

Ecological Consequences of Western Growth Models

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Level and evolution of economic growth and underlying drivers of growth vary from country to country. The post-Keynesian growth regime literature has derived four basic types of growth regimes of developed Western economies that are either domestic demand-oriented or export-oriented and are indebted to foreign countries or hold a surplus of foreign assets. This typology is based on a balance-sheet approach and a comprehensive set of indicators to assess and monitor the development of growth and its drivers. So far, however, little is known about whether specific growth regimes are more or less environmentally damaging. Although ecological issues have long been present in both mainstream economics and heterodox approaches and post-Keynesian models exist that include ecological variables, the literature in the field of macroeconomic growth regimes does not focus in detail on ecological consequences of specific growth models. This paper addresses this gap by comparing the growth regimes of selected countries to the resource consumption and emissions and waste they generate. Due to the limited data available, a purely descriptive, indicator-based approach is chosen. It turns out that, in general, export orientation and a build-up of assets against foreign countries go hand in hand with a higher environmental impact per capita, which can be explained by the export surplus causing a higher use of resources and more bads. Further research is required to take into account global value chains and short-term effects of changes of growth regimes.

1. Introduction

Ecological issues have long been present in both mainstream economics and heterodox approaches. Malthus (1798), known for his conclusions on population theory, arrived at them based on the assumption that food production can at best grow arithmetically due to the finite number of cultivable areas, but population can grow geometrically. At the beginning of the 20th century, Hotelling (1931) developed a model for the use of non-renewable resources that is still fundamental today. Georgescu-Roegen (1971) addressed energy and material flows at the beginning of the 1970s and argued that resource use always goes hand in hand with resource consumption. Today economic advice is also sought on ecological issues such as the internalisation of costs in prices and

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the creation of certificate markets, but recently other disciplines and actions were probably more influential in the public debate and in politics. In Western industrial nations, for example, the report of the Club of Rome (Meadows et al. 1972) with its scenario modelling reached both the academic and the broader public, just as today the Intergovernmental Panel on Climate Change succeeds with its reports in drawing well-founded attention to ecological problems, especially climate change (cf. for example the latest report on climate change, IPCC 2022).

For economics, insofar as it explicitly wants to model ecological limits of economic activity and sustainable economic activity, the question immediately arises as to whether the role of growth, which is perceived as positive in economics and is deeply anchored in the models of the discipline, can still be maintained. In this regard, an extensive literature has developed in recent years that questions the capitalist growth model and focuses on a significant reduction of growth (cf. as an overview Hickel 2019 and Kallis et al. 2012 as well as for the concrete effects of a shrinking or stagnating economy the model-based scenario analyses in Victor 2011 and Jackson/Victor 2020).

In order to answer the question of the environmental consequences of economic growth, this paper takes a look at the post-Keynesian growth regime theory, which allows us to identify specific growth regimes and to show their *economic* consequences. Based on this, the aim of this paper is to show the *ecological* consequences of growth regimes.

Accordingly, the paper is structured in such a way that Chapter 2 provides an overview of the growth regime literature and elaborates to what extent ecological issues have been taken into account so far. The third chapter provides a theoretical framework culminating in a typology of growth regimes based on sectoral balances, growth contributions and the current account. Chapter 4 describes the indicator-based approach, the results of which are presented in chapter 5 for six selected euro area countries. The sixth chapter situates the results before the last chapter briefly summarises them.

2 The growth regime literature and its blind spot

The Varieties of Capitalism-approach (Hall/Soskice 2001, Hall/Gingerich 2009) is still the reference model in comparative research on growth models or regimes. The distinction between liberal versus coordinated market economies, which is fundamental to this approach, still shapes the discussion today. Based on national characteristics of industrial relations and country-specific variants of business cooperation or competition, two large groups of developed, capitalist economies can be distinguished, each of which supports growth in its own specific way. The competitive liberal type relies on competition at the firm level and is characterised by decentralised wage bargaining, while the counter-type of a coordinated economy is characterised by sectoral wage bargaining, cooperative industrial relations and networks between firms. Growth is primarily driven by radical innovations in the case of liberal market economies; incremental innovations dominate in the case of coordinated economies.

Due to the lack of a macroeconomic embedding of this literature, there have been recent attempts to complement or replace the Varieties of Capitalism-approach with the post-Keynesian growth regime literature (Baccaro/Pontusson 2016, Behringer/van Treeck 2019). Like the Varieties of Capitalism-approach, post-Keynesians have developed a typology of growth regimes that also seeks to explain in what way and how successfully economies can generate growth, but is based on macroeconomic indicators. The linchpin of the classification is whether economies are more export-oriented or more domestic demand-led. The reason for developing the approach was external imbalances in the euro area that built up until the global financial and economic crisis of 2007/8, as well as the consequences of this crisis for the growth regimes after the crisis and the subsequent austerity policies in many euro area countries. The post-Keynesian growth regime approach aims to analyse these imbalances and it presents economic policy recommendations to reduce them (van Treeck/Niechoj 2011, Priewe 2012). Distributional issues in particular are made a subject of discussion (Behringer/van Treeck 2019). The focus is particularly on Germany with its current account surpluses over many years that have contributed significantly to imbalances and debt in some European countries (Lucarelli 2011). Price competitiveness via wage restraint, non-price competitiveness via quality advantages and the role of foreign demand are discussed as causes of the German current account surplus (Stockhammer 2011, Storm/Nastepaad 2015, Niechoj 2016, Priewe 2018). Possible negative consequences for Germany and the question of the generalisability of this growth regime are also explored (Niechoj 2012, 2014a, Eicker-Wolf/Niechoj 2018).

The post-Keynesian growth regime theory does not systematically consider the ecological consequences of growth regimes, hardly even in a cursory way. Post-Keynesian literature on ecological issues already exists but it does not directly connect to the above mentioned growth regime typology. It attempts to expand post-Keynesian models in a stock- and flow-size-consistent manner to include ecological variables (cf. for example Davermos et al. 2018) or examines the extent to which a possibly ecologically necessary zero or negative growth can be captured and analysed by post-Keynesian models (Hein/Jimenez 2022). For it is clear that all economies are coming up against ecological limits in the face of climate change, declining biodiversity and a continued seemingly unrestrained consumption of resources. This raises the question of the extent to which a change towards a greener growth model is possible and whether this can continue to be accompanied by quantitative growth. As Priewe (2022) shows with a scenario analysis, a zero-growth path would have far-reaching consequences for modern, accumulation-driven economies and would tend to have a destabilising effect, i.e. it would cause crises, and moreover could not even guarantee that the ecological carrying capacity of the planet would be maintained. But qualitative growth in the sense of decoupling economic growth from negative ecological consequences is also very unlikely, as the study by Schröder and Storm (2020) shows by means of a regression analysis for 58 OECD countries.

3. Debt- and export-led growth regimes

The term growth regime describes a constellation of factors that bring about economic growth in a country-specific way. In one country, for example, growth dynamics can be based primarily on an export surplus, whereas elsewhere domestic consumption drives growth. The term regime does not necessarily mean that national (or, in the case of the EU, supranational) actors have consciously produced or created a certain growth constellation; rather, it is an interplay of actors' interests, historical contingencies and path dependencies that lead to a growth regime and stabilise it.

