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Contents

Introduction

Europe is experiencing a dramatic shift in its demographic structure, bringing three centuries of unprecedented population growth to an end. Whether population ageing and eventually its decline should be regarded as a problem is a controversial matter. There are few empirical estimates of the realised effect of such a process on economic growth. The first chapter attempts to fill this gap in the literature by assessing the impact of the demographic transition on the long-run economic performance of six European countries between 1971 and 2019. Applying time-varying-parameter estimation techniques, it is shown that the rate of growth compatible with equilibrium in the balance-of-payments (y_{BP}) is a good predictor of long-run growth. These estimates are employed to investigate the importance of population dynamics as one of its determinants. The obtained effects are moderate, and there is significant heterogeneity between countries. In Italy, for instance, a 10-points increase in the old-age dependency ratio is associated with a 3% lower y_{BP}, while in France, we actually have a slightly smaller opposite effect. Analogously, for a 0.5% annual rate population decline, y_{BP} slows down between 0.3 and 2.25% in Portugal, Germany, France, and Austria, but is expected to accelerate in Italy.

The second chapter investigates the correlation between place of death and frequency of hospitalisations based on a set of sociodemographic and health variables sourced from the Survey of Health, Ageing and Retirement in Europe (SHARE) database covering 7,960 people aged 48 years and over who died between 2004 and 2017 in 11 European countries using a combination of binary and multinomial logistic models. The countries are divided into two clusters to account for country healthcare specifics and analyse differences in place of death. The results reveal that countries where public financing and end-of-life care are particularly well organised have a higher share of out-of-hospital deaths (at care homes and home), whereas the second cluster of countries has a higher share of persons dying at home and at hospital which is especially significant for cancer patients. Patients who died of cancer in the first group of countries were more likely to die at home, while patients in countries with the lowest expenditure on long-term care had a higher risk of dying in hospital than

at home or care home, suggesting that health policies targeting de-hospitalisation of care for cancer patients may lead to a significant reduction in public health care costs. Moreover, waiting for death at home in countries with private funding of end-of-life care is linked to a higher frequency of hospitalisations at the end of life since acute care becomes a substitute for long-term and palliative care. In general, the results reveal the importance of investing in long-term and palliative care as a substitute for acute care, when aiming at de-hospitalisation of care given that many requirements for the elderly can be met by hospices (palliative care) or nursing homes.

The third chapter seeks to present the latest trends and developments in the trade of healthcare services and medical goods drawing on the example of a small open economy such as Croatia. As the number of elderly rise throughout Europe, economies are facing challenges transitioning to markets that are increasingly driven by goods and services linked to the elderly. Ageing society combined with rising incomes has led to changes in the structure of world demand as consumers of goods and services demand higher quality, better service, more choice and greater flexibility. Under the premise that what is bought and sold in international markets reflect the fundamentals of the economy and taking advantage of Thirlwall's functions for export and import, the third chapter investigates the latest trends and developments in the trade of healthcare services and medical goods drawing from the experience of a small open economy such as Croatia. This is done by estimating the price and income elasticities of exports and imports of medical goods and health services with the help of a 'State-space' econometric model and applying Kalman filtering techniques. Elasticity is estimated for the aggregate exports and imports of medical goods and health services. The analysis is then repeated so that trade is separated between medical goods and health services to obtain the elasticity for each sector.

Overall, results show that price elasticity has not been statistically significant in the long run except in health services imports, while income elasticity seems to be highly significant in all other cases. In detail, aggregate exports seem to be more income elastic than aggregate imports, with health services exports more income elastic than medical goods exports. Under the premise that income elasticities capture non-price characteristics of goods and services, such as their technical sophistication and quality, these results reflect structural characteristics of Croatia's health sector and productive structure. Moreover, the results show that imports and exports of medical goods and health services demonstrated resilience during the financial crisis which is important evidence knowing that the economic performance of a country or region crucially depends on how the respective productive structure responds to changes in foreign and domestic demand during the crisis and in general.

1 Demographic Transition and Economic Growth in 6-EU Member States

After three centuries of unprecedented population growth, Europe is rediscovering the fear of demographic decline. Years of below-replacement fertility rates suggest that the negative population momentum has set in (e.g. Lutz et al., 2003; Reher, 2007). Decline and ageing share a common cause in low birth rates, with a reduction in mortality exacerbating the latter (Coleman and Rowthorn, 2011). Whether these trends should be regarded as a problem is a controversial matter. There are few empirical estimates of the realised effect of such a process on economic growth. Among alternative theories of growth and distribution, even fewer analysis have investigated the issue. The present article contributes to this literature by assessing the impact of the demographic transition on the long-run economic performance of six European countries covering the tim e period from 1971 to 2019.

However, contrary to most studies in the field that heavily rely on problematic Cobb-Douglas type of production functions (for a recent critique, see Zambelli, 2018; Gechert et al., 2021), we adopt an open economy approach under the premise that the income elasticity of exports and imports reflects the fundamentals of the productive structure. Such an approach allows us to explore a novel link between demographic transition and economic performance in the so-called dynamic Harrod-trade multiplier, bringing a new piece of evidence on the macroeconomic effects of changes in population age structures and uneven development. Frequently referred to as Thirlwall's (1979) law or Krugman's 45° rule, it states that a country trading in a foreign currency cannot sustain persistent and increasing current account imbalances. Thus, its long-run growth rate can be well-approximated by the ratio between the trade elasticities multiplied by the rate of growth of the rest of the world.

Our exercise is divided into two parts. First, we apply time-varying-parameter estimation techniques to obtain the respective income elasticities of exports and imports (as in Felipe et al., 2019; Felipe and Lanzafame, 2020). In this empirical context, we are able to show that the rate of growth compatible with equilibrium in the balance-of-payments provides a fair approximation of long-run growth trends in Italy (IT), Spain (ES), Portugal (PT), Germany (DE), France (FR), and Austria (AT). These countries virtually represent two different institutional arrangements in the continent, namely, Southern and Western Europe. Finally, our initial estimates are employed to investigate the importance of population dynamics to the productive structure, as captured by the ratio between the elasticity of exports over imports. The obtained effects are moderate, and there is significant heterogeneity between countries. In Italy, for instance, 10 points increase in the old-age dependency ratio (OADR) is associated with a 3% lower y_{BP}, while in France, we have a slightly smaller opposite effect. Moreover, population decline effects are conditional to controlling for migration, with Germany and Austria differentiating themselves from their Southern Europe counterparts.

These findings join existing studies on the macroeconomic effects of demographic transition and the possible implications in terms of innovation or savings behaviour (e.g. Prettner, 2013; Sheiner, 2014). By referring to Thirlwall's law, we explore an alternative mechanism that offers a unique framework to combine demand and supply constraints to explain international growth rate differences and structural change. We also confirm some previous insights that ageing and population decline might not *always* be a problem (see Coleman and Rowthorn, 2011). One should also consider to what extent population (de)growth is driven by internal or migration dynamics.

The remainder of the paper is organised as follows. In the next Section, we revisit some stylised facts regarding the process of demographic transition in our sample of six European nations. Section 3 presents the fundamentals of the dynamic Harrod trade-multiplier and our estimates of the trade equations. Section 4 combines a Bayesian Model Averaging (BMA) and Weighted Averaging Least Squares (WALS) techniques to investigate the correspondence between a set of demographic variables and the productive structure. Some final considerations follow.

1.1 Some Stylised Facts

As mentioned at the beginning of this article, the potential macroeconomic implications of population ageing and eventually decline have gained attention in academic circles and the public debate. Our purpose in this Section is to provide a general overview of the ongoing demographic changes in six countries that virtually correspond to two different institutional

arrangements. On the one hand, we have Italy, Spain, and Portugal representing Southern Europe. On the other hand, Germany, France, and Austria stand for the Western part of the continent.

Using data from Eurostat, Fig. 1 presents the main trajectories of a set of seven demographic variables in our first group of economies. On panels (a), (c), and (e), we have the share of the population up to 14 years old, those between 15 and 64, and those above 65 years old. While it is already possible to see a marked increase in the importance of the last group, we use the same data to compute the OADR, understood as the population ages 65-plus divided by the population ages 15-64. OADRs have increased from 15 to 30 in the past four decades. Such trajectories are in line with broad trends in developed countries. According to OECD (2017), OADRs are expected to more than double in the next 50 years, ranging in between 70 and 80. Moreover, the increase in dependency ratios is projected to continue, and demographically younger countries are expected to age even more rapidly.

The evolution of dependency ratios is contingent on mortality rates, fertility rates and migration. Not by surprise, ageing has followed a dramatic decrease in fertility rates, especially during the 1980s, as reported by the World Bank Development Indicators. The Total Fertility Rate (TFR) is defined as the total number of children that would be born to each woman if she were to live to the end of her child-bearing years and give birth to children in alignment with the prevailing age-specific fertility rates. It fell from close to 3 to 1.5, way below replacement rates. These dynamics, of course, are very much related to the fact that fertility decisions have become conscious and individual women participation in the labour market has increased over the past decades, and we have experienced a revolution in contraceptive technologies (for a detailed discussion, see Reher, 2007).

Specifically, in what concerns population growth, we can see that the population started to decline at some point between the great financial crisis and the European debt crisis if we disregard migration. The modern form of population reductions is novel because now it is accompanied by ageing. Before the Industrial Revolution, effects on birth rates were transient, with the decline being provoked by wars and epidemics. Over the past century, low birth rates and an increase in life expectancy are the keys. Panels (b), (d), and (f) show that all three Southern countries currently register in between 0.1 and 0.3% annual population reduction. The introduction of migration dramatically changes the picture. Italy and Spain experienced a long-wave of net immigration that increased the growth rate of their populations up to 1.6% before the financial crisis. The case of Portugal is somehow different, with two immigration waves in between an episode of people leaving the country in the 1980s. Still, in all three countries, a general negative trend is quite evident.

Western Europe is not an exception to these trends. Fig. 2 presents the same set of variables for Germany, France and Austria. The increase in the OADR is perhaps less pronounced, but only because fertility rates started to fall a decade before. In fact, in the case of Germany, the population growth rate without migration has been consistently negative, fluctuating around -0.1 and -0.2%. Contrary to Southern Europe, nonetheless, the population has been growing thanks to immigration. In this respect, France is an outlier. Fertility rates have stabilised around 2 in the 1980s, allowing the population to grow at a stable rate of 0.4% without migration and slightly above this figure once we take immigrants into account. Such trajectories tell us something about the centre-periphery dynamics inside the European Union, and no doubt they are subject to economic as well as political constraints.

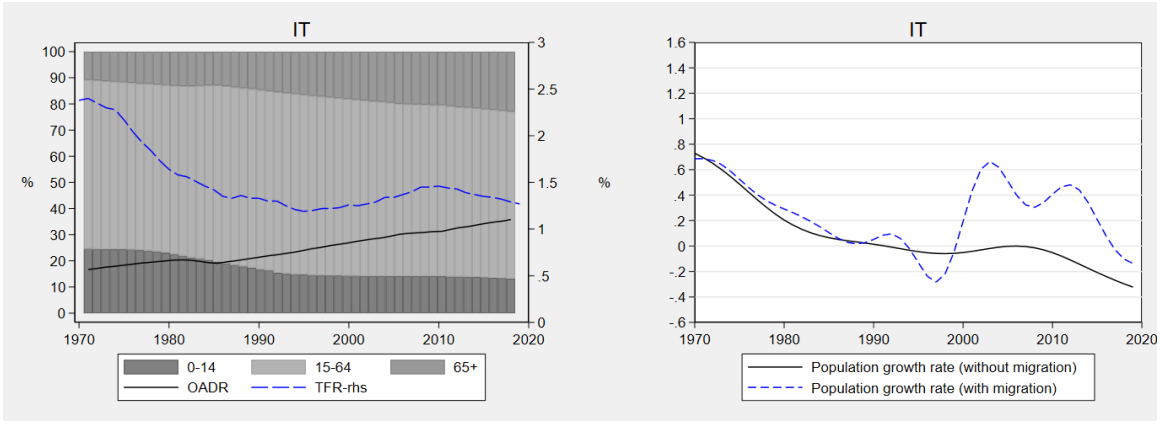
France has never reported a natural population decline, indicating that the underlying relationship between demography and growth in this country might differ from the rest of our sample. The country has a comprehensive family policy with explicit pro-natal goals. However, it combines those elements with high female labour force participation rates and aims to guarantee significant income redistribution as well as an all-encompassing public system of child-care facilities (see, for example, Lechevalier, 2019). The policies that were put in place to encourage three-children families include (i) nearly minimum-wage cash incentives for a mother to stay off work for one year following the birth of her third child; (ii) large reductions in train fares; (iii) an income tax based on the principle the more children, the less tax; (iv) three years paid parental leave that both parents can use; and (v) full-time schools.

Overall, differences in the population growth rate with and without migration also indicate distinct implications in terms of growth. In this paper, we are interested in exploring a novel link between demographic transition and economic performance, referring to the so-called dynamic Harrod trade-multiplier. The main idea is that the income elasticity of exports and imports reflect reflect the fundamentals of the productive structure (e.g. Araújo and Lima, 2007; Cimoli et al., 2019; Dávila-Fernández and Sordi, 2020). While we leave a formal exposition to the next Section, Fig. 3 depicts the main trends of output (Y), exports (X), and imports (M), using data from the World Bank Indicators.

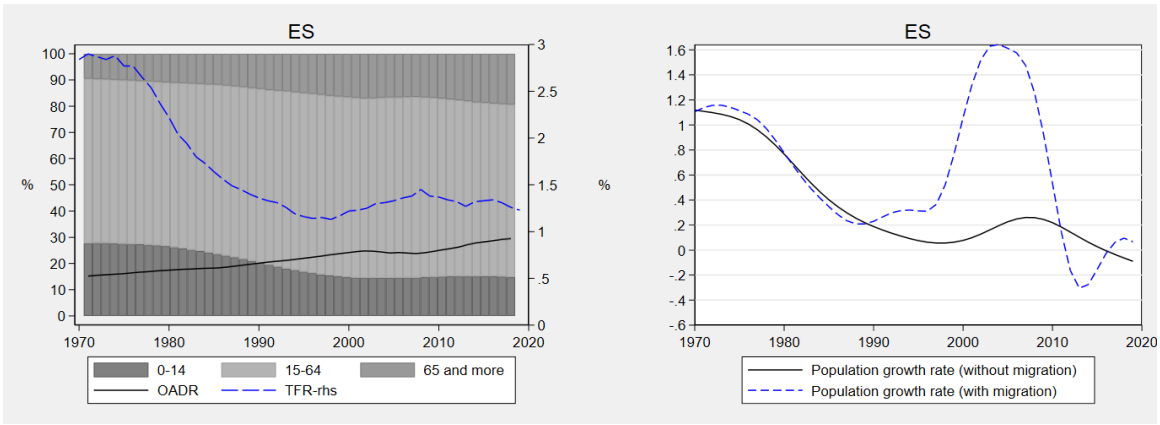
We want to highlight some crucial differences between the two regions in terms of those three variables. In Southern Europe, the 2007 financial crisis and the subsequent debt crisis were followed by a pronounced reduction in production. In Italy, the economy has stagnated afterwards, while Spain and Portugal could recover pre-crisis production levels only in the last two years of our sample. It is possible to see the rise in trade deficits that preceded Spain and Portugal collapse in 2010. Equilibrium in trade was recovered afterwards, and Spain has registered a surplus ever since. Panico and Purificato (2013) argued that, before 2007, the

flaws in the institutional organisation of the process of coordination between monetary and fiscal policy affected the cyclical and growth operation in those countries. There is a certain consensus that the adoption of the Euro was a shortcut for catching-up countries to gain access to international finance that later led to banking, sovereign, and foreign debt crisis, in that order (e.g. Bordo and James, 2013; Reinhart, 2015; from a comprehensive account, see Cesaratto, 2017).

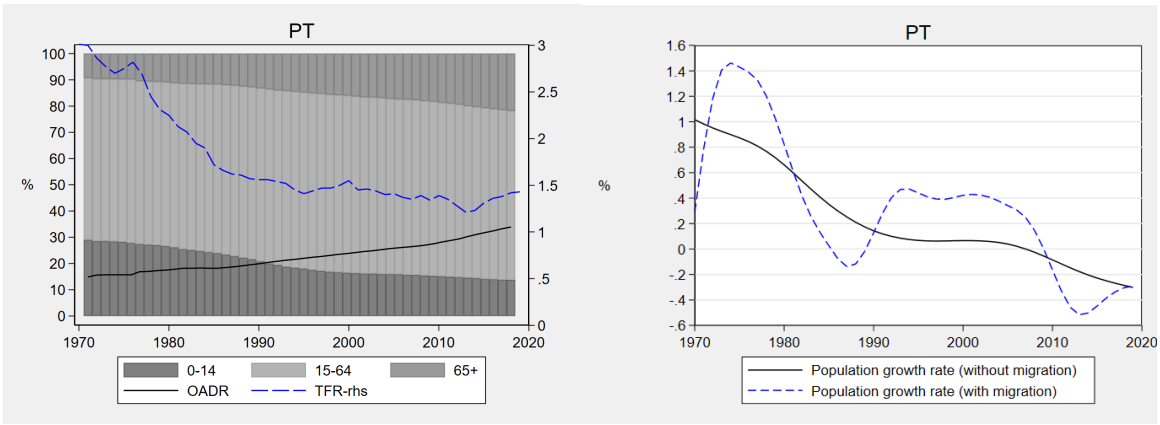
While in Southern Europe, credit money creation by local and foreign banks was directed to construction and consumption bubbles that fuelled imports and inflation, in Western countries, this was followed by current account surpluses. Fig. 3 depicts the well-known trade surpluses in Germany and Austria after the full adoption of the Euro. Overall, trajectories in this last set of economies are smoother, with minor effects on levels or trends. Under the premise that economies grow by upgrading the products they produce and export (Hidalgo et al., 2007), the subsequent Section presents the dynamic trade-multiplier as a possible connecting bridge between long-run economic performance and demographic change.



(a) **(b)**

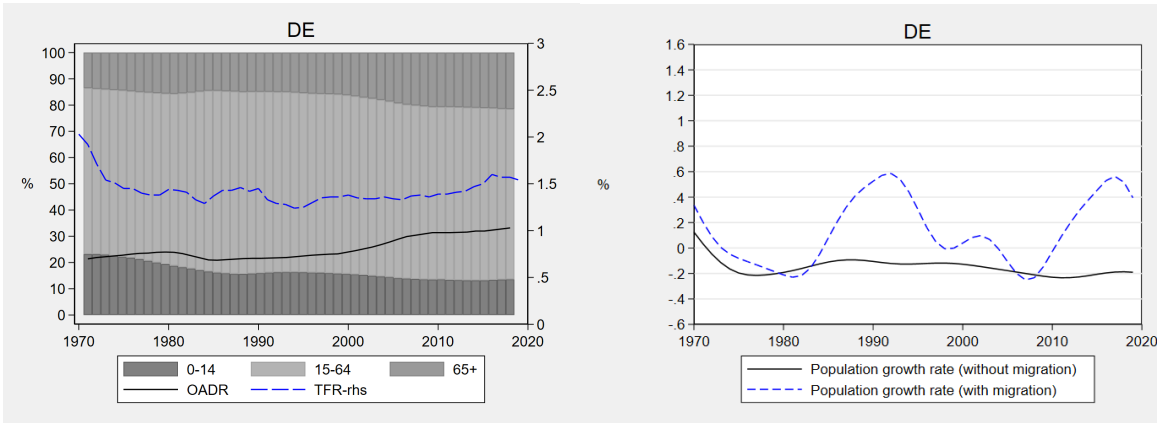


(c) **(d)**

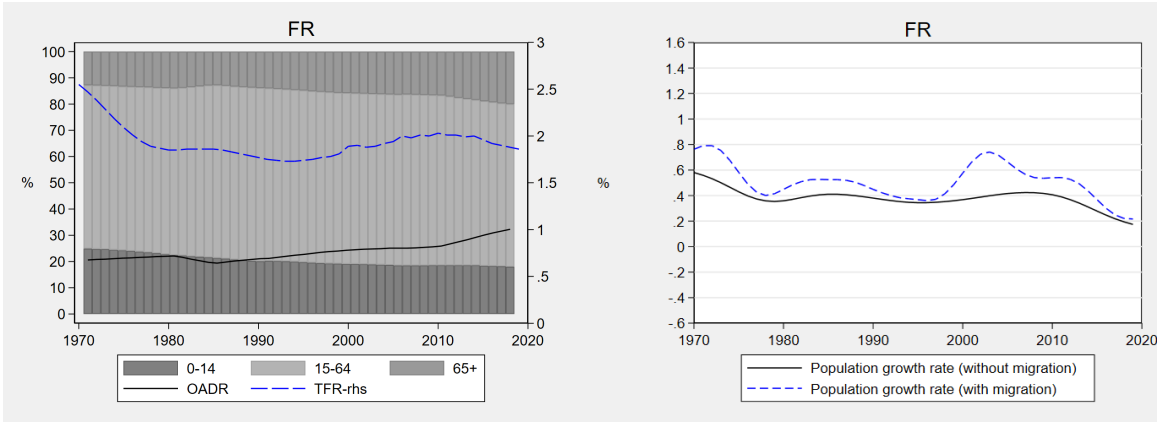


(e) **(f)**

Figure 1.1 Demographic structure in Italy, Spain, and Portugal, 1971-2020.



(a) (b)



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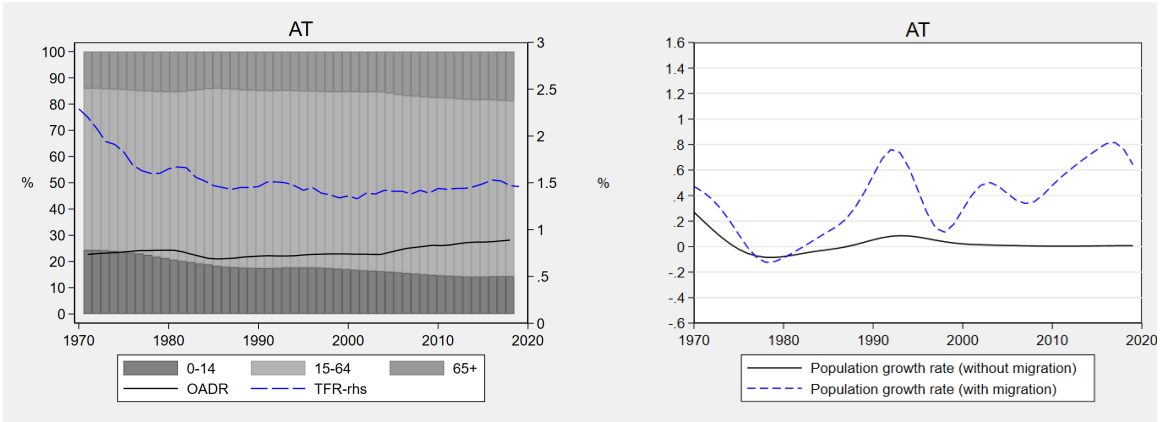

(e) (f)

Figure 1.2 Demographic structure in Germany, France, and Austria, 1971-2020.

