (0.00)
M^{G+S}	1.75*** (0.00)	—	0.37*** (0.00)
X^{G+S}	—	2.04*** (0.00)	0.37*** (0.00)

Note: The coefficients are the long-run elasticities of import volumes (M) and export volumes (X) as a consequence of changes in domestic income (y), foreign income (y*) and the real effective exchange rate (q). We distinguish between Services (S), Goods (G) and Goods and Services (G + S). p values in parentheses. $^*p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

TABLE 2 | Panel (FM-OLS) results for Eurozone, United Kingdom, United States, Canada: Coefficients for domestic real income (y), foreign real income (y*) and real effective exchange rate (q).

	Panel United States, United Kingdom, Eurozone, Canada		
	y	y*	q
M^S	2.39*** (0.00)	—	0.42*** (0.00)
X^S	—	2.24*** (0.00)	0.36*** (0.00)
M^G	1.45*** (0.00)	—	0.37*** (0.00)
X^G	—	1.06*** (0.00)	0.43*** (0.00)
M^{G+S}	1.67*** (0.00)	—	0.40*** (0.00)
X^{G+S}	—	1.41*** (0.00)	0.41*** (0.00)

Note: The coefficients are the long-run elasticities of import volumes (M) and export volumes (X) as a consequence of changes in domestic income (y), foreign income (y*) and the real effective exchange rate (q). We distinguish between Services (S), Goods (G) and Goods and Services (G + S). *p* values in parentheses. $^*p<0.10$, $^{**}p<0.05$, $^{***}p<0.01$.

5.2.1 | Large economies in the western hemisphere (Eurozone, United Kingdom, United States and Canada)

For the Eurozone, United Kingdom, United States and Canada group, the panel results in Table 2 indicate that the coefficients for domestic and foreign income have the expected positive sign and are highly significant. This implies that an increase in domestic income will increase imports, whereas an increase in foreign income will increase exports. The income elasticities for services are notably higher than the income elasticities for goods and for goods and services.

The panel outcome also reveals that after a REX depreciation, both export and import volumes increase, with exports increasing more than imports, mainly for goods and marginally for goods and services combined, whereas the opposite effect is observed for services alone. To further investigate this empirical outcome, Table 3 reveals the results from the ARDL regressions based on each individual economy. Overall, there is evidence of heterogeneity within the group related to the various effects on import and export volumes from a REX depreciation.

More specifically, looking at the results for services for the UK economy, it appears that after a REX depreciation, both export and import volumes increase, with imports increasing more than exports. It is worth noting that the above relationship between export and import elasticities, following a REX depreciation, is also apparent for goods and for goods and services combined, with all coefficients being significant.

The fact that imports of services increase after a REX depreciation may be attributed to the necessity of the imported services, which cannot be substituted by domestic services. In addition, the REX depreciation of the pound and the resulting increase in the prices of imports (in domestic currency terms) may increase the cost of exported services, which may have an adverse effect on export volumes.[9] Multinational enterprises may also contribute to the positive import effect since they have global supply chains, and even with a REX depreciation, they may increase imports in order to

TABLE 3 | ARDL method: Coefficients for domestic real income (y), foreign real income (y*) and real effective exchange rate (q) for the Eurozone, United Kingdom, United States and Canada.

	Eurozone			United Kingdom			United States			Canada		
	y	y*	q	y	y*	q	y	y*	q	y	y*	q
ΔM^S	4.64*** (0.00)	—	0.61* (0.05)	1.77*** (0.00)	—	0.38*** (0.00)	1.84*** (0.00)	—	0.59*** (0.00)	1.40*** (0.00)	—	−0.40*** (0.00)
ΔX^S	—	2.44*** (0.00)	0.40*** (0.00)	—	2.87*** (0.00)	0.23** (0.03)	—	2.68*** (0.00)	1.54*** (0.00)	—	1.47*** (0.00)	0.34*** (0.00)
ΔM^G	1.69** (0.01)	—	−1.13 (0.12)	0.86*** (0.00)	—	0.82*** (0.00)	2.11*** (0.00)	—	1.07*** (0.00)	0.87*** (0.00)	—	−0.12 (0.34)
ΔX^G	—	1.76*** (0.00)	0.36 (0.11)	—	0.64*** (0.00)	0.67*** (0.00)	—	1.94*** (0.00)	1.93*** (0.00)	—	0.64*** (0.00)	0.29** (0.04)
ΔM^{G+S}	2.14*** (0.00)	—	−1.12*** (0.00)	0.98*** (0.00)	—	0.90** (0.01)	1.35*** (0.00)	—	1.06*** (0.00)	0.99*** (0.00)	—	−0.13 (0.27)
ΔX^{G+S}	—	1.97*** (0.00)	0.37*** (0.00)	—	1.48*** (0.00)	0.58*** (0.00)	—	2.16*** (0.00)	1.80*** (0.00)	—	0.66*** (0.00)	0.30** (0.01)

Note: The coefficients are the long-run elasticities of import volumes (M) and export volumes (X) as a consequence of changes in domestic income (y), foreign income (y*) and the real effective exchange rate (q). We distinguish between Services (S), Goods (G) and Goods and Services (G + S). *p* values in parentheses.
$^*p<0.10$, $^{**}p<0.05$, $^{***}p<0.01$.

increase their exports. Another important possibility is the emergence of China as a major exporting nation following its entrance into the WTO in 2001. Chinese exports increased dramatically following its WTO entrance, and they are reflected in increased imports not only for the United Kingdom but also for other countries in our sample; we refer to this, hereafter, as the China effect.

