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International trade and economic growth in Croatia

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HRVATSKA NARODNA BANKA · CROATIAN NATIONAL BANK

The views expressed in this paper are not necessarily the views of the Croatian National Bank.

Međunarodna trgovina i gospodarski rast Hrvatske

Sažetak

U istraživanju analiziramo povezanost hrvatskoga gospodarskog rasta u posljednja dva desetljeća i dinamike i strukture međunarodne razmjene robe i usluga. Korištenjem agregatnih funkcija izvoza i uvoza robe i usluga te uz pomoć modela State-space, procijenjena su vremenska kretanja neopazivih varijabla – cjenovnih i dohodovnih elastičnosti izvoza i uvoza robe te usluga čiji omjer predstavlja dobar pokazatelj necjenovne konkurentnosti male otvorene države kao što je Hrvatska. Osim toga, pod pretpostavkom da dohodovne elastičnosti odražavaju proizvodnu strukturu te korištenjem takozvanoga Harrodova dinamičkog multiplikatora trgovine, izračunata je ravnotežna stopa rasta platne bilance i uspoređena s dugoročnom trend-stopom gospodarskog rasta. Nadalje, kako bi se prikazala velika uloga i važnost usluga (posebno turizma) u hrvatskom gospodarstvu, analiza je ponovljena tako da su izvoz i uvoz razdvojeni između robe i usluga. Sveukupno, rezultati pokazuju da su interakcije izvoza i uvoza ključne u određivanju dugoročne stope rasta hrvatskoga gospodarstva, pri čemu zemlja ne može rasti brže od ravnotežne stope rasta platne bilance, a procijenjene elastičnosti i necjenovna konkurentnost odražavaju karakterističnost hrvatske izvozne i proizvodne strukture i pružaju osnovu za daljnji uvid u mehanizme koji stoje u pozadini procesa sustizanja zemalja Europske unije. Potom se u nastavku rada istražuju odrednice prethodno procijenjene necjenovne konkurentnosti Hrvatske korištenjem takozvanoga Bayesova modela prosjeka (engl. *Bayesian Model Averaging*, BMA) i ponderiranog prosjeka najmanjih kvadrata (engl. *Weighted Average Least Squares*, WALS). Rezultati pokazuju kako su ulaganja u istraživanje i razvoj te akumulacija ljudskoga kapitala, uz demografske varijable, najvažnije objašnjavajuće varijable necjenovne konkurentnosti Hrvatske, odnosno najvažnije pokretačke snage dugoročnoga ekonomskog uspjeha.

Ključne riječi: gospodarski rast, međunarodna trgovina, model State-space, Bayesov model prosjeka, Hrvatska

JEL: F43, O11, O40

International trade and economic growth in Croatia*

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Abstract

This article argues that Croatia's economic performance over the past two decades is deeply related to the dynamics of international trade. Under the premise that what is bought and sold in international markets reflects the economy's fundamentals, we show that the rate of growth compatible with equilibrium in the balance-of-payments, i.e. the dynamic Harrod trade multiplier, is a good predictor of the country's actual long-run growth rate. For this purpose, we apply a state-space model and the Kalman smoother to obtain time-varying parameter estimates of the exports and imports functions. We proceed by using these estimates to investigate the determinants of international non-price competitiveness. Bayesian Model Averaging (BMA) and Weighted Average Least Squares (WALS) techniques are combined to tackle model selection uncertainty. It is shown that R&D investments and human capital accumulation are the most important explanatory variables. We conclude by highlighting the policy relevance of our findings to the evaluation of Croatia's catching-up performance as part of the European Union.

Keywords: Economic growth, International trade, State-space model, Bayesian model averaging, Croatia.

JEL: F43, O11, O40

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Contents

1 Introduction

Croatia declared independence on June 25, 1991, a year after the parliamentary elections that resulted in the dissolution of the previous association with former Yugoslavia. A prolonged economic transition, restructuring, and liberalisation of markets started immediately afterwards, ensuring a certain degree of macroeconomic stability. As a result, the country became a member of the World Trade Organisation (WTO) in 2000, joined the Central European Free Trade Agreement (CEFTA) in 2003, and finally entered the European Union (EU) as a member state in 2013. This strategy has enabled domestic firms to compete relatively well in international markets. However, it must be noted that a limited number of studies have directly assessed the impact of Croatia's international specialisation on growth. Therefore, this article attempts to provide some answers under the premise that what is bought and sold in international markets reflects deep fundamentals of the economy.

The relationship between trade performance and economic growth has been for a long time subject to considerable interest in economics (e.g. Feder, 1983; Feenstra and Romalis, 2014). For instance, the literature on export-led growth has consistently estimated price and income elasticities in export functions as well as investigated growth effects associated with exports (see, for example, Berg et al., 2012; Freund and Pierola, 2012; Tang et al., 2015). Among the powerful reasons why exports matter, there is the fact that they are the only component of demand that can pay for import requirements, especially those of capital goods. The experience of several developing and transition economies indicates a limit to current-account imbalances beyond which international financial markets are not willing to continue lending. In this context, trade directly affects demand, but it is also related to the provision of international currency and the capacity of the domestic economy to access modern production techniques.

The present paper contributes to the growth literature in transition countries in several ways. Our analysis is divided into two main parts. Using quarterly data covering the period from 2000 to 2020, we first test whether the rate of growth compatible with equilibrium in the balance-of-payments, i.e. the dynamic Harrod (1933) trade-multiplier, is a good predictor of the actual long-run growth rate in this country. Empirical evidence supporting it can be found in the literature for single and country groups (e.g. Bagnai 2010; Gouvêa and Lima, 2013; Kvedaras et al., 2020), including former socialist states (Kvedaras, 2005), and China (see Felipe and Lanzafame, 2020). The main idea is that a country trading in international currency cannot sustain increasing balance-of-payments imbalances. Therefore, in the long run, growth is well approximated by the ratio between the income elasticity of exports over imports multiplied by the rest of the world growth rate. The first element captures non-price factors that affect international commerce, such as the technical sophistication or quality of goods and services traded, representing a measure of non-price competitiveness. We are the first to test this model for Croatia to the best of our knowledge. Following the methodology proposed in Felipe and Lanzafame (2020), trade equations are estimated by applying a state-space model and the Kalman smoother.

We show that the trade multiplier is a good predictor of Croatia's long-run growth rate, offering an alternative explanation that considers the growth-enhancing effects of exports. Due to the prominent role of tourism activities in this country, the analysis differentiates between goods and service sectors. Our estimates indicate that price elasticities are not statistically significant and have a neglectable impact on growth. On the other hand, exports are more income-elastic than imports, while goods are less income-elastic than services. It is shown that the Croatian economy has undergone at least two different processes of structural

change, especially regarding the composition of exports. We argue that non-price competitiveness has significantly grown after Croatia acceded to the EU, further confirming the positive effects of being part of the union for this economy.

As a second step, we investigate the determinants of the growth rate compatible with equilibrium in the balance-of-payments. Using our previous estimates, we combine Bayesian Model Averaging (BMA) and Weighted Average Least Squares (WALS) techniques to assess what explains non-price competitiveness. We show that the most important driving forces are Research and Development (R&D) investment as a proportion of Gross Domestic Product (GDP) and human capital accumulation. Demographic variables also play a relevant role in explaining the country's long-run economic performance. To the best of our knowledge, we are the first to test the empirical relevance of the trade-multiplier to the case of Croatia, exploring supply and demand interactions through international trade. Our estimates are useful for capturing the impact of different processes of structural change in the economy and can be used for macroeconomic forecasts in growth models for small open economies.

The remainder of the paper is organised as follows. Section 2 presents some stylised facts about the Croatian economy, emphasising recent trends in international trade. Section 3 revisits the multisectoral version of the dynamic Harrod trade-multiplier and present our estimation strategy. Section 4 applies time-varying parameter estimation techniques to assess the relevance of the theoretical model in explaining long-run growth in the country. Section 5 brings our BMA and WALS estimations of the determinants of non-price competitiveness. Some final considerations follow.

2 Some stylised facts

With the separation of Croatia from other Yugoslav republics, economic transition and market restructuring began, maintaining macroeconomic stability and increasing the standard of living. For small open economies such as Croatia, the integration into different economic organisations is important as it allows the free movement of goods and services and access to foreign technologies and modern production techniques. As anticipated in the previous Section, from 2000 to 2013, the country became a member of the WTO, joined CEFTA, and finally entered the EU. Such a strategy has enabled domestic firms to compete relatively well in international markets and achieve a GDP per capita of over 20,000 euros (PPP, current prices).

As we can see in Fig. 1 (a), after entering the WTO and before the outbreak of the great financial crisis, Croatia registered significant growth in exports, in blue, and imports, in red, of both goods and services. Interestingly, the trade deficit in the exchange of goods contrasts with a surplus coming from the service sector. Until the onset of the financial crisis, the latter was not enough to compensate for the former, resulting in a deterioration in the current account. Total exports rose from 11.8 billion euros in 2000 to 19.2 billion in 2008, an average annual growth rate of 6.3%. In this period, goods exports, in blue, grew faster than services, in grey, as depicted in panels (c) and (d). At the same time, imports grew faster than exports, more than doubling from 11.7 billion euros in 2000 to over 24 billion in 2008, an average expansion of 9.5% per year. Most of it came from the goods sector, as shown in panels (e) and (f).

The volume of trade at the global level fell sharply in 2008 due to the financial crisis, which led to a more pronounced decline in total imports than exports in Croatia. This fact can be explained as a stronger contraction in domestic rather than foreign demand. The correspondent variation rates are presented in panel (b). Exports fell to 16.3 billion euros in