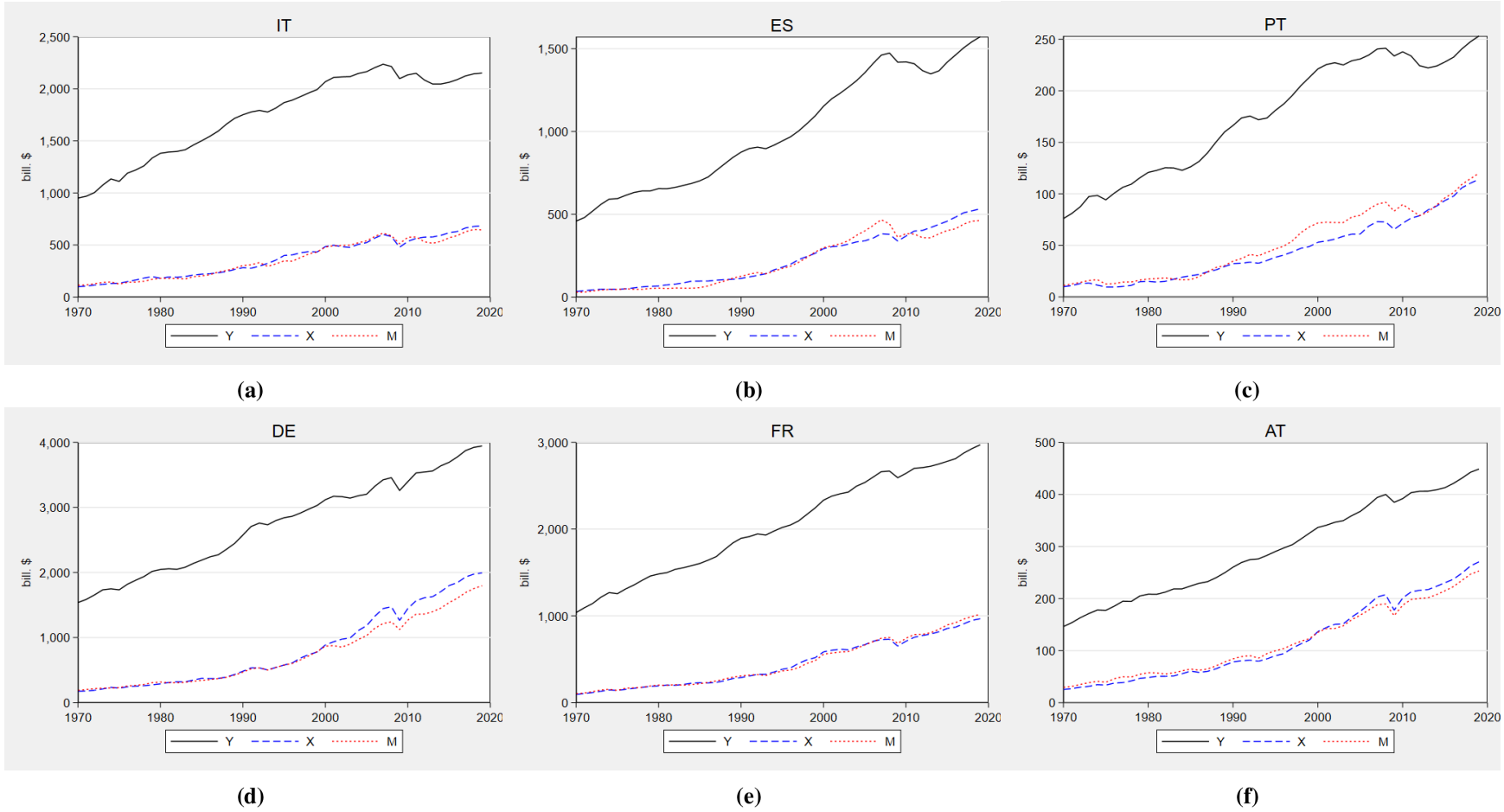

Figure 1.3 International trade in 6-EU selected countries (2010 US dollars).

1.2 The Dynamic Harrod Trade-Multiplier

The idea of a balance-of-payments constraint on growth stands as one of the most powerful empirical regularities among alternative theories of growth and distribution (for a review, see Thirlwall, 2011). It states that a country that trades in foreign currency cannot sustain persistent and increasing current account imbalances. The model has been generalised in several directions, including the incorporation of multi-sectoral issues by Araújo and Lima (2007). Countries in the European Union fit well this framework, given that they either trade in US dollars or Euros. The latter is managed by the Frankfurt-based European Central Bank (ECB) and has substituted national currencies. In this representation, suppose a small open economy divided into n sectors. The rate of growth of aggregate exports (x) and imports (m) are given by:

$$x_t = \sum_{i=1}^{n} \theta_{i,t} x_{i,t} \tag{1.1}$$

$$m_t = \sum_{i=1}^{n} \Omega_{i,t} m_{i,t} \tag{1.2}$$

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

$$\begin{gathered} x_{i,t} = x_i\left(rer_t, z_t\right),\ x_{i\ rer} > 0,\ x_{i\ Z} > 0,\ x_i(0,0) = 0 \\ m_{i,t} = m_i\left(rer_t, y_t\right),\ m_{i\ rer} < 0,\ m_{i\ Y} > 0,\ m_i(0,0) = 0 \end{gathered} \tag{1.3}$$

where rer stands as variations in the real exchange rate, z is the rate of growth of output in the rest of the world, and y corresponds to the domestic rate of growth.

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:

$$x_t = rer_t + m_t \tag{1.4}$$

Substituting (1.3) into Eqs. (1.1) and (1.2), inserting the resulting expressions into Eq. (1.4) 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), $rer = 0$. Assuming for simplicity that $x_i(\cdot)$ and $m_i(\cdot)$ are linear, it follows:

$$y_{BP,t} = \rho_t z_t \tag{1.5}$$

where

$$\rho_t = \frac{\sum_{i=1}^{n} \theta_{i,t}\phi_{i,t}}{\sum_{i=1}^{n} \Omega_{i,t}\pi_{i,t}} \tag{1.6}$$

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.

In the simplest aggregate case, when $i = 1$, it follows that:

$$\rho_t = \frac{\phi_t}{\pi_t} \tag{1.7}$$

For values of $\rho > 1$, the economy grows faster than the rest of the world, falling behind when $\rho < 1$. That is the reason why such a variable is frequently considered to capture the non-price competitiveness conditions of a country or region (see Cimoli and Porcile, 2014). It has proved to be helpful in explaining international growth rate differences. Income elasticities are assumed to capture non-price factors that affect trade. For example, the supply characteristics of goods and services, such as their technical sophistication or quality, are behind their ratio (see McCombie and Thirlwall, 1994).

Still, for a long-time, ρ has maintained the status of a "measure of our ignorance", being somehow equivalent to the Solow residual in standard growth theory. Thus, even though it occupies a central position in the model, it remains exogenously determined. Only recently, Felipe et al. (2019) and Felipe and Lanzafame (2020) have provided groundbreaking evidence on the determinants of non-price competitiveness in this framework. Their work refers to Indonesia and China, respectively, but comes with a distinct feature: estimating time-varying trade elasticities based on the Kalman filter. In what follows, we will adopt a similar estimation strategy to obtain time-varying estimates of ρ and, in a second step, investigate the possible relevant correlations with population dynamics:

$$\rho = \rho\,(Dem)\,, \;\; \partial\rho/\partial Dem \gtreqless 0$$

where Dem is a vector capturing the process of demographic transition.

1.2.1 Estimation strategy

State-space modelling using Bayesian methods has a long history and shares several features with many of the non-parametric models, with the notable distinction that they define the evolution of the time-varying parameters, or states, in the direction of time (for a recent

review, see Chan and Strachan, 2020). We specify our system consisting of two sets of equations, namely, *measurement* and *state*. Imports are given by:

$$\begin{aligned} m_t^T &= \eta rer_t + \pi_t y_t^T + \varepsilon_{m,\,t} \\ \pi_t &= \pi_{t-1} + \varepsilon_{\pi,\,t} \end{aligned} \tag{1.8}$$

while for exports:

$$\begin{aligned} x_t^T &= \sigma rer_t + \phi_t z_t^T + \varepsilon_{x,\,t} \\ \phi_t &= \phi_{t-1} + \varepsilon_{\phi,\,t} \end{aligned} \tag{1.9}$$

where η and σ are the price elasticities of imports and exports while ε are independent normally distributed errors with zero mean and constant variance.

This approach allows us to separate the effects of price from non-price competitiveness. The superscript T indicates that series have been purged from short-run fluctuations using two different techniques: the Christiano-Fitzgerald (CF) and the traditional Hodrick-Prescott (HP) filter. The former is a band-pass (frequency) method that takes a two-sided weighted moving average of the data where cycles in a "band", given by a specified lower and upper bound, are "passed" through or extracted, and remaining cycles are "filtered" out. We adopted the full sample asymmetric version of the filter, where the weights on the leads and lags are allowed to differ. It is assumed a low cycle period of 2 and a high one of 20. On the other hand, we applied the HP filter using a smooth parameter $\lambda = 200$. Given the small-time dimension of our database and that we are not interested in price elasticities, we do not allow the latter to change over time.[1]

We have the choice to report either filtered or smoothed estimates. Each of them serves different purposes and have a distinct economic meaning. As pointed out by Sims (2001), smoothed estimates tell us something about the difference between the best estimates made at the time t and *ex-post* estimates that use all available data today. We shall report them in what follows.

[1]The issue of how or even whether it is possible to separate trend and cycle in macroeconomic series is as old as the profession itself. The flaws of HP have been known for a while. Alternative strategies include Christiano and Fitzgerald (2003) and, more recently, Hamilton (2018). While the issue continues to be open, there is some evidence indicating that Hamilton dominates HP in basic time series, while in more complex models, the reverse is true (e.g. Hodrick, 2020). For this paper, we maintain a conservative position and assess the robustness of our estimates to the use of two different filters: the Christiano-Fitzgerald and the well-known HP.

1.3 Data and Empirical Analysis

In this first stage of our analysis, we rely on annual data between 1971 and 2019. Output, exports, and imports series come from the World Development Indicators measured at constant 2010 US dollars. Exports and imports correspond to the value of all goods and other market services traded with the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. On the other hand, they exclude compensation of employees and investment income (formerly called factor services) and transfer payments. Income of the rest of the world is computed as the difference between global and domestic Gross Domestic Product (GDP) at constant 2010 US dollars.

Fig. 4 reports the estimated income elasticity of imports and exports for Italy, Spain, and Portugal. They are not constant over time, thus justifying the relevance of our estimation strategy. Both CF and HP filters deliver similar results, though there are some differences worth stressing. In Italy, for example, we observe an increase in π from the 1970s until the beginning of the 2000s. Afterwards, however, HP indicates relative stability of the income elasticity of imports, between 2.5 and 3, while CF suggests a reduction to 2. The income elasticity of exports, on the other hand, presents the opposite behaviour. It was relatively stable until the end of the 1990s, depicting a negative trend afterwards that is only slightly reverted after 2010. In Spain, we have an inverted U for both elasticities. The 2010 European debt crisis seems to have left an important mark, especially when it comes to π. The response of imports to changes in domestic demand fell sharply from 1.5 to 0.5 in those years. When it comes to Portugal, trajectories are relatively similar to Italy. The elasticity of imports has been stable since the 1990s, fluctuating around 2.5, while ϕ fell from the 1980s until 2010.

Of course, such preliminary insights remain incomplete unless we consider the ratio between ϕ and π. Fig. 4, panels (c), (g), and (k) report the behaviour of ρ over time. Two different moments are worth highlighting. Until the 1990s, Southern Europe was growing more or less at the same pace as the rest of the world, $\rho \approx 1$. Such a trajectory has changed, nonetheless, in the last 30 years of our sample. Italy and Portugal have been growing consistently less, $\rho < 1$. On the other hand, panels (d), (h), and (l) compare the respective growth trends, as obtained with the CF filter, and the estimated rate of growth compatible with equilibrium in the balance-of-payments using the same filter. The dotted light line stands as the actual rate of growth. The continuous black line and the dotted blue one are very close. In the Empirical Appendix A.1, we present a series of tests that show that the trade-multiplier works as a centre of gravity of the economy. It is shown that the difference between y and

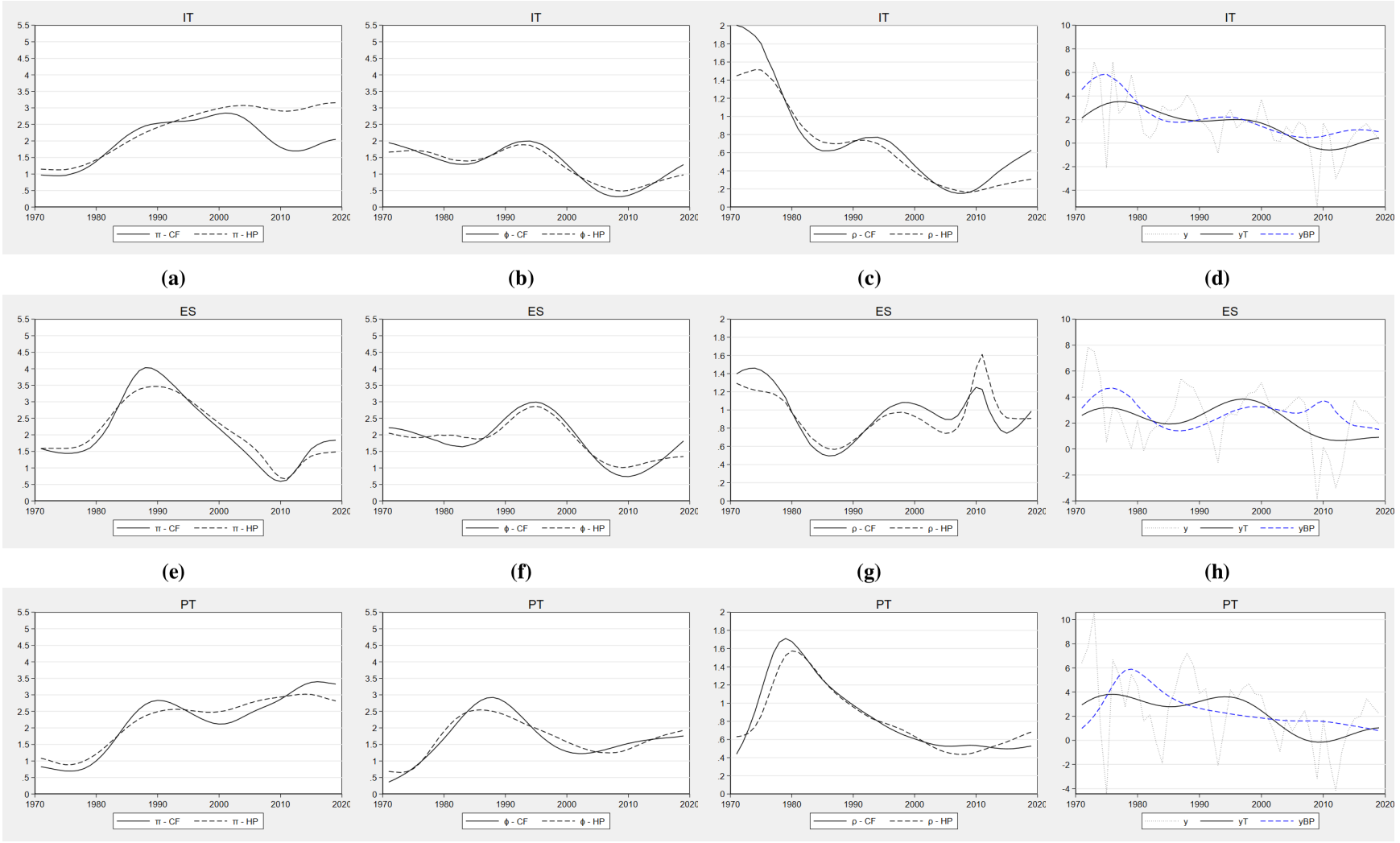

Figure 1.4 Time-varying estimates of non-price competitiveness and y_{BP} in Italy, Spain and Portugal, 1971-2019. The rate of growth compatible with equilibrium in the balance-of-payments was obtained using $\rho - CF$ estimates. Growth trends were also obtained using the CF filter.

y_{BP} is a zero-mean reverting process.Perhaps the most surprising result comes from the spike in non-price competitiveness in Spain around 2010. We explain it as an artificial outcome from the dramatic decrease in π during those years. Given the macroeconomic context at the time, Spain was forced to reduce its imports requirements strongly. Such a decrease implies that the balance-of-payments constraint rate of growth significantly deviates from the long-run trend. The findings of this study have to be seen in the light of the limitation mentioned above. With this exception, Alonso (1999) (employing Johansen cointegration test and VAR Analysis) and Leon-Ledesma (1999) (employing Two Stage Least Squares technique) showed that Spanish economy's growth rate has been very close to the estimated balance-of-payments equilibrium growth rate using the data covering the time period from 1960 to 1994.

When it comes to Western Europe, some differences and similarities with respect to the previous region are worth stressing. As reported in Fig. 5, we have a sort of inverted-U shape function in Germany and France again. Both elasticities increased up to a certain point and fell afterwards. In the case of Germany, the peak was in the 2000s. For France, π peaked in 2010, but ϕ did it in the mid-1990s. Austria, on the other hand, presents itself as somehow a unique case. The income elasticity of imports has been relatively stable, with a slightly positive trend over the whole period. Two waves can be identified for ϕ, but the elasticity of exports has basically fluctuated around 1.5.

Although there is no similar time-variant analysis in the literature, in order to check if the estimated values of elasticities in this paper are similar to those already reported in other works, a comparative analysis was made. This analysis is based on several papers for developed countries or combination of developed and developing countries from specific geographical region. The comparative analysis shows that the coefficient of income elasticity of the imports and exports reported in other works is very similar to our estimations or fall in a range, which can be seen from the table in Appendix A.2.

If we take the ratio between the elasticities into account, Fig. 5 shows, in panels (c), (g), and (k), it is possible to separate the sample again in two different moments. Before the 1990s, Germany, France, and Austria were growing more or less at the same pace as the rest of the world. After that, all three countries have been growing proportionally less. Panels (b), (h), and (l) indicate that the trade-multiplier provides a fair prediction of the actual long-run rate of growth. That, of course, has happened in the context of at least two significant changes in the international arena. First, we have the consolidation of the European Union and the introduction of the Euro that has unified monetary policy without doing the same in terms of fiscal and industrial policies. There are ongoing rearrangements in the productive structure of the continent, with countries from Eastern Europe engaging in the process of catching-up.

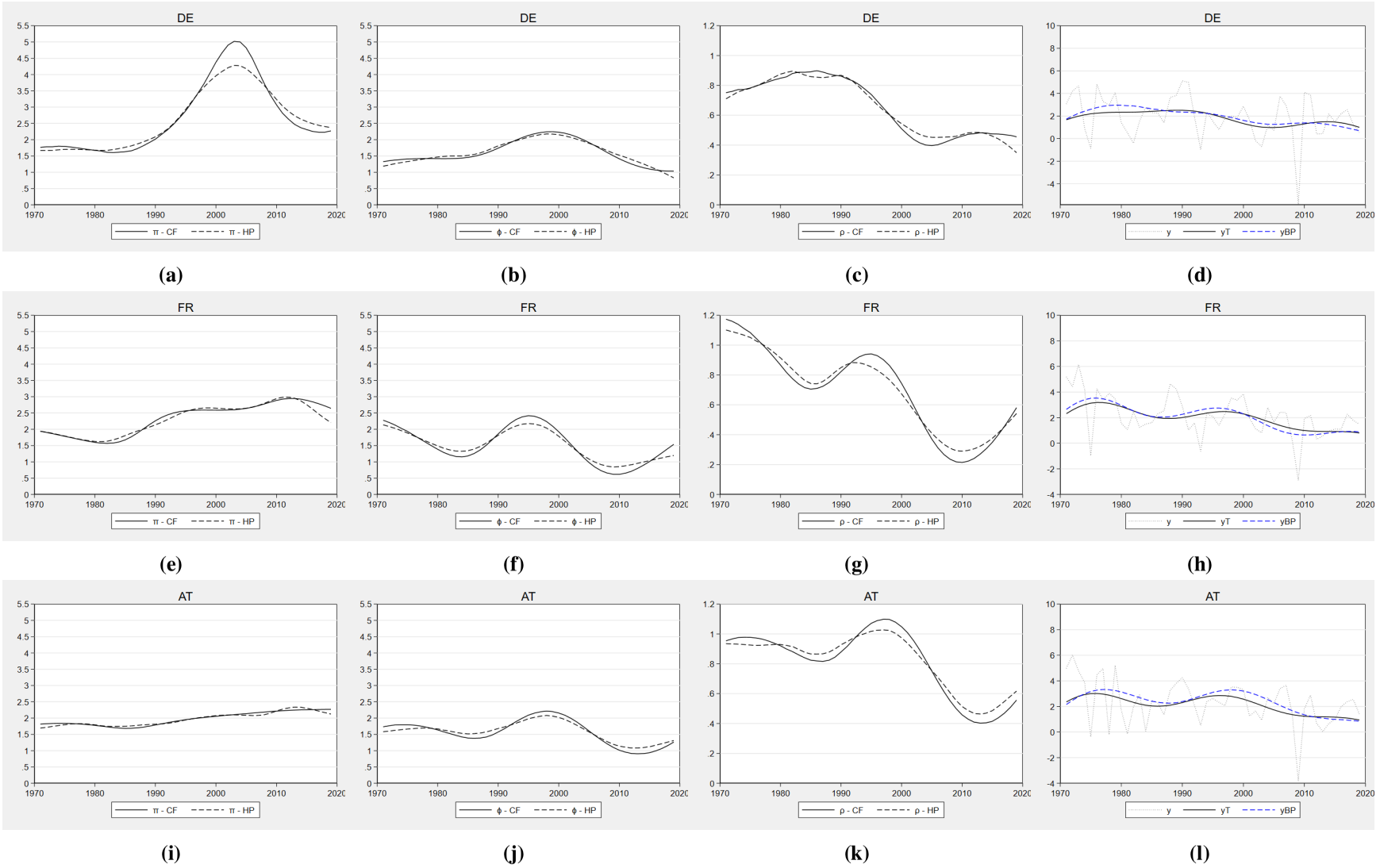

Figure 1.5 Time-varying estimates of non-price competitiveness and y_{BP} in Germany, France and Austria, 1971-2019. The rate of growth compatible with equilibrium in the balance-of-payments was obtained using $\rho - CF$ estimates. Growth trends were also obtained using the CF filter.

Western and Southern Europe have grown proportionally less as several regional value chains have moved towards the East.

Furthermore, over the past thirty years, China has emerged as a leading economy, changing productive relations globally. Asia initially competed only in price terms, but the continent has increasingly improved the technical sophistication and quality aspects of its produced goods. As the region accelerated its growth rate, our sample of 6-EU countries has been growing proportionally less. Our estimates suggest that Italy, Portugal, Germany, France, and Austria currently have a growth rate that is half the rest of the world. Spain is still growing less but maintains a position relatively close to the average global behaviour.