We observe a similar result for the US economy, with an increase in both export and import volumes following a REX depreciation of the dollar. Both the United Kingdom and United States have experienced a deficit on the goods balance and a surplus on the services balance since the start of our sample period. However, there are some differences too; for the US, the increase in exports outperforms the increase in the volume of imports for services, for goods, and for goods and services combined, with all coefficients highly significant. Compared to the United Kingdom, the magnitude of the import effects relative to the export effects is not as strong for the US economy, possibly because the import of services is more oriented towards travel and transportation. Again, we suspect that there is a China effect on US imports throughout this period, resulting in the contrary to expected sign on the import elasticity of demand.

For the Eurozone, exports of goods increase, and imports of goods decrease after a REX depreciation of the Euro, which is in line with the conventional economic theory. This does not apply to services. Similar to the United Kingdom, we observe an increase in the import volume for services after a REX depreciation of the Euro for the Eurozone economies, which also appears to be larger than the increase in exports. The Eurozone has a surplus in both goods and services balance over the period under study.

Canada's exports of services, goods and goods combined increase following a REX depreciation of the Canadian dollar, whereas imports for all three cases decrease after a REX depreciation of the Canadian dollar, which is compatible with conventional economic theory. Similar to the Eurozone, Canada had a surplus on both the services and goods balances until 2008. This changed in the later 2000s, with a deficit emerging in services and alternating deficits and surpluses in the goods balance. Turning to the coefficients for domestic and foreign income, it appears that for all individual economies examined in the group, the coefficients come with the expected positive sign and are all highly significant. It also appears that the income elasticities for services are notably higher than the income elasticities for goods and for goods and services combined. Both effects are compatible with the outcome reported from the overall panel analysis.

5.2.2 | Asia-Pacific economies (Singapore, Hong Kong, Japan, South Korea, Taiwan, New Zealand and Australia)

The results for the Asia-Pacific panel are shown in Table 4. It appears that a REX depreciation of the local currency increases both exports and imports of services, with exports increasing more than imports. The same effect from a REX depreciation is also apparent for goods and for goods and services combined. For all three categories examined, the evidence suggests that the coefficients for the domestic and foreign income all come with the expected positive signs and are all highly significant.

TABLE 4 | Panel (FM-OLS) results for Asia-Pacific panel: Coefficients for domestic real income (y), foreign real income (y*) and real effective exchange rate (q).

	Panel Asia-Pacific (Constant level-grouped)		
	y	**y***	**q**
M^S	1.31*** (0.00)	—	0.52*** (0.00)
X^S	—	2.88*** (0.00)	0.64*** (0.00)
M^G	1.72*** (0.00)	—	0.66*** (0.00)
X^G		2.23*** (0.00)	0.74*** (0.00)
M^{G+S}	1.65*** (0.00)	—	0.64*** (0.00)
X^{G+S}	—	2.42*** (0.00)	0.74*** (0.00)

Note: The coefficients are the long-run elasticities of import volumes (M) and export volumes (X) as a consequence of changes in domestic income (y), foreign income (y*) and the real effective exchange rate (q). We distinguish between Services (S), Goods (G) and Goods and Services (G + S). *p* values in parentheses. $^{*}p<0.10$, $^{**}p<0.05$, $^{***}p<0.01$.

To further investigate the empirical outcome for the Asia-Pacific group, we also report evidence from the individual economies, which again reveal heterogeneity. Table 5 presents the ARDL regressions for each economy separately.

For all economies, the income coefficients for goods, for services, and for goods and services combined are all highly significant with the expected positive sign, which is also compatible with the panel evidence. As with the Eurozone, United Kingdom, United States and Canada group, there is clear evidence that for the Asian-Pacific economies, an increase in domestic income will increase imports and that an increase in foreign income will also increase exports. For the majority of the countries (Singapore, Taiwan, New Zealand, and Australia), services respond stronger to changes in income than goods, while for Hong Kong and South Korea, the goods response is stronger. The picture is mixed for Japan, whose imports of goods respond more to changes in domestic income, while its exports of services respond stronger to changes in foreign income.

Turning to the import and export price elasticities of demand reported for individual countries in Table 5, we observe that for the majority of the economies, namely, Singapore, Hong Kong, Japan, South Korea (not significant) and New Zealand, a REX depreciation of the local currency increases both exports and imports of services volumes, with exports increasing more than imports, all reported coefficients being highly significant. By contrast, in the cases of Taiwan and Australia, the import elasticities of services demand have the expected negative coefficient. For goods, the picture is more heterogeneous, with Singapore, Hong Kong and Taiwan having positive and significant coefficients for both exports and imports, Japan and Australia being

TABLE 5 | ARDL method: Coefficients for domestic real income (y), foreign real income (y*), and real effective exchange rate (q) for Singapore, Hong Kong, Japan, South Korea, Taiwan, New Zealand and Australia.

	Singapore			Hong Kong			Japan			South Korea		
	y	y*	q	y	y*	q	y	y*	q	y	y*	q
ΔM^S	1.60*** (0.00)	—	0.92*** (0.00)	0.28** (0.01)	—	0.99*** (0.00)	2.11*** (0.00)	—	0.65*** (0.00)	1.37*** (0.00)	—	0.35 (0.12)
ΔX^S	—	4.16*** (0.00)	0.99** (0.01)	—	1.11*** (0.00)	1.72*** (0.00)	—	1.07*** (0.00)	1.62*** (0.00)	—	6.29*** (0.00)	0.53 (0.70)
ΔM^G	0.96*** (0.00)	—	1.70** (0.01)	1.80*** (0.00)	—	1.004*** (0.00)	7.13*** (0.00)	—	−0.64 (0.30)	2.62** (0.04)	—	1.55 (0.21)
ΔX^G	—	2.34*** (0.00)	2.24*** (0.00)	—	1.23*** (0.00)	1.01*** (0.00)	—	0.52* (0.06)	0.97** (0.01)	—	12.13*** (000)	1.28** (0.04)
ΔM^{G+S}	1.07*** (0.00)	—	1.25*** (0.00)	1.48*** (0.00)	—	1.04*** (0.00)	5.87*** (0.00)	—	−0.3 (0.41)	4.62*** (0.00)	—	0.65** (0.01)
ΔX^{G+S}	—	2.91*** (0.00)	2.16** (0.01)	—	1.26*** (0.00)	1.07*** (0.00)	—	0.73*** (0.00)	1.04*** (0.00)	—	11.18*** (0.00)	1.36* (0.09)