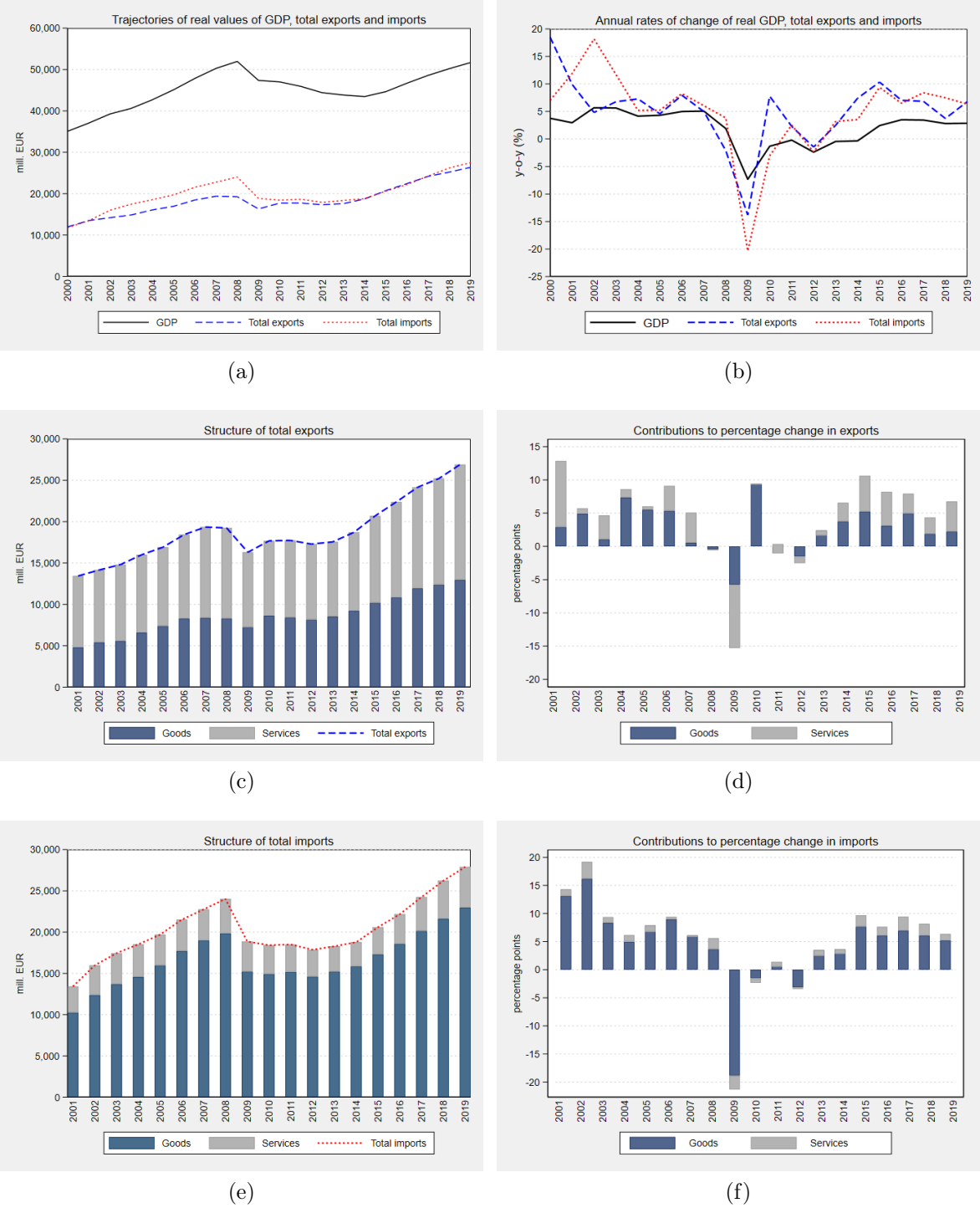


Figure 1: Trajectories of GDP, exports and imports in Croatia, 2001-2019, constant 2015 euros.

2009, mainly due to the decline in service exports. Total imports decreased to 18.8 billion euros, primarily due to the decline in imports from the goods sector. If we look at the dynamics of the two segments separately, we observe that the decline in imports of goods was more substantial than the respective decline in exports, while the fall in service exports was more substantial than the decline in imports.

As the income of its main trading partners recovered faster than domestic demand, Croatian exports strengthened accordingly, resulting in a significantly lower trade deficit in goods and a surplus in services. In 2014, total exports and imports began to grow, supported by improved domestic and international macroeconomic conditions and easier access to the common market after EU accession in 2013. Thus, in 2014, exports reached the pre-crisis level, registering 26.9 billion euros in 2019, an average annual growth rate of 5.2%. After the great financial crisis, goods exports expanded at an average annual rate of 6.2%, reaching 13.0 billion euros in 2019. On the other hand, services presented a slightly less robust performance and reached 13.9 billion euros. When it comes to imports, pre-crisis levels were only recovered in 2017. Imports of goods grew at an average annual rate of 4.3% and in 2019 amounted to 23.0 billion euros while services expanded 3.3% per year, reaching a modest 4.9 billion in 2019.

Although goods trade has consistently grown faster in recent years, services, especially tourism, continue to be of central importance to Croatia. This sector reflects a natural comparative advantage as the country continues its integration process with the EU. As indicated by the grey bar in panel (c), basically half of the total exports are still related to that sector, mainly responsible for covering current account deficits in the balance-of-payments. Regarding such patterns of specialisation, there is some evidence suggesting that Croatia has been less successful in adopting new technologies and attracting investment compared to the other EU members (see Kovač et al., 2012). Focusing on manufacturing industry competitiveness, Stojčić et al. (2012) concluded that the country should pursue a process of structural change capable of improving the quality of export products, rather than on price competitiveness. In addition, scholars such as Ranilović (2017) have indicated that a trading bias towards countries of the former Yugoslavia also persists.

Furthermore, the analysis of the role of foreign direct investment (FDI) in promoting growth has shown that it did not play a significant role in fostering such a structural transformation (Vukšić, 2005 and Dritsaki and Stiakakis, 2014). There is also a certain consensus that EU integration has generally had a positive effect on Croatia's competitiveness (e.g. Ranilović, 2017; Buturac et al., 2019). In fact, after 2013, Croatia's GDP has grown consistently, as shown in panels (a) and (b). Still, we understand that the number of studies formally assessing the impact of international specialisation on growth in this country is quite limited. The following section presents the dynamic Harrod trade-multiplier as a possible framework for this endeavour.

3 Underlying framework and estimation strategy

As a small open economy that trades with the rest of the world in a foreign currency, Croatia cannot sustain increasing and persistent current-account imbalances. In this context, exports become particularly important because they are the only component of demand that can pay for the import requirements of growth. As output rises, imports also have to increase to satisfy consumption and investment needs. This fact does not mean that all production is tradable. A significant part of the economy might not be exposed to trade. However, if the economy does not obtain sufficient export earnings to pay for the import content of

the other expenditure components, then demand will have to be constrained. In the short term, the country may grow faster than the growth rate compatible with equilibrium in the current account, especially when international conditions are favourable. However, in the long term, imbalances cannot be persistently increasing. The central proposition of the dynamic trade-multiplier is that such an adjustment in the balance-of-payments does not happen through prices but rather in terms of income, such that growth becomes balance-of-payments constrained.[1]

While its roots go back to Harrod (1933), the dynamic version of the model was developed by Thirlwall (1979) and extended to a multisectoral framework by Araújo and Lima (2007). We will rely on this previous study to develop our estimation strategy in the present paper. Our choice is justified because their specification is compatible with a differentiation between goods and services, which fits well the case of Croatia. Still, in Appendix A, we discuss in more detail the mechanics behind the static and dynamic versions of this theory (for a recent review, see Blecker, 2021).

3.1 The dynamic Harrod trade-multiplier

Suppose a small open economy divided in n sectors. The rate of growth of aggregate exports (x) and imports (m) are given by:

$$x_t = \sum_{i=1}^{n} \theta_{i,t} x_{i,t} \tag{1}$$

$$m_t = \sum_{i=1}^{n} \Omega_{i,t} m_{i,t} \tag{2}$$

where θ_i and Ω_i are the shares of each sector in international trade while x_i and m_i are the respective sectoral magnitudes. They are such that:

$$\begin{aligned} x_{i,t} &= x_i\left(rer_t, z_t\right), \ x_{i\ rer} > 0, \ x_{i\ Z} > 0, \ x_i(0,0) = 0 \\ m_{i,t} &= m_i\left(rer_t, y_t\right), \ m_{i\ rer} < 0, \ m_{i\ Y} > 0, \ m_i(0,0) = 0 \end{aligned} \tag{3}$$

where rer stands as variations in the real exchange rate, z is the rate of growth of the main trading partners' income, and y corresponds to the rate of domestic income growth. A more depreciated exchange rate reduces the cost of domestically produced goods and services in foreign markets while increasing the price of those produced abroad. Therefore, it leads to higher exports and lower imports. The reader might ask whether the terms-of-trade should also be included in (3). We show in Appendix B that they have moved together with rer over time in Croatia, thus making redundant its inclusion. On the other hand, a growing output is related to increasing demand. Therefore, as the income of the rest of the world increases, exports expand accordingly. Analogously, as domestic income increases, Croatian households and firms demand more goods and services from other countries.

[1] Economies open to international trade might present stable current-account imbalances as a proportion of GDP in the long run. However, disequilibrium in the balance-of-payments cannot persistently increase over time. Croatia's currency, the Kuna, has used the Euro as its primary reference in the past two decades. A long-held policy of the Croatian National Bank has been to keep the exchange rate within a relatively stable range. On July 10, 2020, the country joined the Exchange Rate Mechanism with a nominal band of 15%. It is unclear when and if eventually, Croatia will adopt the Euro.

Equilibrium in trade, which for our purposes stands as *proxy* for equilibrium in the balance-of-payments, rules out the possibility of ever-increasing trade deficits or surpluses:

$$x_t = rer_t + m_t \tag{4}$$

which means that exports and imports must grow approximately at the same pace.

Substituting (3) into Eqs. (1) and (2), inserting the resulting expressions into Eq. (4) and rearranging, we obtain the rate of growth of output compatible with equilibrium in the balance-of-payments (y_{BP}). Under Purchasing Power Parity (PPP), the relative price of tradable goods across countries $rer_t = 0$. Assuming for simplicity that $x_i(\cdot)$ and $m_i(\cdot)$ are linear, it follows:

$$y_{BP,t} = \rho_t z_t \tag{5}$$

where

$$\rho_t = \frac{\sum_{i=1}^{n} \theta_{i,t}\phi_{i,t}}{\sum_{i=1}^{n} \Omega_{i,t}\pi_{i,t}} \tag{6}$$

is a measure of non-price competitiveness of a country or region with $\phi_i = \partial x_i/\partial z$ and $\pi_i = \partial m_i/\partial y$ standing as the sectoral income elasticities of exports and imports, respectively. For values of $\rho > 1$ the economy is growing faster than the rest of the world, whereas for $\rho < 1$ it is falling behind.

In the aggregate case, there is no differentiation between sectors, i.e. $n = 1$, and Eq. (6) is reduced to:

$$\rho_t = \frac{\phi_t}{\pi_t} \tag{7}$$

Hence, to obtain the growth rate compatible with equilibrium in the balance-of-payments, we only need to estimate the aggregate income elasticity of exports and imports. This is done by specifying a state-space model and applying Kalman filtering techniques.

3.2 Estimation strategy

We are ready to describe our estimation strategy to test whether the theoretical framework described so far is appropriate for studying growth trajectories in Croatia. To this end, we estimate the respective trade equations, removing first their cyclical component. Then, by applying time-varying parameter estimation techniques, we can obtain dynamic series for the income elasticity of exports and imports, which allows us to compute an indicator of non-price competitiveness for this economy. With these results in hand, we can also obtain the growth rate compatible with equilibrium in the balance-of-payments and verify how close it is to actual growth paths.

To this end, we begin by defining two state-space models, one for exports and one for imports, each model consisting of two *state* and one *space* equations. For this purpose, we follow very closely the methodology applied in Felipe and Lanzafame (2020). Then, the state-space model is used to estimate dynamic time-series involving unobserved variables or parameters – in this case, price and income elasticities – which describe the movements and evolution of the state of the basic system:

$$
\begin{aligned}
x_t^T &= \sigma_t rer_t + \phi_t z_t^T + \varepsilon_{x,\,t} \\
\sigma_t &= \sigma_{t-1} + \varepsilon_{\sigma,\,t} \\
\phi_t &= \phi_{t-1} + \varepsilon_{\phi,\,t}
\end{aligned} \tag{8}
$$

$$
\begin{aligned}
m_t^T &= \eta_t rer_t + \pi_t y_t^T + \varepsilon_{m,\,t} \\
\eta_t &= \eta_{t-1} + \varepsilon_{\eta,\,t} \\
\pi_t &= \pi_{t-1} + \varepsilon_{\pi,\,t}
\end{aligned} \tag{9}
$$

where η and σ are the time-varying price elasticities of imports and exports, respectively; as before ϕ and π are the correspondent income elasticities; while ε are independent normally distributed errors with zero mean and constant variance.

The superscript T indicates that series have been purged from short-run fluctuations using the Corbae and Ouliaris (2006) filter. This procedure guarantees that our estimates reflect the long-term nature of the dynamic Harrod trade multiplier. Moreover, it has a major advantage over the commonly used Hodrick-Prescott filter or the more recent Hamilton (2018) formulation: it handles both deterministic and stochastic trends, avoiding the end-point issue by estimating the end-points directly. To obtain the time-series of the state variables, we apply the "smoothing" procedure. In comparison with the so-called "filtered" approach, it comes with the desired property of using all the information in the sample to provide smoothed state estimates (see Sims, 2001; a comparison between filtered and smoothed estimates of the imports function can be found in Appendix C).