Accordingly, regimes are stable over certain periods of time, otherwise they could hardly be identified, but this does not exclude the possibility of changes when either the environment changes or the regimes reconfigure themselves. In recent years, it was above all the global financial market crisis of 2007/8 with the subsequent debt crisis in the euro area and, most recently, the growth slump caused by the Covid 19 pandemic and further problems due to the Ukraine war that not only reduced growth but also influenced the growth drivers in the respective countries and, especially in the case of debt-oriented growth regimes, revealed the economic limits of such regimes.

The starting point for a typology of growth regimes is the balance sheet of the sectors of an open economy: the private sector, which includes households and businesses, the public sector, and foreign countries that trade with the domestic economy (cf. also the much more in-depth presentation in Zezza 2006). These sectors can be found in the simple model of an open economy, in which national income Y is based on private consumption C , private investment I , government consumption G and the difference between exports and imports ($X - M$).

Accordingly, by definition it holds:

$$Y = C + I + G + (X - M).$$

Since by definition it is also true that national income equals consumption, household saving (S) and taxes (T), so that $Y = C + S + T$ holds, equating the two national income equations and eliminating C on both sides results in:

$$S + T = I + G + (X - M).$$

And finally, by subtracting I , G and $X - M$ on both sides:

$$(T - G) + (S - I) + (M - X) = 0.$$

Since $T - G$ represents government revenue and expenditure, $S - I$ household saving and business investment (together, therefore, the private sector), and $M - X$ the foreign sector (whereas $X - M$ represents net exports from the perspective of the home country), it follows that all sectors taken together must add up to zero. Or put another way: If the balance of a sector is negative, i.e. it shows a deficit, it is imperative that at least one other sector shows a positive balance, i.e. it achieves a surplus. If, for example, the foreign sector shows a deficit, the sum of the private and public sectors must be positive. Or formulated in even more detail: If a country exports more in value to a foreign

country than it imports, the foreign sector is in the red, i.e. it must go into debt in order to be able to pay for the export surplus of the home country; then either the government and/or the private sector of the home country must show a surplus, which means that the government spends less than it takes in and/or the private sector saves, namely the value of the export surplus, since the goods and services corresponding to the export surplus are not used in the country but flow abroad, so that the home country acquires claims against the foreign sector, i.e. other countries.

These balance mechanics are inherently compelling, i.e. all balances taken together must be balanced by definition at the end. How the sectors develop and whether there is a current account surplus or deficit depends on what drives growth or, to put it another way, what contributions to growth the individual sectors make. These are always cyclical and fluctuate accordingly. In principle, however, growth can be driven more by domestic demand (private and public sector) or by foreign demand (foreign sector or exports). Another factor is whether domestic demand is financed by foreign debt (foreign sector with positive balance and current account deficit of the country) or not. These different growth contributions and sectoral balances are in turn reflected in the current account balance, which turns out positive or negative or roughly balanced. In the end, however, this balance mechanics view says nothing about the underlying causalities. Why exports contribute strongly to growth in one country or why domestic growth stagnates in another country requires an additional, empirically based and theory-supported analysis and cannot be derived from the balance mechanics view, but the theoretical interpretation of the empirical situation must be compatible with the balance mechanics.

Data for the sectors mentioned are available. In the balance of payments, i.e. the statistical recording of a country's transactions with foreign countries, the sectoral balances correspond to the balance mechanical consideration of a) net lending/borrowing of households and companies (private sector), b) net lending/borrowing of the public sector, and c) the current account balance including changes in assets, which thus includes not only trade in goods and services but also inflows and outflows of earned and investment income and various types of transfers (cf. Federal Statistical Office 2019: 443-453). Values for the foreign sector are obtained by reversing the sign of the current account incl. the changes in assets of the domestic sector.

The four growth regimes relevant to the literature can be described on the basis of the balance mechanical view as in Table 1 (cf. for an analogous distinction Hein/Martschin 2021, p. 497f.).

Table 1: Typology of growth regimes

Regime	Growth contributions	Sectoral balances	Current account
Debt-led domestic demand growth	Private sector supports growth through debt	Private sector in deficit, foreign sector in surplus	Negative
Balanced domestic demand growth	Domestic sectors primarily contribute to growth	Household sector in surplus, public sector and possibly corporate sector in deficit, roughly balanced foreign sector	Balanced or slightly negative
Weak export-led growth	Exports and/or private sector demand drive growth	Private and public sector slightly negative and foreign sector slightly positive or private and public sector slightly positive and foreign sector slightly negative	Slightly negative or positive
Strong export-oriented growth	Exports carry the growth	Private sector in surplus, foreign sector in deficit	Significant surplus

Source: Own representation

Two regimes tend to be supported by growth in domestic demand and especially in the private sector. They differ in whether the domestic demand-led growth is accompanied by a more or less balanced or negative current account and is correspondingly hardly or clearly supported by debt to foreign countries. The other two regimes have either a rather balanced current account or a current account in surplus, so that in the latter case claims on foreign countries arise. In the weakly export-oriented model, growth in these two regimes is partly driven by exports and partly by the domestic sector; in the strongly export-oriented model, exports clearly dominate and the private sector realises a surplus.

Indicators that depict the ecological side of an economy have not yet been systematically integrated into this approach. Nevertheless, economic activity does of course have an impact on the environment in that it extracts resources from the environment, converts them into products using energy and labour, thus providing benefits for consumers, but also generating resource consumption and waste during production. Depending on the volume of goods and services produced and the technology used, this has more or less harmful consequences for biodiversity, resource stocks or the climate.

From the perspective of growth regime theory, it is interesting to figure out whether the extent of ecological consequences or the structure of the influence on the environment is growth regime-specific or whether no patterns emerge here. As a kind of null hypothesis, one could formulate that there is no systematic connection between growth regimes and ecological footprint. (Of course, this would not mean that growth regimes have no influence on the environment, it would only mean that the influence does not depend specifically on the growth regime). Alternatively, one could assume that export-oriented regimes have a different impact on the environment than debt- or domestic demand-led ones. However, the correlations here are not clear. For example, it can be argued that a successful export-oriented economy like Germany's certainly uses resources extensively and produces emissions and other waste in view of the high value added. At the same time, however, the German economy is internationally interconnected and technologically quite advanced. Accordingly, it would be reasonable to assume that a significant share of resource consumption or environmental pollution does not occur in Germany, but where intermediate products are produced for the German economy. A high level of development generally indicates a more careful use of resources and energy and outsourcing of bads. This would tend to result in a relatively lower burden on the environment from German production. In the case of debt-oriented regimes, it could be assumed that –if debt leads to a high real growth rate and a prosperous domestic economy– resource consumption (for example in the construction sector) would have to be relatively high. On the other hand, many products would be imported, so that negative environmental impacts would accrue elsewhere in production. The aim of this paper is therefore, if possible, to identify patterns of environmental stress and to assign them to growth regimes – or to show that this is not possible, or at least not possible given the data presented here.

4. Indicators for growth regimes and ecological consequences

In order to give a first assessment of whether different growth regimes have different ecological consequences, in the following I contrast the growth regimes elaborated in the theoretical part with indicators that measure the ecological state (and its development) on the basis of data on energy and resource consumption as well as emissions.