	Taiwan			New Zealand			Australia		
	y	y*	q	y	y*	q	y	y*	q
ΔM^S	0.90*** (0.00)	—	−0.2 (0.51)	0.86*** (0.00)	—	0.31*** (0.00)	1.25*** (0.00)	—	−0.25*** (0.00)
ΔX^S	—	3.08*** (0.00)	0.18 (0.71)	—	1.93*** (0.00)	0.57*** (0.00)	—	2.59*** (0.00)	0.93*** (0.00)
ΔM^G	0.67*** (0.00)	—	1.85*** (0.00)	0.67*** (0.00)	—	0.01 (0.96)	0.62*** (0.00)	—	−0.45*** (0.00)
ΔX^G	—	1.15*** (0.00)	1.92*** (0.00)	—	1.41*** (0.00)	0.78*** (0.00)	—	1.74*** (0.00)	−0.22 (0.56)
ΔM^{G+S}	0.71*** (0.00)	—	1.52*** (0.00)	0.84*** (0.00)	—	0.20* (0.09)	0.86*** (0.00)	—	−0.33** (0.04)
ΔX^{G+S}	—	1.59*** (0.00)	2.48*** (0.00)	—	1.33*** (0.00)	0.70*** (0.00)	—	1.78*** (0.00)	−0.07 (0.74)

Note: The coefficients are the long-run elasticities of import volumes (M) and export volumes (X) as a consequence of changes in domestic income (y), foreign income (y*) and the real effective exchange rate (q). We distinguish between Services (S), Goods (G) and Goods and Services (G + S). p values in parentheses.
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

TABLE 6 | Panel (FM-OLS) results for Switzerland, Norway, Sweden, Denmark panel: Coefficients for domestic real income (y), foreign real income (y*) and real effective exchange rate (q).

	Panel Non-euro Europe (Constant level-grouped)		
	y	**y***	**q**
M^S	2.58*** (0.00)	—	−0.14 (0.41)
X^S	—	2.61*** (0.00)	0.01 (0.95)
M^G	1.75*** (0.00)	—	−0.06 (069)
X^G	—	1.83*** (0.00)	−0.38** (0.01)
M^{G+S}	1.88*** (0.00)	—	0.48*** (0.00)
X^{G+S}	—	2.01*** (0.00)	−0.30** (0.03)

Note: The coefficients are the long-run elasticities of import volumes (M) and export volumes (X) as a consequence of changes in domestic income (y), foreign income (y*) and the real effective exchange rate (q). We distinguish between Services (S), Goods (G) and Goods and Services (G + S). *p* values in parentheses. $^{*}p<0.10$, $^{**}p<0.05$, $^{***}p<0.01$.

the only two countries with the expected negative effect from a REX depreciation on imports of goods. For imports of goods and services combined, an unexpected positive and significant coefficient of the price elasticity of demand for imports is obtained for Singapore, Hong Kong, Taiwan, South Korea and New Zealand, with the latter being significant only at the 10% level. The China effect may well help to explain the unexpected positive sign of the import elasticity of demand for these countries, especially given the high degree of intra-regional trade in this region with China.

Despite the heterogeneity in the group, it appears that for most of the Asia-Pacific economies examined, both imports and exports of services increase after a REX depreciation, with the increase in exports dominating the increase in imports of services. For Singapore, Hong Kong and Taiwan, the above relationship also holds for goods and for goods and services combined with highly significant coefficients.

5.2.3 | Non-euro European economies: Switzerland, Norway, Sweden and Denmark

Treating Switzerland, Norway, Sweden and Denmark (SNSD) as a group, Table 6 reveals that after a REX depreciation of their currencies, their imports of services decrease and exports of services increase, which is compatible with conventional economic theory. However, there is limited evidence in terms of the significance of the coefficients. Turning to goods, while imports decline following a REX depreciation, the exports also decline, with the latter result being contrary to economic theory. The coefficients for domestic and foreign income are all positive and significant, with the income elasticities for services being notably greater than those of goods and goods plus services combined.

Table 7 presents the empirical results for each economy separately. Turning to income elasticities, the evidence reveals positive and highly significant coefficients for both domestic and foreign income for services, for goods, and for goods and services combined. This is the case for each individual economy, with the only exemption being Denmark, where the domestic income coefficients for goods and goods and services combined, although coming with the expected positive sign, are insignificant. For the three Scandinavian economies, services respond stronger to changes in income than goods, as evidenced by the higher domestic and foreign income coefficients for services. For Switzerland, the goods balance is more sensitive to changes in income than the services balance.

Regarding the export and import elasticities to changes in the REX, we observe again a high degree of heterogeneity among the economies. Interestingly, the REX coefficient for export of services is positive for Switzerland and positive but not significant for Norway, but unexpectedly negative and significant for Sweden and for Denmark. As predicted by conventional economic theory, the relevant coefficient for import services is negative for all economies and significant, apart from Sweden. However, when it comes to goods and goods and services combined, the results reveal that the REX coefficient for imports is negative as expected for Norway, Sweden, and Denmark but unexpectedly positive in the case of Switzerland. Due to the high coefficient reported for Switzerland, it leads to an unexpected positive sign for the price elasticity of demand for imports for goods and services combined for the SNSD panel result reported in Table 6.