Income elasticities capture non-price factors that affect exports and imports, while the effect of price competition on trade is reflected in price elasticities. Hence, systems (11) and (12) allows us to separate between these two effects. The model predicts that the price element will be either not statistically significant or very small, such that income is the adjustment variable bringing the rate of growth to the one compatible with equilibrium in the current account. Supply characteristics of international specialisation patterns – ranging from technical sophistication and quality of goods and services – determine ρ (McCombie and Thirlwall, 1994).

4 Testing the trade-multiplier

We describe, in this Section, where our data comes from and report two different sets of estimations. First, we obtain price and income elasticities without differentiating between the exports of goods and services, $n = 1$. Second, we proceed by presenting our results for the case we allow for such a disaggregation, i.e. $n = 2$. This last step permit us to assess the robustness of the trade-multiplier. Furthermore, it comes with the advantage of highlighting the role of services, which in Croatia mainly means tourism. Finally, we will show that deviations of the actual growth rate from the one compatible with equilibrium in the balance-of-payments are a zero-mean reverting process. Such a result means that the multiplier works as a sort of anchor of long run growth.

4.1 Data and empirical analysis

Our analysis is carried out using quarterly data from 2000q1 – 2020q2. Series from the 1990s are not included because numerous political and economic system changes have led

to significant structural breaks, making them unreliable. Seasonally and calendar-adjusted quarterly data on Croatian exports and imports were taken from the Eurostat database at constant 2015 euros. We use the difference between EU-27 and Croatia's GDP as a *proxy* for the output of the rest of the world. Our choice is justified by the fact that the country mainly trades within the EU. As in the previous case, data is at constant 2015 EUR both seasonally and calendar-adjusted taken from the Eurostat database. The real exchange rate is computed using the nominal exchange rate of the Kuna against the Euro deflated by the harmonized index of consumer prices (HICP) at constant 2015 EUR, both taken from the Croatia National Bank's (CNB) database.

Fig. 2 reports, in panel (a), the income elasticity of imports, in panel (b), the elasticity of exports, in panel (c), the ratio between them and, in panel (d), the rate of growth compatible with equilibrium in the balance-of-payments. On average, we find that exports are more income elastic than imports. Our non-price competitiveness indicator suggests that Croatia has been growing 1.68× the rate of growth of the rest of the world. It must be noted, however, that averages hide significant time variations. Most of the time, Croatia grew slightly above the EU average. Panel (e) shows that y_{BP} and z^T move quite close except for three main moments that we will discuss in what follows. Notice that panels (c) and (e) are equivalent given that, rearranging the variables in Eq. (5), ρ is equal to the ratio between the balance-of-payments constrained rate of growth and the long-run growth trend of its main trade partners. Two critical moments are worth highlighting. On the one hand, after the country joined CEFTA in 2003, we observed an increase in non-price competitiveness that persisted until the great financial crisis in 2008. On the other hand, there is also a very strong surge in ρ during the first three years after joining the EU.

CEFTA replaced the previous bilateral free trade treaties network during the first wave, which raised mutual trade relations to a multilateral level. It also increased the trade of industrial products between members, which were fully liberalised. This process has enabled the Croatian industry to gain access to foreign technologies, with a positive impact on productivity in the domestic industry, reflecting the growth process driven by the increasing integration of Croatia in international trade. Unfortunately, it was somehow interrupted with the crash of the Lehman Brothers in the United States. In the years that followed the financial crisis, we observed a reduction in ρ, which approaches 1, meaning that the country rate of growth converged to the average one of its trade partners.

With Croatia's accession to the EU in 2013, there was a significant increase in non-price competitiveness, pointing to the positive effects of having free access to EU markets. The benefits came not only in the possibility of accessing superior inputs and technologies but also with a significant increase in the potential market for Croatian products. In the past seven years, the country has consolidated itself as a tourist hub and has experienced the emergence of an expressive automotive industry. In addition, data from the Croatian Bureau of Statistics (CBS) compiled by the CNB indicates a marked increase in exports of medicinal and pharmaceutical products that registered a peak of almost 10% of total exports in 2017.

Our estimates suggest price effects are either non statistically significant or minimal and close to zero. They are reported in the Appendix D. These findings confirm one of the central insights of the trade-multiplier: the role of price competitiveness in determining exports and imports is only minor. They are also in line with Bobić (2010) and Mervar and Payne (2007) who showed more significant income than price effects, both in exports and imports. Finally, panel (d) allows us to compare the trend of the actual growth rate, in red, with the predicted growth rate compatible with equilibrium in the balance-of-payments, in blue. We interpret these trajectories as evidence supporting the accuracy of the chosen theoretical framework.

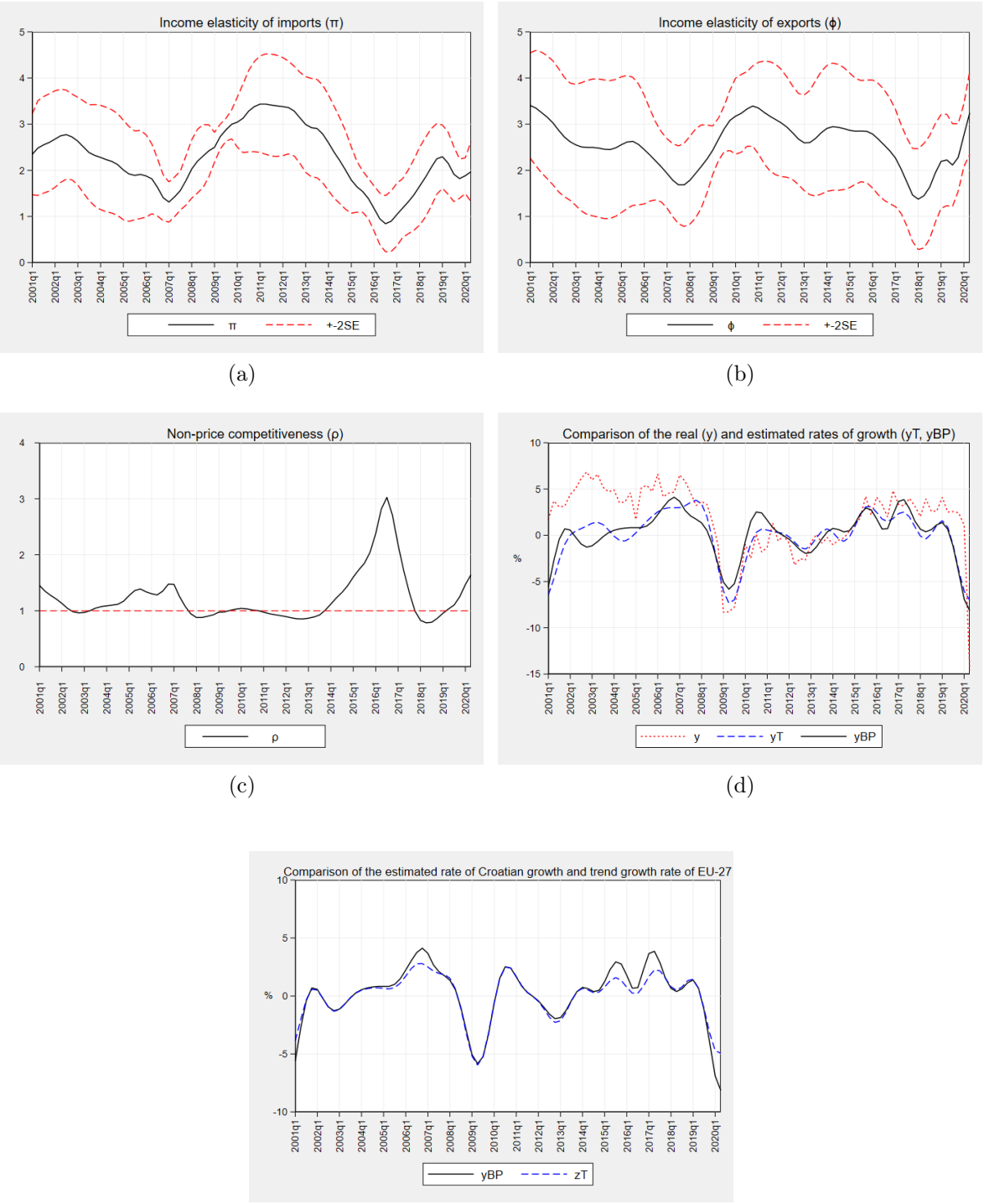


Figure 2: Time-varying estimates of the trade elasticities, non-price competitiveness, and a comparison between actual and predicted growth rates.

In other words, the growth rate of Croatia's economy is closely related to the dynamics of the balance of payments growth rate (y_{BP}) and the structural characteristics of the Croatian export and import sector in the long term. In what follows, we will assess the robustness of such a claim.[2]

4.2 Disaggregating between goods and services

The Croatian economy heavily depends on service activities, especially tourism, reflected in its high share in total exports. Hence, we give one step forward and divide trade between goods (G) and services (S), i.e. $n = 2$. From Eq. (6), we have that, in this case, the income elasticity of exports and imports is equal to the weighted sum of the respective elasticity in each sector:

$$\begin{aligned} \phi_t &= \theta_{G,t}\phi_{G,t} + \theta_{S,t}\phi_{S,t} \\ \pi_t &= \Omega_{G,t}\pi_{G,t} + \Omega_{S,t}\pi_{S,t} \end{aligned} \tag{10}$$

Therefore, now we have four state-space models – two for exports and two for imports – each model consisting of two state and one space equations.

$$\begin{aligned} x_{i,t}^T &= \sigma_{i,t} rer_t + \phi_{i,t} z_t^T + \varepsilon_{x_i,\,t} \\ \sigma_{i,t} &= \sigma_{i,t-1} + \varepsilon_{\sigma_i,\,t} \\ \phi_{i,t} &= \phi_{i,t-1} + \varepsilon_{\phi_i,\,t} \end{aligned} \tag{11}$$

$$\begin{aligned} m_{i,t}^T &= \eta_{i,t} rer_t + \pi_{i,t} y_t^T + \varepsilon_{m_i,\,t} \\ \eta_{i,t} &= \eta_{i,t-1} + \varepsilon_{\eta_i,\,t} \\ \pi_{i,t} &= \pi_{i,t-1} + \varepsilon_{\pi_i,\,t} \end{aligned} \tag{12}$$

where $i = \{G, S\}$. By assessing the multisectoral version of the model, we can provide insights into how policymakers could increase the country's competitiveness and growth rate by supporting the exports of sectors with higher income elasticity. In other words, a more favourable change in the structure of Croatian exports or imports will affect the long-term growth rate in line with the balance-of-payments equilibrium growth rate (Romero and McCombie, 2016).

Fig. 3 reports the sectoral income elasticities of exports and imports. Panels (a) and (d) allow us to compare π and ϕ of the aggregate and multisectoral model. The response of imports to changes in domestic income seems to be more stable than the reaction of exports to foreign demand. Such differences come from the exports of goods instead of services. Panels (b), (c), and (f) show that the income elasticity of imports of goods and services, as well as the elasticity of exports of services, are relatively stable if compared to ϕ of goods. The described trends indicate that the latter underwent several structural changes during the observed period, of which the most significant were joining WTO, CEFTA, the great financial crisis, and finally entering the EU. From panel (e), it is evident that goods' exports shape the dynamics of ϕ, making it more volatile. Going back to panel (a), the multisectoral income elasticity of imports responds to what is happening in the goods sector because the share of services in Croatia's total imports is relatively small.