Our results are in line with the recent literature that analyses the dynamics of macroeconomic divergence in the context of European integration (Grabner et al., 2019) and highlights the importance of non-price factors as the key determinant of trade balances and current accounts (Simonazzi, et al., 2013; Storm and Nastepaad, 2015). In particular, if we take income elasticities as indicator for specialisation in goods (McCombie and Thirlwall, 1994), German manufacturers, with their specialisation in highly complex and high-quality products seem to have a strong competitive advantage according to Storm and Nastepaad (2015) who identify non-price competitiveness as main contributors in explaining Germany's success in international markets. High income elasticities of demand for exports reflect strong non-price competitiveness and are characteristic of countries with product differentiation and specialisation in high-technology and complex products (McCombie and Thirlwall, 1994).

1.4 Demographic Transition and Non-price Competitiveness

When elaborating on the reasons why some European countries were not successful in accumulating current account surpluses such as Germany (Grabner et al., 2017), the literature has pointed out the lack of technological capabilities to ensure non-price competitiveness and corresponding export success (Storm and Nastepaad, 2015). The economic performance of a country or region crucially depends on how the respective productive structure responds to changes in foreign and domestic demand. An important question that remains to be answered concerns what are the determinants of non-price competitiveness. In this paper we are interested in whether the variables capturing demographic transition are relevant in explaining the dynamics of ρ. Following Felipe and Lanzafame (2020), we shall rely on the BMA estimator to answer this issue. Still, we differentiate ourselves from their seminal contribution in two ways. First, we focus our 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. A country will be growing faster or slower than the rest of the world conditional to this variable being $\gtrless 1$. Finally, we explore the robustness of our results to the WALS estimator.

1.4.1 Estimation strategy

A useful set-up for investigating the relationship between non-price competitiveness, population dynamics, and a vector of control variables (W) is as follows:

$$\ln \rho_{t+1} = \psi Dem_t + \gamma W_t + \varepsilon_{\rho,t} \tag{1.10}$$

where ψ and γ are the coefficients associated with Dem and W; and ε_ρ represents the error term.[2]

Our immediate interest is to evaluate the role of a set of demographic variables on long-run growth through non-price competitiveness. Decline and ageing share a common cause in low fertility rates. However, one does not implies the other (Coleman and Rowthorn, 2011). Hence, to differentiate between these two mechanisms, we make use of the OADR, the growth rate of the population with (PoP) and without (Nat) migration, and the net migration growth rate (Mig). The latter is defined as the difference between immigration and emigration. Of course, introducing considerations on migration opens the door to a series of questions on the determinants of a person's decision to move to another country. They include the intrinsic heterogeneity in immigration profiles, as well as possible interactions with ageing (e.g. Bettio et al., 2006). A comprehensive assessment of those issues goes beyond the scope of the paper. The findings of this study have to be seen in the light of the limitation mentioned above.

Since:

$$Pop = Nat + Mig$$

for each country, we run two different sets of regressions. First, considering only Pop as an explanatory variable. Later on, we used Nat and Mig instead. Time series are annual and come from Eurostat. Fig. 6 shows the scatter plots between ρ against OADR, Pop, Nat, and Mig when we pooled data. At first glance, we have a negative correlation between

[2] Given that $y_{BP} = \rho z$, the reader might notice some similarities between Eq. (1.10) and conventional estimations of the so-called growth equation. Our approach, nonetheless, comes with two important differences. First, we are dealing with the rate of growth compatible with equilibrium in the balance-of-payments, that was showed to be very closed to actual growth trends. Second, we are assessing the impact of a set of explanatory variables on long-run growth through non-price competitiveness effects as in the dynamic Harrod trade-multiplier.

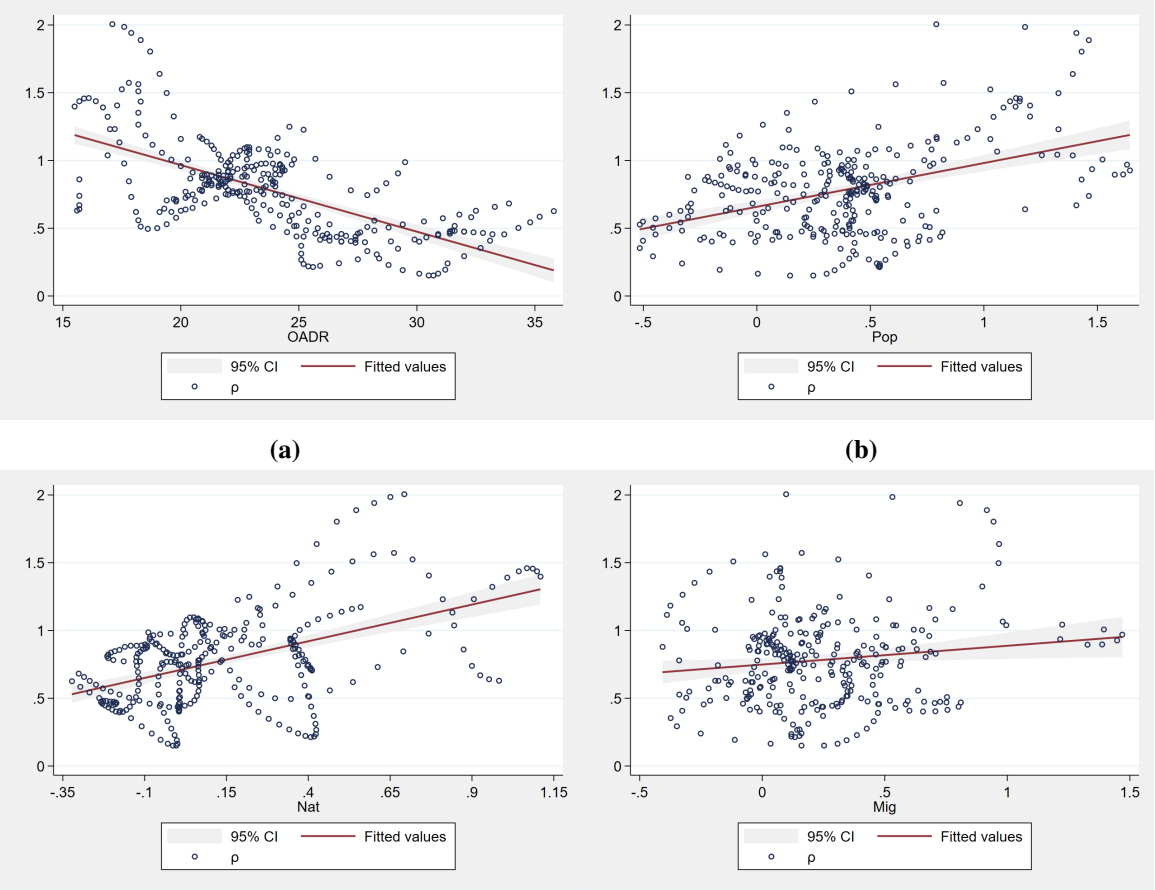

Figure 1.6 Scatter plots of the correlations between non-price competitiveness (ρ) and OADR, population growth with (Pop) and without (Nat) migration, and net migration (Mig).

ageing and non-price competitiveness. We can also infer that population decline is negatively related to long-run growth through ρ. Nonetheless, these initial insights mask significant heterogeneity among countries and further require controlling for different confounding effects.

We select a number of additional potential determinants of non-price competitiveness, dividing them into three main groups:

- Factors of production.
- Aggregate demand and inequality.
- The real exchange rate

The set of controls capturing the role of production factor accumulation comes from the Penn World Table (PWT 10.0). More conventional approaches have highlighted that human capital is an essential explanatory variable of economic prosperity (Lucas, 1988; Klemp and

Weisdorf, 2018). Different measures and indexes of human capital have been built over the years. Here we limit ourselves to include the growth rate of the human capital index (HC), based on the average years of schooling as reported by the PWT. In line with a long tradition emphasising that technical progress is to some extent capital embodied (e.g. Kaldor, 1980; Romero, 2019), we include the rate of growth of capital accumulation, from the PWT, and the Economic Complexity Index (ECI), as reported by the Atlas of Economic Complexity. We have incorporated the ratio between total factor productivity in the domestic economy and the technological frontier (TFP), i.e. the United States. This indicator has some similarities with the technological gap approach. It has been argued that it plays a role in explaining the non-price competitiveness of a given country or region (e.g. Verspagen, 1993; Cimoli and Porcile 2014; Cimoli et al., 2019).

One of the main findings of Felipe and Lanzafame (2020) was that the composition of aggregate demand matters to determine the rate of growth compatible with equilibrium in the balance-of-payments. Hence, we include in our regressions the investment rate (I/Y) and government expenditures (G/Y) as a proportion of GDP. This last set of controls also includes the degree of openness of the economy ($Open$) measured as the sum of exports and imports over GDP. Data comes from the PWT. Using the Macro-History Database from Jordà et al. (2017), we included the public debt to GDP ratio (D/Y), except Austria, for which time series were not available.

Given the existing evidence indicating that the level of the exchange rate appears to influence 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 natural logarithmic of the real exchange rate (RER) from the Bruegel datasets. Finally, we control for the share of income going to the so-called top 1%. In this case, series were obtained from the World Inequality Database. We apply the CF filter to all growth rates to remove the cyclical component of the series. In the Empirical Appendix A.3, we report robustness checks using $\rho - HP$ and applying the Hodrick-Prescott filter to the remaining rates of growth among our explanatory variables. One should point out that growth rates are in the scale $[0, 100]$, which allows a more straightforward interpretation of the estimated coefficients.

1.4.2 WALS and BMA estimates

Even though 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 apply the WALS and BMA estimators developed by Leamer (1978) and Magnus et al. (2010), relying 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 considering 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 greatly reduces the computational burden and allowing a more transparent concept of ignorance about the role of the auxiliary regressors (see also Danilov and Magnus, 2004).[3]

We begin reporting in Tables 1 and 2 our WALS estimates of the determinants of non-price competitiveness in Southern and Western Europe. 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. Recall that, as a dependent variable, we have taken the natural logarithm of the ratio between the income elasticities, $\ln \rho$. Given that $y_{BP} = \rho z$, as in Eq. (1.5), this allows us to interpret the obtained coefficients as percentage changes of the long-run rate of growth.

In Italy and Spain, an increase in the OADR is associated with reducing ρ. The estimated coefficient ranges from -0.06 to -0.32. They mean that ageing harms long-run economic growth perspectives. Germany and Austria also present a negative coefficient but with a lower magnitude that sometimes is not statistically significant. Results are inconclusive in the case of Portugal. A 10-points increase in the OADR is associated with a 3% lower y_{BP} in Italy. Still, in France, we found the opposite effect, in line with the idea that whether ageing itself should always be regarded as a problem is a controversial matter. A 10-points increase in the French OADR is related to 1-2% higher y_{BP}. Differentiating between population growth with and without migration, the magnitude of effects in France and Italy is similar, though with the opposite sign. Indeed, the two countries are in very different moments in the

[3] 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. For completeness, we assume all variables are auxiliary, resulting in a model-space up to 8192 models.

Table 1.1 WALS estimates of the determinants of non-price competitiveness in Southern Europe

	Dependent variable: ln ρ_{t+1}											
	Italy				Spain				Portugal			
Explanatory	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
$OADR_t$	-0.3239104	-3.48	-0.1779249	-2.97	-0.0610007	-1.51	-0.2064358	-4.13	0.0945807	5.30	-.0397226	-2.91
Pop_t	-1.154448	-2.44	–	–	-0.1570261	-0.37	–	–	0.6997513	5.57	–	–
Nat_t	–	–	7.279481	5.86	–	–	-2.769414	-3.55	–	–	1.055696	20.44
Mig_t	–	–	-5.195095	-7.94	–	–	-1.085395	-2.42	–	–	-1.03749	-6.51
HC_t	-14.946	-3.73	-7.991907	-3.22	-3.411898	-3.06	-8.221735	-5.22	1.050384	16.64	.0979182	1.11
K_t	-0.0097834	-0.11	-0.5944816	-5.98	-0.0089699	-0.10	-0.043101	-0.55	0.1071401	4.14	-.1066565	-5.03
TFP_t	-0.0093819	-0.63	0.0332468	2.91	-0.002624	-0.35	0.0009475	0.16	-0.0013005	-0.62	-.0005255	-0.66
ECI_t	-0.5917236	-0.88	0.3314771	0.67	0.8083374	3.85	0.3278926	1.59	0.0931058	1.36	.0572322	2.19
I_t/Y_t	-0.0191972	-0.48	-0.0343302	-1.30	0.0267396	1.78	-0.0092722	-0.59	0.0029822	1.17	.0028126	2.95
G_t/Y_t	-0.09536	-1.22	-0.1361973	-2.53	-0.0074215	-0.23	-0.0176613	-0.66	-0.0043862	-0.73	-.0121326	-5.20
$Open_t$	-0.0403579	-3.31	-0.0198912	-2.18	-0.0192779	-3.11	-0.0172929	-3.53	-0.0010806	-1.18	-.0014149	-4.16
D_t/Y_t	-0.0399365	-2.78	0.004981	0.44	0.0107831	2.87	-0.0047951	-0.96	-0.0005113	-0.75	-.0017232	-5.98
In RER_t	-1.755668	-1.88	-0.6740962	-1.13	1.247787	3.10	0.8303679	2.44	-0.0932245	-0.75	.2237972	4.31
Top $1\%_t$	-0.3034523	-3.09	-0.1668503	-2.51	-0.0178356	-0.26	-0.0238382	-0.43	-0.0197386	-1.56	.0035908	0.73
Const.	40.3211	4.18	18.1387	2.78	-2.406644	-1.08	9.739825	2.67	-3.690815	-4.48	.3826602	0.78
k_1	1		1		1		1		1		1	
k_2	12		13		12		13		12		13	
q	1.0000		1.0000		1.0000		1.0000		1.0000		1.0000	
c	0.6931		0.6931		0.6931		0.6931		0.6931		0.6931	
kappa	74.0		86.6		68.5		106.6		77.9		194.3	

Table 1.2 WALS estimates of the determinants of non-price competitiveness in Western Europe

	Dependent variable: ln ρ_{t+1}											
	Germany				France				Austria			
Explanatory	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
$OADR_t$	-0.009638	-0.98	-0.0135389	-1.45	0.1111791	3.04	0.1949957	8.29	-0.0443817	-4.65	-0.0271306	-3.08
Pop_t	0.6791929	11.93	–	–	4.538136	2.87	–	–	0.1389893	0.50	–	–
Nat_t	–	–	-0.038277	-0.05	–	–	14.55643	9.11	–	–	-16.97719	-3.68
Mig_t	–	–	0.6607606	11.43	–	–	-2.459178	-1.76	–	–	12.74896	3.81
HC_t	1.684702	7.60	1.513467	5.63	0.2890993	1.33	1.227033	6.32	1.303762	1.58	26.44622	3.97
K_t	0.0127076	1.23	0.0191339	1.78	-0.3845542	-5.23	-0.4745512	-10.87	-0.0499819	-8.94	-0.2757755	-4.60
TFP_t	0.0076775	3.58	0.0064628	2.63	-0.0275415	-2.83	-0.0039578	-0.57	0.0078605	2.30	0.0101888	3.67
ECI_t	-0.0694986	-0.88	-0.0590708	-0.76	-0.2196358	-1.08	-0.048137	-0.37	0.0988695	0.80	0.1300834	1.31
I_t/Y_t	0.0044833	1.10	0.0073481	1.48	0.0097937	0.69	-0.0364415	-3.39	0.0226643	3.73	0.0091389	1.45
G_t/Y_t	0.0286006	3.27	0.0211242	2.07	-0.0478708	-1.77	-0.0140106	-0.83	-0.0036278	-0.21	-0.002365	-0.19
$Open_t$	0.002237	1.62	0.0012093	0.83	-0.0184586	-5.38	0.0026627	0.72	-0.0049659	-5.74	-0.0018241	-1.76
D_t/Y_t	0.0054715	3.39	0.004976	3.10	-0.0012228	-0.33	0.0007755	0.35	–	–	–	–
In RER_t	0.1990504	1.81	0.2596922	2.08	0.1933294	0.69	-0.5847398	-2.91	-0.1072113	-0.43	-0.0011887	-0.01
Top $1\%_t$	0.0035167	0.41	0.0037134	0.44	0.0586964	1.98	0.0663621	3.57	0.0119925	1.33	0.0075136	1.07
Const.	-3.610551	-5.57	-3.603963	-5.63	-1.5159	-0.93	-6.187469	-5.29	-0.3636259	-0.32	-17.62636	-3.83
k_1	1		1		1		1		1		1	
k_2	12		13		12		13		11		12	
q	1.0000		1.0000		1.0000		1.0000		1.0000		1.0000	
c	0.6931		0.6931		0.6931		0.6931		0.6931		0.6931	
kappa	41.0		52.7		47.8		46.2		41.1		441.7	

process of demographic transition. While Italy shows a clear negative trend in population growth (without migration) and has a fertility rate below 1.5, France has experienced a steady demographic expansion with fertility rates slightly below 2.

As pointed out at the beginning of the paper, France never reported a natural population decline. This country has adopted an explicit set of pro-natal policies that, among other things, guarantees an all-encompassing public system of child-care facilities (e.g. Lechevalier, 2019). Our findings somehow suggest the possibility of relevant non-linearities or thresholds in the OADR-growth relationship. A deeper assessment of the differences between alternative regimes goes beyond the scope of the paper, but it is essential to acknowledge their existence. On the other hand, in Portugal, Germany, and France, our results indicate that for a 0.5% annual rate of population decline, output growth will slow down between 0.3 and 2.25%. This calculation follows that the estimated coefficient of Pop lies in the range of 0.67 in Germany to 4.5 in France.

Furthermore, our results demonstrate a change of sign of the coefficients of human capital and the investment share in Germany and Austria as compared to Italy and Spain. In the context of population ageing, it is well known that declining birth rates lead to a reduction of the active labour force while a large theoretical literature has demonstrated that population ageing in various ways affects the incentives for individual households and firms to work, to save and to invest in human and physical capital (Devriendt and Heylen, 2017; Aksoy et al., 2015; Onder and Pestieau, 2014; Fougere, 2009). If fertility and the size of the working-age population decline, this will cause an increase in the capital-labour ratio and reduce the marginal productivity of physical capital ((Devriendt and Heylen, 2017). The lower rate of return to physical capital may then lead to a fall in investment (Ludwig et al., 2012). Likewise, changes in investment behaviour will affect labour productivity. Therefore, a better response to demographic changes in countries like Germany and Austria compared to Italy and Spain may indeed indirectly, through human capital and investment, allow for improvements in non-price conditions resulting in higher ρ as it is known that a well-educated workforce and investments are behind the development and differentiation of goods and services.

Moreover, it is worth noting that our results indicate that an exchange rate depreciation also seems to have a strong impact in ρ, which is something that BOP-constrained models usually neglect. These models only consider the possibility that changes in the RER affect the equilibrium rate of growth, but not the level (for a further, more detailed, discussion see Blecker and Setterfield, 2019). Our result aligns with the idea that tradable goods and services are particularly prone to market failures that a more undervalued currency helps to counterbalance. The idea is that the RER plays an important role in inducing producers to enter new product lines and markets, shifting the production structure so that competitiveness

increases through quality instead of prices. The East Asian development experience and its management of relative prices are now at the centre of much debate on the topic. Given that European countries strongly rely on imported inputs, some policymakers have actually promoted a selective currency overvaluation. The estimates presented here seem to support the view that a more depreciated currency might positively impact growth.

Tables 3 and 4 add robustness checks using the BMA approach. In this case, the computational burden required to obtain the appropriate estimate is proportional to the dimension of the model space. Some coefficients lose significance. For example, OADR is no longer significant for Germany. Such a change also happens in Austria in the last set of regressions. Still, overall our main results are the same. An increase of 10-units in the OADR is related to reducing up to 2% in ρ for Italy and Spain. In Portugal and France, there is an increase in non-price competitiveness up to 2%. On the other hand, population decline is likely to be a problem in these two countries. We understand these differences might be explained by the different moments each country finds itself in the process of demographic transition and characteristics of the respective productive structures.

The relationship between demographic transition and the productive structure, as captured by ρ, might be mediated by labour productivity. This fact could explain why we obtain coefficients with opposite signs in different countries. At least three mechanisms may be involved. First, in the long run, a reduction in the size of the population is associated with shrinking markets. A weaker investment follows the prospect of declining demand, increasing the average plant age, reducing its competitiveness and the ability to explore dynamic economies of scale. The expected final result is a reduction in labour productivity that might affect the non-price competitiveness of the country.

On the other hand, as there is a reduction in the workforce size, labour shortages might increase the bargaining power of workers and their ability to obtain real wage increases above productivity gains. Firms respond by increasing their search for labour-saving production techniques, thus increasing labour productivity. This argument has many similarities with the induced technical change hypothesis and goes back to classical authors such as K. Marx and more modern references such as J. Hicks in his *The Theory of Wages* (for a formalisation in those lines applied to the ageing problem, see Manfredi and Fanti, 2006; Rada, 2012). Another element in this puzzle corresponds to age-specific productivity profiles. An older workforce may be less open to innovation and the adoption of new technologies. Evidence on this last claim is controversial as some studies indicate that more experienced workforces can be more productive (as in Malmberg et al., 2008). Further research on disaggregating between each effect is to be encouraged.