It is true that the literature knows numerous indicators for identifying and describing growth regimes, for example real interest rates, unit labour costs or the extent of public investment play a major role. However, as a rule of thumb a few indicators are sufficient to identify growth regimes, which can also be used to illustrate the possible causalities. These are the sectoral balances already mentioned in the theory section, their growth contributions and the current account balance. Data sources are the AMECO database and Eurostat. For supplementary indicators and empirical studies, reference is made here to works such as Hein/Martschin (2021), Hein et al. (2021) or Kohler/Stockhammer (2021), which reflect the current state of the discussion.

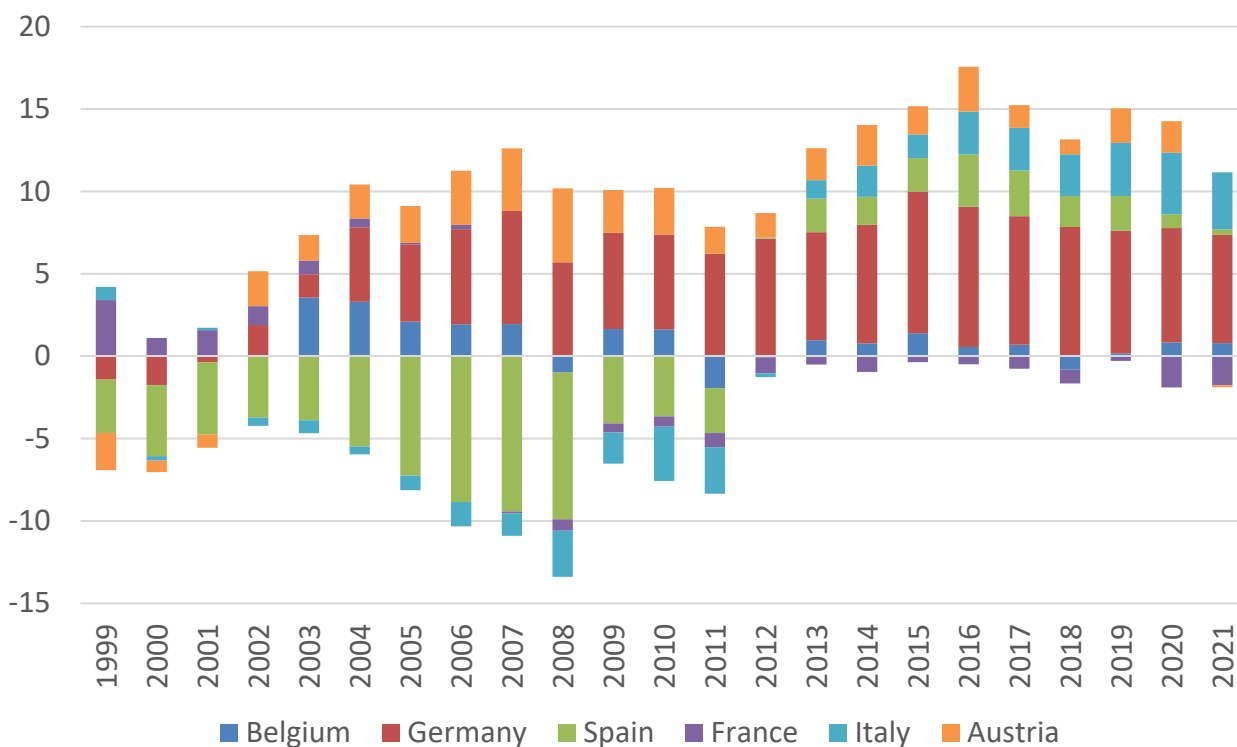
There is now no shortage of indicators for measuring ecological impacts. However, many indicators are unfortunately not available over longer periods of time and not for all the countries examined here. The study is based on data from Eurostat, as the survey methods are standardised here and extensive data is available for European countries, although here too the time series do not necessarily go back very far.

The countries were selected on the basis of theory and according to the four types of regimes distinguished above. Spain represents the type of debt-driven domestic growth, dominated by the private sector. Germany's growth, on the other hand, is driven by exports, whereas private demand hardly contributes to growth. In between are France and Italy. France represents a growth regime that is also dominated by domestic demand, but this is not accompanied by high foreign debt. Italy represents a country that is also export-oriented, but does not have the same high export surpluses as Germany. Consequently, all growth types are represented by one country, which makes a comparison between growth regimes possible. In order to be able to make an initial assessment of whether the similarities and differences that can be identified in this way are actually due to the different growth models or possibly have other causes, Germany as the representative of a strongly export-oriented growth regime is also compared with two other countries that are similarly dominated by exports: Austria and Belgium. If all three export-oriented countries showed the same pattern, this would be a further indication of stable, growth regime-specific consequences of economic activity for the environment. The time series of the countries start from the year for which data are available for all selected countries. It should be noted that while all the countries mentioned now use the euro and thus exchange rate fluctuations between these countries no longer play a role, this is not the case for the first years considered here, as exchange rates were only finally fixed in the course of monetary union from 1999 onwards and thus exchange rate fluctuations before 1999 affected sectoral balances. As with all the literature on growth regimes, the focus here is on developed economies, specifically Western European economies, in order to ensure a reasonably similar level of technology, so that technology-related distortions in the results can be at least partially excluded.

5. Growth regimes and ecological consequences of growth

When describing the sectoral balances of the selected countries, it is helpful to distinguish between two periods. This is because most countries show clear differences after 2007/8 compared to previous years, which can be seen in the development of current account balances (cf. Figure 1).

Figure 1: Current account balances summed by deficits and surpluses as a percentage of national GDP, selected countries, 1999-2011 (Belgium: 2003-2021)