[2] An empirical literature that goes back to Thirlwall (1979) has differentiated between two formulations of the trade multiplier. The first does not specify a function for exports and is referred to as a "weak" version. The second corresponds to the one used in this article and is referred to as the "strong" multiplier. Still, Appendix E provides a brief discussion of the main differences between them and shows empirically that our estimates of y_{BP} are fundamentally the same.

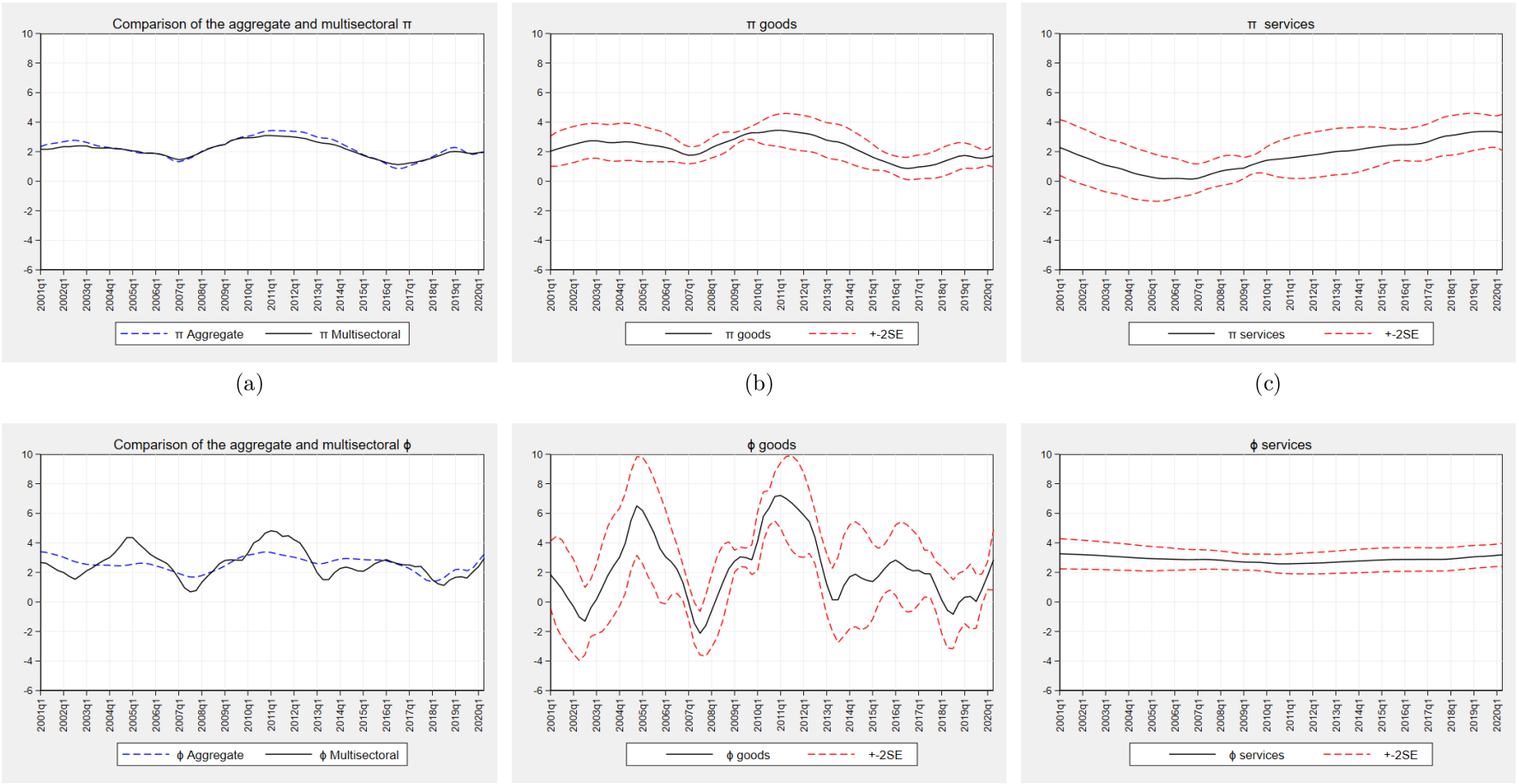
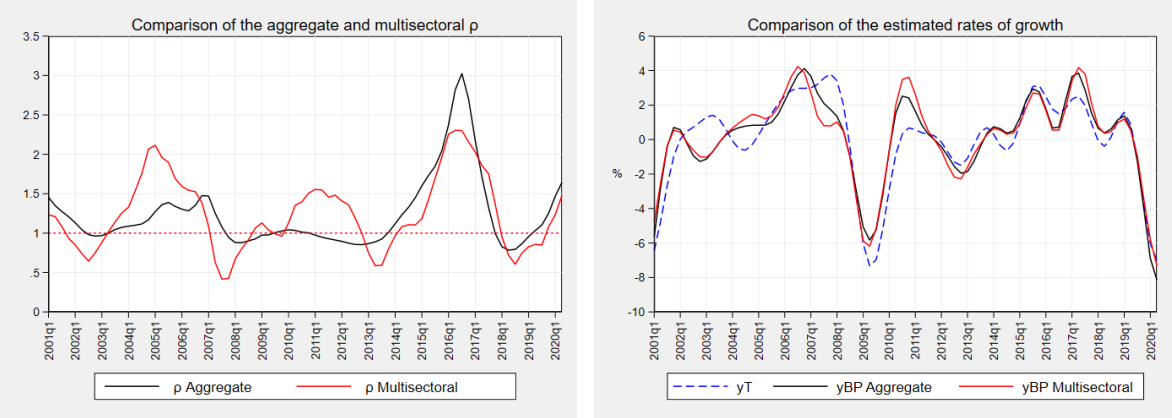


Figure 3: Time-varying estimates of the sectoral income elasticities of exports and imports.

Overall, our results show that exports and imports of services are on average more income-elastic than goods. On the other hand, services exports are more income-elastic than imports in this sector, while exports of goods are more income-elastic than imports. A possible explanation for the high elasticity of tradable services is that they involve high tech activities such as information, telecommunications, health, R&D, among others. There are several channels through which services, in general, and tourism, in particular, may have a positive impact on economic growth (e.g. Nowak et al., 2007; Holzner, 2011; Hajdinjak, 2014; Ghalia and Fidermuc, 2015). Tourism in Croatia includes summer vacations and people looking for health care. Providing health services requires investment in equipment and products of higher technological value. In addition, travelling and related activities encourage investment in new infrastructure, promote other industries directly and indirectly, and accelerate the adoption of new technologies. For instance, tourism growth is related to important backward and forward linkages to the rest of the productive structure, strengthening the economy and standing as a development alternative.

After the great financial crisis, the increase in tourism revenues resulted in a positive current account balance of Croatia. These flows enable the strengthening of domestic demand and investment through importing capital goods and the modernisation of industry. Hajdinjak (2014) investigated the impact of tourism on industry and Croatia's economic growth in the short term and found evidence that tourism in Croatia is boosting capital goods imports, which in turn supports real GDP growth. Such positive correlation has also been documented for other countries (see, for example, Nowak et al., 2007; Holzner, 2011; Ghalia and Fidermuc, 2015). The emerging consensus of this literature is that tourism can potentially affect economic growth by strengthening imports of industrial goods and productivity-enhancing machinery.

Finally, Fig. 4 allows us to compare actual and estimated growth rates. First, on panel (a), we report our estimated non-price competitiveness indicator (ρ), both for the aggregate and multisectoral cases. As suggested in our previous discussion, the estimated income elasticity of goods exports introduces significantly more volatility into the system, explaining the higher fluctuations of the continuous black line with respect to the dotted blue one. Still, the ratio between the trade elasticities fluctuates around one, with two clear accelerating growth periods: the first after the country joined CEFTA in 2003, and the second after joining the EU in 2013. The black line on panel (b) stands for the growth trend (y^T), while the blue and red dotted lines indicate the growth rate compatible with equilibrium in the balance-of-payments. They are very close one to another, highlighting the relevance of the underlying theoretical framework in explaining growth trajectories in this country.



(a) (b)

Figure 4: A comparison between filtered and predicted long run rates of growth.

4.3 The anchor of long run growth

Various econometric methods have been used to test the dynamic trade multiplier empirically. They range from Spearman's rank (as in Thirlwall, 1979) to cointegration techniques, in all cases evaluating if the difference between estimated and actual growth rates is statistically significant (see, for example, Bagnai 2010; Gouvêa and Lima, 2013; Kvedaras et al., 2020). Whenever such discrepancies are proven to be approximately zero, the underlying theoretical model is concluded to fit the data satisfactorily. We understand such an approach is somehow incomplete and prefer the alternative offered by Felipe and Lanzafame (2020). It consists of testing whether deviations from the growth rate compatible with equilibrium in the balance-of-payments are a zero-mean reverting process. Define $\Upsilon = y - y_{BP}$. The discussion above is consistent with two testable hypotheses:

- Hypothesis I: Υ is a zero-mean stationary process.
- Hypothesis II: y_{BP} does not differ significantly from y^T.

To verify the first condition, we proceed in two steps. First, we show that Υ is stationary. As reported in Tables 1 and 2, both the traditional Augmented Dickey-Fuller (ADF) and the non-parametric Phillips-Perron (PP) test strongly reject the null of a unit root, suggesting that series are I(0). Thus, it is possible to conclude that the difference between actual and predicted growth rates reverts to the mean. We continue by estimating the following Autoregressive process:

$$\Upsilon_t = \alpha_0 + \sum_{i=1}^{l} \alpha_i \Upsilon_{t-i} + \varepsilon_{\Upsilon,i}$$

with $l = 1, 2, 3$. As long as

$$H_0 : \ \alpha_0 = 0$$

deviations from y_{BP} have zero-mean. The aggregated and disaggregated version of the model indicate that only the first lag of Υ is statistically significant. Altogether, they show that we are dealing with a zero-mean stationary process. The actual growth rate in Croatia tends to be equal, on average, to the one compatible with equilibrium in the balance-of-payments. Short-term divergences between the two rates do not last, neither are they very persistent.

Table 1: Testing the robustness of aggregate y_{BP} as a centre of gravity

Hypothesis I: Mean reverting			
Unit root test Υ			
ADF		PP	
t	Prob.	Adj.-t	Prob.
-7.971494	0.0000	-6.898143	0.0000
Hypothesis I: Zero-mean			
Dependent variable: Υ_t			
Explanatory	OLS	OLS	OLS
Υ_{t-1}	0.702693***	0.5080941***	0.568462***
Υ_{t-2}	–	0.136628	0.058197
Υ_{t-3}	–	–	0.126570
α_0	0.333432	0.297219	0.261141
Hypothesis II			
Dependent variable: $y_{BP,t}$			
Explanatory	Restriction	Restriction	OLS
y_t^T	1	1	0.845402***
β_0	–	0	0.143834
Wald F-stat.	11.18021	6.290154	–

*, **, ***, stand for 10%, 5%, and 1% of significance, respectively

Table 2: Testing the robustness of multisectoral y_{BP} as a centre of gravity

Hypothesis I: Mean reverting			
Unit root test Υ			
ADF		PP	
t	Prob.	Adj.-t	Prob.
-7.798369	0.0000	-6.909660	0.0000
Hypothesis I: Zero-mean			
Dependent variable: Υ_t			
Explanatory	OLS	OLS	OLS
Υ_{t-1}	0.723715***	0.619305***	0.613328***
Υ_{t-2}	–	0.114342	0.052676
Υ_{t-3}	–	–	0.094749
α_0	0.283748	0.252435	0.228707
Hypothesis II			
Dependent variable: $y_{BP,t}$			
Explanatory	Restriction	Restriction	OLS
y_t^T	1	1	0.801137***
β_0	–	0	0.204383
Wald F-stat.	13.79943	7.954126	–

*, **, ***, stand for 10%, 5%, and 1% of significance, respectively

Finally, the last condition is verified by regressing:

$$y_{BP,t} = \beta_0 + \beta_1 y_t^T + \varepsilon_{y,t}$$

under

$$H_0 : \beta_0 = 0,\ \beta_1 = 1$$

If restricted and unrestricted estimates are not significantly different, we conclude y_{BP} is equivalent to y^T. The last part of Tables 1 and 2 indicates this is indeed the case. Such a result is in line with the proposition that the balance-of-payments equilibrium condition determines the long-term performance from which economies can deviate only in the short run.