Based on the evidence from our empirical investigation, some interesting conclusions can be reached in relation to the effects of income elasticities on trade and current account balances. As previously mentioned, for all of the economies examined in our sample, there is evidence that an increase in domestic income will increase imports. Similarly, an increase in foreign income will increase exports. However, it is apparent that for the economies within the Western Hemisphere group, notably the United Kingdom, the United States and Canada, the income elasticity of demand for imports in goods is higher than the income elasticity of exports in goods, which, in the presence of equal growth rates, would imply a deterioration of the trade balance in goods over time. Interestingly, this is not the case for services and for goods and services combined, where we observe the opposite effect. In addition, for most of the countries belonging to the Asia-Pacific group, we report evidence that for all three cases examined, namely for services, goods and goods and services combined, the income elasticity of demand for exports dominates the income elasticity of demand for imports. This is also the case for Switzerland, Sweden and Denmark. The evidence reported has important implications for policy making since it suggests that the economies in the Western Hemisphere, as opposed to the other economies in our sample, should consider policies to suppress their high-income elasticity of demand for imports of goods. Such policies could include increasing domestic substitutes for imported goods and increasing the quality and reliability of domestically produced import substitute goods.

TABLE 7 | ARDL method: Coefficients for domestic real income (y), foreign real income (y*) and real effective exchange rate (q) for Switzerland, Norway, Sweden and Denmark.

	Switzerland			Norway			Sweden			Denmark		
	y	y*	q	y	y*	q	y	y*	q	y	y*	q
ΔM^S	2.00*** (0.00)	—	−0.28** (0.03)	3.42*** (0.00)	—	−0.63** (0.04)	2.30*** (0.00)	—	−0.31 (0.69)	1.88*** (0.00)	—	−4.85*** (0.00)
ΔX^S	—	2.20*** (0.00)	0.63** (0.04)	—	1.74*** (0.00)	0.24 (0.28)	—	4.66*** (0.00)	−2.54* (0.06)	—	1.99*** (0.00)	−0.92*** (0.00)
ΔM^G	2.68*** (0.00)	—	2.22** (0.01)	2.49*** (0.00)	—	−0.27 (0.17)	1.56*** (0.00)	—	−0.21 (0.44)	0.6 (0.61)	—	−1.06 (0.59)
ΔX^G	—	4.34*** (0.00)	2.05*** (0.00)	—	1.49*** (0.00)	−2.63*** (0.00)	—	2.31*** (000)	0.54** (0.04)	—	1.43*** (0.00)	0.76** (0.03)
ΔM^{G+S}	2.31*** (0.00)	—	1.09** (0.01)	2.96*** (0.00)	—	−0.43** (0.02)	1.80*** (0.00)	—	−0.1 (0.73)	0.48 (0.35)	—	−4.71*** (0.00)
ΔX^{G+S}	—	3.93*** (0.00)	1.99** (0.03)	—	1.59*** (0.00)	−2.03*** (0.00)	—	2.49*** (000)	0.49* (0.06)	—	1.82*** (0.00)	0.92** (0.01)

Note: The coefficients are the long-run elasticities of import volumes (M) and export volumes (X) as a consequence of changes in domestic income (y), foreign income (y*), and the real effective exchange rate (q). We distinguish between Services (S), Goods (G) and Goods and Services (G + S). *p* values in parentheses.
$^{*}p<0.10$, $^{**}p<0.05$, $^{***}p<0.01$.

5.3 | Export and import elasticities for changes in the exchange rate

To gain insight into the long-term international trade dynamics, we analyse the difference in the elasticities of demand for exports and imports.

The results for the individual economies are reported in Table 8 and are somewhat mixed.

Interestingly for the United Kingdom, there is a negative effect of a depreciation of the REX for services, goods and goods and services combined, the only country where it is negative in all three cases. This indicates that a REX depreciation of the pound tends to lead to a deterioration of the trade balance and current account balance for the United Kingdom. Related to the trade in services, the same empirical outcome is also supported by Trofimov (2023) both for aggregated data and also for several subcategories of services, including travel, transportation, and financial services. The United Kingdom is one of the world's biggest services exporters. Our findings highlight the importance of the degree of the import content of services in the UK economy as a topic that merits future empirical investigation. It appears that a REX depreciation of the pound against its international trading partners will increase the domestic prices of imports, which then has an adverse effect on the cost of exported services, leading to a potentially adverse effect on export volumes. In addition, a number of service exports in the United Kingdom may be set in foreign currencies, and if this is the case, then a REX depreciation of the pound may have a limited effect on the volume of services exports. In a similar manner, related to the UK goods, our evidence suggests that after a REX depreciation of the pound, the trade balance in goods also deteriorates. The evidence reflects the importance of raw materials and intermediate inputs into the production of UK exports of goods, which are heavily oriented towards manufacturing industries. The increase in import prices, caused by a REX depreciation by raising the costs of exports, can therefore adversely affect export of goods volumes. In aggregate, a similar story applies to the goods and services combined. Of course, there may well be a significant China effect for the United Kingdom, as imports from China have risen significantly over time.

Contrary to the United Kingdom, for Canada and the United States, the evidence suggests that the trade balance of services, goods, and goods plus services improves after a REX depreciation. This may be attributed to a lower degree of dependency of exports on imported goods and services in these economies. For the Eurozone economies, for services, we observe similar effects on the services trade balance as for the UK economy; namely, a REX depreciation leads to a deterioration of the trade balance in services; however, for goods and services combined, there is an improvement of the current account balance, as is reported for the United States and Canada, which highlights the positive contribution from the goods sector. In the case of Canada, we observe a fall in imports and an increase in exports following a REX depreciation of the Canadian dollar, although the coefficients for imports of goods and imports of goods and services combined are not significant at the 10% level.