Source: Eurostat, own calculations and own presentation

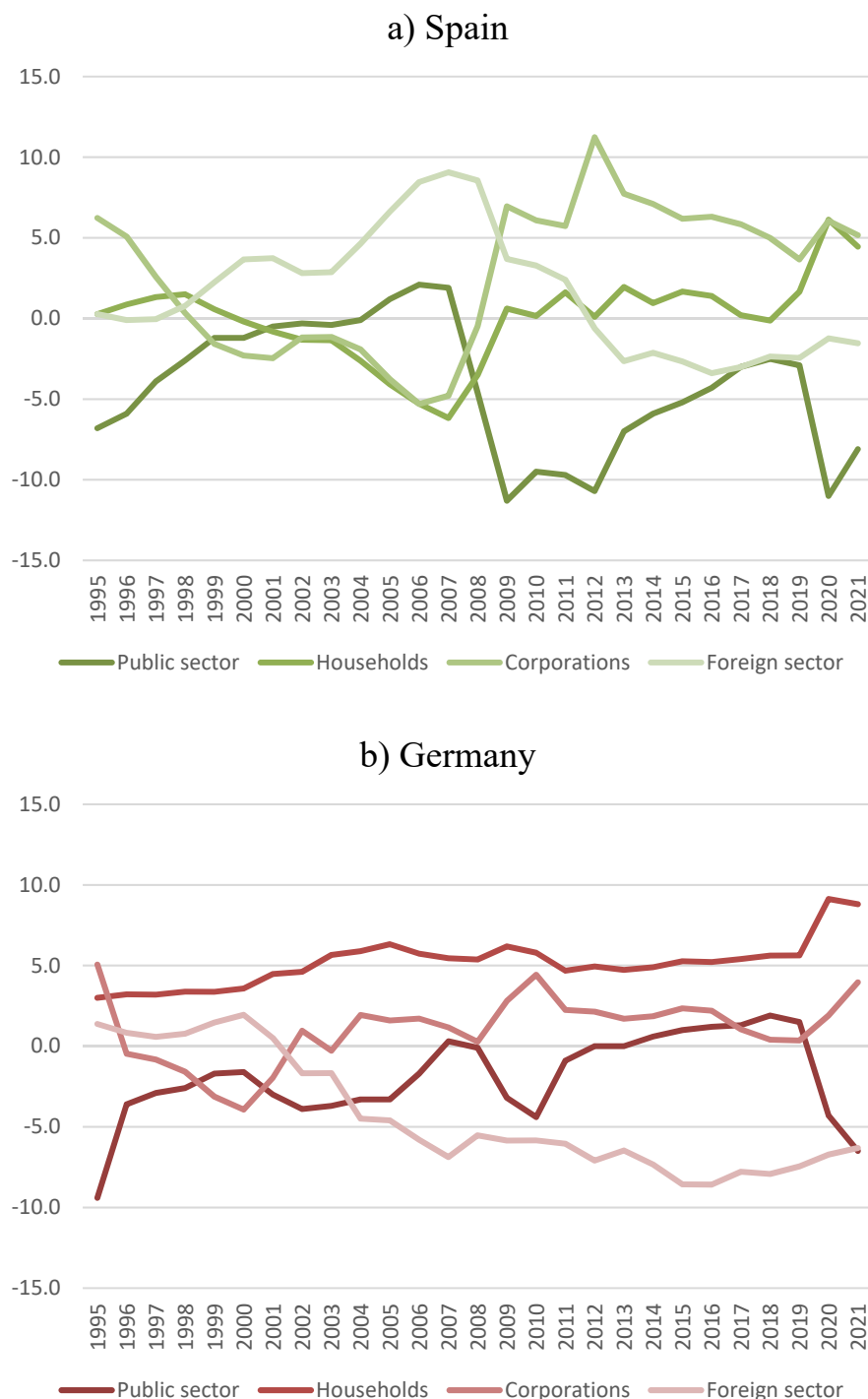
The background to the changes and thus also shifts in the growth regimes is the global financial and economic crisis, the collapse of economic performance in the years that followed and the problems of private and public debt, which were partly caused by the 2007/8 crisis but also partly inherent in the growth regimes, and most recently the Covid 19 pandemic with its negative consequences for the national economies. As Niechoj (2014b) shows, the austerity policies implemented in many countries reduced the domestic demand of the private sector, so that as a result imports declined, whereas exports tended to remain constant or even increase. Thus, after 2011, all the countries discussed here were able to roughly balance their current account or achieve surpluses – including Spain, which had been running significant deficits for years in the period before.

In this first period, the euro area as a whole had a roughly balanced current account (cf. Niechoj 2014b: 299). If one adds that a large part of trade in this period took place within the euro area, it can thus be deduced that the current account surpluses of a euro area country by and large corresponded to the deficits of other euro area countries. The discernible debt imbalances were thus intra-euro area imbalances. This changed significantly with the period from 2009 and especially from 2012. From the latter year onwards, with the exception of France, all the countries considered show a current account balance that is roughly balanced or even clearly in positive territory. The reason for this is export surpluses, which lead to foreign debt vis-à-vis the countries with a

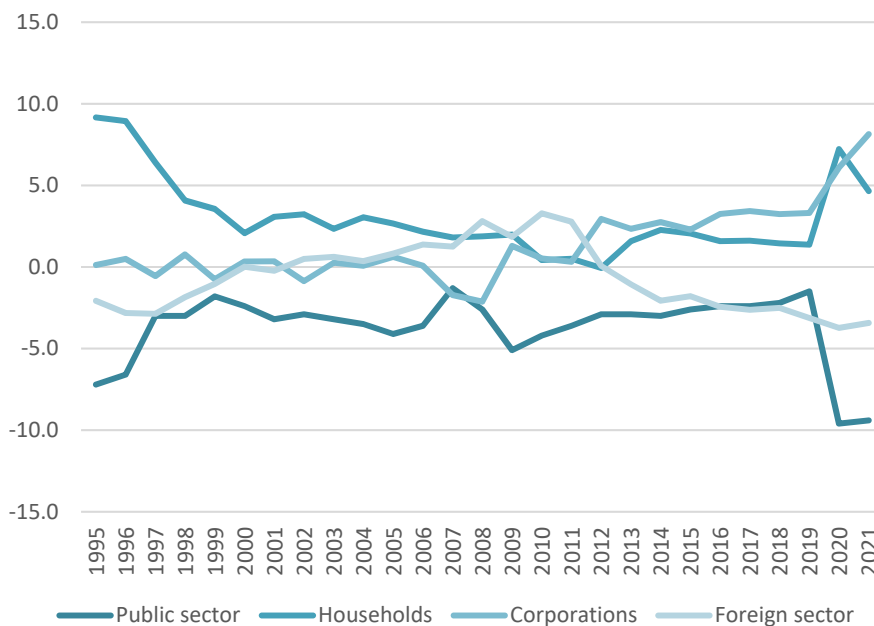
positive current account balance. The imbalances have now shifted from intra-euro area imbalances to global imbalances between the euro area and the rest of the world.

After this first look at the current account balances, all sectoral balances will now be examined (cf. Figure 2a to f). Data for the balance sheets have been available in full since 1995 for all countries considered here and extend up to the year 2021.

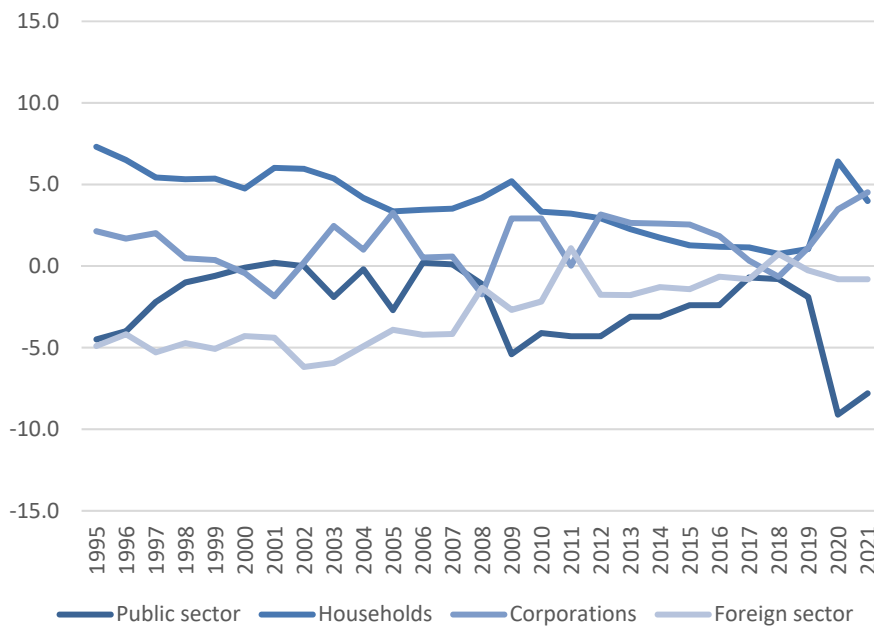
Figure 2a to f: Balance sheets of the public sector, private sector - broken down by households and enterprises - and foreign countries as a percentage of GDP, selected countries, 1995-2021