5 Investigating the determinants of non-price competitiveness

As a small open economy, Croatia has little influence over international incomes. Still, its economic performance depends on how the respective productive structure responds to changes in foreign and domestic demand. Thus, an important question remains to be answered: what are the determinants of non-price competitiveness, ρ? To some extent, this variable is equivalent to the so-called "Solow residual", given that it has proven to be critical to long-run growth but initially was assumed to be exogenous to the model.

Among studies that directly refer to the dynamic Harrod trade-multiplier, several contributions have formally assessed the role of innovation (e.g. Fagerberg, 1988; Cimoli and Porcile, 2014), relative prices under dynamic economies of scale (as in Araújo, 2013), the sectoral composition of the economy (Araújo and Lima, 2007; Gouvêa and Lima, 2013), capital accumulation as a determinant of export behaviour (see Razmi, 2016; Romero and McCombie, 2018), and the interplay between institutional with structural change (for example, Dávila-Fernández and Sordi, 2020), among other variables relevant to long-run growth. While some of them have also provided valuable empirical insights, it must be noted that, in all cases, variability in ρ comes almost exclusively from changes in θ_i and Ω_i, as in Eq. (6). This limitation comes from the fact that standard econometric techniques do not estimate time-varying parameters.

5.1 Estimation strategy

Felipe and Lanzafame (2020) made use of a state-space model and the Kalman filter to obtain aggregate time-varying estimates of non-price competitiveness in China. In a second step, they applied the Bayesian Model Averaging (BMA) estimator to explain y_{BP} and π. Their findings highlighted the role of structural change, capital accumulation, and the composition of aggregate demand in economic prosperity. Building on their efforts, a good set-up for investigating the determinants of non-price competitiveness is as follows:

$$\ln \rho_{t+1} = \beta \ln \rho_t + \gamma W_t + \epsilon_t \tag{13}$$

where W stands as a vector of control variables, β and γ are the coefficients associated with the explanatory variables, while ϵ represents the error term.[3] Still, we differentiate

[3]Given that $y_{BP} = \rho z$, the reader might notice some similarities between Eq. (13) and conventional estimations of the so-called growth equation. However, our approach comes with two important differences.

ourselves in two ways. First, we focus the analysis on ρ instead of y_{BP}. We believe this is preferable because the former corresponds to a proper measure of catching-up and falling-behind dynamics. Croatia will grow faster or slower than the rest of the world, conditional to this variable being $\gtrless 1$. Second, as reported in Fig. 4, we obtained an aggregate estimate of non-price competitiveness but also a multisectoral version that differentiates between goods and services. To some extent, they allow us to assess simultaneously inter- and intra-sectoral dynamics.

While economic theory provides valuable information on the empirical model specification, it offers little guidance about the "true" data-generating process. This fact creates a fundamental problem of model uncertainty, given that it is not clear *a priori* which explanatory variables must be included or which functional forms are appropriate. For instance, the choice of excluding a subset of regressors comes with a trade-off between bias and precision. To tackle such an issue, we use the BMA and WALS estimators developed by Leamer (1978) and Magnus et al. (2010), based on the implementation package in De Luca and Magnus (2011). These model-averaging techniques provide a coherent way of making inference on the regression parameters by taking into account the uncertainty due to both the estimation and the model selection steps.

The basic idea of BMA is that we need first to estimate the parameters of interest conditional on each model in the model-space, later computing the unconditional estimate as a weighted average of the former. Its key ingredients are the sample likelihood function and the prior distributions on both the regression parameters of the model and the model-space. On the other hand, WALS relies on preliminary orthogonal transformations of the auxiliary regressors and their parameters. It dramatically reduces the computational burden, allowing a more transparent concept of ignorance about the role of the auxiliary regressors (see also Magnus and Durbin, 1999; Danilov and Magnus, 2004).[4]

5.2 Data and empirical analysis

Following our previous assessment of the related literature, we select a number of potential determinants of non-price competitiveness, dividing them into four main groups:

- R&D investments.
- Sectoral composition of the economy.
- Education and demography.
- EU integration and Foreign Direct Investment (FDI).

Innovative efforts are captured by relying on the share of R&D investment in GDP. The importance of this variable for long-run growth has been extensively discussed in the literature and does not require a lengthy explanation. Authors such as Albaladejo and Martínez-García (2015) and Iglesias-Sánchez et al. (2020), in particular, have investigated the role of

First, we are dealing with the growth rate compatible with equilibrium in the balance-of-payments, which was shown to predict actual growth trends quite well. Second, we assess the impact of a set of explanatory variables on non-price competitiveness as in the dynamic Harrod trade-multiplier.

[4]Based on a classical linear regression framework, these estimators divide explanatory variables into two subsets: focus and auxiliary. The former consists of regressors with solid theoretical support, while the latter corresponds to additional variables whose inclusion is less certain. The number of possible models to be considered is equal to 2^k, where k is the number of auxiliary regressors. We assume all variables are auxiliary for completeness, resulting in a model-space up to 65536 models.

innovation in the context of a tourist based economy. R&D efforts allow for the expansion of infrastructure, transportation networks, accommodation facilities, social media's impact on the profile of tourists, and the variety of attractions can be broadened to increase the tourism carrying capacity. In the case of Croatia, it is worth mentioning that the country has recently become a key destination for medical tourists looking for treatment abroad. The cost of medical procedures in Croatia is significantly lower when compared to countries such as the United States, Japan, or the United Kingdom. In particular, medical tourists visit Croatia for cosmetic, dentistry, and orthopaedic surgery. Hence, R&D is also likely to affect non-price competitiveness through this additional channel. We further disaggregate such a variable between business enterprises, education institutions, and the government. It allows us to have a clearer picture of the differences in the origin of investments to develop and improve new products or services. Data is quarterly and comes from Eurostat.

There is a long tradition in development economics suggesting that the economy's sectoral composition matters for economic performance. Some authors, for instance, have made the case that, historically, manufacturing has functioned as the main engine of economic development (e.g. Szirmai, 2012; Szirmai and Verspagen, 2015), exhibiting strong unconditional convergence in labour productivity (as in Rodrik, 2013). Others have argued that this role corresponds to modern activities such as financial and information industries (Jayaratne and Strahan, 1996; for a critical view see Stockhammer, 2004). More recently, empirical studies have identified the existence of thresholds for the finance-growth nexus (see Law et al., 2013). We thus include in our regressions the share in GDP of these three sectors and government activities, using quarterly data from CNB. To further control for changes in the composition of capital between tangible and intangible assets, we introduce the share of intangibles as reported by the Croatian Financial Agency (FINA). Data, in this case, is annual, and we rely on "low to high" frequency quadratic polynomial interpolation methods to obtain quarterly series.[5]

More conventional approaches have highlighted that human capital and demographic transitions are essential when explaining economic prosperity (Lucas, 1988; Klemp and Weisdorf, 2018). Different measures and indices of human capital have been built over the years. Here we limit ourselves to include the average years of schooling in the population as reported in the Human development reports by United Nations. When it comes to demography, we consider two main dimensions: the young age dependency ratio (YADR) and the old-age dependency ratio (OADR). The former consists of the number of people under 15 years old over the working-age population. The latter follows a similar rationale and takes those above 65 years old over the working-age population. Series, as reported in Eurostat, are annual; hence, once more, we rely on quadratic polynomial interpolation methods to obtain quarterly data.

As for our last group of controls, we include three variables to capture the role of FDI and the process of EU integration to non-price competitiveness. Regarding the latter, we use data from CNB that differentiates between EU funds for current payments (EUCP) and those directed for capital investments (EUK). Funds allocated from the EU are reported in the current or capital accounts. The differentiation between types of transactions is based on the

[5]The quadratic polynomial is formed by taking sets of three adjacent points from the source series and fitting a quadratic. The average of the high-frequency points matches the low-frequency data observed. One point before and one point after the period currently being interpolated provides the three points. For endpoints, the two periods are taken from the one side where data are available. This is a purely local method. The resulting interpolation curves are not constrained to be continuous at the boundaries between adjacent periods. Hence, the method is better suited to situations where relatively few data points are being interpolated, and the source data is fairly smooth.

data of the Ministry of Finance. Foreign direct investments include equity capital, reinvested earnings and debt relations between ownership-related residents and non-residents. Direct investments are investments whereby a foreign owner acquires a minimum of 10% interest in the equity capital of a company, regardless of whether a resident invests abroad or a non-resident invests in Croatian residents. It has been argued that FDI is a critical element of international economic development because it creates stable and long-lasting links between economies. It might also be an essential channel for transferring technology between countries and promoting international trade through access to foreign markets.

Given the existing evidence indicating that the level of the exchange rate influences resource allocation and, thus, might impact non-price competitiveness, especially in developing countries (Rodrik, 2008; for a review see Demir and Razmi, 2021), we control for this effect including the logarithmic of the real exchange rate (RER) from the CNB. As shown in the previous Section, our estimates of the trade equations already controlled for price effects and the respective price elasticities are not statistically significant. However, we still have to investigate whether there is a development channel from price to non-price competitiveness. It might be helpful to think in the following terms. A more depreciated exchange rate immediately impacts trade because it becomes easier to export and more challenging to import. Hence, a certain country might start to export or substitute imports because it is cheaper to do domestically, though production quality is likely to be very low. Our results so far take into account such an effect. However, it has been argued that if sustained over time, such a depreciation may compensate for problems of asymmetric information and allow for processes of learning-by-doing or learning-by-exporting in developing economies. In this case, quality is expected to improve slowly, and the exchange rate level might influence ρ.

Table 3 reports our findings for the determinants of aggregate ρ. A regressor is considered robust if the t ratio on its coefficient is greater than one in absolute value. Alternatively, Masanjala and Papageorgiou (2008) indicated that a posterior inclusion probability (pip) > 0.5 stands as an equivalent condition. Our estimates show that by all means, R&D is the most important explanatory force of non-price competitiveness in Croatia. Total R&D investments over GDP have an elasticity of 0.45 that masks different magnitudes depending on the source of innovation. For example, the business sector does not appear as a critical player, contrasting with education and government that have an elasticity between 0.48 and 3.65.

Moving on to our second block of explanatory variables, we find limited evidence of specific sectors having a determinant role in this dimension of competitiveness. Estimated parameters are not statistically significant in BMA regressions, while manufacturing, information, and government are significant in WALS models but with small coefficients. In all cases, the obtained elasticity is lower than $|0.05|$. Something similar happens concerning the composition of capital between tangent and intangible assets. We can reject the null hypothesis that coefficients are equal to zero only for WALS. Still, the estimated elasticity is relatively small, ranging between 0.03 and 0.04.