The economies from the Asia Pacific region demonstrate that a REX depreciation will most likely lead to an improvement in trade

TABLE 8 | Import and export demand elasticities.

	Singapore	Hong Kong	Japan	Korea	Taiwan	New Zealand	Australia
Import elasticity, services	0.92	0.99	0.65	0.35^{NS}	-0.20^{NS}	0.31	−0.25
Export elasticity, services	0.99	1.72	1.62	0.53^{NS}	0.18^{NS}	0.57	0.93
Difference (export – import)	0.07	0.73	0.97	0.18	0.38	0.26	1.18
Evidence	Improve	Improve	Improve	Improve	Improve	Improve	Improve
Import elasticity, goods	1.70	1.00	-0.64^{NS}	1.55^{NS}	1.85	0.01^{NS}	−0.45
Export elasticity, goods	2.24	1.01	0.97	1.28	1.92	0.78	-0.22^{NS}
Difference (export – import)	0.54	0.01	1.61	−0.27	0.07	0.77	0.23
Evidence	Improve	Improve	Improve	Deteriorate	Improve	Improve	Improve
Import elasticity, G&S	1.25	1.04	-0.30^{NS}	0.65	1.52	0.20	−0.33
Export elasticity, G&S	2.16	1.07	1.04	1.36	2.48	0.70	-0.07^{NS}
Difference (export – import)	0.91	0.03	1.34	0.71	0.96	0.50	0.26
Evidence	Improve	Improve	Improve	Improve	Improve	Improve	Improve

	Canada	United States	United Kingdom	Eurozone	Switzerland	Norway	Sweden	Denmark
Import elasticity, services	−0.40	0.59	0.38	0.61	−0.28	−0.63	-0.31^{NS}	−4.85
Export elasticity, services	0.34	1.54	0.23	0.40	0.63	0.24^{NS}	−2.54	−0.92
Difference (export – import)	0.74	0.95	−0.15	−0.21	0.91	0.87	−2.23	3.93
Evidence	Improve	Improve	Deteriorate	Deteriorate	Improve	Improve	Deteriorate	Improve
Import elasticity, goods	-0.12^{NS}	1.07	0.82	-1.13^{NS}	2.22	-0.27^{NS}	-0.21^{NS}	-1.06^{NS}
Export elasticity, goods	0.29	1.93	0.67	0.36^{NS}	2.05	−2.63	0.54	0.76
Difference (export – import)	0.41	0.86	−0.15	1.49	−0.17	−2.36	0.75	1.82
Evidence	Improve	Improve	Deteriorate	Improve	Deteriorate	Deteriorate	Improve	Improve
Import elasticity, G&S	-0.13^{NS}	1.06	0.90	−1.12	1.09	−0.43	−0.10	−4.71
Export elasticity, G&S	0.30	1.80	0.58	0.37	1.99	−2.03	0.49	0.92
Difference (export – import)	0.43	0.74	−0.32	1.49	0.90	−1.60	0.59	5.63
Evidence	Improve	Improve	Deteriorate	Improve	Improve	Deteriorate	Improve	Improve

Note: Insignificant coefficients are denoted with NS, and we report the estimated coefficient in each case.

balances, for services, for goods, and for goods and services combined. For services, there is an apparent difference compared with the United Kingdom since most of the export services in the United Kingdom are oriented towards financial services, insurance, consultancy, professional and technical services, whereas most of the exports of services in the Asian group are mainly focused on transportation, tourism and business management, which may not require a high degree of professional and technical support as in the case of the United Kingdom. Related to the trade balance in goods, again for the Asian group, we report an improvement in the trade balance following a REX depreciation of their currencies. The improvement in the trade balance for these economies may be due to the nature of their exports, which again may not be so highly dependent on import components. Most of the exports in the Asian group, like Singapore, Hong Kong, South Korea and Japan, are oriented towards integrated circuits, electronics, metals and to some extent vehicles; however, the production of these goods appears to be less dependent on import components. This effect may be more apparent for New Zealand, which exports mainly food products and imports machinery and petroleum, and for Australia, which mainly exports coal, iron, and wheat but imports refined petroleum and machinery.

Overall, the evidence from the non-euro European countries is quite mixed. For Norway, there is a positive trade balance effect of a REX depreciation for services but a negative effect for goods and for goods and services combined balances. Denmark has a similar effect to Norway only for services. This may be due to the similar nature of exports and imports of services in these two economies, where exports of services are mainly oriented towards sea transportation and imports of services towards travel. Sweden has the opposite trade effect to Norway and Denmark for services but a positive effect for goods and for goods and services combined. The opposite effect on services may be due to the nature of imports and export services in Sweden, which are mainly oriented towards miscellaneous business, professional, and technical services. Switzerland's case is different, as a depreciation tends to improve its trade balance in services and goods and services combined, while it deteriorates the balance for trade in goods only.

Overall, the evidence highlights the importance of the import dependency of exports (IDE) for the economies under investigation and its potential relationship with the trade and current account balance. Such an interaction may have important policy implications. As reported by Terzioglu and Subasat (2018), if the rapid increase in the IDE, facilitated by the rapid development of global value chains, is associated with current account imbalances, reducing such imbalances becomes an important policy consideration in order to prevent subsequent corrective crises. The current literature on such an association is quite scarce, and based on our empirical results, it appears that examining both the correlation and also the causation between IDE and current account imbalances for the countries in our sample would be an important extension of our research with possibly significant policy implications.

In Table 9 we report the results of our panel analysis, where the results are once again rather mixed.