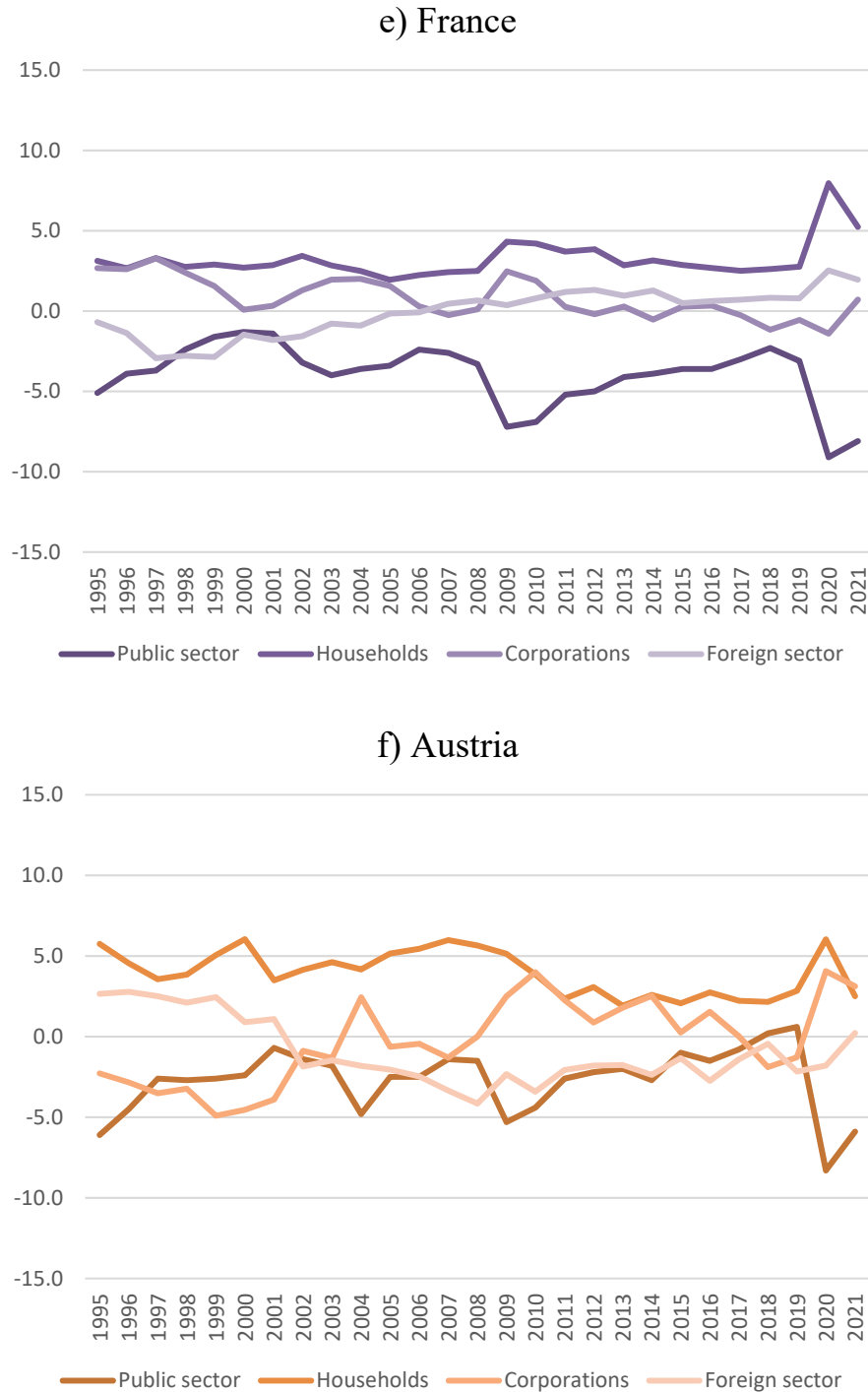


c) Italy



d) Belgium





Source: AMECO database, own calculations and own presentation

For the years 1995 to 2008, Spain shows a tendency of increasing surpluses in the foreign sector, which means that the country had to borrow more and more from abroad in order to be able to obtain goods and services from abroad. While the public sector was initially strongly in negative territory, the private sector has increasingly moved into negative territory, i.e. has become indebted. This is understandable for the corporate sector, as it borrows to make investments. A negative household sector, however, indicates that households cannot meet their expenses from current income, so they have

to go into debt. Thus, Spain corresponds to the regime of debt-driven domestic growth in this period. The counter-model to this is Germany, with a foreign sector that is still slightly positive at the beginning, but then moves clearly into negative territory. The background to this is the export surpluses, which lead to claims on foreign countries. It is also noteworthy that not only the household sector has a surplus, i.e. it saves, but also the corporate sector has surpluses in the second half of the period. The public sector is largely in deficit, i.e. it is borrowing in order to be able to meet part of its expenditure. This constellation indicates that due to the surpluses, the private sector contributes little to growth; only the public sector supports domestic growth through its deficits. Growth is supported by foreign demand, which is reflected in current account surpluses and a deficit of the foreign sector. Germany thus represents a regime of strong export orientation. A very similar picture emerges for Austria, which is also export-oriented. Belgium, also export-oriented, has had current account surpluses and foreign sector deficits since 1995 and differs from Belgium and Germany in that the public sector has shown a balanced or positive balance in four of the years 1995 to 2008 and the household sector has tended to show declining surpluses.

In the first period, Italy shows itself to be initially export-oriented, then moderately domestic demand-led. The foreign sector is in deficit at first, but then changes into positive territory. While the corporate sector has a more or less balanced account, the surplus of households reduces significantly over time, which strengthens domestic consumption. The public sector is indebted over the period under consideration and thus contributes to domestic growth. For France, the foreign sector starts in deficit and shows a slight surplus at the end of the period, indicating an increase in the role of domestic growth. This is primarily driven by the public sector, which is in deficit, while the private sector (households plus companies) has a positive balance. France can thus be described as a country with low foreign debt growth and domestic demand-orientation in this period.

In summary, France can be described as domestic demand-led and Spain as a country with debt-driven domestic growth in the first period under review. Italy turns out to be partly weakly export-oriented and partly domestic demand-led. Germany, Belgium and Austria can be characterised as export-oriented (to varying degrees).