Demography, as well as education conditions, stand as crucial variables in explaining ρ. One year of schooling is related to 0.11 to 0.39% higher non-price competitiveness. As expected, ageing has a negative correspondence with economic performance. We consistently obtained a negative elasticity, though the magnitude of the effect is relatively small. On the one hand, increases in the YADR are related to up to 0.19% greater non-price competitiveness conditions. At least two mechanisms might be involved. On the other hand, a long-run reduction in the workforce is associated with the perspective of shrinking markets. The prospect of declining demand reduces investment, increasing the average plant age, damaging

Table 3: Determinants of aggregate ρ

	Dependent variable: Non-price competitiveness (aggregate $\ln \rho_{t+1}$)									
	BMA			WALS		BMA			WALS	
Explanatory	Coef.	t	pip	Coef.	t	Coef.	t	pip	Coef.	t
R&D Tot$_t$	0.4512143	1.53	0.79	0.1680777	0.77	–	–	–	–	–
R&D Buss$_t$	–	–	–	–	–	0.0218518	0.23	0.11	-0.0908556	-0.31
R&D Educ$_t$	–	–	–	–	–	0.0609429	0.31	0.16	0.4819205	1.26
R&D Gov$_t$	–	–	–	–	–	3.658776	2.92	0.96	1.660551	1.13
Manuf$_t$	-0.0106667	-0.58	0.35	-0.0519442	-3.30	-0.0068282	-0.50	0.26	-0.0471896	-2.80
Info$_t$	0.0012109	0.11	0.08	-0.0346131	0.98	0.0003567	0.04	0.07	-0.0339231	-0.96
Finan$_t$	0.0032923	0.18	0.12	-0.0072147	-0.12	0.0010868	0.10	0.08	-0.0212958	-0.39
Gov$_t$	0.003133	0.25	0.14	0.0440369	1.65	0.001414	0.21	0.11	0.0551325	2.02
Intan. Share$_t$	0.0098904	0.49	0.28	0.0440756	1.87	-0.0001237	-0.01	0.10	0.0339674	1.09
Educ$_t$	0.1172111	1.15	0.72	0.3439847	3.04	0.0369685	0.68	0.52	0.3920368	3.23
YADR$_t$	0.0092726	0.15	0.19	0.1971072	2.08	-0.0026381	-0.07	0.26	0.1986147	2.13
OADR$_t$	-0.0435361	-1.33	0.74	-0.0797021	-3.36	-0.0010585	-0.09	0.15	-0.0850811	-2.81
EUK$_t$	0.0062727	0.20	0.13	0.099525	2.10	0.0045255	0.25	0.12	0.1023553	2.27
EUCP$_t$	-0.0012733	-0.06	0.09	-0.0147227	-0.27	0.0019383	0.12	0.09	0.0017337	0.03
FDI$_t$	0.0000209	0.03	0.07	-0.0008037	-0.35	-2.93e-06	-0.01	0.06	-0.002011	-0.87
$\ln$ RER$_t$	0.094053	0.14	0.11	-0.9870608	-0.58	0.7123318	0.56	0.31	-1.72822	-0.90
$\ln \rho_t$	0.9386208	24.01	1.00	0.8721317	21.65	0.9892427	24.00	1.00	0.8681643	20.61
Const.	-1.139541	-0.51	1.00	-6.493692	-2.36	-1.781353	-1.01	1.00	-6.802969	-2.55
k_1	1			1		1			1	
k_2	14			14		16			16	
q	–			1.0000		–			1.0000	
c	–			0.6931		–			0.6931	
kappa	–			38.7		–			42.3	
Model Space	16384			–		65536			–	

A regressor is considered robust if the t ratio on its coefficient is greater than one in absolute value or if the posterior inclusion probability (pip) > 0.5.

its ability to explore dynamic economies of scale. The expected final result is a reduction in labour productivity that might affect non-price competitiveness. On the other hand, an older workforce may be less open to innovation or the adoption of new technologies, resulting in a similar negative coefficient.

Finally, we present some evidence of the positive effects joining the EU has had on Croatia. A visual inspection of Fig. 2 shows that after 2013, the country was growing up to 3× faster than its trade partners. It was suggested that this fact reflected a new scenario in which Croatia had free access to EU markets as well as inputs and technologies from the union. At least in what concerns our WALS estimates, we find that an increase of 1 percentage point in the funds received from Brussels to capital investment leads to 0.1% higher ρ. The magnitude of the coefficient is moderate but relatively robust, as we will show in the remaining of the analysis. This result contrasts with the estimated elasticity of EUCP and FDI, both non statistically significant. Such a result suggests that the European Union has somehow successfully contributed to Croatia's long-run growth through capital projects. On the other hand, we do not find significant effects from relative prices to non-price competitiveness.

Of course, these results are based on aggregate estimates of exports and imports functions. As argued throughout the paper, tradable services are responsible for basically half of Croatia's exports and have very specific dynamics that we need to consider. We repeat our exercise for our multisectoral version of ρ. Table 4 presents our main findings. While they fundamentally confirm our previous insights, this step is necessary to assess their robustness. For instance, R&D continues to stand as one of the main determinants of non-price competitiveness. The obtained elasticity is significantly higher, around 1.28. Furthermore, we now have that business R&D investments are statistically significant, with an elasticity up to 1.20, though smaller in magnitude to the education sector, 1.95. We notice that innovation goes hand in hand with increases in years of schooling. An additional year at school is related to 0.58 to 0.68% higher non-price competitiveness. A well-educated workforce and investments in innovation are behind the development and differentiation of goods and services. As this process allows for improvements in non-price conditions, firms are better prepared to respond to increases in foreign demand, thus, resulting in higher ρ.

Controlling for differences between trade in goods and services allows us to appreciate the role of the economy's sectoral composition. We want to highlight that finance becomes an important determinant of ρ. An increase of one percentage point of the financial sector on GDP improves from 0.19 to 0.29% in non-price related competitiveness attributes.[6] Demographic variables continue to be an important force driving ρ. Compared to the aggregate case, YADR and OADR show more substantial effects. For instance, we document that a one-point increase in the old-age dependency ratio might reduce long-term economic performance by up to 0.16%, while a similar rise in the YADR is related to an improvement of 0.51%.

Last but not least, WALS regressions confirm that entering the EU was followed by an enhancement of long-term economic performance. An increase of one percentage point of EU funds allocated to capital investment increased our indicator of non-price competitiveness by 0.1%. Still, such a result is not robust to the BMA estimator. Moreover, we do not find support to the idea that a more depreciated RER can foster long-run growth, at least not

[6] A possible interpretation of the fact that these coefficients were not significant in the previous case can be related to the nature of tourism activities. The removal of barriers to travel, including the easing of entry requirements and the adoption of open skies policies, are directly related to the expansions of a financial structure capable of accommodating supply and demand for travelling. Such effects only became visible once we allowed for the differentiation between goods and services in our non-price competitiveness indicator.

Table 4: Determinants of multisectoral ρ

	Dependent variable: Non-price competitiveness (multisectoral $\ln \rho_{t+1}$)									
	BMA			WALS		BMA			WALS	
Explanatory	Coef.	t	pip	Coef.	t	Coef.	t	pip	Coef.	t
R&D Tot$_t$	1.289467	2.11	0.91	1.275003	3.61	–	–	–	–	–
R&D Buss$_t$	–	–	–	–	–	0.5567174	0.67	0.43	1.209907	2.26
R&D Educ$_t$	–	–	–	–	–	0.3327062	0.50	0.28	1.951413	3.19
R&D Gov$_t$	–	–	–	–	–	1.62925	0.72	0.42	-0.1321769	-0.06
Manuf$_t$	-0.0136062	-0.50	0.28	-0.0720673	-2.74	-0.0091899	-0.42	0.22	-0.0744433	-2.83
Info$_t$	-0.0025453	-0.11	0.09	-0.0648508	-1.17	-0.0003265	-0.02	0.07	-0.0706011	-1.34
Finan$_t$	0.1996001	1.31	0.71	0.2719815	2.93	0.061367	0.47	0.25	0.2995833	2.99
Gov$_t$	-0.0765272	-1.22	0.67	-0.0530771	-1.29	-0.0253217	-0.46	0.25	-0.0397916	-0.85
Intan. Share$_t$	0.0032983	0.15	0.15	-0.0022029	-0.06	0.0065875	0.30	0.16	0.0207775	0.47
Educ$_t$	0.0835823	0.51	0.35	0.5806244	3.21	0.0284237	0.26	0.17	0.6873193	3.65
YADR$_t$	0.0285735	0.24	0.17	0.4688072	2.98	0.0170513	0.20	0.14	0.5169696	3.33
OADR$_t$	-0.0703029	-1.57	0.81	-0.1250459	-3.52	-0.020382	-0.49	0.29	-0.1641247	-3.64
EUK$_t$	-0.0029588	-0.08	0.11	0.1020273	1.40	-0.0007827	-0.03	0.10	0.1003039	1.35
EUCP$_t$	0.0060046	0.13	0.10	0.0661214	0.69	0.004228	0.11	0.10	0.089252	0.94
FDI$_t$	-0.0027825	-0.62	0.35	-0.0085307	-2.21	-0.0020956	-0.50	0.26	-0.009652	-2.53
$\ln$ RER$_t$	-0.3219329	-0.20	0.13	-4.43008	-1.58	-0.0888425	-0.07	0.09	-6.78763	-2.20
$\ln \rho_t$	0.9347116	20.60	1.00	0.8753474	21.20	0.9284951	18.89	1.00	0.8602276	20.91
Const.	-0.598293	-0.16	1.00	-12.39821	-2.79	-0.6804094	-0.25	1.00	-12.12143	-2.80
k_1	1			1		1			1	
k_2	14			14		16			16	
q	–			1.0000		–			1.0000	
c	–			0.6931		–			0.6931	
kappa	–			37.4		–			39.6	
Model Space	16384			–		65536			–	

A regressor is considered robust if the t ratio on its coefficient is greater than one in absolute value or if the posterior inclusion probability (pip) > 0.5.

through the channel investigated in this Section. Overall, the picture that emerges from our analysis is: since the 2000s, the trajectory of the growth rate compatible with equilibrium in the balance-of-payments has been primarily influenced by the dynamics of innovation investments, educational institutions, and demography. We thus offer an alternative channel to explain Croatia's growth, considering the role those variables might have on international trade performance.

5.3 Some additional robustness checks

By estimating a set of BMA and WALS models of Eq. (13), we were able to identify R&D investment, human capital accumulation, demography, and EU funding as the most critical determinants of non-price competitiveness in Croatia. In this subsection, we aim to check the robustness of such results. This step is done in two different ways. First, we notice that our initial assessment does not differentiate between *focus* and *auxiliary* variables. The former consists of regressors with solid theoretical support, while the latter corresponds to those with less certain inclusion. In this framework, the choice of excluding subsets of auxiliary variables is motivated by a trade-off between bias and precision (see Danilov and Magnus, 2004; De Luca and Magnus, 2011). To avoid our priors from influencing the outcome, we initially assumed all auxiliary. However, using our results from Tables 3 and 4, we can give one step forward and explicitly differentiate two groups: R&D, Educ, OADR, EUK and $ln\rho$ are taken as focus regressors while the remaining continue to be auxiliary.

As a second robustness check, we notice that the variations in non-price competitiveness are slow-motion processes regarding long-run dynamics. Given the nature of our data, we should not expect major effects to happen from one quarter to another. Hence, we also compute the five-year moving average of the correspondent time-series and re-estimate the model. Results are reported in Tables 5 and 6 for the aggregate and multisectoral cases, respectively. While we believe the main message of our exercise is preserved, some interesting new features emerge. For instance, in all scenarios R&D related to education has a positive and significant impact on non-price competitiveness. The elasticity varies from 0.5 to 3.25, the largest among the variables in our sample. Government and business innovation efforts lose significance as we move to the multisectoral scenario that removes short-term fluctuations in the underlying data. Further research on the topic is to be encouraged, but it seems relatively clear that the education sector plays a significant role in the long-run economic performance of the country.