Table 3: BMA estimates of the determinants of non-price competitiveness in Southern Europe

	Dependent variable: ln ρ_{t+1}																	
	Italy						Spain						Portugal					
Explanatory	Coef.	t	pip	Coef.	t	pip	Coef.	t	pip	Coef.	t	pip	Coef.	t	pip	Coef.	t	pip
$OADR_t$	-0.2131691	-1.48	0.77	-0.2152581	-1.95	0.89	-0.0630536	-1.61	0.81	-0.214398	-5.90	1.00	0.1019155	6.42	1.00	0.0099257	0.36	0.75
Pop_t	-0.2180814	-0.47	0.34	–	–	–	-0.2752271	-0.61	0.49	–	–	–	0.8153868	7.31	1.00	–	–	–
Nat_t	–	–	–	7.435716	4.25	1.00	–	–	–	-2.580826	-5.40	1.00	–	–	–	0.9122014	6.82	1.00
Mig_t	–	–	–	-5.157901	-6.42	1.00	–	–	–	-0.9244487	-3.93	1.00	–	–	–	-0.2254762	-0.66	0.57
HC_t	-9.440539	-1.57	0.80	-7.091474	-1.54	0.80	-3.798806	-3.91	1.00	-8.03414	-8.54	1.00	1.129706	15.52	1.00	0.5178463	2.62	0.91
K_t	-0.0074935	-0.18	0.13	-0.7176401	-6.15	1.00	0.0235494	0.27	0.23	-0.0462118	-0.81	0.47	0.125426	5.64	0.99	-0.015533	-0.37	0.54
TFP_t	-0.0158143	-0.60	0.34	0.0271152	1.36	0.74	-0.002002	-0.43	0.28	0.0003284	0.13	0.10	0.0001003	0.11	0.09	0.0001772	0.16	0.11
ECI_t	-0.8938852	-0.85	0.50	0.0296711	0.14	0.09	0.9039822	4.06	1.00	0.2761489	0.97	0.57	0.0068563	0.16	0.09	0.0077188	0.16	0.13
I_t/Y_t	0.005063	0.26	0.17	-0.0069939	-0.35	0.20	0.0277334	2.07	0.87	-0.0003064	-0.06	0.12	0.0006034	0.35	0.18	0.0028169	0.83	0.49
G_t/Y_t	-0.0047847	-0.16	0.13	-0.0507043	-0.77	0.48	-0.0130569	-0.40	0.25	-0.0087345	-0.58	0.34	-0.0002624	-0.13	0.09	-0.0025544	-0.42	0.24
$Open_t$	-0.0492266	-2.78	0.99	-0.0102631	-0.67	0.40	-0.0208897	-4.05	0.99	-0.0203746	-4.75	1.00	-0.0000409	-0.09	0.08	0.0000188	0.04	0.09
D_t/Y_t	-0.0136701	-0.94	0.64	0.0125839	0.90	0.55	0.0113347	2.26	0.89	-0.001096	-0.37	0.22	-0.0000417	-0.12	0.09	-0.0001616	-0.24	0.16
In RER_t	-0.3075675	-0.40	0.22	-0.0832672	-0.25	0.14	1.196737	2.36	0.91	0.9005545	2.46	0.92	0.004322	0.09	0.08	0.047824	0.39	0.19
Top $1\%_t$	-0.3425113	-1.79	0.83	-0.223757	-1.70	0.83	-0.0024053	-0.10	0.10	-0.0050771	-0.23	0.11	-0.003451	-0.28	0.14	-0.0032814	-0.31	0.16
Const.	23.1521	2.26	1.00	14.36371	1.83	1.00	-2.145597	-0.73	1.00	8.808334	3.04	1.00	-4.846588	-6.81	1.00	-1.345627	-1.16	1.00
k_1	1			1			1			1			1			1		
k_2	12			13			12			13			12			13		
Model space	4096			8192			4096			8192			4096			8192		

Table 4: BMA estimates of the determinants of non-price competitiveness in Western Europe

	Dependent variable: ln ρ_{t+1}																	
	Germany						France						Austria					
Explanatory	Coef.	t	pip	Coef.	t	pip	Coef.	t	pip	Coef.	t	pip	Coef.	t	pip	Coef.	t	pip
$OADR_t$	0.0075556	0.67	0.39	0.0028675	0.47	0.27	0.123842	2.15	0.92	0.2088946	6.65	1.00	-0.0462225	-2.00	0.89	-0.0023514	-0.28	0.15
Pop_t	0.7961317	11.07	1.00	–	–	–	5.312225	1.82	0.87	–	–	–	0.067567	0.23	0.25	–	–	–
Nat_t	–	–	–	-0.0293109	-0.14	0.13	–	–	–	15.06028	9.66	1.00	–	–	–	-23.88571	-4.62	0.99
Mig_t	–	–	–	0.798474	11.16	1.00	–	–	–	-1.52305	-0.85	0.52	–	–	–	18.26771	4.85	0.99
HC_t	2.160956	7.92	1.00	1.972123	8.35	1.00	0.0781693	0.38	0.20	1.094857	6.46	1.00	1.181541	0.98	0.70	38.18578	5.25	1.00
K_t	0.0021453	0.29	0.16	0.0023223	0.34	0.18	-0.4093869	-3.23	1.00	-0.5015563	-10.25	1.00	-0.0524519	-4.60	1.00	-0.3809158	-5.97	1.00
TFP_t	0.0091707	2.71	0.95	0.0065472	1.90	0.88	-0.0284867	-1.85	0.85	-0.0069538	-0.84	0.8	0.0082402	1.07	0.64	0.0068736	1.23	0.69
ECI_t	-0.0379453	-0.41	0.21	-0.0330149	-0.43	0.22	-0.2574199	-0.84	0.50	-0.0271415	-0.29	0.14	0.0227141	0.23	0.14	0.0074317	0.15	0.10
I_t/Y_t	2.57e-06	0.00	0.09	0.0002669	0.15	0.09	0.0194514	0.89	0.5	-0.0287673	-1.88	0.91	0.0250079	2.17	0.89	0.0008869	0.21	0.12
G_t/Y_t	0.0117514	1.01	0.59	0.0010545	0.23	0.14	-0.044424	-0.99	0.56	-0.0021598	-0.19	0.12	-0.0049005	-0.31	0.17	-0.0013665	-0.18	0.10
$Open_t$	0.0020076	1.08	0.61	0.0010522	0.75	0.43	-0.021971	-5.36	1.00	0.0001172	0.06	0.11	-0.0053073	-4.22	1.00	-0.0000625	-0.09	0.09
D_t/Y_t	0.0083604	3.76	1.00	0.0076144	4.49	1.00	-0.0000901	-0.03	0.17	0.0011351	0.40	0.20	–	–	–	–	–	–
In RER_t	0.0265074	0.32	0.17	0.0524007	0.48	0.25	0.0519638	0.27	0.13	-0.2101536	-0.69	0.40	0.0220845	0.17	0.10	0.0249098	0.22	0.11
Top $1\%_t$	0.0006844	0.16	0.10	0.0009718	0.22	0.11	0.0309085	0.61	0.36	0.0491119	1.35	0.73	0.0029329	0.36	0.18	0.0014292	0.26	0.13
Const.	-3.380066	-4.22	1.00	-2.934565	-3.96	1.00	-1.129871	-0.55	1.00	-8.28695	-5.96	1.00	-0.6192759	-0.65	1.00	-25.15719	-4.86	1.00
k_1	1			1			1			1			1			1		
k_2	12			13			12			13			11			13		
Model space	4096			8192			4096			8192			2048			8192		

So far, our discussion has not separately considered the natural rate of growth of the population and the effect coming from net migration. Differentiating between these two elements brings significant heterogeneity into the picture.[4] For instance, in Spain, Pop and Mig have a negative sign. On the other hand, a reduction in population growth without migration positively correlates with long-run economic performance. More importantly, immigrants also seem to be related to reducing non-price competitiveness. A possible explanation for these findings is that, in this country, high qualified labour is emigrating while those arriving might not be occupying "good jobs", which could explain why native high-skilled labour left the country in the first place. Finally, notice that a consistent population decline is technically impossible in conventional (semi)endogenous growth models because it implies that no long-run balanced growth path exists in the first place (see, for example, Prettner, 2013).

We also documented a negative correlation between ρ and Mig for Italy, Portugal, and France. However, the coefficient of Nat is positive and significant. From Tables 1 and 2, we estimate that, without migration, a 0.5% population decline in those countries correlates with 3% lower long-run growth in Italy, 0.5% in Portugal, and 7.25% smaller y_{BP} in France. Natural population decline and net immigration seem to be related to lower growth in these nations. There is an evident contrast of such a profile with the case of Austria. It appears at the other extreme because, for a 0.5% annual rate of population decline, output growth will speed up 8% through ρ. Moreover, an increase of 1 percentage point in the net migration rate is related to 0.66% higher growth in Germany and 12.7% in Austria. We interpret these coefficients as reflecting a specific productive structure in which "good jobs" have been created in a proportion that has allowed immigrants to be absorbed in sectors related to higher long-run growth.

While we have argued that, in the long run, growth is balance-of-payments constrained, the reader may question whether similar results could be obtained in terms of simple growth trends, y^T. The Empirical Appendix A.4 reports alternative WALS models for this case. Our evaluation is that, in general, this last set of regressions confirms the main results presented in the paper. However, we want to highlight two in particular. First, the contrast between an "Italian model" in which ageing is strongly related to lower growth while population decline is associated with improved economic performance; and the "French case", where we have opposite signs in motion. Second, a contrast between countries in Southern Europe, in which

[4] We would like to emphasise that the determinants of immigration as well as emigration are particular and would require an investigation in its own right. Such an assessment might involve additional elements, including gender, education, age, among others. A comprehensive assessment of those issues goes beyond the scope of this paper. However, research exploring them, especially in an open-economy framework, is to be encouraged.

Mig does not seem to be correlated with better economic performance, and the Germany & Austria club, where migration and growth seem to be moving hand-in-hand.

1.5 Concluding Remarks

Europe is experiencing a dramatic shift in its demographic structure that ends three centuries of unprecedented population growth. Whether population ageing and eventually its decline should be regarded as a problem is a controversial matter. There are few empirical estimates of the realised effect of such a process on economic growth. The present article attempts to fill this gap in the literature by assessing the impact of the demographic transition on the long-run economic performance of six European countries between 1971 and 2019.

Most studies on the field have relied on problematic production functions in which factors are paid accordingly with marginal productivities in a closed economy set-up. Instead, we adopted an open economy framework under the premise that the income elasticity of exports over imports reflects the fundamentals of the productive structure. In this way, we explored a novel link between demographic transition, long-run economic performance, and the dynamic trade-multiplier. Applying time-varying-parameter estimation techniques, we showed that the growth rate compatible with equilibrium in the balance-of-payments is a good predictor of long-run growth. Under the premise that the ratio between the income elasticity of exports over imports reflects the fundamentals of the productive structure, these estimates were employed to investigate the importance of age structure dynamics as one of its determinants. In Italy, for instance, a 10-points increase in the old-age dependency ratio is associated with a 3% lower y_{BP}, while in France, we have a slightly smaller opposite effect. The consequences of population decline are conditional to controlling for migration, with Germany and Austria differentiating themselves from their Southern Europe counterparts.

The relationship between demographic transition and the productive structure, captured by non-price competitiveness as in the trade-multiplier, might be mediated by labour productivity. We argued that at least three mechanisms could be involved. First, a reduction in the size of the population signals the prospect of declining aggregate demand. Under shrinking markets, firms would respond by reducing investment plans, thus increasing the average plant age and reducing its correspondent competitiveness. Furthermore, one should expect a lower ability to explore dynamic economies of scale, with adverse effects on overall productivity. Second, a reduction in the size of the labour force might increase *ceteris paribus* the bargaining power of workers, reducing investment profitability. To save profit margins, however, firms respond by increasing their search for labour-saving production techniques, increasing productivity and non-price competitiveness. Finally, an age-specific productivity profile might play an important role, as an older workforce is prone to be less open to adopting new technologies. The interaction between such contrasting forces explains

why the net final effects of the demographic transition on long-run growth seem moderate, and there is significant heterogeneity between countries.

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Appendix

Appendix 1.A The trade-multiplier as a centre of gravity

Theory indicates that, in the long-run, the actual rate of growth does not deviate from the rate compatible with equilibrium in the balance-of payments, i.e. $y = y_{BP}$. Define $\Upsilon = y - y_{BP}$. This is consistent with the following testable hypothesis:

- Υ is a zero-mean reverting process.

To assess this condition, we proceed in two steps. First, we show that Υ is stationary. As reported in Tables A1 and A2, both the traditional Augmented Dickey-Fuller (ADF) and the non-parametric Phillips-Perron (PP) tests strongly reject the null of a unit root, suggesting that series are integrated of order zero, I(0). Thirlwall's law, y_{BP} was obtained using $\rho - CF$ estimates. 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 $l = 1, 2, 3, 4$. As long as

$$H_0 : \ \alpha_0 = 0$$

deviations from y_{BP} have zero-mean.

Tables A1 and A2 indicate that we cannot reject the null that α_0 is equal to zero. Altogether, these results support the idea that we are dealing with a zero-mean stationary process. In Fig. 5 and 7, we already showed that the long-run trend of the rate of growth in our sample of 6-EU countries is well-approximated by y_{BP}. Our last set of regressions suggests that short-term divergences between actual and estimated rates do not last nor are very persistent. Similar outcomes are obtained if we instead rely on $\rho - HP$ estimates. They are available to the reader under request.

Table 1.A.1 y_{BP} as a centre of gravity in Southern Europe

Mean reverting process: Unit root test Υ												
	Italy				Spain				Portugal			
	ADF		PP		ADF		PP		ADF		PP	
	t	Prob.	Adj. t	Prob.	t	Prob.	Adj. t	Prob.	t	Prob.	Adj. t	Prob.
	-6.224120	0.0000	-6.206480	0.0000	-3.324050	0.0193	-2.806135	0.0649	-2.676113	0.0875	-4.146205	0.0020
Zero mean process: Dependent variable Υ_t												
	Italy				Spain				Portugal			
Explanatory	AR(1)	AR(2)	AR(3)	AR(4)	AR(1)	AR(2)	AR(3)	AR(4)	AR(1)	AR(2)	AR(3)	AR(4)
Υ_{t-1}	0.099749	0.101889	0.131548	0.134425	0.711633***	0.820117***	0.797043***	0.789867***	0.494917***	0.543017***	0.494808***	0.695892***
Υ_{t-2}	–	-0.12055	-0.120315	-0.122682	–	-0.177916	-0.116773	-0.116086	–	-0.180433	-0.321080**	-0.435730***
Υ_{t-3}	–	–	0.177461	0.180662	–	–	-0.066725	0.041630	–	–	0.158813	0.470043***
Υ_{t-4}	–	–	–	-0.019175	–	–	–	-0.141642	–	–	–	-0.384704***
α_0	-0.400701	-0.443131	-0.372847	-0.382868	-0.104547	-0.194619	-0.215094	-0.210936	-0.140312	-0.236420	-0.398469	-0.222001

*, **, ***, stand for10%, 5%, and 1% of significance, respectively

Table 1.A.2 y_{BP} as a centre of gravity in Western Europe

Mean reverting process: Unit root test Υ												
	Germany				France				Austria			
	ADF		PP		ADF		PP		ADF		PP	
	t	Prob.	Adj. t	Prob.	t	Prob.	Adj. t	Prob.	t	Prob.	Adj. t	Prob.
	-6.054544	0.0000	-6.507068	0.0000	-5.474242	0.0000	-5.382005	0.0000	-5.670317	0.0000	-5.932124	0.0000
Zero mean process: Dependent variable Υ_t												
	Germany				France				Austria			
Explanatory	AR(1)	AR(2)	AR(3)	AR(4)	AR(1)	AR(2)	AR(3)	AR(4)	AR(1)	AR(2)	AR(3)	AR(4)
Υ_{t-1}	0.153787	0.183303	0.130797	0.142580	0.0239740*	0.250864*	0.215650	0.178748	0.156312	0.108915	0.061731	0.045945
Υ_{t-2}	–	-0.296953**	-0.300586**	-0.314346**	–	-0.125424	-0.177791	-0.203983	–	-0.149373	-0.212477	-0.294966*
Υ_{t-3}	–	–	-0.065011	-0.040772	–	–	-0.055654	-0.022039	–	–	0.107678	0.098074
Υ_{t-4}	–	–	–	-0.077664	–	–	–	-0.20494	–	–	–	-0.188983
α_0	-0.057297	-0.111567	-0.177578	-0.162454	0.034131	0.026882	-0.030045	-0.034843	-0.130298	-0.226962	-0.282093	-0.382238

*, **, ***, stand for10%, 5%, and 1% of significance, respectively

Appendix 1.B The comparative analysis of estimated elasticites

Table 1.B.1 The comparative analysis of estimated elasticities

Country	Period	π	ϕ	Method	Authors
Austria	1960 - 1993	-	0.83	PH	Senhadji&Montenegro (1998)
France	1960 - 1992	2.06	2.15	ARDL	Caporale&Chui (1999)
	1960 - 1993	-	0.49	PH	Senhadji&Montenegro (1998)
Germany	1960 - 1992	2.06	2.01	ARDL	Caporale&Chui (1999)
Italy	1960 - 1992	1.72	2.02	ARDL	Caporale&Chui (1999)
	1980 - 2012	-	1.24	VECM	Algieri (2014)
Portugal	1980 - 2012	-	1.03	VECM	Algieri (2014)
Spain	1960 - 1994	1.77	2.13	VAR	Alonso (1999)
	1980 - 2012	-	1.33	VECM	Algieri (2014)

Notes: PH - Phillips Hansen fully modified OLS procedure

π - income elasticity of the import

ϕ - income elasticity of the export

Appendix 1.C Robustness checks using the HP filter

As indicated in the main text, we employed two different filters to separate trend and cycle components before estimating the respective trade equations, namely CF and HP. The use of alternative methods allowed us to obtain two different indicators of ρ. Section 4 presented our estimates of the effect of the demographic transition on growth using $\rho - CF$. In this Appendix, it is our purpose to show that those findings are robust to using $\rho - HP$. Tables A3 and A4 report the WALS estimates for both samples of countries. There are somehow important differences in terms of the magnitudes of the obtained coefficients. For instance, in the case of Italy, we obtained an increase of 1 point in OADRs is related to 0.8-0.15% reductions in ρ, almost half of what was reported in Table 1. Still, the signs are the same, bringing some robustness to our analysis. The importance of differentiating between population growth with and without migration is highlighted. We obtained a negative and significant effect of Mig in Italy, Spain, Portugal, and France, while a positive sign for Germany and Austria.

We proceed by performing a series of similar tests with the BMA estimator, as in Tables A5 and A6. OADR coefficients lose significance for Italy, Portugal, Germany, and Austria.

Table 1.C.1 WALS estimates of the determinants of non-price competitiveness in Southern Europe

	Dependent variable: ln ρ_{t+1}											
	Italy				Spain				Portugal			
Explanatory	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
$OADR_t$	-0.1569018	-1.63	-0.0837966	-0.95	-0.1044779	-3.00	-0.2160816	-4.48	0.0152468	1.32	-0.0058625	-0.55
Pop_t	-0.2694958	-0.64	–	–	0.0149404	0.04	–	–	0.0096259	0.09	–	–
Nat_t	–	–	1.961696	1.76	–	–	-2.85624	-2.72	–	–	0.5946747	4.25
Mig_t	–	–	-1.372372	-2.09	–	–	-1.018241	-1.98	–	–	-0.70526	-3.93
HC_t	-5.168715	-1.31	-3.201182	-0.93	-4.220871	-3.94	-8.291712	-4.89	1.082831	26.78	0.6662324	6.72
K_t	0.0232484	0.40	-0.0194523	-0.37	-0.105526	-1.90	-0.0796707	-1.64	-0.0766106	-5.75	-0.0919232	-8.06
TFP_t	-0.0203092	-1.83	-0.0111627	-0.97	-0.0135297	-1.68	-0.012086	-1.85	0.0083565	4.88	0.0039096	2.30
ECI_t	-0.5064401	-0.98	-0.0722058	-0.14	1.050297	4.06	0.5971045	2.28	-0.0478253	-0.74	-0.0675138	-1.32
I_t/Y_t	0.0109206	0.41	0.0014534	0.06	0.0332412	2.22	-0.0057382	-0.30	-0.0060081	-2.60	-0.0013937	-0.65
G_t/Y_t	-0.0682291	-1.29	-0.125545	-2.19	0.0356004	1.48	-0.0143349	-0.54	0.0171009	3.01	-0.0065571	-1.03
$Open_t$	-0.0379891	-4.87	-0.0386006	-5.26	-0.0256349	-3.79	-0.025663	-4.53	0.0023092	2.86	0.0002001	0.25
D_t/Y_t	-0.0163024	-1.48	-0.0080334	-0.77	0.0112969	3.52	-0.0038611	-0.65	0.0001664	0.25	-0.0005188	-1.02
In RER_t	-0.3580496	-0.55	-0.3143799	-0.52	1.911248	3.99	1.618523	3.88	-0.2567277	-2.01	0.0083743	0.06
Top $1\%_t$	-0.1592378	-2.29	-0.1098425	-1.54	-0.1029401	-1.37	-0.1053472	-1.67	-0.0076684	-0.71	0.009588	1.02
Const.	17.11914	1.98	7.730649	1.58	-2.292845	-0.90	8.668729	2.02	-1.184298	-1.86	-0.6681814	-1.27
k_1	1		1		1		1		1		1	
k_2	12		13		12		13		12		13	
q	1.0000		1.0000		1.0000		1.0000		1.0000		1.0000	
c	0.6931		0.6931		0.6931		0.6931		0.6931		0.6931	
kappa	105.9		115.5		48.1		93.6		57.1		97.6	

Only in Spain and France, we can reject the null hypothesis that they are different from zero. Nonetheless, Nat and Mig are very significant, with the obtained signs similar to those reported in Tables 1-4. Given the small time-dimension of our sample, and that BMA uses a less transparent concept of ignorance about the role of the auxiliary regressors (see De Luca and Magnus, 2011), it is not completely surprising that variances are higher in BMA than in WALS. We conclude that the obtained effects are moderate, and there is significant heterogeneity between countries. In any case, we believe empirical evidence gives some support to the hypothesis that demographic transition is likely to affect long-run growth through non-price competitiveness, as in Thirlwall's law.