As already indicated, this changes to some extent in the period from 2009 onwards. In all countries except Germany, the public sector shows a significantly more negative balance for this second period due to the crisis, as the countries lose tax revenues and have to spend public money on rescuing the banking system and on labour market measures. Germany is a special case in that after initial public deficits the labour market recovers quickly. Firstly, because the government's fiscal policies are relatively expansionary compared to other countries, secondly because industrial relations, which are characterised by co-determination and instruments such as short-time work, largely avoid layoffs, and thirdly because foreign demand picks up quickly in markets in which Germany has a good market position (Herzog-Stein et al. 2010, Herzog-Stein/Seifert

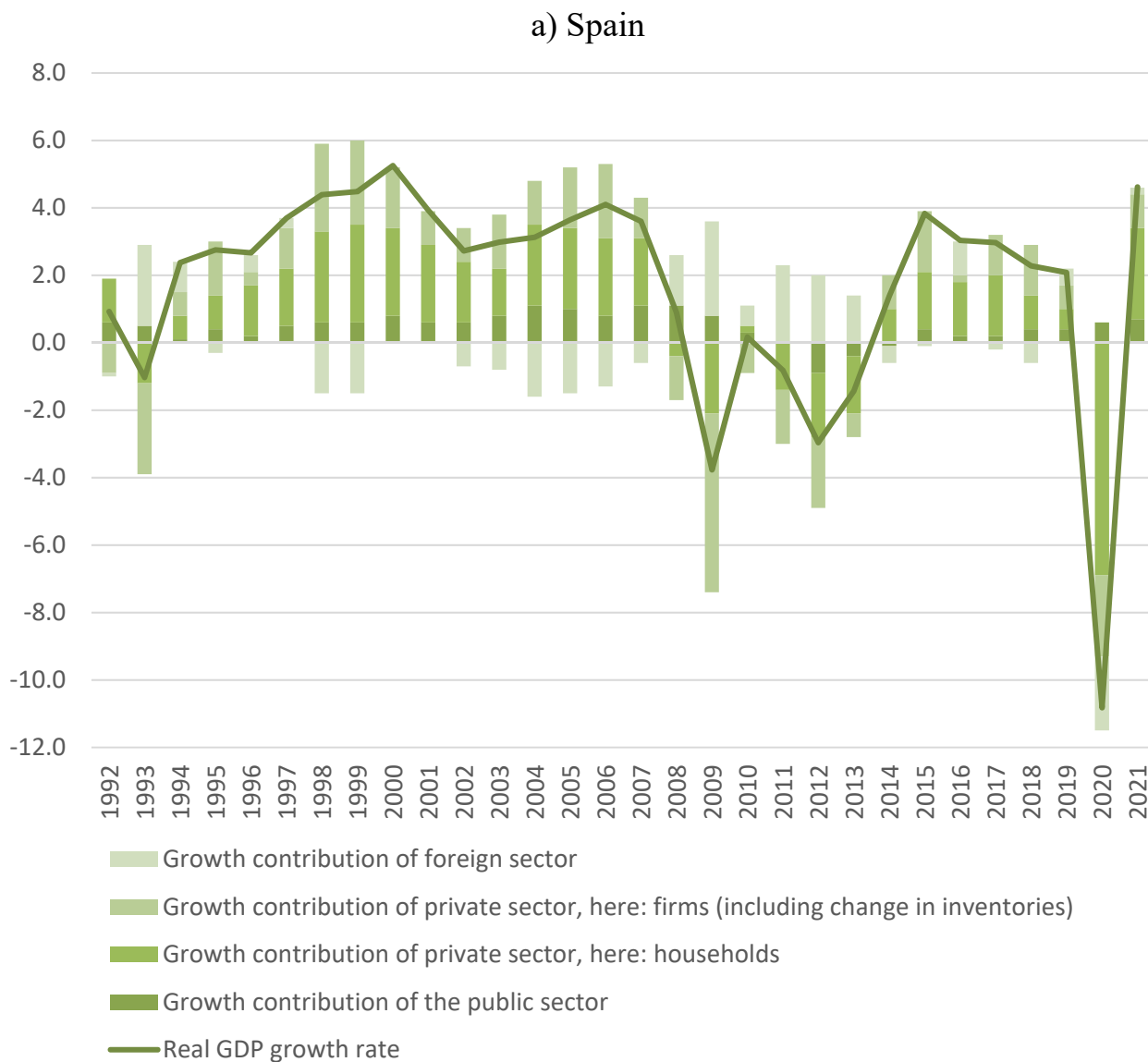
2010). This results in high government revenues and subsequently surpluses of the public sector over several years.

Mirroring the current account balances from Figure 1, Figure 2 shows the increasing deficits of the foreign sector because, with the exception of France, the countries achieve export surpluses or can at least balance the current account. France is the exception here and shows a positive foreign sector balance in the second period under review, so that foreign countries build up claims against France. Spain and Italy achieve export surpluses in the period under consideration, so they now have a foreign sector in deficit, while the private sector is positive. Using the sectoral balance sheets as a yardstick, Italy changes from a moderately export-oriented to a strongly export-oriented country; Spain changes from a debt-driven domestic growth to an export-oriented country. Germany remains a strongly export-oriented country, whereas the export orientation weakens somewhat according to the available data for Belgium and Austria.

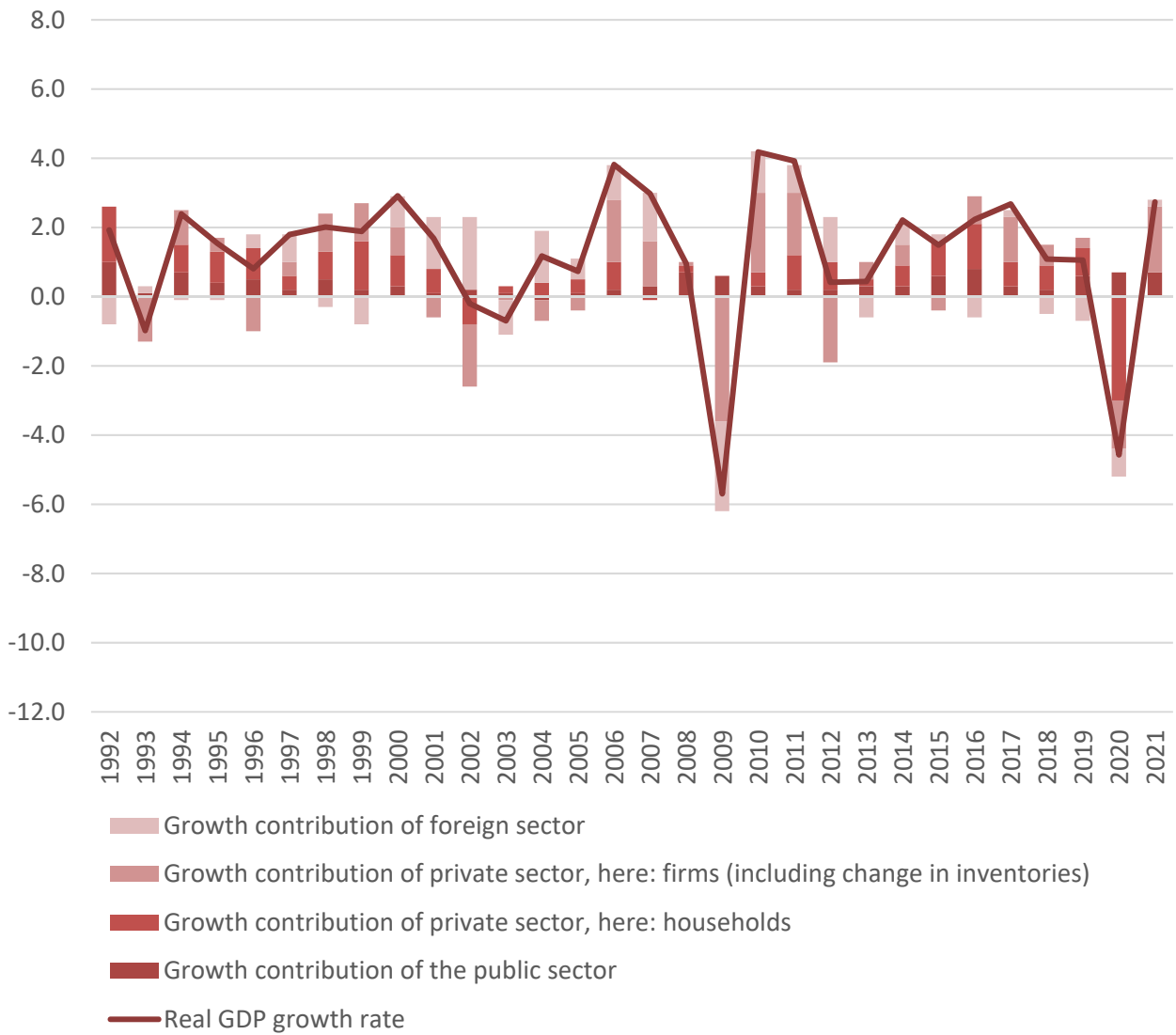
The growth contributions of the respective sectors in Figure 3 support the results derived from the sectoral balances. It should be noted, however, that in times of crisis the growth drivers from upswings or normal phases can turn into their opposite. Germany in 2009 can serve as an example here. Here, not only domestic growth collapsed, but also the growth contribution of foreign demand, as exports weakened sharply, so that Germany's export orientation in this crisis year (as in other years of crisis) is a disadvantage, as foreign demand dominates growth and a collapse in foreign demand leads to a significant slump in growth.