In fact, years of schooling continues to be a fundamental determinant of ρ. If we concentrate on the estimates using a five-year moving average, we have that an extra year of schooling increases competitiveness by 0.3 to 0.5%. EU continues to give an essential contribution to long-run growth, with a coefficient varying between 0.5, in the aggregate, case to 0.1 when we differentiate between goods and services. Moreover, we would like to highlight the marked negative impact of ageing. An increase of one unit of the OADR is related to a reduction between 0.15 and 0.2% in growth through non-price competitiveness. This result is a major worrying reason for the country given that current demographic trends indicate Croatia's old-age dependency ratio could increase 20 points in the next thirty years, while the population is expected to shrink to 3.1 million by 2050, after reaching its peak of 4.7 million in 1991, according to Eurostat. Finally, the kappa value significantly drops from 37-42 intervals to 6-15. A considerable value of κ suggests parameters are prone to significant numerical errors. Hence, its reduction confirms an improvement in the quality of our last estimates.

Table 5: Determinants of aggregate ρ

	Dependent variable: Aggregate $\ln \rho_{t+1}$									
	Simple					Five-year moving average				
	BMA			WALS		BMA			WALS	
Explanatory	Coef.	t	pip	Coef.	t	Coef.	t	pip	Coef.	t
R&D Buss$_t$	0.0626079	0.20	1.00	-0.0896068	-0.28	-0.9223327	-5.43	1.00	-0.8014096	-4.02
R&D Educ$_t$	0.7419675	2.04	1.00	0.797316	2.00	0.507156	3.32	1.00	0.5190757	2.30
R&D Gov$_t$	3.077719	2.62	1.00	1.95093	1.32	3.483126	5.31	1.00	2.546711	2.42
Educ$_t$	0.1992263	1.99	1.00	0.3967105	3.41	0.2802667	6.21	1.00	0.3473277	3.15
OADR$_t$	-0.0648974	-2.52	1.00	-0.098299	-3.18	-0.1322945	-5.42	1.00	-0.1491641	-4.21
EUK$_t$	0.0781736	1.52	1.00	0.114832	2.19	0.3241269	5.24	1.00	0.3651382	5.24
$\ln \rho_t$	0.9498073	23.48	1.00	0.9227724	21.62	0.8659321	20.26	1.00	0.8644468	20.70
Manuf$_t$	-0.0209669	-0.90	0.56	-0.0451359	-2.85	-0.024317	-1.96	0.90	-0.0348825	-2.57
Info$_t$	-0.0004694	-0.04	0.11	-0.0197621	-0.61	-0.0038271	-0.26	0.15	-0.0278766	-0.97
Finan$_t$	0.0062215	0.25	0.19	-0.0120473	-0.20	-0.1084022	-2.44	0.92	-0.0797639	-2.00
Gov$_t$	0.0122562	0.64	0.40	0.0499309	1.73	0.0492341	2.48	0.93	0.0543522	1.94
Intan. Share$_t$	0.0013067	0.11	0.12	0.0249499	0.81	-0.0002466	-0.03	0.13	0.0204379	0.97
YADR$_t$	0.0375176	0.46	0.28	0.1827993	2.03	0.0075209	0.23	0.16	0.0639667	0.90
EUCP$_t$	0.0015237	0.07	0.10	0.0223988	0.43	-0.0013918	-0.04	0.10	-0.0559421	-0.55
FDI$_t$	0.0000273	0.04	0.10	-0.0008841	-0.46	0.0017112	0.63	0.37	0.0024039	0.94
$\ln$ RER$_t$	-0.1176065	-0.13	0.14	-2.255241	-1.20	0.0625054	0.08	0.18	-0.3646789	-0.23
Const.	-2.643814	-1.01	1.00	-5.867409	-2.36	-0.9946815	-0.78	1.00	-2.351327	-1.21
k_1	8			8		8			8	
k_2	9			9		9			9	
q	–			1.0000		–			1.0000	
c	–			0.6931		–			0.6931	
kappa	–			6.9		–			15.2	
Model Space	512			–		512			–	

A regressor is considered robust if the t ratio on its coefficient is greater than one in absolute value or if the posterior inclusion probability (pip) > 0.5.

Table 6: Determinants of multisectoral ρ

	Dependent variable: Multisectoral $\ln \rho_{t+1}$									
	Simple					Five-year moving average				
	BMA			WALS		BMA			WALS	
Explanatory	Coef.	t	pip	Coef.	t	Coef.	t	pip	Coef.	t
R&D Buss_t	1.392455	2.21	1.00	1.244056	2.27	0.1871999	0.53	1.00	0.1940053	0.52
R&D Educ_t	2.195576	2.74	1.00	2.20168	3.14	3.258273	7.45	1.00	2.969112	6.74
R&D Gov_t	-0.3826567	-0.17	1.00	-0.2838649	-0.12	-0.0597566	-0.03	1.00	-0.1292665	-0.08
Educ_t	0.6463173	1.99	1.00	0.7572293	4.08	0.4605805	2.35	1.00	0.5594721	3.29
OADR_t	-0.1699096	-3.00	1.00	-0.1814587	-3.78	-0.1855779	-3.16	1.00	-0.1905794	-3.44
EUK_t	0.0958581	1.00	1.00	0.0932772	1.10	0.1106645	0.88	1.00	0.1126577	0.93
$\ln \rho_t$	0.9217643	21.01	1.00	0.9188998	21.99	0.8163302	26.66	1.00	0.8323113	25.81
Manuf_t	-0.0758243	-1.66	0.82	-0.0781027	-2.96	0.04213	1.45	0.74	0.0122047	0.49
Info_t	-0.0096206	-0.28	0.16	-0.0672778	-1.24	-0.0083406	-0.25	0.16	-0.0589349	-1.03
Finan_t	0.2459939	2.06	0.91	0.2716205	2.88	0.2720948	3.96	1.00	0.258884	3.71
Gov_t	-0.0311805	-0.57	0.34	-0.0190761	-0.44	0.0009362	0.04	0.19	0.0202827	0.52
Intan. Share_t	0.0065958	0.24	0.15	0.0137052	0.28	0.0307506	0.72	0.42	0.0537825	1.48
YADR_t	0.4341158	1.55	0.79	0.5222237	3.39	0.1226741	0.68	0.41	0.222964	1.52
EUCP_t	0.024313	0.34	0.18	0.0990462	0.98	0.033421	0.27	0.16	0.0590813	0.26
FDI_t	-0.0063311	-1.16	0.67	-0.0077496	-2.29	-0.0209023	-3.11	0.98	-0.0196569	-3.23
$\ln \text{RER}_t$	-7.03156	-1.35	0.73	-8.150289	-2.51	-5.50918	-2.54	0.96	-5.977423	-2.70
Const.	-9.320883	-1.39	1.00	-11.69121	-2.64	-2.461501	-0.49	1.00	-5.262335	-1.22
k_1	8			8		8			8	
k_2	9			9		9			9	
q	–			1.0000		–			1.0000	
c	–			0.6931		–			0.6931	
kappa	–			6.1		–			15.6	
Model Space	512			–		512			–	

A regressor is considered robust if the t ratio on its coefficient is greater than one in absolute value or if the posterior inclusion probability (pip) > 0.5.

6 Conclusions

This paper argued that Croatia's growth performance over the past twenty years is deeply related to what is bought and sold in international markets. Taking the dynamic Harrod trade-multiplier as the starting point, we applied the Kalman filter and state-space estimation methods to obtain time-varying parameters of the respective trade equations. As a result, we showed that the growth rate compatible with equilibrium in the balance-of-payments is a good predictor of Croatia's long-run growth rate. Furthermore, disaggregating exports and imports between goods and services allowed us to have a more precise measure of the income elasticities, which in turn we showed could be interpreted as capturing the non-price competitiveness of the country.

Croatia has been growing significantly faster than the rest of the EU, despite the adverse effects of the 2007 financial crisis, the European debt crisis, and the COVID-19 outbreak. Given its strong dependence on tourism activities, 2020 has been particularly challenging. Employing a set of BMA and WALS estimation techniques, we investigated the determinants of the ratio between the income elasticities of exports and imports, as obtained in the first part of the paper. We show that R&D investment as a proportion of GDP and human capital accumulation are the most important driving forces. Demographic variables also play a relevant role in explaining the country's long-run economic performance. Our understanding is that policymakers should not underestimate the importance of innovation efforts for economic prosperity.

The experience of several transition and developing countries suggests the existence of a limit to current-account imbalances beyond which the rate of growth of output must adjust to international liquidity conditions. We showed that Croatia's economic growth depends on how its productive structure responds to foreign and domestic demand changes. As income increases, consumption decisions are increasingly influenced by quality, technological superiority and advanced services.

If Croatia continues its catching-up process in the EU, it is crucial to develop domestic learning capabilities. Action includes rising overall educational levels and the interaction between firms and universities. Current R&D expenditures as a proportion of GDP are far below the 2% European average. The present paper identified that such a type of investment comes with high returns regarding non-price competitiveness that have not been fully realised or implemented. Each year that Croatia lags behind the R&D investment efforts and human capital accumulation of other nations, the more the current output gap is compounded. Therefore, cooperation between academia and business should be prioritised.

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A Appendices

A.1 From the static to the dynamic trade-multiplier

What determines a country's growth rate and why countries grow at different rates has always been a central issue in economics. More traditional approaches have focused on the availability of resources and the supply of factors for production. An implication is that, in an open economy, most resources required for growing are not fixed in supply and can be imported. For example, labour, capital, and technology inputs are relatively elastic in supply and endogenously given. When it comes to small open economies that trade in foreign currency, the so-called trade-multiplier posits an additional mechanism that explores the interaction between demand and supply constraints relating them to international specialisation patterns.

Croatia fits well this last framework given that domestically it uses the Kuna but trades mainly in Euros or US dollars. Economies in this condition cannot sustain increasing and persistent current-account imbalances. Changing relative prices does not automatically eliminate a deficit or the lack of foreign exchange. Such a deficit cannot be financed indefinitely at a constant interest rate, which constraints the output growth rate. The static version of the model was initially proposed by Harrod (1933), and can be easily derived from a trade balance condition:

$$X = M \tag{A.14}$$

and a simple relationship describing the behaviour of imports (M), such that:

$$M = mY \tag{A.15}$$

where X are exports, Y stands for output, while m is the marginal propensity to import. Substituting Eq. (A.15) into (A.14) and rearranging, we have that:

$$Y = \frac{X}{m} \tag{A.16}$$

i.e. the trade-multiplier. The level of output compatible with equilibrium in trade – which in this case works as a *proxy* of the balance-of-payments – is equal to the level of exports divided by the marginal propensity to import.

The dynamic version of the model is derived from a generalisation of Eq. (A.15). Let us rewrite it as:

$$M = M(Y) \tag{A.17}$$

such that increases in output are related to higher demand, leading as a result to higher imports. Substituting this function into Eq. (A.14), equilibrium in the current account now requires:

$$X = M(Y) \tag{A.18}$$

Taking log derivatives of the expression above and rearranging, we obtain:

$$y = \frac{x}{\pi} \tag{A.19}$$

where y and x correspond to the rate of growth of output and exports, respectively, and $\pi = (\partial M/\partial Y)(Y/M)$ is the income elasticity of imports.

If instead, we assume exports depend on the level of output of the rest of the world (Z), that is:

$$X = X(Z) \tag{A.20}$$

it is not difficult to see that the rate of growth compatible with equilibrium in the balance-of-payments becomes:

$$y = \rho z \tag{A.21}$$

where $\rho = \phi/\pi$ and $\phi = (\partial X/\partial Z)(Z/X)$ is the income elasticity of exports. Growing faster than this rate would imply increasing balance-of-payments imbalances that are not sustainable in the long run. In Thirlwall (1979), Eq. (A.19) is referred to as the *weak* version of the multiplier while (A.21) stands for its *strong* formulation.