Table 1.C.2 WALS estimates of the determinants of non-price competitiveness in Western Europe

	Dependent variable: ln ρ_{t+1}											
	Germany				France				Austria			
Explanatory	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
$OADR_t$	-0.0085373	-0.95	-0.0308288	-2.98	0.0590954	1.71	0.1678493	5.63	-0.0252668	-2.05	-0.005814	-0.55
Pop_t	0.4056811	5.08	–	–	0.1932654	0.22	–	–	0.3071395	1.06	–	–
Nat_t	–	–	-1.9331	-2.11	–	–	9.440837	5.53	–	–	-2.716356	-3.26
Mig_t	–	–	0.3235554	4.20	–	–	-5.305258	-4.57	–	–	1.39975	4.22
HC_t	1.303351	5.04	0.8992342	3.37	-0.2213311	-0.93	-0.0194168	-0.11	1.837584	1.95	4.458835	4.84
K_t	0.0663779	6.49	0.066817	7.20	-0.091066	-2.96	-0.1348192	-5.94	-0.0475811	-5.17	-0.0882664	-7.30
TFP_t	0.0067379	3.17	0.002957	1.24	-0.0157302	-1.98	-0.0137075	-2.44	0.0078768	2.27	0.0021764	0.71
ECI_t	-0.0750163	-1.1	0.0074441	0.10	0.0206981	0.11	0.1262954	0.94	0.0708465	0.58	0.0968193	1.03
I_t/Y_t	0.0117378	3.22	0.0165795	4.60	-0.0100392	-0.92	-0.0246818	-3.38	0.0238716	4.01	0.0191603	3.80
G_t/Y_t	0.0144745	1.78	0.0059684	0.71	-0.0996163	-5.00	-0.060681	-4.03	0.0083519	0.56	-0.0151447	-1.13
$Open_t$	-0.0014137	-1.19	-0.0024007	-2.07	-0.0192292	-5.08	-0.0074674	-2.11	-0.004173	-5.05	-0.0038032	-5.69
D_t/Y_t	0.0066799	3.85	0.0052375	3.33	-0.0077033	-1.88	-0.0111079	-3.84	–	–	–	–
In RER_t	0.0133936	0.13	0.108211	1.12	0.8457296	2.87	-0.0383765	-0.15	-0.1757272	-0.69	-0.0287324	-0.15
Top $1\%_t$	-0.0052877	-0.66	0.0028097	0.37	0.0515036	1.76	0.0487238	2.40	0.0149316	1.67	0.0129202	1.95
Const.	-2.26851	-3.34	-2.069548	-3.31	-1.071984	-0.59	-3.471223	-2.70	-1.096112	-0.96	-2.81829	-3.14
k_1	1		1		1		1		1		1	
k_2	12		13		12		13		11		12	
q	1.0000		1.0000		1.0000		1.0000		1.0000		1.0000	
c	0.6931		0.6931		0.6931		0.6931		0.6931		0.6931	
kappa	47.3		65.1		40.0		44.4		41.2		52.8	

Table 1.C.3 BMA estimates of the determinants of non-price competitiveness in Southern Europe

	Dependent variable: ln ρ_{t+1}																	
	Italy						Spain						Portugal					
Explanatory	Coef.	t	pip	Coef.	t	pip	Coef.	t	pip	Coef.	t	pip	Coef.	t	pip	Coef.	t	pip
$OADR_t$	-0.0129241	-0.30	0.20	0.0012658	0.07	0.15	-0.1592567	-4.90	0.99	-0.2573229	-7.22	1.00	0.019977	0.70	0.51	0.0010612	0.14	0.10
Pop_t	0.0512576	0.30	0.23	–	–	–	-0.8100578	-2.82	0.94	–	–	–	0.0670262	0.36	0.31	–	–	–
Nat_t	–	–	–	3.264317	3.04	0.96	–	–	–	-3.064578	-6.07	1.00	–	–	–	0.5594984	3.62	0.98
Mig_t	–	–	–	-1.923064	-2.39	0.92	–	–	–	-1.366608	-4.50	0.99	–	–	–	-0.4373836	-3.25	0.97
HC_t	-0.0833501	-0.06	0.15	-0.259668	-0.35	0.25	-6.829618	-7.43	1.00	-9.527961	-10.33	1.00	1.095104	14.74	1.00	0.7779034	10.09	1.00
K_t	-0.0004994	-0.03	0.09	-0.0065207	-0.30	0.15	-0.0065622	-0.25	00.13	-0.0299707	-0.68	0.40	-0.0759354	-2.16	0.87	-0.092206	-8.36	1.00
TFP_t	-0.0342987	-3.57	0.98	-0.0059718	-0.61	0.40	-0.0014138	-0.25	0.15	-0.0016486	-0.32	0.16	0.0056778	1.37	0.76	0.0009896	0.43	0.23
ECI_t	-0.0487312	-0.16	0.13	-0.0318278	-0.20	0.12	1.399813	5.55	1.00	0.7173427	2.07	0.89	-0.0021932	-0.04	0.11	-0.0084335	-0.20	0.10
I_t/Y_t	0.0043829	0.33	0.17	-0.0026432	-0.23	0.14	0.0036906	0.45	0.25	-0.00063	-0.15	0.11	-0.0023643	-0.57	0.33	-0.0001155	-0.08	0.10
G_t/Y_t	-0.026445	-0.69	0.41	-0.1490141	-2.37	0.93	-0.0005575	-0.06	0.12	-0.0015069	-0.22	0.12	0.0198173	1.82	0.84	-0.0007376	-0.14	0.14
$Open_t$	-0.0509148	-6.02	1.00	-0.0482128	-7.87	1.00	-0.0163905	-2.86	0.97	-0.0249457	-4.50	1.00	0.0005256	0.40	0.21	0.0000258	0.006	0.08
D_t/Y_t	-0.0111777	-1.87	0.85	-0.0000614	-0.02	0.19	0.010047	3.55	0.99	0.0001074	0.07	0.11	0.0003184	0.40	0.24	-0.0000446	-0.13	0.09
In RER_t	-0.0239725	-0.13	0.10	-0.1948206	-0.47	0.25	1.658128	4.35	1.00	1.347151	2.96	0.99	-0.1724909	-0.48	0.27	-0.0165012	-0.18	0.10
Top $1\%_t$	-0.0771201	-0.85	0.50	-0.0187374	-0.38	0.20	-0.0049073	-0.17	0.11	-0.0829308	-1.12	0.64	-0.002817	-0.23	0.14	0.0012877	0.18	0.10
Const.	7.275062	2.84	1.00	6.001112	2.46	1.00	0.5289658	0.82	1.00	9.773213	3.54	1.00	-1.627506	-1.25	1.00	-0.7452885	-1.75	1.00
k_1	1			1			1			1			1			1		
k_2	12			13			12			13			12			13		
Model space	4096			8192			4096			8192			4096			8192		

Table 1.C.4 BMA estimates of the determinants of non-price competitiveness in Western Europe

	Dependent variable: ln ρ_{t+1}																	
	Germany						France						Austria					
Explanatory	Coef.	t	pip	Coef.	t	pip	Coef.	t	pip	Coef.	t	pip	Coef.	t	pip	Coef.	t	pip
$OADR_t$	0.0002285	0.07	0.11	-0.0016363	-0.22	0.14	0.0018544	0.17	0.15	0.1982563	3.74	0.99	-0.0167291	-0.71	0.42	-0.000044	-0.01	0.10
Pop_t	0.5664483	7.46	1.00	–	–	–	-0.2952011	-0.47	0.30	–	–	–	0.2981145	0.76	0.50	–	–	–
Nat_t	–	–	–	-0.0823213	-0.15	0.11	–	–	–	12.74281	4.54	0.99	–	–	–	-2.804044	-2.35	0.93
Mig_t	–	–	–	0.5986975	5.91	1.00	–	–	–	-6.398482	-5.08	1.00	–	–	–	1.779419	3.94	0.99
HC_t	1.892974	9.72	1.00	1.924223	6.12	0.99	-0.040655	-0.29	0.15	-0.0401088	-0.29	0.18	2.07039	1.43	0.78	5.802388	5.49	1.00
K_t	0.0535335	5.26	1.00	0.0520498	4.45	1.00	-0.1222791	-3.07	0.94	-0.1857637	-3.93	0.99	-0.0542301	-3.05	1.00	-0.1054668	-6.86	1.00
TFP_t	0.008124	3.32	0.98	0.0091945	3.47	0.97	-0.000584	-0.23	0.13	-0.0097873	-0.98	0.58	0.0056872	0.76	0.46	0.0005768	0.28	0.15
ECI_t	-0.0205648	-0.36	0.18	-0.0031215	-0.11	0.08	-0.0014647	-0.02	0.09	0.0179796	0.25	0.12	0.0075091	0.12	0.12	0.0112116	0.20	0.11
I_t/Y_t	0.00189	0.47	0.25	0.0046781	0.81	0.49	-0.0024101	-0.28	0.16	-0.0173856	-1.23	0.69	0.0198107	1.76	0.87	0.020944	3.51	0.98
G_t/Y_t	0.0016053	0.34	0.8	0.0001953	0.07	0.09	-0.0872063	-3.27	1.00	-0.030309	-0.95	0.57	-0.0001432	-0.02	0.12	-0.0031726	-0.29	0.16
$Open_t$	-0.0001014	-0.16	0.10	-0.0003577	-0.34	0.17	-0.0220383	-6.77	1.00	-0.0047128	-0.86	0.52	-0.0046707	-3.92	1.00	-0.0030534	-3.69	1.00
D_t/Y_t	0.0091812	5.28	1.00	0.0094004	4.55	0.99	-0.0000921	-0.07	0.11	-0.011174	-2.25	0.98	–	–	–	–	–	–
In RER_t	0.0039902	0.11	0.08	0.0051157	0.14	0.08	1.027308	2.08	0.89	-0.0202743	-0.15	0.10	0.0172154	0.15	0.10	0.014	0.15	0.09
Top $1\%_t$	-0.000415	-0.13	0.09	-0.0004927	-0.16	0.09	0.0846955	2.93	0.96	0.0451442	1.27	0.71	0.0048576	0.48	0.26	0.0041055	0.51	0.27
Const.	-2.767827	-5.68	1.00	-3.01672	-5.05	1.00	-2.602684	-0.87	1.00	-6.236666	-2.67	1.00	-1.55328	-1.81	1.00	-3.809611	-4.51	1.00
k_1	1			1			1			1			1			1		
k_2	12			13			12			13			11			13		
Model space	4096			8192			4096			8192			2048			8192		

Appendix 1.D Robustness checks using y^T

Throughout this paper, we argued that, in the long-run, growth is balance-of-payments constrained as in the dynamic trade-multiplier. We showed that our estimates of y_{BP} work as a centre-of-gravity of the economy, to the extent that the difference with the actual rate of growth is a mean-reverting process. The income elasticity of exports over imports captures the non-price competitiveness of the country and is determined by the fundamentals of the productive structure. Empirical evidence seems to give some support that ρ changes hand-in-hand with the demographic transition, though the estimated effects are moderate and there is significant heterogeneity between countries.

Still, the reader might wonder whether analogous correlations can be obtained in terms of output growth trends, y^T. Indeed, in Figs. 4 and 5, we could see that y_{BP} and the filtered rate of growth are very similar. This Appendix reports WALS estimates of Eq. (1.10) using y^T as a dependent variable. The latter was obtained using the CF filter. For consistency, control variables in growth rates were also detrended using the same method. Table A.7 presents results for Southern Europe, while in Table A.8, we have the case of Western Europe. Our evaluation is that, in general, this last set of WALS regressions confirms the main results reported in the paper. BMA estimations do not provide additional qualitative insights and are available under request. For instance, in Italy, population ageing is negatively correlated with long-run growth. Population decline, on the other hand, is associated with higher growth. The Italian model can be contrasted with the French one, given that in the latter, an increase in OADR is related to higher growth while the coefficient of Pop is positive.

Ageing is also negatively correlated with growth in Spain. Some differences appear, however, in the cases of Portugal, Germany, and Austria. Our previous estimates were inconclusive for Portugal, while now we have a clear negative and significant coefficient for OADR, ranging between -0.25 and -0.42. In Germany, something similar happens. The reported coefficients in Table 2, 4, and A.8 were either very small or non-significant. Austria perhaps appears as the main surprise, given that the modest but negative coefficient is now positive and quite significant, ranging between 0.1 and 0.14.

Migration continues to harm growth in Italy and Portugal, becoming non-significant in Spain and France. Once more, we obtain a strongly significant effect in Germany and Austria. We explained these differences as reflecting a specific productive structure in which jobs have been created in a magnitude that has allowed immigrants to be absorbed in sectors related to higher long-run growth. It is well known that these two countries compete in the international arena in terms of the quality and differentiation of the goods or services they produce rather than price.

Table 1.4.1 WALS estimates of the determinants of y^T in Southern Europe

	Dependent variable: y^T_{t+1}											
	Italy				Spain				Portugal			
Explanatory	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
OADR$_t$	-0.2132285	-2.62	-0.1253319	-2.32	0.0072676	0.07	-0.3147582	-2.28	-0.4266949	-5.94	-0.2542133	-2.15
Pop$_t$	-0.5569018	-1.33	–	–	2.487826	1.80	–	–	-2.496926	-4.97	–	–
Nat$_t$	–	–	5.632905	4.84	–	–	-2.814076	-1.43	–	–	-2.822067	-4.97
Mig$_t$	–	–	-3.659033	-5.53	–	–	1.023507	0.88	–	–	-0.1197902	-0.09
HC$_t$	-6.230053	-1.79	-1.671028	-0.79	5.414503	1.56	-3.668908	-0.93	1.742976	6.86	3.008562	3.93
K$_t$	-0.2161479	-2.68	-0.6642229	-6.68	-0.3752642	-1.43	-0.5101373	-2.10	-0.6495579	-6.25	-0.3563266	-1.94
TFP$_t$	-0.0101233	-0.74	0.0226524	1.87	-0.0096902	-0.42	-0.0075104	-0.44	0.0009056	0.10	-0.0001189	-0.01
ECI$_t$	-0.5594725	-0.93	0.0780686	0.16	2.549506	4.27	1.396655	2.24	-0.0834147	-0.30	-0.1216335	-0.40
I$_t$/Y$_t$	-0.0034261	-0.10	-0.0159009	-0.60	0.0582934	1.35	-0.0142707	-0.34	0.0131642	1.31	0.017014	1.61
G$_t$/Y$_t$	-0.1160152	-1.67	-0.1474971	-2.73	-0.2821081	-3.09	-0.2745477	-3.41	-0.1022093	-4.43	-0.0891509	-3.48
Open$_t$	-0.0410607	-3.71	-0.0236286	-2.48	-0.0354373	-2.03	-0.0334024	-2.38	-0.0060444	-1.55	-0.0052493	-1.38
D$_t$/Y$_t$	-0.0280586	-2.24	0.0036925	0.35	0.0482906	4.58	0.0181082	1.36	0.0023398	0.92	0.0058033	1.81
In RER$_t$	-1.129782	-1.37	-0.4321532	-0.75	3.49887	3.05	2.912502	2.93	1.445426	2.86	1.068341	1.97
Top 1%$_t$	-0.2901688	-3.29	-0.1921535	-2.86	-0.3608187	-1.84	-0.4053163	-2.46	0.0707406	1.40	0.0434939	0.81
Const.	28.58847	3.40	13.81192	2.42	-13.60204	-1.99	10.68951	1.12	8.509701	2.60	2.685203	0.58
k_1	1		1		1		1		1		1	
k_2	12		13		12		13		12		13	
q	1.0000		1.0000		1.0000		1.0000		1.0000		1.0000	
c	0.6931		0.6931		0.6931		0.6931		0.6931		0.6931	
kappa	74.0		86.6		68.5		106.6		77.9		194.3	

Table 1.4.2 WALS estimates of the determinants of y^T in Western Europe

	Dependent variable: y^T_{t+1}											
	Germany				France				Austria			
Explanatory	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
OADR$_t$	0.024683	1.10	0.0020873	0.10	0.0925742	1.13	0.1678037	1.95	0.1096574	7.12	0.1438156	13.34
Pop$_t$	1.641936	12.40	–	–	6.315984	1.79	–	–	2.62341	5.93	–	–
Nat$_t$	–	–	-0.9652392	-0.61	–	–	15.14115	2.63	–	–	-27.33738	-5.33
Mig$_t$	–	–	1.589143	12.60	–	–	0.4583183	0.11	–	–	24.31587	6.56
HC$_t$	4.049481	7.96	3.383906	5.72	1.00188	1.92	1.806273	2.82	12.34836	9.44	55.41043	7.51
K$_t$	0.0760477	3.15	0.0900593	3.70	-0.4630047	-2.82	-0.5438915	-3.41	-0.1389653	-16.45	-0.5284515	-7.95
TFP$_t$	0.0239993	4.88	0.0186739	3.46	-0.005871	-0.27	0.0138733	0.62	-0.0190584	-3.56	-0.0158068	-4.56
ECI$_t$	-0.3377462	-1.87	-0.3027112	-1.74	-0.7393677	-1.56	-0.6254039	-1.39	0.60617	3.53	0.6775091	5.92
I$_t$/Y$_t$	-0.0128639	-1.38	-0.0021312	-0.19	-0.0315011	-0.97	-0.0697871	-1.99	0.0088863	0.99	-0.0164035	-2.31
G$_t$/Y$_t$	0.0155062	0.77	-0.0040485	-0.17	-0.0311236	-0.52	-0.0002184	0.00	-0.0013997	-0.05	-0.0150926	-0.88
Open$_t$	0.0031186	0.99	0.0008283	0.24	-0.0050038	-0.59	0.0138487	1.09	-0.0041173	-3.17	0.0006108	0.50
D$_t$/Y$_t$	0.0114851	3.11	0.0090874	2.55	-0.0060137	-0.72	-0.0045396	-0.59	–	–	–	–
In RER$_t$	0.2869565	1.14	0.5608251	2.04	2.047529	2.94	1.365784	1.79	-0.489009	-1.51	-0.2391441	-1.12
Top 1%$_t$	-0.0312627	-1.59	-0.0284456	-1.52	0.011263	0.17	0.012775	0.20	-0.0107594	-0.88	-0.0176411	-2.28
Const.	-4.178	-2.83	-4.29027	-3.05	-8.523139	-2.21	-12.59175	-2.94	-4.207897	-2.70	-33.82178	-6.64
k_1	1		1		1		1		1		1	
k_2	12		13		12		13		11		12	
q	1.0000		1.0000		1.0000		1.0000		1.0000		1.0000	
c	0.6931		0.6931		0.6931		0.6931		0.6931		0.6931	
kappa	41.0		52.7		47.8		46.2		41.1		441.7	

2 Factors Influencing Place of Death and Frequency of Hospitalisations: Evidence gathered from 11 European Countries

One of the greatest human achievements over the past fifty decades, fighting diseases and improving health care, has led to increased longevity. Combined with decreased fertility rates, this has resulted in a growing share of elderly people requiring care and support from an ageing and shrinking working-age population.

Care of the elderly or long-term care (hereafter LTC or out-of-hospital end-of-life care) refers to care for people with chronic mental illness or physical disability where the disability is usually defined as (i) not being able to perform one or more activities of daily living (ADLs) including bathing, bed mobility, personal care, eating, medication, etc. and (ii) requiring assistance with instrumental activities of daily living (IADLs), including routine activities such as meal preparation, housework, shopping, travel to medical services and telephone use (Edvartsen, 1998, Norton, 2000, Piculescu et al., 2012). LTC services are provided often on a daily basis, formally or informally, at home or in institutions (Costa-Font and Courbage, 2012).

While policymakers are confronted with an increased percentage of national income devoted to health care and long-term care services, the elderly are faced with uncertainties in disability and associated costs arising from medical, social, and personal care services. Although ageing is not the direct cause of higher total health care expenditures, some authors (Yang et al., 2003) have found evidence that the time leading up to death is the main reason for higher inpatient care expenditures. In contrast, ageing is the main reason for higher long-term care expenditure. In other words, as the probability of death grows as people get older and because a greater proportion of the population is in their last year of life - health care expenditures are higher on average for older people higher ages (Yang et al, 2003).

Gaining insight into the different conditions in which people die in various countries reveals information on the type of care received prior to death and is important for policymakers devising health policies on end-of-life care in order to control health care costs and presuming that hospitalisation increases expenditure in comparison to other types of care (past research has shown that dying in a hospital setting is double the cost of dying at home under hospice care,Hoverman et al., 2020). Moreover, the topic is a contributing factor to individual well-being given that a survey conducted by the OECD (2017) identified a widespread aversion to dying in hospitals.

Place of death has already been explored in a panel analysis using data for 16 European countries and Israel using the SHARE database (waves 2 - 5) by Orlovic et al. (2017). This paper is different in several ways. Firstly, the present paper uses the same source but a different selection of countries as the interest is in comparing countries where policymakers support both institutional (long-term and palliative care) and informal (home) care versus those that rely on informal (home) care provided by family members and for which the only alternative is the most expensive acute care. Furthermore, instead of using a logistic regression and odds ratios (OR), in this paper we employ the multinomial logistic regression where the results are expresses with relative risk ratios (RRR). When there is no association between exposure and outcome, both OR and RR are identical but when there is an association between an exposure and an outcome, OR exaggerates the estimate of the relationship (more on the methodology will be said in the next section). Finally, while Orlović et al. (2017) use a *wave* as a dummy variable in their analysis to control for fixed cross-national group differences and secular trends, this study uses *time* for the same purposes. The problem with controlling for a wave is that each wave yields data on patients who had died in different years (i.e. in 2004 and 2012), hence the wave dummy variable can never capture time-related differences such as increasing investments in LTC (health) and an increasing number of nursing homes over time.

To verify whether a shift to formal LTC, generally accompanied by higher public expenditure in LTC, is associated with (a)lower chances of dying at hospitals, as compared to dying at home or in care homes and (b)higher chances of resorting to palliative care in last days of life, this study assesses the correspondence between the place of death and a set of sociodemographic and health variables for 7,960 people aged 48 years and over who died between 2004 and 2017 in 11 European countries (Austria, Belgium, Denmark, France, Germany, Greece, Italy, the Netherlands, Spain, Sweden and Switzerland) using SHARE database and a combination of binary and multinomial logistic models. The countries were divided into two clusters in order to account for country healthcare specifics and analyse differences in place of death and frequency of hospitalisation. Based on high expenditure on

long-term care (health), the first group of countries provides public funding for end-of-life care, while the second group of countries has a private provider of end-of-life care, with Germany and Switzerland as the exceptions.

The results reveal the importance of investing in LTC as a substitute for acute care, with the aim of de-hospitalisation of care. Many needs of the elderly can be met by hospices (palliative care) or nursing homes given that countries with particular strong public financing and organisation of LTC have a higher share of out-of-hospital (care home and home deaths). In comparison, countries with private financing of end-of-life care and low investments in long-term care have a higher share of hospital and home deaths.

The paper is organised as follows. The introduction is followed by the 'Data and Methodology' section, where details on the SHARE database are given together with an explanation of the criterion used to organise certain countries into two groups is given. The construction of variables used in the model and the model itself is also described. After explaining the methodology, the results are presented in the third section, followed by a discussion in the fourth section and conclusions in the last section.

2.1 Data and Methodology

This study used data on 7,960 individuals pooled from the end-of-life questionnaire module administered for waves 2 (2006–07), 3 (2008–09), 4 (2011–12), 5 (2013), 6 (2015), and 7 (2017) of the SHARE project (Börsch-Supan, 2019a-g). SHARE is a multidisciplinary and cross-national panel database of microdata on health, socio-economic status as well as social and family networks of about 140,000 individuals from 27 European countries and Israel aged 50 or over and their partners irrespective of the age (SHARE home page of April 1 2020). Data on 7,960 deceased come from eleven countries (Austria, Belgium, Denmark, France, Germany, Greece, Italy, the Netherlands, Spain, Sweden and Switzerland) who participated in the survey from the beginning. End-of-life interviews were conducted with proxy respondents. The proxy-respondents can be a family or household member, a neighbour or any other person from the closer social network of the deceased respondent. The end-of-life module provides information on the hospital stay, care in a nursing home, hospice stay and other information on the respondent's last year of life and the circumstance of their death as well as time and cause of death.

To investigate the relationship between place of death and LTC (health) expenditure, the latest data on the latter was taken from the Eurostat database in terms GDP. Figure 1 shows a strong positive relationship between the LTC expenditure and dying outside hospitals, particularly in care homes. We now aim for gaining a clearer understanding of this observed

positive relationship. To this end, we start with dividing the countries in clusters, where members of the same cluster are similar to each other, but distinct to members of other clusters. Depending on the LTC expenditure and the proportion of deceased in care homes, the countries can be separated into two groups. The first group (Country Group 1) consists of countries that spend more than 2 per cent of GDP on LTC (health) and have over 15% of the deaths occurring in care homes. These countries are Belgium, Denmark, the Netherlands, Sweden and Switzerland, with particularly strong public financing and organisation of LTC in Belgium, Denmark, the Netherlands and Sweden. As a country with predominantly private funding of end-of-life care, Switzerland is an exception in this group. However, it has been included since its patients are more likely to afford formal LTC; moreover, Switzerland invests more than 2% of GDP on LTC. The second cluster (Country Group 2) includes countries that scored low both in expenditure on LTC and the number of deaths in care home settings, specifically Austria, France, Germany, Greece, Italy and Spain. Moreover, these countries have a care system that is predominantly privately funded, with Germany as an exception. Germany provides inadequate public funding of LTC, resulting in a lower share of deaths in care home facilities. In other words, Germany is similar to countries like Austria and France in the second group of countries (for a more detailed discussion on the typology of long-term care systems see Appendix 2.A). It is important to note that these practices are linked to social norms about who should be responsible for caring for the elderly. In-country group 1 it is often the state, while in-country group 2, it is the family (Cohen et. al. 2007; Grootegoed and Van Dijk, 2012; Koren, M. J., 2010; Brown et. al., 2012).