For the Asia-Pacific nations, in accordance with the evidence from the individual economies in Table 8, the panel results reveal that a REX depreciation improves the trade balance for all categories examined, namely, for services, goods, and for goods and services combined. Notably, all coefficients from the panel experiments are highly significant. For the Eurozone, United Kingdom, United States and Canada (EUUC) group, there is a deterioration in the services balance but an improvement in goods and goods and services combined, with all coefficients being highly significant. This may highlight the unique nature of the export of services in the United Kingdom and the Eurozone compared to the United States and Canada. For Switzerland, Norway, Sweden and Denmark (non-euro Europe) grouping, there is an improvement from a REX depreciation for the services balance and a deterioration for the goods balance, and also for the goods and services combined. Finally, for all the 15 countries, there is

TABLE 9 | Panel data results.

	Asia–Pacific panel	EUUC panel	Non-euro Europe panel	15 Economies panel
Import elasticity, services	0.52	0.42	-0.14^{NS}	0.31
Export elasticity, services	0.64	0.36	0.01^{NS}	0.39
Difference (export -import)	0.12	−0.06	0.15	0.08
Evidence	Improve	Deteriorate	Improve	Improve
Import elasticity, goods	0.66	0.37	-0.06^{NS}	0.39
Export elasticity, goods	0.74	0.43	−0.38	0.36
Difference (export -import)	0.08	0.06	−0.32	−0.03
Evidence	Improve	Improve	Deteriorate	Deteriorate
Import elasticity, G&S	0.64	0.40	0.48	0.37
Export elasticity, G&S	0.74	0.41	−0.30	0.37
Difference (export -import)	0.10	0.01	−0.78	0.00
Evidence	Improve	Improve	Deteriorate	Balanced

Note: Insignificant coefficients are denoted with NS, and we report the estimated coefficient in each case.

an improvement in services, a deterioration in the goods, and a balance for goods and services combined, with all coefficients being highly significant.

5.4 | Comparing our results with the empirical literature

Finally, we briefly compare our results and findings with some of the more recent empirical literature. We restrict ourselves to studies with a comparable time horizon and selection of advanced economies.

Our results confirm Bahmani et al. (2013) that analyse a set of 29 countries, that largely overlap with our sample, for the period 1970–2009. We also find that domestic and foreign income have a significant and positive impact on imports and exports as would be expected. For the REX, our results coincide with their mixed outcomes on imports: a REX depreciation in Hong Kong, United Kingdom and United States appears to have a positive and significant impact on imports, while for Australia, Canada, Japan, and Norway the impact is negative. We find for all countries except Australia and Norway a positive and significant coefficient for exports, while they find that the impact from a real depreciation on exports is significantly negative for Canada, Eurozone (Germany, Italy), South Korea, Sweden and Switzerland.

Our results are partially in line with Aiello et al. (2015) who analyse a smaller number of countries (China, France, Germany, Italy, Japan, United Kingdom and United States) over the period 1990–2012, which is shorter and somewhat different than our sample period. We confirm that elasticities of domestic and foreign income for imports and exports are significant with the expected positive sign. Similar to their results, we find that these elasticities are asymmetric, which helps to explain why global trade imbalances are persistent. Our results on the effects of a depreciation of the REX are similar when it comes to exports, but there are some notable dissimilarities when it comes to imports. For example, we detect that a REX depreciation has a positive effect on US and UK imports and the expected negative effect for the Eurozone and Japan, while they detect the expected negative effect for three countries: the US, Germany and Japan. When it comes to the United Kingdom, we detect that a REX depreciation of the pound has a positive effect on UK imports, which is similar to what they find, so the unexpected results we find for the United Kingdom are also confirmed in their study. Our study, which covers more countries, also suggests that the United States and United Kingdom the unexpected coefficient for aggregate imports in goods and services can also be found in other countries such as Singapore, Hong Kong, South Korea, Taiwan, New Zealand and Switzerland; precisely why this unexpected effect occurs clearly merits future research.

Bussiere et al. (2020) study the exchange rate elasticities for 25 advanced and 26 emerging market economies in the period 1995–2012. Our findings coincide for the exchange rate elasticities for export volumes with positive significant coefficients for all countries, except for Australia and Norway, which do not have significant coefficients. For the price elasticity of demand for imports, much of our results are contrary to their findings. They find that the import elasticities are mostly correctly signed in that a REX depreciation leads to a fall in the volume of imports. Whereas, as mentioned above, we report that a REX depreciation has a positive impact on the demand for imports of goods and services combined for the United Kingdom, United States, Singapore, Hong Kong, South Korea, Taiwan, New Zealand and Switzerland.

6 | Conclusions

Understanding the impact that changes in the exchange rates, as well as changes in domestic and foreign real income have on international trade has been studied widely. We use the income and elasticities approaches to investigate whether changes in real income and the REX impact the exports, imports of goods and services, and ultimately the trade and current account balances.

We use the REX and foreign income based on trade weights, which is more precise than the standard approach of examining bilateral trade relations. Unlike previous studies, we examine the differing effects of changes in the REXs and trade-weighted real GDPs on the demand for services, goods, and goods and services combined. This is an important contribution as different countries have different reliances on goods and services in both their imports and exports. Importantly, goods and services also have different sensitivities to changes in real income and the real exchange rate. We apply the ARDL methodology on a full panel of 15 advanced economies, as well as on regional subpanels, and on the 15 individual economies.

Related to the real income effect, we find that all countries show the sign expected by the standard economic theory, which is that exports are positively related to foreign income and imports are positively related to domestic income. Our evidence suggests that the United Kingdom, United States, and Canada should consider policies towards reducing their income elasticity of demand for imports relative to exports to reduce their trade deficits in goods. This is also apparent for the Eurozone, not only for the trade in goods but also for the trade in goods and services combined. Interestingly, as opposed to the Western hemisphere, this issue is not apparent for the majority of the Asia-Pacific economies and non-euro Europe.