For the period 1995 to 2008, Spain and France show high contributions to growth from the private sector—households and firms—until the 2007/8 crisis, existing but less pronounced contributions from the public sector, and low or often even negative contributions to growth from the foreign sector, all pointing to the domestic orientation of the two countries. Spain, however, is able to achieve significantly higher real growth rates than France over this period, although this is accompanied by foreign indebtedness, as mentioned above. Italy shows a somewhat more mixed picture, with private sector growth contributions dominating over this period. Italy's real growth rate is below those of France and Spain in almost all years. In Germany, Belgium and Austria, (almost) all sectors contribute positively to growth in most years. It is noteworthy that for this time period the strongly export-oriented country of Germany has only relatively low real growth rates. At least with regard to this indicator and for the period under consideration, the export orientation has not paid off for the country.

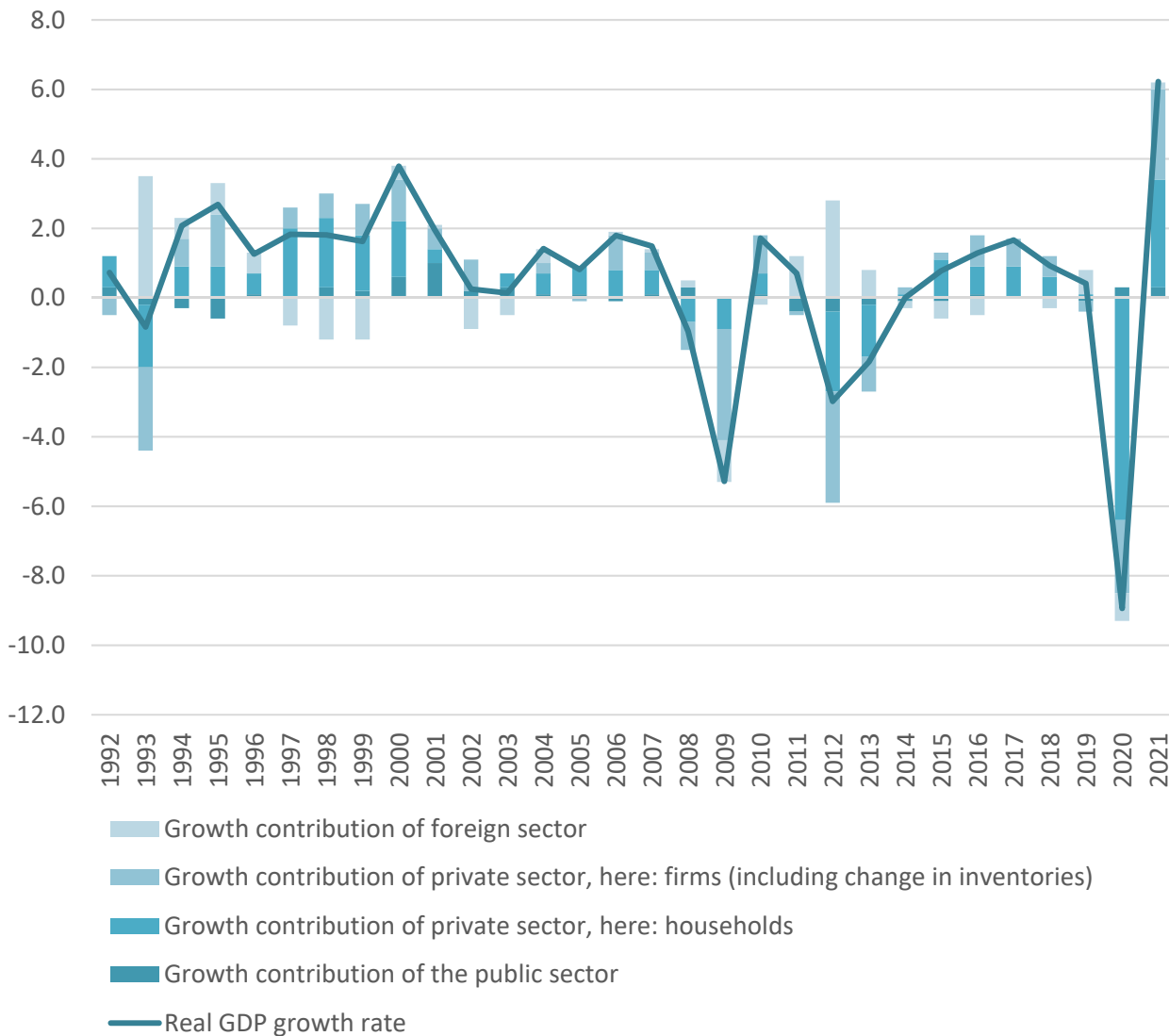
Figure 3a to f: Real growth rate and contributions to growth, selected countries, 1992-2021