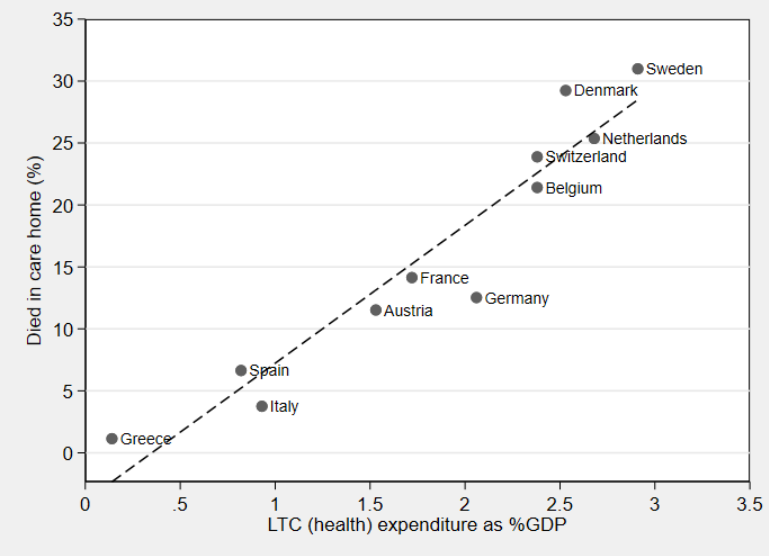

Figure 2.1.1 Percentage of deaths in care homes in terms of total deaths (2004-2017) and expenditure on LTC (health) in terms of GDP (2017) in 11 European countries.

The analysis is divided into two parts. First, multinomial logistic regression is used to test the association between place of death, end-of-life care system typology, and individual circumstances in the last year of life. Second, binary logistic regression is used to analyse the determinants of frequency of hospitalisation.

Multinomial logistic regression is used to model nominal outcome variables. In this case, the nominal dependent variable - place of death - is categorised as "hospital", "home", and "care home", where the hospital serves as a baseline category and home and care home are a comparison group. Explanatory variables include demographic characteristics (age, gender), socioeconomic status and support (marital status, own home), services received in the last year of life (number of hospital stays), factors related to illness (cause of death, duration of illness) and "year died" (2004-2011, 2012-2017) – the time dummy variable to control the effect of time such as an increasing number of LTC beds.

Multinomial logistic regression is often chosen because it does not assume normality, linearity, or homoskedasticity but assumes independence among dependent variable choices. This assumption states that the choice or outcome in one category is not related to the choice or outcome of another category. This research tested the assumption of independence using the Hausman-McFadden test, which is a usual procedure. Besides assuming independence, multinomial logistic regression also assumes non-perfect separation meaning that, if the groups of the outcome variable are perfectly separated by the predictor(s), then unrealistic coefficients will be estimated, and effect sizes will be greatly exaggerated (Greene, 2018).

The results from a multinomial logistic regression are expressed by relative risk ratios (RRR), and binary logistic regression is expressed by odds ratios (OR). While the interpretation of OR is a well-known procedure (the odds that an outcome will occur given a particular exposure, compared to the odds of the outcome occurring in the absence of that exposure), interpretation of RRR is less common. The RRR of a coefficient compares the risk of the outcome falling in the comparison group to the risk of the outcome falling in the reference group changes with the respective variable. A RRR > 1 indicates that the risk of the outcome falling in the comparison group relative to the risk of falling in the referent group increases as the variable increases. In other words, the comparison outcome (home, care home) is more likely. An RRR < 1 indicates that the risk of the outcome falling in the comparison group relative to the risk of falling in the referent group decreases as the variable increases. In general, if the RRR < 1, the outcome is more likely to be in the referent group (hospital).

2.2 Results

2.2.1 Study population

The sample of the individual-level survey data consists of 7,960 patients who died in the period from 2004 to 2017. As can be seen in Table 1, 47.6% and 52.4% of the deceased were female and male, respectively. The majority (56.8%) of the deceased in the sample who died were 80 years of age or older, and 43.2% died younger than 80 years of age, while the mean age of the deceased in the sample is 79. Among the countries that provided information on the use of hospices and nursing homes in the last year of life, Denmark (23.5%), Sweden (19.9%) and Belgium (16.1%) recorded the highest use of nursing home care services, while hospice care was most prevalent in France (15%), Sweden (12.0%), Belgium (11.3%) and Switzerland (10.3%). Greece, Italy and Spain had the lowest use of nursing home care and hospices. The most common cause of death was a heart attack, stroke or other cardiovascular diseases (CVDs; 36%), whereas the second most common was cancer (27.7 per cent). Nearly 65% of cancer patients were younger than 80 years, while persons who died of heart attack, stroke or other CVDs were mainly older than eighty. The highest share of recorded deaths from heart attack and stroke was in Greece (59.8%) and lowest in Denmark (24.2%). Cancer was the main cause of death in the Netherlands (39.7%) and Switzerland (35.5%), whereas the lowest proportion of persons who died of cancer was in Greece (19.5%). Most of the deceased who died of cancer had been ill for one year or more, and those who were ill for one year or more were also hospitalised more than five times. These trends suggest that health care policies aiming at de-hospitalisation of care for cancer patients may reduce health care costs. Each cause of death was equally distributed by gender except for decrepitude, dotage and senility, where 65% of the deceased were female. Substantial variations in place of death were found (Table 3). Even though hospitals was the most common place of deaths for most countries included in the study, the share of hospital deaths varied from 32% in the Netherlands to 56% in Spain. The highest share of care home deaths was recorded in Sweden (30.9%), followed by Denmark (28.8%), the Netherlands (25.4%), Switzerland (23.9%) and Belgium (21.4%). The highest proportion of the deceased who died at home was in Greece (50.19%) and Italy (50.23%), which is not surprising given that those countries also had the highest proportion of deceased who died of heart attacks and strokes (ranging from 59.8% in Greece to 42.1% in Italy; Table 1). Based on these trends, Table 2 shows that most of the deceased in the Country Group 2 died at home (50.7%) while most of the patients in the Country Group 1 died at hospital (42.1%) with a substantial share of patients who died in care homes (26.6%) compared to Country Group 2 with only 7.4% of the deceased coming from

care homes. If we look at the most common place for deaths of cancer patients, the picture is much different in Country Group 2 (Table 3). Most of the cancer patients in Country Group 2 died at hospital (57.8%), while in Country Group 1, a lower share of cancer patients (46.0%) died at hospital compared to Country Group 2.

Table 2.2.1 Characteristics of deceased persons in 11 European countries by gender, age, marital status and use of end-of-life care services in 2004-2017

Country	Characteristics of deceased persons					Use of end-of-life care services	
	N	Female (%)	Mean Age - Female	Mean Age - Male	Married(%)	Nursing Home	Hospice
Austria	634	51.7	79.6	75.6	41.6	10.4	2.8
Belgium	814	47.2	80.8	77.7	50.9	16.1	11.3
Denmark	736	51.2	80.2	78.0	41.3	23.5	4.2
France	721	47.9	82.2	77.7	49.9	15.1	15.0
Germany	426	43.9	76.8	74.5	60.8	13.4	4.7
Greece	816	52.2	84.6	80.8	42.6	1.2	0.0
Italy	863	46.6	80.1	77.7	60.7	5.3	2.4
Netherlands	277	40.1	77.9	74.8	55.6	14.8	4.3
Spain	1499	46.6	83.1	79.3	50.0	7.1	1.7
Sweden	853	46.7	82.5	80.7	45.5	19.9	12.0
Switzerland	321	41.4	81.0	79.1	54.8	12.2	10.3
Total	7960	47.6	81.4	78.3	49.5	12.2	5.8

Note: Percentages might not sum to 100 because the categories “other” and “unknown” were omitted.

Table 2.2.2 Cause of death of deceased persons in 11 European countries in 2004-2017

Country	Cause of death					
	Hearth attack, stroke or other CVDs	Cancer	Disease of the digestive system	Severe infectious disease	Respiratory disease	Decrepitude, dosage, senility
Austria	41.4	22.1	4.3	7.6	3.9	8.5
Belgium	29.0	29.7	3.6	7.2	6.2	8.6
Denmark	24.4	31.9	3.3	6.5	7.2	12.4
France	33.2	31.9	3.2	3.9	6.5	6.7
Germany	35.5	30.8	2.6	8.3	3.1	5.2
Greece	59.8	19.5	1.3	4.3	5.7	3.3
Italy	42.1	32.8	2.7	3.9	6.3	3.5
Netherlands	29.4	39.7	2.5	7.3	2.2	6.2
Spain	37.1	24.0	2.7	5.6	10.5	7.0
Sweden	33.4	29.3	1.6	6.3	3.9	13.0
Switzerland	27.1	35.5	3.2	7.8	3.7	10.6
Total	36.9	28.3	2.8	5.9	6.3	7.6

Note: Percentages might not sum to 100 because the categories “other” and “unknown” were omitted.

Table 2.2.3 Place of death in 11 European countries as a percentage, 2004-17

Country	Hospital		Home		Care home	
	Total	Female	Total	Female	Total	Female
Austria	49.0	47.0	34.7	53.3	11.5	63.4
Belgium	48.1	43.5	26.5	35.3	21.4	66.5
Denmark	40.8	51.5	23.5	36.1	28.8	64.3
France	54.6	44.9	24.8	47.1	14.1	64.3
Germany	47.9	41.7	33.5	43.9	12.5	53.9
Greece	47.5	52.4	50.2	52.7	1.1	55.6
Italy	42.9	45.4	50.2	46.7	3.7	62.5
Netherlands	32.0	27.6	37.5	33.3	25.4	60.9
Spain	56.5	44.4	34.9	48.3	6.6	54.1
Sweden	39.3	42.4	22.4	41.0	30.9	58.9
Switzerland	44.3	42.5	24.8	32.1	23.9	48.0
Total	47.5	45.2	33.5	45.4	14.7	60.6
Country Group 1	42.1	43.8	25.3	36.3	26.6	61.1
Country Group 2	38.5	45.9	50.7	49.0	7.4	59.4

Note: Percentages might not sum to 100 because the categories “other” and “unknown” were omitted.

Table 2.2.4 Place of death of cancer patients as a percentage, 2004-17

Country	Hospital	Home	Care home
Austria	65.7	26.9	1.5
Belgium	55.3	25.7	10.6
Denmark	41.5	29.0	15.2
France	63.3	20.2	6.0
Germany	54.6	27.7	6.2
Greece	61.6	37.1	0.6
Italy	43.6	48.9	3.9
Netherlands	29.9	52.3	9.4
Spain	62.1	33.4	3.1
Sweden	45.3	28.6	16.3
Switzerland	52.2	25.7	12.4
Country group 1	46.0	30.3	13.3
Country group 2	57.8	33.7	3.6

Note: Percentages might not sum to 100 because the categories “other” and “unknown” were omitted.

2.2.2 Determinants of Place of Death

Reference is now made to the model used and interpretation of the results. The outcome measure in multinomial logistic regression analysis is the place of death with hospital treated as the referent group given that it is the most frequently occurring group. Under place of death are two replicates of predictor variables, representing the estimated two models: home relative to hospital and care home relative to hospital. Explanatory variables are demographic characteristics (age, gender), socioeconomic status and support (marital status, own home), services received in the last year of life (number of hospital stays), factors related to illness (cause of death, duration of illness) and "year died" (2004-2011, 2012-2017) – a time dummy variable to provide control for the effect of time such as an increasing number of LTC beds. The choice of the variables is based on the past similar reasearch (see Cohen, J and Deliens, L., 2012; Cohen et. al., 2007; Pivodic et. al., 2017).

Results show that in comparison with patients who died of other diseases (reference group), cancer patients in Country Group 1 had a significantly higher risk of dying at home than in hospital (Table 4). On the other hand, a person with cancer in Country Group 2 lowers the risk of dying at home or care home than in hospital. Generally speaking, cancer patients in Country Group 2 were more likely to die in hospital. Older patients and those suffering from decrepitude, dotage or senility in Country Group 1 have a significantly higher risk of dying at home or in a care home setting than in hospital. Conversely, older patients in Country Group 2 are more likely to belong to the comparison group (at home or in a care home) relative to hospital. A woman in Country Group 1 has a higher risk of dying in a care home setting than in hospital, subject to other factors remaining constant. When it comes to socioeconomic status, owning a home or being married in Country Group 1 increases the risk of dying at home rather than in hospital, while owning a home is not a significant factor contributing to dying at home in Country Group 2. Moreover, the relative risk of dying at home rather than in hospital for Country Group 1 increases with time, suggesting certain positive trends in unobserved variables such as investment in LTC over time.

Table 2.2.5 The relative risk ratio for factors related to the probability of dying in hospital, at home or in the care home for 11 European countries, 2004-2017

	Country group 1		Country group 2	
Factor	Home	Care Home	Home	Care Home
Intercept	0.298***	1.023	0.760	0.213***
Cause of death				
Hearth attack, stroke or other CVDs (ref:Other)	2.056***	0.577**	0.770	0.604
Cancer (ref:Other)	1.992***	0.341****	0.634**	0.302**
Disease of the digestive system (ref:Other)	0.562	0.270**	0.614	0.123**
Severe infectious disease (ref:Other)	0.372**	0.369***	0.297****	0.370*
Respiratory disease (ref:Other)	1.013	0.457**	0.356****	0.446*
Decrepitude, dotage, senility (ref:Other)	3.200***	1.710*	1.581	1.741
Age 80 and older	0.859	3.725****	1.602****	2.518****
Female	0.887	1.341*	1.010	1.388
Married	1.314*	0.502****	0.951	0.512***
Own home	1.293*	0.565****	0.956	0.799
No. of times in hospital				
Not at all (ref: 1-2)	2.345****	1.359	3.451****	1.073
Three times or more (ref:1-2)	0.761	0.683**	0.988	1.087
Duration of illness				
< 6m > 1y (ref: 1y or more)	1.244	1.066	0.840	0.801
< 6m (ref: 1y or more)	0.699**	0.437****	0.656	0.610**
Year died				
2012-2017 (ref: 2004-2011)	1.313*	1.041	0.866	1.221

*p < 0.10 **p < 0.05 ***p < 0.01 ****p < 0.001

2.2.3 Determinants Contributing to Frequency of Hospitalisation

Table 5. shows the results of binary logistic regression used to predict the odds of being hospitalised three times or more in the period 2004-2017, based on the values of the independent variables (predictors), which in this case are demographic characteristics (age, gender), factors related to illness (cause of death, duration of illness) and "year died" (2004-2011, 2012-2017) – and a time dummy variable to control for change of other unobservable variables over time (the choice of covariates is based on Pivodic et al., 2017). Odds ratios for factors related to the probability of being hospitalised three times or more varies between the two country groups. In both country groups, the duration of illness, age and cause of death are significant in assessing the probability of being hospitalised three times or more. Patients who were ill less than six months have less chance of being hospitalised many times, while being ill for a more prolonged period logically increases the chance of being hospitalised more times. Therefore, it is not surprising that having cancer raises the odds of being hospitalised three times or more since the descriptive analysis shows that cancer patients are often ill for one year or more. However, it must be noted that the effect of having cancer on the frequency of hospitalisation is much stronger in the second group of countries where the expenditure on LTC is low and is predominantly privately funded. Accordingly, cancer patients in Country Group 1 were 1.694 ($p < 0.01$) times more likely to be hospitalised three times or more, while cancer patients in Country Group 2 were 2.381 ($p < 0.001$) times more likely to be hospitalised for three times or more. Besides cancer, having a severe infectious disease in Country Group 2 is also highly associated with increasing the odds of being hospitalised three times or more. Finally, older persons seem to be less likely to be hospitalised three times or more.

Table 2.2.6 Odds ratios for factors related to the probability of being hospitalised three times or more (ref: 1-2 or not at all) in the last year of life 11 European countries, 2004-2017

	Country Group 1	Country Group 2
Factor	n=1,622	n=2,000
Intercept	0.828	0.491****
Cause of death		
Hearth attack, stroke or other CVDs (ref:Other)	0.965	1.227
Cancer (ref:Other)	1.694***	2.356**
Disease of the digestive system (ref:Other)	1.111***	1.082
Severe infectious disease (ref:Other)	0.894	2.381***
Respiratory disease (ref:Other)	1.468	0.879
Decrepitude, dotage, senility (ref: Other)	0.923	0.803
Age 80 and older	0.743**	0.694****
Female	0.938	1.059
Duration of illness		
> 6m > 1y (ref: 1y or more)	0.728*	1.166
< 6m (ref: 1y or more)	0.325****	0.224****
Year died		
2012-2017 (ref: 2004-2011)	1.381***	1.372**

*p < 0.10 **p < 0.05 ***p < 0.01 ****p < 0.001

2.3 Discussion

The data analysed in this paper shows substantial differences in the proportion of patients dying in hospital, care homes or at home across countries, suggesting a country-specific difference in end-of-life practices. While countries like Belgium, Switzerland, Denmark, Netherlands and Sweden had over 20 per cent of the total sample who died in a care home setting, countries like Greece had merely 1.1%, Italy 3.7% and Spain 6.6% of persons who passed away in care homes. The results of the multinomial analysis show that the place of death is partly influenced by individual factors such as the person's age, gender and living situation. Analysis of the age groups shows that younger patients have a higher risk of dying in hospital (rather than at home or in a care home setting) in countries where investments in end-of-life care are lower and where acute care is used as a substitute for informal and palliative care. Those older than eighty years of age seem to have a higher risk of dying in a care home setting in both country groups; however, the risk is much higher in Country Group 1 than 2. Descriptive analysis shows that the majority of patients who died of "old-age" (decrepitude, dotage and senility) were female and the mean age of death was higher for female than male (81.4 compared to 78.3), which is in line with other studies showing that women have a higher need for formal LTC services at the end of life due to the fact that (1) their life expectancy is higher, and (2) they are usually younger than and hence survive their spouses, which often implies that they are living alone and in need for formal care (Eisen, R. and Sloan, F. A. (eds.), 1996). The multinomial analysis shows that, in countries with a higher investment in LTC, women tend to have a higher risk of dying at home and in a care home setting than in hospital. This result suggests that those countries that invest more in LTC provide strong formal and informal support for patients at the end of their lives, which seems to be a good substitute for acute care provided by hospitals. There is some evidence suggesting that the use of formal LTC prolongs life expectancy, meaning that residents in nursing homes live longer than seniors living at home because they benefit from closer supervision (Weaver et al., 2009).

Nevertheless, some scholars argue that the opposite can also apply, in other words, after institutionalisation, older people may lose interest in life and die faster than if they remain in the community (Colombo et al., 2011). Despite differing views on the outcomes of formal and informal care, researchers agree that the elderly and infirm and their families need to be given a choice based on the type of service and choice of service provider, keeping in mind that socio-demographic transformations have caused an increase in the number of older people living alone in all European countries, while the number of those living with their children is declining (Ranci and Pavolini, 2013). Furthermore, it is a well-known fact that

women often remain widows and are more likely to depend on their own resources, such as children when needing care (Bettio and Platenga, 2004). Therefore, an appropriate public policy should support both formal and informal forms of care in order to avoid discrimination against individuals living alone and thus ensure LTC becomes a fundamental right of citizens.

The place of death is also influenced by factors related to illness. Some of these factors are straightforward and include dying of heart attack, stroke or other CVDs which increases the risk of dying at home rather than in hospital, and seems to be especially true for countries with high expenditure on LTC. However, results obtained in the case of cancer patients are rather interesting. While the descriptive analysis shows that the majority of cancer patients in both country groups die at hospital, the multinomial analysis shows that cancer patients have a higher risk of dying at home rather than in a hospital in the country group that invests more at the end of life care whereas, in countries that invest less in LTC, cancer patients have a higher risk of dying in hospital compared to both home and care home. This evidence suggests that countries like Belgium, Switzerland, Denmark, Netherlands and Sweden indeed provide cancer patients with out-of-hospital palliative care, meaning that they can even receive care in a home setting at the end of their lives. The descriptive statistics in this research shows that most of the persons who died of cancer had been ill for one year or more and were hospitalised the highest number of times in the last year of life. These results suggest that persons who died of cancer needed end-of-life care the longest and may benefit the most from hospice and palliative care. Moreover, the multinomial analysis shows that the risk of dying at home rather than in hospital increases with time in a country group that invests more in out-of-hospital care. Results from binary logistic analysis of determinants involving hospitalisation three times or more in the last year of life show that cancer is strongly associated with such hospitalisation. However, the effect is much more intense in the group of countries that invest less in end-of-life care and which is predominantly privately funded. There are many benefits from substituting acute care with long-term or hospice care. Proper out-of-hospital care may lower the number of hospitalisations, lower the incidence of late and fatal hospitalisations, and lower the chances of in-hospital deaths. In countries like Greece, Italy and Spain, with predominantly private funding of end-of-life care and low investments in this type of care in general, there is a higher propensity to be admitted to an acute care setting given the financial burden.

2.4 Concluding Remarks

Under the premise that an acute care setting is a substitute for hospice and long-term care in countries where end-of-life care is privately funded, this paper investigates the differences in the place of death between two country groups in order to account for country healthcare specifics. With a higher expenditure on long-term (health) care, the first group of countries provides public funding of end-of-life care, while the second group of countries is orientated more toward private funding of end-of-life care, with Switzerland and Germany as the exceptions in both groups. With the help of binary and multinomial logistic models, this paper investigates differences in some form of association of place of death and frequency of hospitalisation between the two groups with the set of sociodemographic and health variables using the Survey of Health, Ageing and Retirement in Europe (SHARE) database on 7,960 people aged 48 years and over who died between 2004 and 2017 in 11 European countries. The results reveal that countries where public financing and organisation of end-of-life care are particularly strong have a higher share of out-of-hospital (care home and home) deaths, while the other group of countries has a higher share of persons dying at home and in hospital, especially for cancer patients. Patients who died of cancer in the first group of countries were more likely to die at home, while in countries with the lowest expenditure on long-term care, patients had a higher risk of dying in hospital than at home or in a care home, suggesting that health policies targeting de-hospitalisation of care of cancer patients may lead to a reduction in public health care costs. Moreover, waiting for death at home in countries with private funding of end-of-life care is associated with a higher frequency of hospitalisations at the end of life given that acute care is used as a substitute for long-term and palliative care. In general, the results reveal the importance of investing in long-term and palliative care as a substitute for acute care, aimed at de-hospitalisation of care given that many elderly needs can be met by hospices (palliative care) or nursing homes.

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Appendix

Appendix 2.A Comparing Long-term care regimes in selected European countries

Literature differentiates between various typologies of long-term care systems based on the different criteria such as demand and supply of LTC or financing regimes. For example, according to Lamura et al. (2007) who identified five typologies–by considering both care demand elements and factors affecting the supply of (formal and informal) care – which Nies and colleagues (2013) adapted to reach a four-regime typology[1] is summed up in the following table:

Table 2.A.1 Typology of long-term care systems (Lamura, 2007; Nies et al., 2013)

	Demand for care	Provision of informal care	Provision of formal care	Countries
Standard-care mix	Medium/High	Medium/Low	Medium	Germany, Austria, France
Universal-Nordic	Medium	Low	High	Sweden, Denmark, The Netherlands
Family based	High	Low	Low	Spain, Italy, Greece

We can see that our first cluster in the analysis consists of countries with the family-based and standard-care mix. In contrast, the second group of countries mainly includes countries that adapt Universal-Nordic.