In addition, a depreciation of the REX invariably leads to a rise in export volumes as predicted by economic theory. However, we also find that a depreciation of the REX is associated with an increase in import volumes for most economies in our sample. Especially for the UK economy where the evidence suggests that imports increase more than exports leading to a deterioration of the trade balance in services, goods and goods and services combined. Based on the overall empirical evidence that we report, an important area for future research would be to investigate the interrelationship between the import dependency of exports and trade and current account imbalances. This could have important implications for policy making related to dealing with current account imbalances and in assessing whether an exchange rate depreciation strategy is a useful instrument for correcting trade imbalances. Another area for future investigation is the impact of the China effect on the imports of the countries in our study, because its entrance into the WTO in 2001 meant a large increase in imports, particularly of goods into most of the countries in our study and this might help explain why the effective

REX depreciations do not decrease imports in many cases. A similar 'Mexico effect' might apply to the US following the NAFTA in 1994 and the setting up Maquiladoras close to the US border.

Although our analysis is mainly oriented towards the investigation of partial elasticities, we realise that exports and imports may also be affected by other economic variables apart from the real income and the REX. A possible explanation for the overall increase in imports after a REX depreciation can be attributed to the interaction of a number of variables based on the synthesis between the elasticity approach and the absorption approaches to the balance of payments. For example, a synthetic exposition of the various effects may indicate that the final effect on the trade balance from a REX depreciation may be determined by the traditional elasticity approach (as an initial effect where elasticities are treated as partial ones) to which a multiplier is subsequently applied to capture any additional effects from changes in national incomes and hence any induced changes in the domestic imports and exports. The multiplier in question consists of the various propensities coming from consumption, investment and imports. To some extent, we realise that secondary effects may also appear from the fact that a depreciation, through its real wealth effects, can also impact domestic absorption directly through autonomous changes, expectations, and consumer and business sentiments, which will ultimately affect income and imports. The association among a REX depreciation, real income, and absorption is quite complex in terms of causal effects. We believe that investigating the causal relationship between income and absorption is a fruitful area for future research.[10] Further research on the effects on trade from tariff and non-tariff barriers, with the latter being particularly important for services, would also constitute an interesting extension of our work.

A limitation of our work is that China and other large emerging economies such as India are not included in the 15 economies for the trade-weighted REX calculations and trade-weighted real foreign income, but are included in the imports and exports data. As we have mentioned, this may lead to a China effect on imports and help account for the unexpected sign we obtain for import elasticities in many of the countries we study. This could be remedied in future research by using REXs that incorporate these countries. Another consideration is that the countries in the sample typically had very expansive monetary policies in the second half of the period that we study (2009 to 2019) due to their quantitative easing programmes, and this may have increased their demand for imports by boosting their national incomes. For additional extensions of our research, we could consider expanding the panels, which increases the number of observations and variation. This would make it possible to analyse the possible asymmetric impact of a depreciation vis-à-vis an appreciation, regional differences, countries with high, medium, or low degrees of trade openness, and countries with a high level of goods trade compared to countries that rely more on services.

Acknowledgements

We are extremely grateful to the two anonymous referees for their extensive comments and suggestions on earlier versions of this paper. We are also very grateful to the participants of the research seminars at Fern Universität Hagen and Universidad de Guadalajara, the 2024 International Conference on Empirical Economics at PSU-Altoona, the 2024 Northeast Business & Economics Association annual conference in Danbury, CT and the 2024 European Economics and Finance Society Annual Conference in Athens for useful comments and suggestions, particularly from Sushanta Mallick, Dimitrios Asteriou, Reginald Kadzutu, Michael Murach and Xiaopeng Yin. Tjeerd M. Boonman would like to thank the McMullen family and the LHBS Business Council for their support for this research.

Data Availability Statement

The data that support the findings of this study are openly available. Data are collected from IMF's Balance of Payments and International Investment Position Statistics (BOP/IIP) and Bank for International Settlements.

Endnotes

[1] Two notable studies that also use real effective exchange rates are Aiello et al. (2015) and Bussiere et al. (2020).

[2] The IMF and Bank for International Settlements (BIS) present real effective exchange rate indices as foreign units per unit of the domestic currency, so that a rise represents an appreciation of the real exchange rate of the domestic currency. For the purposes of our study we have taken the reciprocal of the BIS real exchange rate series so that a rise in the real exchange rate represents a depreciation of the domestic currency. We do this as this is the convention used in the vast majority of the literature on exchange rates.

[3] A nice summary of the importance of the Marshall Lerner condition is contained in Rose (1991).

[4] See Cheng (2020) and Boyd et al. (2001).

[5] There is strong evidence of co-integration. Results are available upon request.

[6] We perform unit root tests (ADF, PP and KPSS tests) and find that none of the series are I(2).

[7] The economies employed in the current study are the Eurozone, United Kingdom, United States, Canada, Singapore, Hong Kong, Japan, South Korea, Taiwan, New Zealand, Australia, Switzerland, Norway, Sweden and Denmark.

[8] The narrow real effective exchange rate series of the BIS covers 16 countries. Due to data issues we decided to exclude Mexico from the study and reapportion its weights to the other 15 countries. The BIS uses a time varying trade weight system that evolves every 3 years based upon changing trade patterns between countries. The time varying weight formula for the BIS calculation for effective exchange rates is available at https://www.bis.org/publ/qtrpdf/r_qt0603e.pdf.

[9] This effect is also reported by Trofimov (2023) for the UK services.

[10] For a detailed theoretical exposition on the synthesis approach see Gandolfo (1995).