The ratio between the income elasticity of exports over imports captures the non-price characteristics of the international specialisation of the domestic economy. Given that a significant part of technical change is embodied in physical or human capital, innovation will likely affect non-price competitiveness. For example, encouraging investment would increase core capital and stem innovation and technological progress, thus the movement of factors of production from low-productivity to high-productivity sectors. The ability to import more can increase domestic production capacity by making domestic resources more productive. Supply is essential insofar as factors such as the skill and flexibility of the workforce, readiness for innovation, and acceptance of new production techniques are vital in determining the degree of success of exports. When $\rho < 1$ the domestic economy grows less than the rest of the world, corresponding to a process of falling behind. On the other hand, $\rho > 1$ stands for the case of a country catching behind basically because it is growing faster than its trade partners. Over the past four decades, this model has been extended in almost all possible directions (for a review, see Thirlwall, 2011 and Felipe and Lanzafame, 2020).

A.2 Real exchange rate and the terms-of-trade

Macroeconomic manuals usually present exports and imports as a function of exchange rates. The latter corresponds to the value of one country's currency in relation to another currency. Still, a critical reader may ask whether the terms-of-trade, i.e. the relative price of exports in terms of imports, is a more appropriate concept when measuring price competitiveness in international markets. The latter is defined as the ratio of export prices to import prices. It can be interpreted as the amount of import goods an economy can purchase per unit of export goods. Fig. A.5 reports the two series in Croatia from the 2000s. It shows that they have moved together over time. This fact justifies our choice to work with the commonly used and intuitive rer.

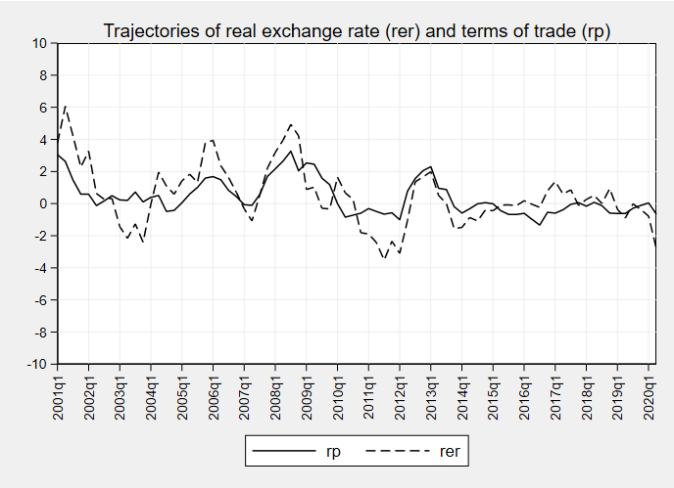


Figure A.5: Real exchange rate (rer) *vs* terms-of-trade (rp).

A.3 *Filtered* vs. *Smoothed* estimated values of income elasticities

The values of the "state" variables can be estimated using the Kalman filter or the Kalman smoother. The most crucial difference between them is that, when using the filter, the recursive estimation of the state moves forward through the data while, with the smoother, the state moves backwards. Hence, the Kalman smoother uses all the information in the sample to calculate smooth estimates. On the other hand, the Kalman filter produces values that contain a variation component obtained using the "learning" method, instead of actual time variations in the behaviour of the economy (for a detailed assessment, the reader is invited to see Sims, 2001). Therefore, smooth estimates of component values – trend and cycle, seasonally adjusted – are more useful for visualization and understanding. We report in Fig. A.6 an example of the two series for the income elasticity of imports. The dotted red line corresponds to the smoothed estimates, while the continuous black line stands for the filtered one. They confirm our previous discussion and justify our choice of working with the first of them.

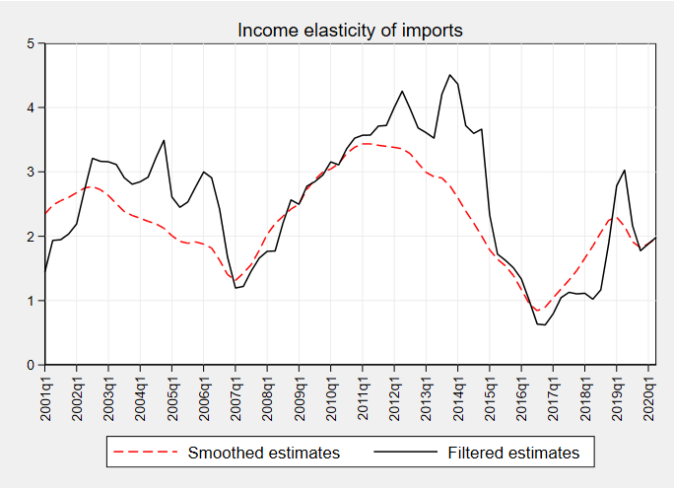
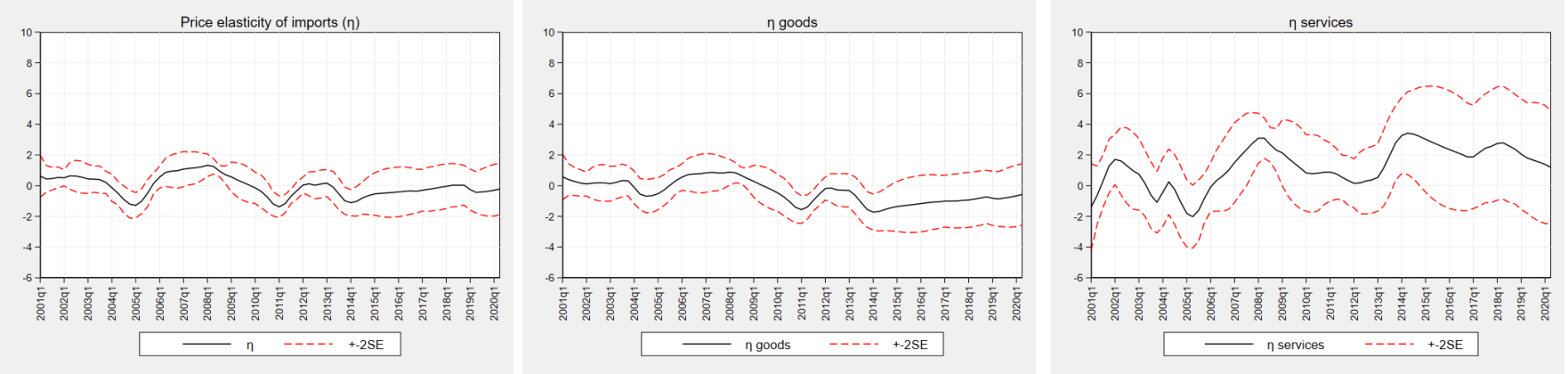


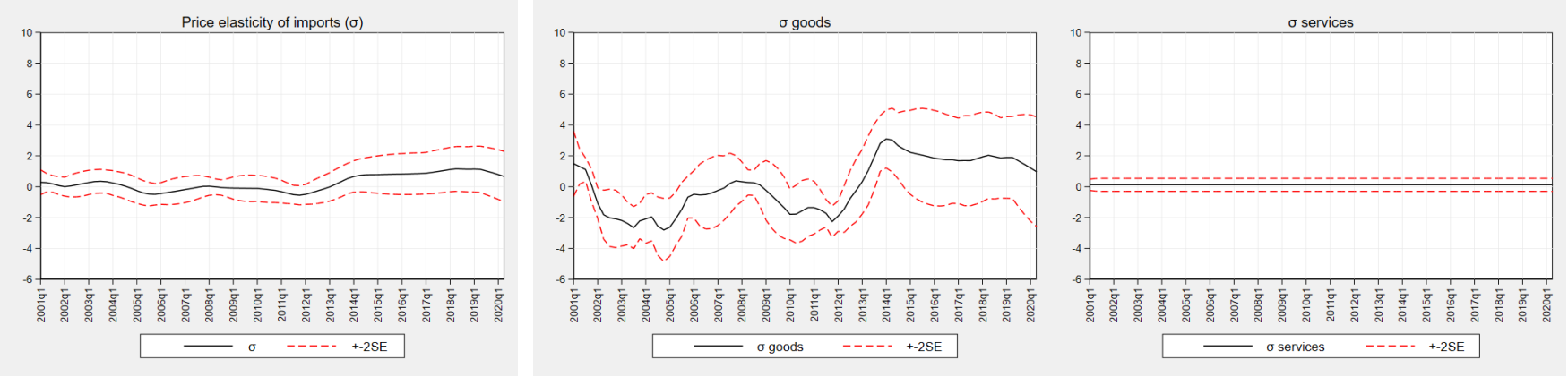
Figure A.6: Filtered *vs* smoothed values of the income elasticity of imports.

A.4 Price elasticities of exports and imports

We report in Fig. A.7 the estimated price elasticities and their confidence interval at 5%. It is possible to observe that they fluctuate around zero. The three panels in (a) correspond to the aggregated and disaggregated imports, while in (b), we have the correspondent elasticities for exports. Our findings confirm one of the central insights of the trade-multiplier: the role of price competitiveness in determining exports and imports is only minor. Results when we estimate aggregate and disaggregated trade equations are fundamentally the same. In the second case, we obtain more volatility, with price elasticity being more stable when not differentiating between goods and services. Still, considering that the exchange rate has been relatively stable in Croatia over the past two decades, it is safe to focus our analysis on non-price factors as the primary determinant of trade in the country.



(a)



(b)

Figure A.7: Estimated aggregate and sectoral price elasticities of (a) imports and (b) exports.

A.5 A comparison of weak and strong test results

A distinction can be drawn between "weak" and "strong" versions of the dynamic trade-multiplier. From an initial balance-of-payments in equilibrium and assuming no change in relative prices, a country's balance-of-payments growth rate can be determined by the ratio of income elasticities multiplied by the growth rate of world income, i.e. the strong form of the model predicts that the country's growth rate will be:

$$y_{BP} = \frac{\phi}{\pi} z \tag{A.22}$$

Such a specification supposes that exports respond to foreign demand as in (3). When relative prices do not change, x is equal to the respective income elasticity multiplied by the rate of growth of the rest of the world.

Alternatively, we might choose not to specify a function for x. In this case, it immediately follows that:

$$y_{BP} = \frac{x}{\pi} \tag{A.23}$$

As a robustness check, we compare the estimation of both versions of the multiplier in the aggregate case. Fig. A.8 shows how the rate of growth compatible with equilibrium in the balance-of-payments varies over time. Differences between the two suggest, among other things, that relative prices might have changed during that period. Still, we can see that such deviations are minimal and that relative prices did not significantly affect y_{BP}.

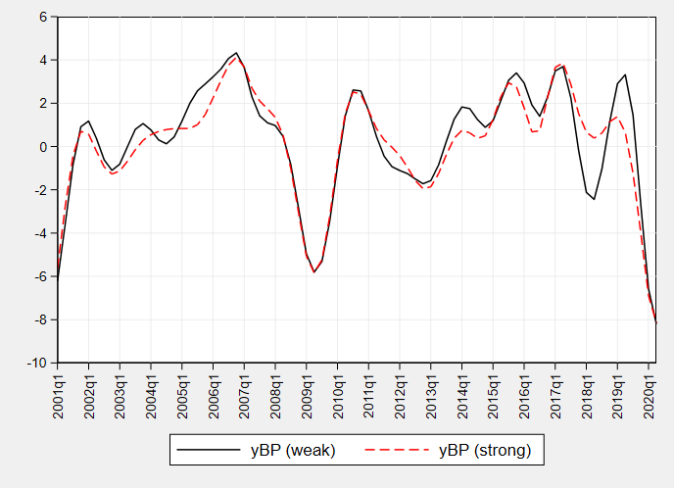


Figure A.8: A comparison of projected values of y_{BP} obtained by the *weak* and *strong* tests of Thirlwall's law.

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