Besides the demand and supply based typology, the financing mechanism for LTC services can be a good starting point of typology analysis of European long-term care systems. From this perspective, we can distinguish LTC systems predominantly funded by social insurance (Bismarkian models) and those mainly funded by taxes (Beveridgean models). Practically, however, EU member States generally adopt mixed strategies (Morciano, 2017).

Countries like Sweden and Denmark have LTC financed almost exclusively from the general government budget through taxes. The LTC system for older people in Sweden

[1]The fourth regime called 'Transition' is excluded from the table as it consists of countries that were not included in the analysis in this paper.

is comprehensive, and spending is higher than the EU-27 average. However, LTC is tax-financed, and out-of-pocket spending is around 4-5% of total costs, which is low compared with most EU-27 countries (European Commission 2021). Denmark has perhaps the most universal LTC system in the world. Danish long-term care (LTC) aims to increase the quality of life of people in need of care and increase their ability to take care of themselves. The LTC sector in Denmark provides formal care delivered primarily by professional welfare staff with relevant qualifications. For the claimant of LTC, public support means that LTC is provided free of charge in most cases. Furthermore, the out-of-pocket payments are low because LTC is financed by general taxation raised at both the local and the central levels. In other words, affordability is not the prime concern when it comes to LTC (European Commission 2021).

To ensure a clear and solid long-term financing base for LTC, several Member States established a dedicated universal social insurance scheme, such as the Netherlands. Along with Sweden and Denmark, the Netherlands make the most use of LTC formal carers. These carers work mainly in the Netherlands and Denmark, where more intensive support is generally given. Long-term care (LTC) for older people falls within the scope of the general LTC system. Governed by different frameworks, it is funded from different sources and organised at different administrative levels. As a result, health and social care and support, and formal and informal care, are mixed (European Commission 2021).

Among others, Belgium and Germany finance about half of their LTC expenditure by means of an insurance-based system. In Belgium, the health insurance system covers health care in nursing homes (residential care) and at home, and it has a well-developed system of social protection for (older) people in need of long-term care (LTC). Provision of LTC at home in Belgium consists of a combination of daycare centres, nurses and social services (home care). As mentioned, LTC in Germany is organised according to the insurance principle. The entire resident population is obliged to pay compulsory insurance contributions for LTC and is entitled to benefits from the LTC insurance scheme. Therefore, the structure and organisation of the LTC insurance scheme are closely linked to the principles of the German health insurance system. In general, a recipient may choose between three different arrangements: a care allowance, home care (in-kind), and residential care. The LTC insurance policy will pay expenses for basic care, social support and treatment according to the care level (European Commission 2021).

It is worth mentioning the case of Austria and France: they are countries with traditional insurance-based health systems, but they attribute only a small (France) or no (Austria) financial role to social insurance for financing LTC. Since the 1990s, France has developed several LTC policy measures and evolved towards a mixed model combining public measures and family care. A wide range of services in the social care and healthcare sectors support

both home care and residential care and additional options. They depend on different regulations (related to healthcare or social care systems), which create financial and administrative complexity (European Commission 2021).

The only country with significant coverage of LTC cost by private insurance in Greece, by financing about 20% of its total LTC spending. LTC in Greece is based on a mixed 'quasi-system' of services comprising formal (provided by public and private entities) and informal care, with primary responsibility for the financial and practical support of dependants resting firmly on the family. Formal LTC services in Greece entail mainly the provision of institutional/residential care and community-based care services, while the provision of home care services is somewhat limited. It should be noted, however, that the services provided are of limited coverage, and their supply falls well short of demand; thus, informal care (provided by family carers and paid carers) is estimated to cover the lion's share of the need for LTC among the Greek population. In Greece, long-term care (including prevention and rehabilitation services) continues to be an underdeveloped policy area, given that no comprehensive formal long-term care services guarantee universal coverage (European Commission 2021).

There is still limited development of home care and community-based services in Spain, and there are territorial imbalances in the supply of services and the different co-payment criteria. Formal employment is characterised by excessively high temporary and part-time employment rates, while informal care work continues to dominate the social structure of care. The primary LTC services are the following: technical assistance, homecare, day/night centres, and residential care. There is no free choice of professional providers. Technical assistance includes home Tele assistance (advice via the internet, alert system, monitoring system, etc.), offered to people with a moderate degree of dependency who live at home. The home care service (HCS) can be considered a support service for carers of people with a high degree of dependency. It includes help with personal care (European Commission 2021).

Italy is the EU-27 country with the highest share of people aged 65 and over. The Italian LTC public system is organised around two main pillars: cash transfers and services. A further distinction must be made between healthcare-related LTC provision and social care-related LTC within the services pillar. The fact that public LTC only partially covers social care and healthcare needs in Italy is evident when examining two phenomena: informal carers; and the share of households in need of LTC not using professional home care services for either financial or financial or non-availability reasons. Although public expenditure on long-term care (LTC) is not low compared with the EU- 27 average, the Italian public LTC system is still firmly based on informal care and migrant care workers, often with irregular contracts and limited diffusion instead of residential and home care services. There

are no national standards for in-home care and residential care, and many decisions and evaluation criteria are delegated to the regional and municipal levels. This situation produces extreme heterogeneity in evaluation conditions and access criteria. The most critical LTC scheme in Italy is the companion allowance (CA), which does not require beneficiaries any type of accountability on how the money granted is spent. More than half of Italian public expenditure on LTC, therefore, goes to a programme that intrinsically does not include any quality-assurance safeguards (European Commission 2021).

3 International Trade in Medical and Pharmaceutical Goods and Health Services: the Case of Croatia

As the number of elderly rise throughout Europe, economies are facing challenges transitioning to markets that are increasingly driven by goods and services linked to the elderly. Ageing society combined with rising incomes has led to changes in the structure of world demand as consumers of goods and services demand higher quality, better service, more choice and greater flexibility.

International trade in both goods and services sector has benefited from the liberalisation of trade and free movement of labour and capital. This is especially the case for the health sector which seems to offer new opportunities for international trade and ageing society as trade liberalisations in medical goods and health services offer countries opportunities to enhance their health systems through the access of foreign technology and generation of additional financial resources to improve infrastructure (Lautier, 2014).

The benefits of encouraging international trade in health are twofold.

- Firstly, making medical goods and health services more tradeable offers the opportunity to improve health status in countries with ineffective or less effective health system, which is beneficial for the welfare of both the health care seekers such as the elderly and the health care providers and population in general.

  While the benefits for the health care seekers may be straightforward, health care providers benefit from the development of the health sector as it generates better career and income opportunities for health professionals, increases the opportunity cost of migration to more prosperous countries and reduces the incentive to departure (Smith, 2004, Smith et al., 2009).

- Secondly, encouraging international trade in health sector imports is essential for the domestic economy as it allows enhancing the domestic health sector through import, making domestic resources more productive. The more productive domestic health sector, in turn, offers goods and services that are of higher quality, making them more desirable on the international markets. Therefore, besides improving the welfare of the elderly and population in general, investing and promoting the health sector could increase the country's non-price competitiveness and growth. Namely, under the premise that what is bought and sold in international markets reflects the fundamentals of the economy, increasing the share of exports of medical and pharmaceutical goods and health services in total exports could raise the countries non-price competitiveness and lead to a higher economic growth according to Thirlwall's law (Thirlwall, 1979).

There are several channels through which increasing the export of medical goods and health services can positively impact economic growth. For one, medical goods belong to the high technology manufacturers according to the Lall (2000) classification. Increasing the share of medical goods in total exports could boost the country's non-price competitiveness and lead to higher economic growth. Health services, on the other hand, require capital and investment in technology and equipment as well. In addition, health services and health-related travel expenditure (i.e. medical services, other health care, food, accommodation, local transport) encourage investment in new infrastructure, promote other industries directly and indirectly, and accelerate the adoption of new technologies. The growth of the health sector, therefore, leads to the growth of production, which has the potential to strengthen the economy and growth just like the export of goods sector (for a detailed discussion on the role of services in promoting growth see Ghalia i Fidermuc, 2015; Hajdinjak, 2014; Holzner, 2011; Nowak et al, 2007).

Under the premise that what is bought and sold in international markets reflects the fundamentals of the economy and taking advantage of Thirlwall's functions for export and import, this paper seeks to present the latest trends and developments in the trade of healthcare services and medical goods in the case of a small open economy such as Croatia. This is done by estimating the price and income elasticities with the help of a 'state-space' econometric model, and applying Kalman filtering techniques. The advantage of using the 'state-space' model is that it produces a dynamic time-varying estimate of the elasticity. Price and income elasticity is estimated for the aggregate exports and imports of medical goods and health services. The analysis is then repeated so that trade is separated between medical goods and health services to obtain the price and income elasticity for each sector. In the export and import functions, income elasticities are assumed to capture non-price factors that affect exports and imports, while the effect of price competition on trade is supposed to be

captured by price elasticities. In other words, this approach allows us to separate the effects of price changes from changes in the non-price factors that determine the income elasticity of demand. Non-price competitiveness encompasses all those factors other than price that influence consumer choice.

Overall, results show that price elasticity was not significantly different from zero in the long run except in health services imports, while income elasticity seems to be positive and highly significant in all other cases. In detail, aggregate exports seem to be more income elastic than aggregate imports, with health services exports more income elastic than medical goods exports. On the other hand, the income elasticity of health services imports does not seem statistically significant.

After presenting some stylised facts (Section 2), Section 3 explains the methodology and data used in the analysis, followed by the results of the analysis (Section 4). The final section of the paper discusses some policy implications (Section 5).

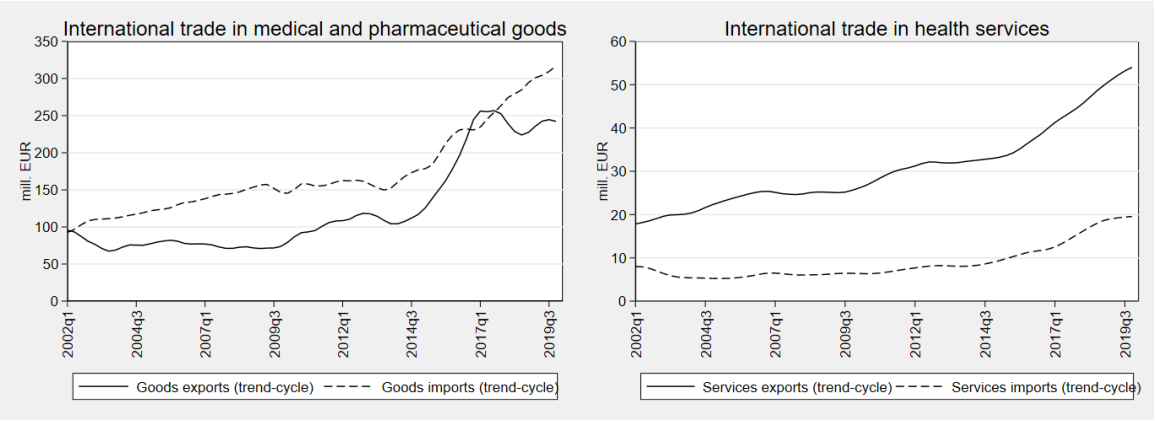
3.1 Some Stylised Facts

For small open economies such as Croatia, economic integration has vast importance as it facilitates trade in goods and services trade and movement of labour and capital, thus providing access to different markets, foreign technologies and best business practices. Croatia became a WTO member in 2000 and joined CEFTA in 2003; however, the benefits of economic integration became apparent after the EU accession in 2013. After joining the EU, Croatian exports and imports of medical and pharmaceutical goods rose sharply due to easier access to the common European market (Figure 1a). Market liberalisation and economic integration into the world market have enabled the Croatian industry to access new and more advanced technologies. Although Croatia has been a net exporter of health services since the 2000s, advances in information and communication technologies increased international mobility of service providers and patients, and growing private-sector participation after the EU accession has led to a sharp increase in exports of health services after 2013 (Figure 1b). The Croatian economy as a small Mediterranean country is highly dependent on the services sector (especially tourism), which is reflected in a significantly high share of exports of services in total exports.

Hajdinjak (2014) investigated the impact of tourism on industry and Croatia's growth in the short term and found evidence that tourism in Croatia is boosting capital goods imports, which in turn supports real GDP growth. Apart from Hajdinjak (2014), the described positive relationship was noticed by other authors on the example of other countries (i.e. Nowak et al., 2007, Holzner, 2011 and Ghalia and Fidermuc, 2015) who found evidence that tourism,

directly and indirectly, affects growth by strengthening the import of industrial goods and machinery which in the end increase productivity.

However, it should be noted that the health sector can boost the non-price competitiveness and economic growth much more than the tourism sector since it is well known that the health sector uses more sophisticated technology in providing health care services to non-residents. Moreover, with an increasing share of elderly in Europe, there is a growing demand for such goods and services linked to the elderly.



(a) **(b)**

Figure 3.1.1 Trajectories of real trade in medical and pharmaceutical goods (a) and health services (b) in Croatia, 2003-2019.

The ageing of the European population leads to an increase in the demand for medical goods and health services. Over the next 30 years, the old-age dependency ratio (elderly population (65+) over working-age population (15-64)) will keep rising in Europe. By 2090, the old-age dependency ratio (OADR) will double from about 30% in 2019 to almost 60% in 2090 (Figure 2). These changes will increase the pressure on health financing systems and call for reforms. Exploiting gains from international trade is an option for saving on resources. Importing more sophisticated technology such as telemedicine, telemonitoring, and other assistive technology could make the domestic health sector more efficient and reduce increasing expenses due to ageing and increasing demand for care. However, it could also satisfy the increasing requirements for better quality.

At the policy level, governments face the alternative of allowing or not the portability of (public or private) insurance. Suppose the portability becomes wholly or partially possible. In that case, a primary institutional barrier to trade will disappear and allow patients from other countries to seek appropriate health care and to purchase healthcare services abroad if the quality of domestic health services providers is not adequate.

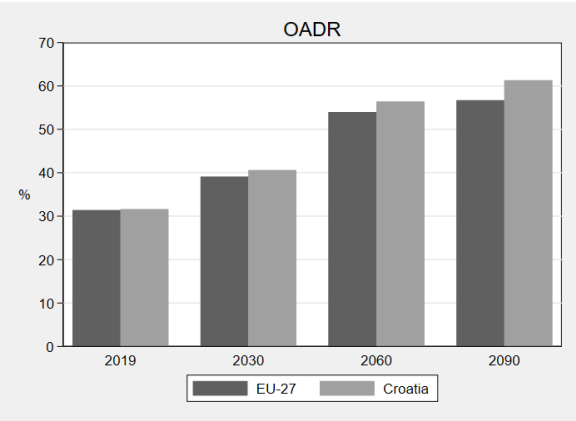


Figure 3.1.2 Projections of Old-age dependency ratio (OADR) for EU-27 and Croatia

In order to assess the developments in the Croatian health sector using indicators of price and non-price competitiveness, we need to estimate the price and income elasticities of exports and imports of medical goods and health services. This is done in the next paragraphs.

3.2 Data and Methodology

The analysis begins with estimating income elasticities of exports and imports with the help of the 'State-space model' and the 'filtering' technique. The 'State-space' model is used to estimate dynamic time series involving unobservable variables or parameters (in this case, elasticity), which describe the movements and evolution of the state of the primary system (in this case, imports and exports). The estimation of elasticities begins by defining two 'State-space' models, one for exports and one for imports, each model consisting of one *state* and two *space* equations. The rate of growth of aggregate exports (x) and imports (m) is given by (Felipe and Lanzafame, 2020):

$$\begin{aligned} x_t^T &= \sigma_t rer_t + \phi_t z_t^T + \varepsilon_{x,\,t} \\ \sigma_t &= \sigma_{t-1} + \varepsilon_{\sigma,\,t} \\ \phi_t &= \phi_{t-1} + \varepsilon_{\phi,\,t} \end{aligned} \tag{3.1}$$

$$\begin{aligned} m_t^T &= \eta_t rer_t + \pi_t y_t^T + \varepsilon_{m,\,t} \\ \eta_t &= \eta_{t-1} + \varepsilon_{\eta,\,t} \\ \pi_t &= \pi_{t-1} + \varepsilon_{\pi,\,t} \end{aligned} \tag{3.2}$$

Where rer stands as variations in the real exchange rate, z is the rate of growth of the main trading partners' income (EU-27 in this case), and y corresponds to the rate of growth of domestic income, where η and σ are the time-varying price elasticities of imports and exports, ϕ and π are the income elasticities of imports and exports, 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 Hodrick-Prescott filter. This procedure guarantees that our estimates reflect the long-term nature of the dynamic Harrod trade multiplier. To obtain time series for the state variables, we apply the "Kalman filtering" procedure to show the dynamics as this procedure contains a component of learning variation. In the export and import functions, income elasticities are assumed to capture non-price factors that affect exports and imports, while the effect of price competition on trade is captured in price elasticities. The supply characteristics of goods and services (such as their technical sophistication, quality, etc.) determine relative income elasticities (McCombie and Thirlwall, 1994).

As for health care, two kinds of determinants drive the demand, demographic and non-demographic (Maisonneuve and Martins, 2013). The demographic driver is related to the number of dependent people in the population and depends on the evolution of life expectancy and health expenditure. The non-demographic drivers are related to income developments and changes in the demand for medical products and health services. Income is assumed to have a direct effect via increases in living standards (GDP per capita) and an indirect effect via labour productivity differential between the health sector and the rest of the economy (relative productivity or Baumol) effects.

For Croatia, the only available data source on the trade of health services is "Balance of Payments Statistics" (BOP; based on the 6th version of the IMF's Balance of Payments and International Position Manual BPM6) obtainable from Croatian National Bank's (CNB) database. A BOP provides details on trade where health services are included in a subcategory of "travel", that is ", health-related travel expenditures". In the BOP, trade refers to goods and services transactions between residents and non-residents of an economy. Health services provided as a result of a non-resident patient moving across the border create exports for the host country. These exports include local expenditures of the foreign patients and their relatives in the hotel, food and transport sectors, the total foreign earnings induced by exports of health services and all other associated health services.

The data on trade of medical and pharmaceutical goods was also obtained from the CNB database as one of the products classified by the Standard international trade classification, abbreviated as SITC - a product classification of the United Nations (UN) used for external trade statistics (export and import values and volumes of goods), allowing for international comparisons of commodities and manufactured goods.

The analysis is carried out using quarterly data for the period 2002q1 - 2019q4. Data from the 1990s are not included in the analysis because numerous changes in the political and economic system have led to significant structural breaks in the data and such data are much less reliable. In addition, since this is a long-run analysis, only real values are used in the analysis. Data on real values (2015 = 100) of exports and imports of medical goods and health services and real GDP for Croatia were taken from the Croatian National Bank (CNB) database. The values of real exchange rates were calculated using data on nominal exchange rate values and consumer price inflation measured by the harmonised consumer price index (HICP; 2015 = 100) for Croatia and the euro area (EA-19) also obtained from the CNB database. Finally, the real values of GDP (2015 = 100) of Croatia's main trading partner - the EU 27, were taken from the Eurostat database.

Quarterly data on trade and GDP had to be seasonally adjusted, hence we applied the Census X-13 procedure using the ARIMA TRAMO Auto method as it provides smoother

trajectories compared to the ARIMA x-11 Auto method. ARIMA TRAMO Auto method was combined with SEATS seasonal adjustment method, which separates the original data into seasonal factors, seasonally adjusted, trend and an irregular component (for the results see A1). In the case of goods imports and total imports, some additional automatic outliers had to be specified as the standard ARIMA TRAMO Auto method was not detecting seasonality in the trajectories. The automatic outliers used in the procedure were additive, level shift, temporary change and seasonal.

3.3 Empirical Analysis and Results

Table 1. reports the results of the estimated elasticities, while Fig. 3 shows the dynamics of those elasticities. Overall, results in Table 1 show that price elasticity has not been significantly different from zero in the long run except in the case of imports of health services, while income elasticity seems to be positive and strongly significant in all other cases (except for health services imports). Aggregate exports seem to be more income elastic (5.1) than aggregate imports (1.4). Under the premise that income elasticity of demand measures the responsiveness of demand for a particular good to changes in consumer income, this evidence suggests that a 1% increase in real income of non-resident consumers leads to a 5.1% increase in export of medical goods and health services on average, after controlling for price effects. On the other hand, the income elasticity of aggregate imports seems to be less responsive to changes in domestic income as the results show that a 1% of increase in the domestic income leads to only a 1.4% increase in the aggregate imports on average.

These results suggest that Croatian people do not feel the need to import health goods and services from abroad when in income rises, implying that local health goods and services are not worst than those they can buy abroad.

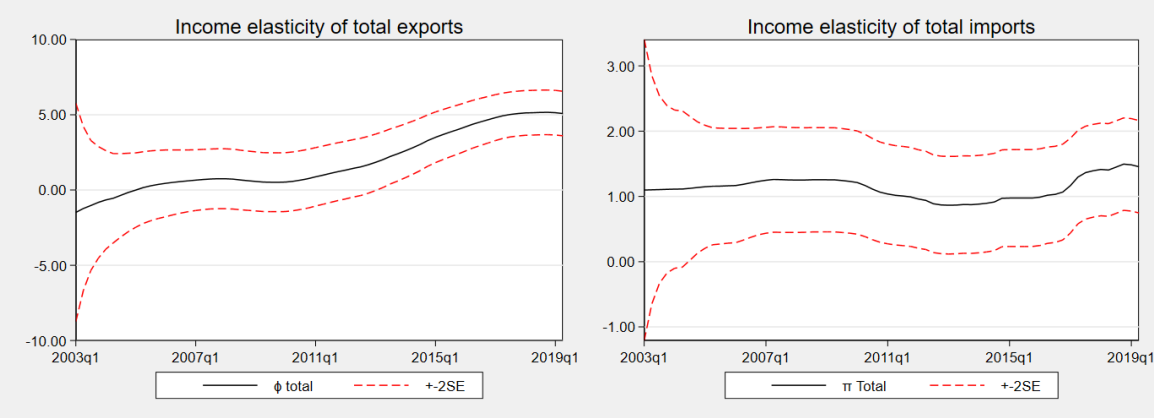
The results of the dis-aggregated analysis show that health services exports are more income elastic (9.2) than medical goods exports (5.5), suggesting that health services are using more advanced technology and sophisticated products to provide health services than the structure of medical goods exports. In other words, medical goods exports seem to be exporting products of lower technological value compared to the technology and products used in providing health services. Under the premise that income elasticities capture non-price characteristics of goods and services such as their technical sophistication and quality, these results reflect structural characteristics of Croatia's health sector and the economy at large, which seems to be in line with the recent evidence from the pilot survey conducted in 2018 by the Institute of tourism (TOMAS Health Tourism 2018). The survey covered was three market segments in health tourism: wellness, health spa and medical. The results

Table 3.3.1 State-space estimates of the price and income elasticities of exports and imports in Croatia, 2003-19

Dependent variable: Exports x			Dependent variable: Imports m		
Explanatory	Coef.	t	Explanatory	Coef.	t
ϕ total	5.083437	0.0000	π total	1.455169	0.0000
σ total	-0.174224	0.4794	η total	-1.435828	0.3374
ϕ goods	5.506694	0.0000	π goods	1.746530	0.0000
σ goods	-0.220611	0.4425	η goods	-2.273581	0.1504
ϕ services	9.183960	0.0000	π services	-0.840773	0.8118
σ services	-0.17747	0.3235	η services	-1.118716	0.0002

of the survey show that health tourism services are purchased by middle age and older individuals and the main motives are physical therapy, rehabilitation, relaxation and dental work. Physician expertise and reputation are the most important factors influencing choice of facility for both health spa and medical tourism segments.