References

Aiello, F., G. Bonanno, and A. Via. 2015. "Again, on Trade Elasticities: Evidence From a Selected Sample of Countries." *Eurasian Business Review* 5: 259–287.

Amiti, M., O. Itskhoki, and J. Konings. 2014. "Importers, Exporters, and Exchange Rate Disconnect." *American Economic Review* 104, no. 7: 1942–1978.

Andersen, P. 1993. "The 45-Rule Revisited." *Applied Economics* 25, no. 10: 1279–1284.

Bahmani, M., H. Harvey, and S. W. Hegerty. 2013. "Empirical Tests of the Marshall Lerner Condition: a Literature Review." *Journal of Economic Studies* 40: 411–443.

Bahmani-Oskooee, M., and S. W. Hegerty. 2010. "The J- and S-Curves: A Survey of Recent Literature." *Journal of Economic Studies* 37: 580–596.

Bayar, G. 2018. "Estimating Export Equations: A Survey of the Literature." *Empirical Economics* 54: 629–672.

Bickerdike, C. F. 1920. "The Instability of Foreign Exchange." *Economic Journal* 30, no. 117: 118–122.

Blecker, R. A. 2021. "New Advances and Controversies in the Framework of Balance-of-Payments-Constrained Growth." *Journal of Economic Surveys* 36: 429–467.

Bottega, A., and J. P. Romero. 2021. "Innovation, Export Performance and Trade Elasticities Across Different Sectors." *Structural Change and Economic Dynamics* 58: 174–184.

Boyd, D., G. M. Caporale, and R. Smith. 2001. "Real Exchange Rate Effects on the Balance of Trade: Cointegration and the Marshall–Lerner Condition." *International Journal of Finance & Economics* 6, no. 3: 187–200.

Bussiere, M., G. Gaulier, and W. Steingress. 2020. "Global Trade Flows: Revisiting the Exchange Rate Elasticities." *Open Economies Review* 31, no. 1: 25–78.

Cheng, K. M. 2020. "Currency Devaluation and Trade Balance: Evidence From the US Services Trade." *Journal of Policy Modeling* 42, no. 1: 20–37.

Chinn, M. D. 2006. "A Primer on Real Effective Exchange Rates: Determinants, Overvaluation, Trade Flows and Competitive Devaluation." *Open Economies Review* 17: 115–143.

Crane, L., M. A. Crowley, and S. Quayyum. 2007. "Understanding the Evolution of Trade Deficits: Trade Elasticities of Industrialized Countries." Economic Perspectives, 4Q/2007.

Eichengreen, B., and P. Gupta. 2013. "the Real Exchange Rate and Export Growth." *Policy Research Working Paper* 6629, The World Bank, Washington D.C.

Engle, R. F., and C. W. Granger. 1987. "Co-Integration and Error Correction: Representation, Estimation, and Testing." *Econometrica* 55, no. 2: 251–276.

Gandolfo, G. 1995. *International Economics II: International Monetary Theory and Open-Economy Macroeconomics*. Springer-Verlag Berlin and Heidelberg GmbH & Co. K.

Goldstein, M., and M. S. Khan. 1985. "Income and Price Effects in Foreign Trade." In *Handbook of International Economics*, vol. 2, 1041–1105. Elsevier.

Gruber, J. W., and S. B. Kamin. 2007. "Explaining the Global Pattern of Current Account Imbalances." *Journal of International Money and Finance* 26: 500–522.

Houthakker, H. S., and S. P. Magee. 1969. "Income and Price Elasticities in World Trade." *Review of Economics and Statistics* 51, no. 2: 111–125.

Johnson, H. G. 1958. "Towards a General Theory of the Balance of Payments." *Readings in International Economics*, 11.

Mann, C. L. 2002. "Perspectives on the US Current Account Deficit and Sustainability." *Journal of Economic Perspectives* 16, no. 3: 131–152.

Marquez, J. 1990. "Bilateral Trade Elasticities." *Review of Economics and Statistics* 72, no. 1: 70–77.

Marquez, J. 2006. "Estimating Elasticities for U.S. Trade in Services." *Economic Modelling* 23: 276–307.

Narayan, S., and P. K. Narayan. 2005. "An Empirical Analysis of Fiji's Import Demand Function." *Journal of Economic Studies* 32, no. 2: 158–168.

Orcutt, G. H. 1950. "Measurement of Price Elasticities in International Trade." *Review of Economics and Statistics* 32, no. 2: 117–132.

Pesaran, M. H., Y. Shin, and R. J. Smith. 2001. "Bounds Testing Approaches to the Analysis of Level Relationships." *Journal of Applied Econometrics* 16, no. 3: 289–326.

Rose, A. K. 1991. "The Role of Exchange Rates in a Popular Model of International Trade: Does the 'Marshall–Lerner' Condition Hold?" *Journal of International Economics* 30, no. 3–4: 301–316.

Senhadji, A. S., and C. E. Montenegro. 1999. "Time Series Analysis of Export Demand Equations: a Cross-Country Analysis." *IMF Staff Papers* 46, no. 3: 259–273.

Terzioglu, N., and T. Subasat. 2018. "Import Dependency of Exports as a Cause of Current Account Deficit." *Central European Review of Economics & Finance* 25, no. 3: 37–49.

Thirlwall, A. P. 1979. "The Balance of Payments Constraint as an Explanation of International Growth Rate Differences." *Banca Nazionale del Lavoro Quarterly Review* 32, no. 128: 45–53.

Trofimov, I. D. 2023. "The J-Curve Effect in Services Trade: a Disaggregated Analysis." *Foreign Trade Review* 58, no. 2: 199–219.

Wren-Lewis, S., and R. L. Driver. 1998. *Real Exchange Rates for the Year 2000*. Vol. 54. Institute for International Economics, Policy Analyses in International Economics.