If we look at the dynamics of our estimates in Fig. 3, we observe that the income elasticity of imports was more or less constant over time, while in the case of the income elasticity of aggregate exports, we see an increase over time. If we look at the dynamics of dis-aggregate income elasticities, we notice that the income elasticity of goods exports has been increasing over the observed period while the income elasticity of services exports display the opposite behaviour. Moreover, we observe that the trends in income elasticity of goods exports and aggregate exports seem to move together suggesting that the structure and volume of the goods exports has a strong effect on the aggregate income elasticity of total exports of the health sector. Interestingly, the response of imports and exports to changes in domestic and foreign demand during the financial crisis has shown resilience, which is important evidence knowing that the economic performance of a country or region crucially depends on how the respective productive structure responds to changes in foreign and domestic demand during the crisis and in general.



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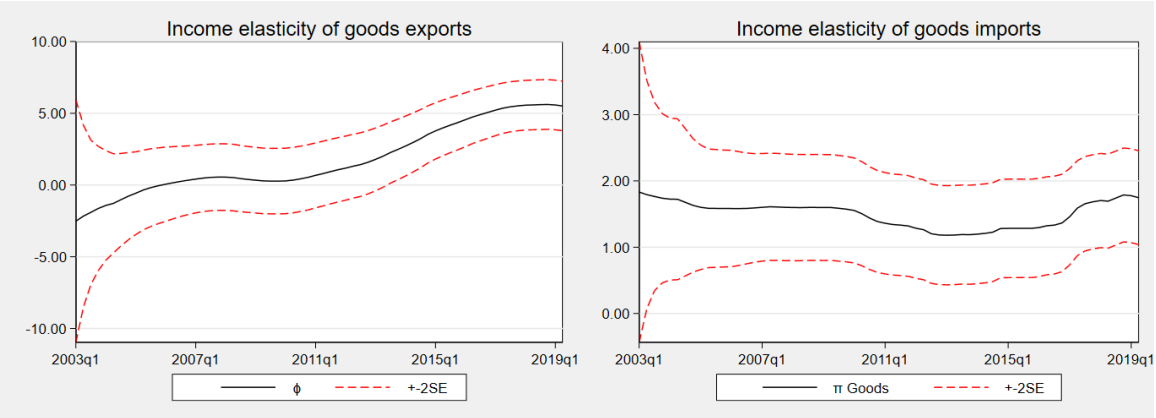

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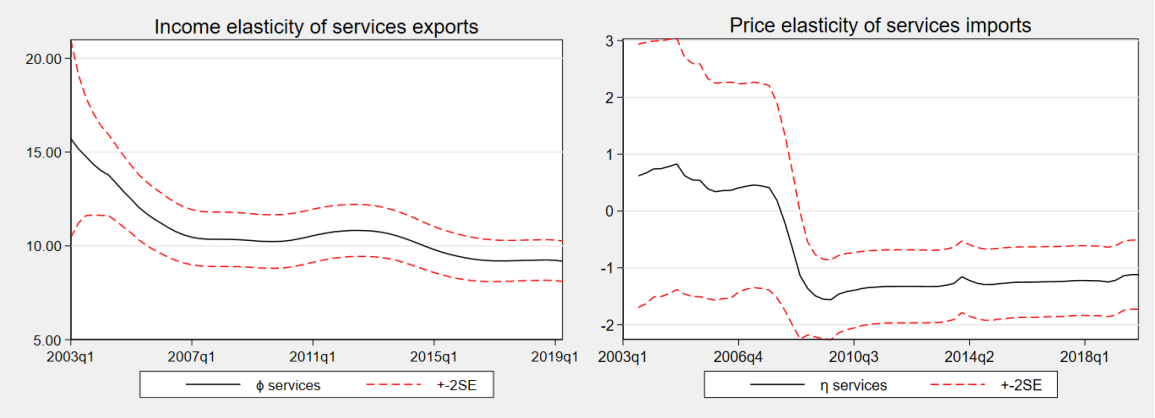

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Figure 3.3.1 Income and price elasticities of aggregate and dis-aggregate exports and imports of medical goods and health services, 2003-2019.

3.4 Concluding Remarks

In countries like Croatia, an increasingly older population combined with rising income are changing the structure of the demand for goods and services towards those consumed by the elderly. These goods and services are mainly related to the health sector resulting in rising health care costs on the one hand and higher quality, more choice and greater flexibility on the other hand.

Processes of globalisation and liberalisation of trade offer countries the opportunity to enhance their health systems through trading health technology in countries with comparative advantages. There are several advantages of encouraging international trade in the health sector. Firstly, trade offers the opportunity to improve health status in countries with ineffective health system through the process of imports, which is beneficial for the welfare of the elderly and population in general. Imports are important as they make domestic resources more productive, enabling the health sector to offer goods and services that are of higher quality, making them more desirable on the international markets. Moreover, the quality of domestic health care supply opens up a potential for the diversification and upgrading of a tourism industry that would be appropriate to the growth and ageing prospects of the European demand, for which the health and wellness dimensions of the tourism product will become increasingly attractive (Lautier, 2014).

Under the premise that what is bought and sold in international markets reflect the fundamentals of the economy and taking advantage of Thirlwall's functions for export and import, this paper presented the latest trends and developments in the trade of healthcare services and medical goods of Croatia. This was done by estimating the price and income elasticities with the help of a 'state-space econometric model and applying Kalman filtering techniques. Elasticity were estimated for the aggregate exports and imports of medical goods and health services. The analysis was then repeated by separating medical goods from health services to obtain the elasticity for each segment. In the export and import functions, income elasticities are assumed to capture non-price factors that affect exports and imports, while the effect of price competitiveness is captured by price elasticities.

Overall, price elasticity appears to have been not statistically different from zero in the long run except in health services imports, while income elasticity turned out to be highly significant in all cases except in health services imports. In detail, aggregate Croatian exports seem to be more income elastic than aggregate imports, with health services exports more income elastic than medical goods exports. Apart from documenting specific structural features of the Croatian economy, these results offer a more general indication, namely that trade in health goods and services significantly contributing to augmenting the economy's resilience

during the financial crisis. A final general policy pointer is that Croatian policymakers should be in favour of facilitating trade, focusing especially in the health and long-term care sector.

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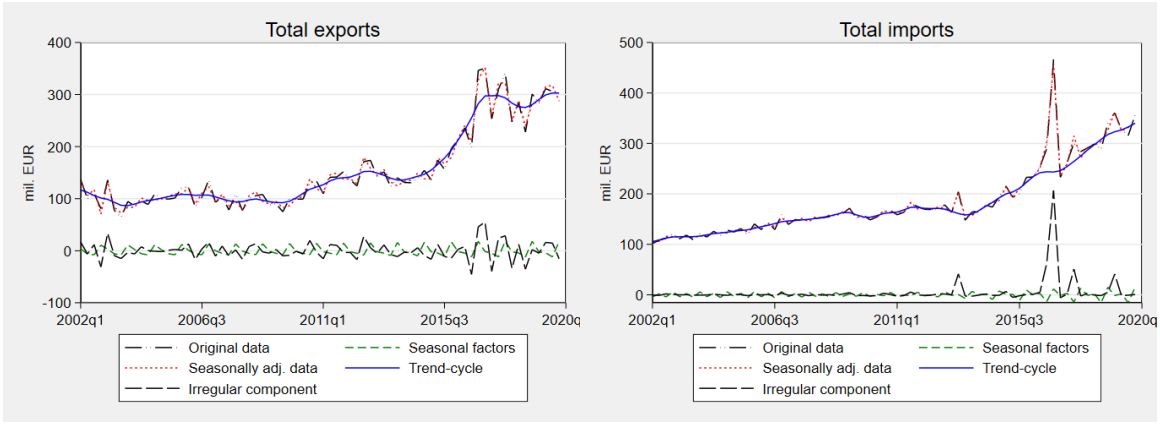
Appendix

Appendix 3.A Seasonally Adjusted Data



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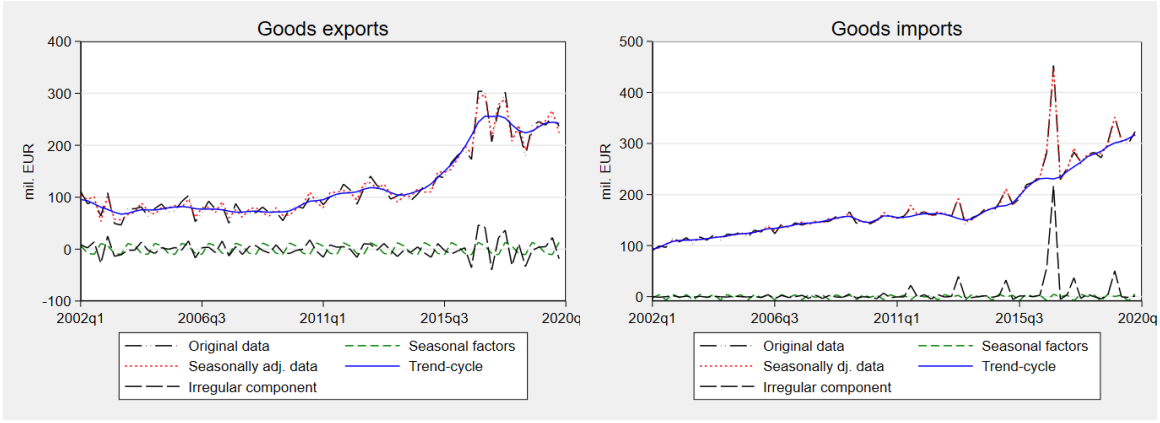

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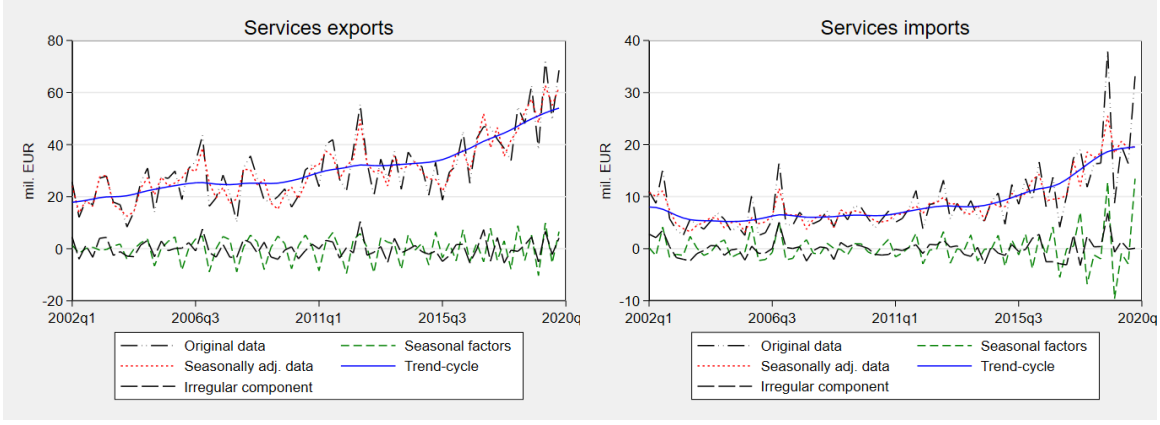

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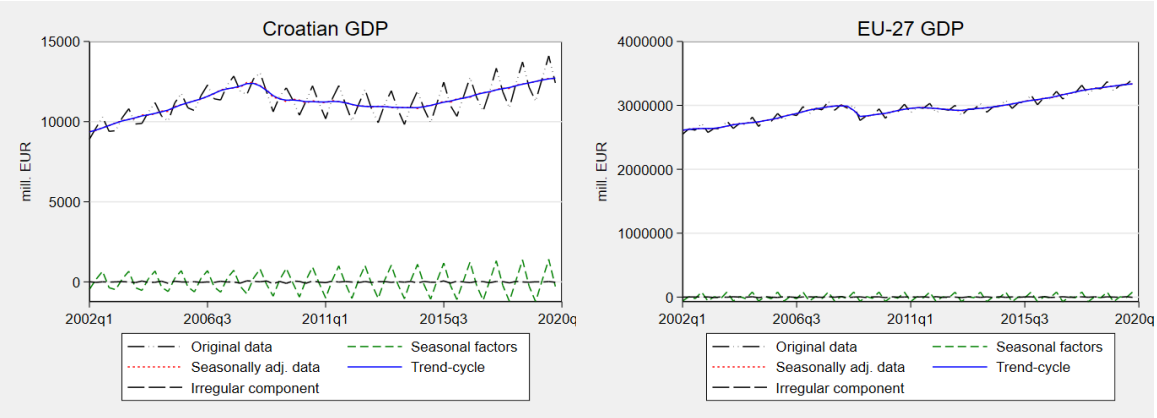
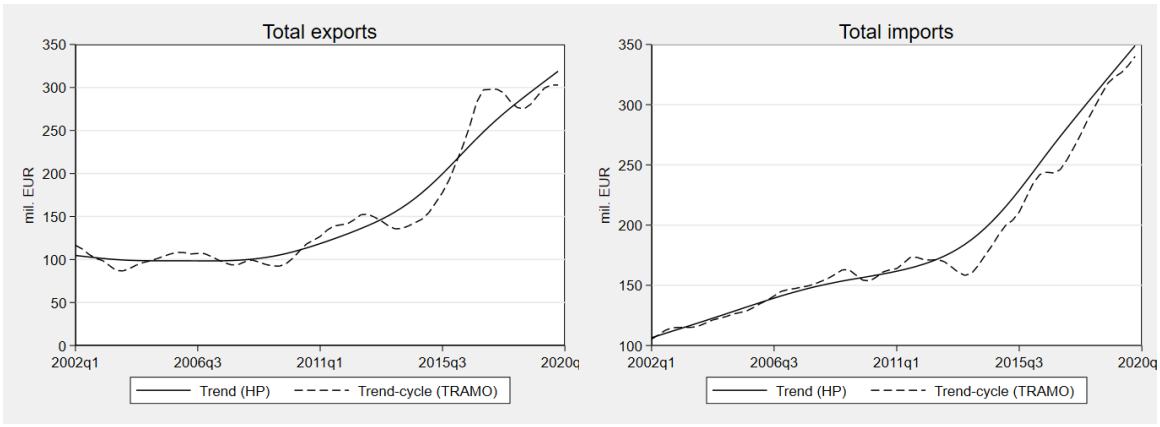
Figure 3.A.1 Seasonally adjusted data on trade and income.



(a) **(b)**

Figure 3.A.2 Income and price elasticities of aggregate and dis-aggregate exports and imports of goods and services, 2003-2019.

Appendix 3.B Comparison Between Trend and Trend-cycle



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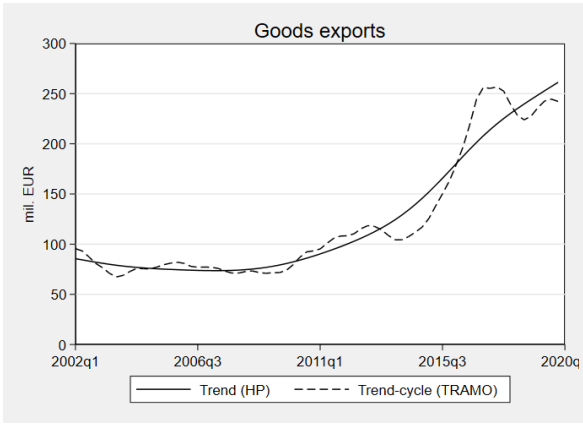

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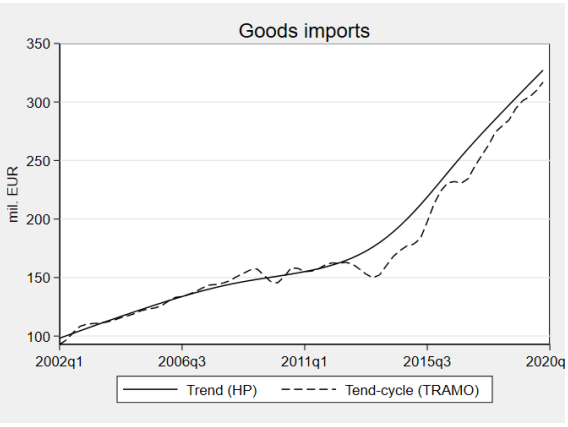

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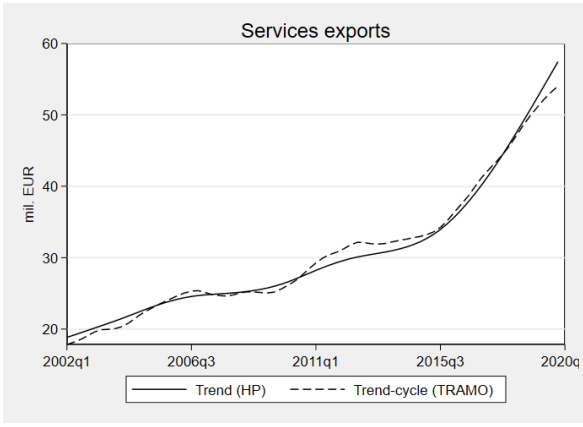

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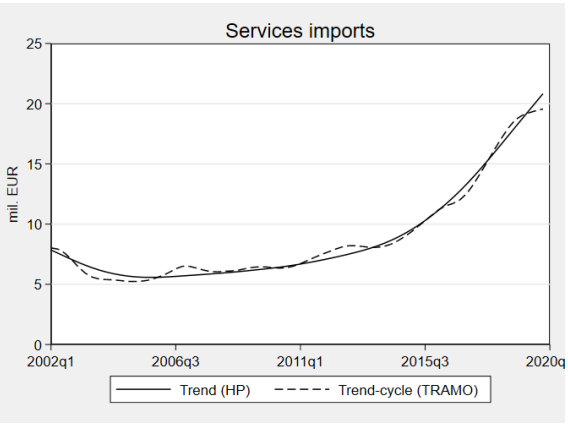

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Figure 3.B.1 Comparison of the trend (Hodrick-Prescott) and trend-cycle (TRAMO Arima) trajectories of exports and imports of medical goods and health services in Croatia, 2003-2019.

Conclusions

Europe is experiencing a dramatic shift in its demographic structure that is bringing to an end three centuries of unprecedented population growth. Whether population ageing and eventually its decline should be regarded as a problem is a controversial matter. There are few empirical estimates of the realised effect of such a process on economic growth. The first chapter of this thesis attempts to fill this gap in the literature by assessing the impact of demographic transition on the long-run economic performance of six European countries between 1971 and 2019.

Most studies on the field have relied on problematic production functions in which factors are paid accordingly with marginal productivities in a closed economy set-up. Instead, we adopted an open economy framework under the premise that the income elasticity of exports over imports reflects the fundamentals of the productive structure. In this way, we were able to explore a novel link between demographic transition, long-run economic performance, and the dynamic trade-multiplier. Applying time-varying-parameter estimation techniques, we showed that the rate of growth compatible with equilibrium in the balance-of-payments is a good predictor of long-run growth. Under the premise that the ratio between the income elasticity of exports over imports reflects the fundamentals of the productive structure, these estimates were employed to investigate the importance of age structure dynamics as one of its determinants. In Italy, for instance, a 10-points increase in the old-age-dependency ratio is associated with a 3% lower y_{BP}, while in France, we actually have a slightly smaller opposite effect. Analogously, for a 0.5% annual rate population decline, y_{BP} slows down between 0.3 and 2.25% in Portugal, Germany, France, and Austria, but is expected to accelerate in Italy.

Under the premise that an acute care setting is a substitute for hospice and long-term care in countries where end-of-life care is privately funded, this paper investigates the differences in the place of death between two country groups in order to account for country healthcare specifics. With a high expenditure on long-term (health) care, the first group of countries provides public funding of end-of-life care, while the second group of countries is orientated more toward private funding of end-of-life care, with Switzerland and Germany as the

exceptions in both groups. With the help of binary and multinomial logistic models, this paper investigates differences in some form of association of place of death and frequency of hospitalisation between the two groups with the set of sociodemographic and health variables using the Survey of Health, Ageing and Retirement in Europe (SHARE) database on 7,960 people aged 48 years and over who died between 2004 and 2017 in 11 European countries. The results reveal that countries, where public financing and organisation of end-of-life care are particularly strong, have a higher share of out-of-hospital (care home and home) deaths, while the other group of countries has a higher share of persons dying at home and in hospital which has shown to be especially significant for cancer patients. Patients who died of cancer in the first group of countries were more likely to die at home, while in countries with the lowest expenditure on long-term care, patients had a higher risk of dying in hospital than at home or in a care home, suggesting that health policies targeting de-hospitalisation of care of cancer patients may lead to the greatest reduction in public health care costs. Moreover, waiting for death at home in countries with private funding of end-of-life care is associated with a higher frequency of hospitalisations at the end of life given that acute care is used as a substitute for long-term and palliative care. In general, the results reveal the importance of investing in long-term and palliative care as a substitute for acute care, aimed at de-hospitalisation of care given that many elderly needs can be met by hospices (palliative care) or nursing homes.

In countries like Croatia, increasingly ageing population combined with an increasing income are changing the structure of the demand for goods and services that are now more linked to the elderly. These goods and services are mainly related to health sector resulting in rising health care costs and putting pressure on enhancing the health sector as they are now demanding more sophisticated goods and services of higher quality, more choice and greater flexibility. Processes of globalisation and liberalisation of trade offer countries the opportunity to enhance their health systems through trading health technology in areas where countries have comparative advantages.

Under the premise that what is bought and sold in international markets reflect the fundamentals of the economy and taking advantage of the Thirlwall's functions for export and import, third chapter presented the latest trends and developments in the trade of health-care services and medical goods on the example of a small open economy such as Croatia. This was done by estimating the price and income elasticities with the help of a 'state-space' econometric model and applying Kalman filtering techniques.

Overall, results showed that price elasticity has not been statistically significant in the long run except in the case of health services imports while income elasticity seems to be highly significant in all other cases. In detail, aggregate exports seem to be more

income elastic than aggregate imports with health services exports being more income elastic compared to medical goods exports. Under the premise that income elasticities capture non-price characteristics of goods and services such as their technical sophistication and quality, these results reflect deep characteristics of Croatia's health sector and productive structure. Moreover, the results showed that response of imports and exports to changes in domestic and foreign demand during the financial crisis has demonstrated the resilience which is important evidence knowing that economic performance of a country or region crucially depends on how the respective productive structure responds to changes in foreign and domestic demand during the crisis and in general. We conclude that the policy makers should encourage international trade in the health sector as the results of this analysis point out that this sector showed the resilience during the financial crisis and increasing the share of exports of health sector in total exports can increase the non-price competitiveness and economic growth in a small-open economies such as Croatia.

List of Figures

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