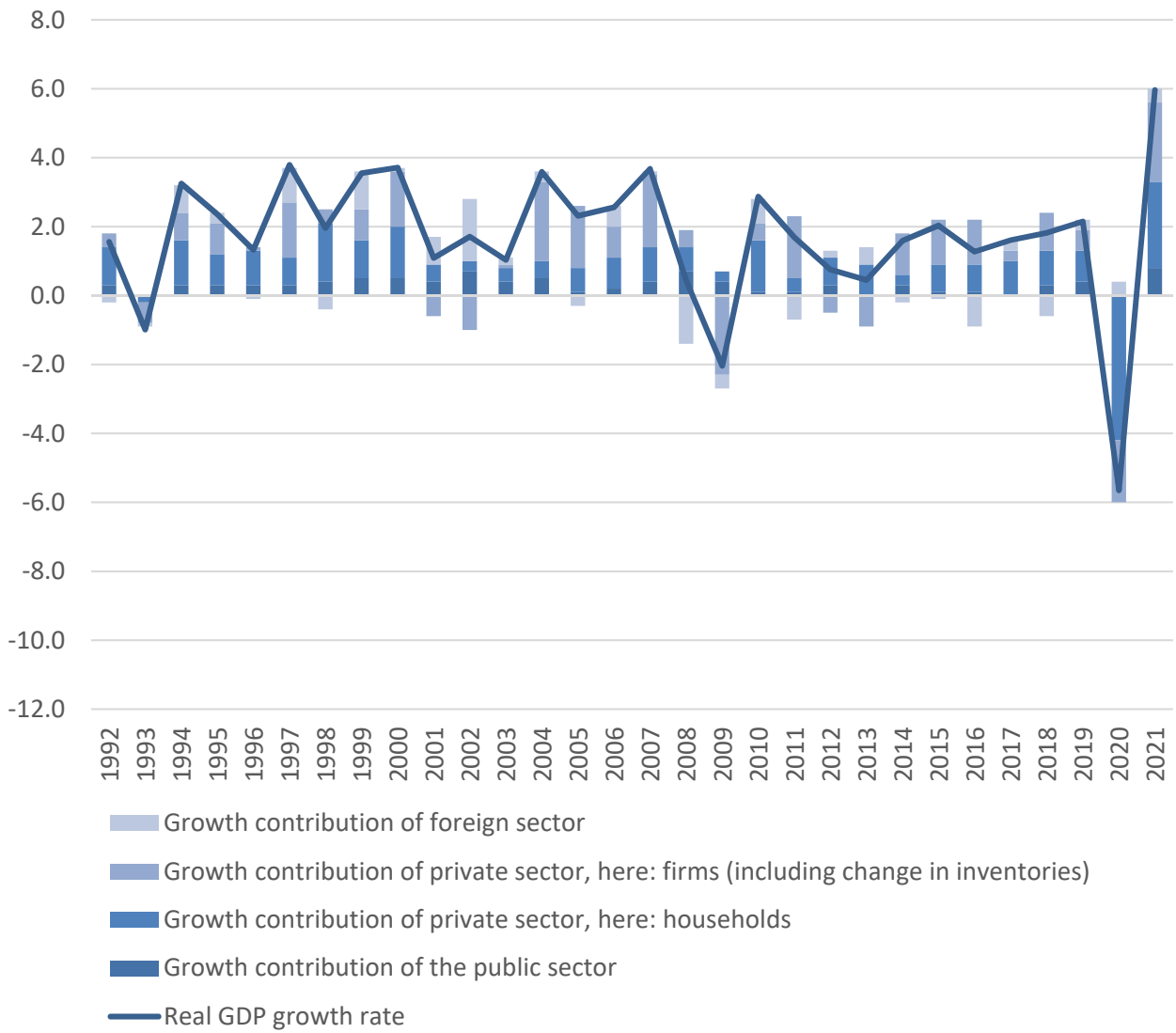
b) Germany



c) Italy

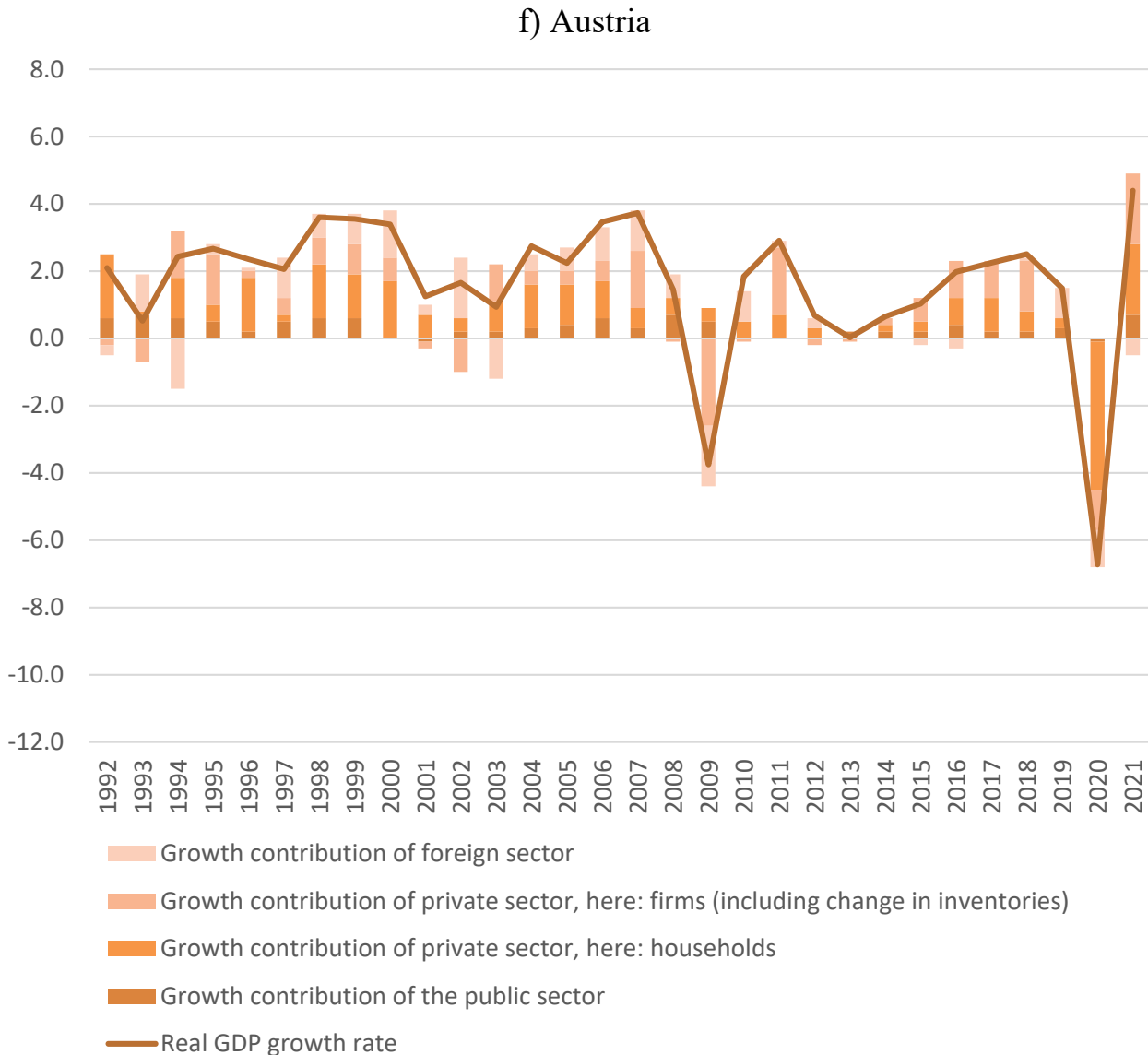


d) Belgium



e) France





Source: AMECO database, own calculations and own presentation

The subsequent period from 2009 onwards is more difficult to interpret, as the growth rate is quite volatile due to the crises. The private sector contributes *cum grano salis* in all countries negatively to growth in times of crisis and positively in times of recovery. In Spain and Italy, the foreign sector contributes positively to growth in some crisis years. The reasons for this are probably export successes or import restrictions. In Germany, the public sector contributes more to growth, which is an indication of relatively expansionary fiscal policies in Germany. In several years, the foreign sector contributes negatively to growth in Germany, Belgium and Austria, but this applies similarly to all countries and points to export problems and lower foreign demand.

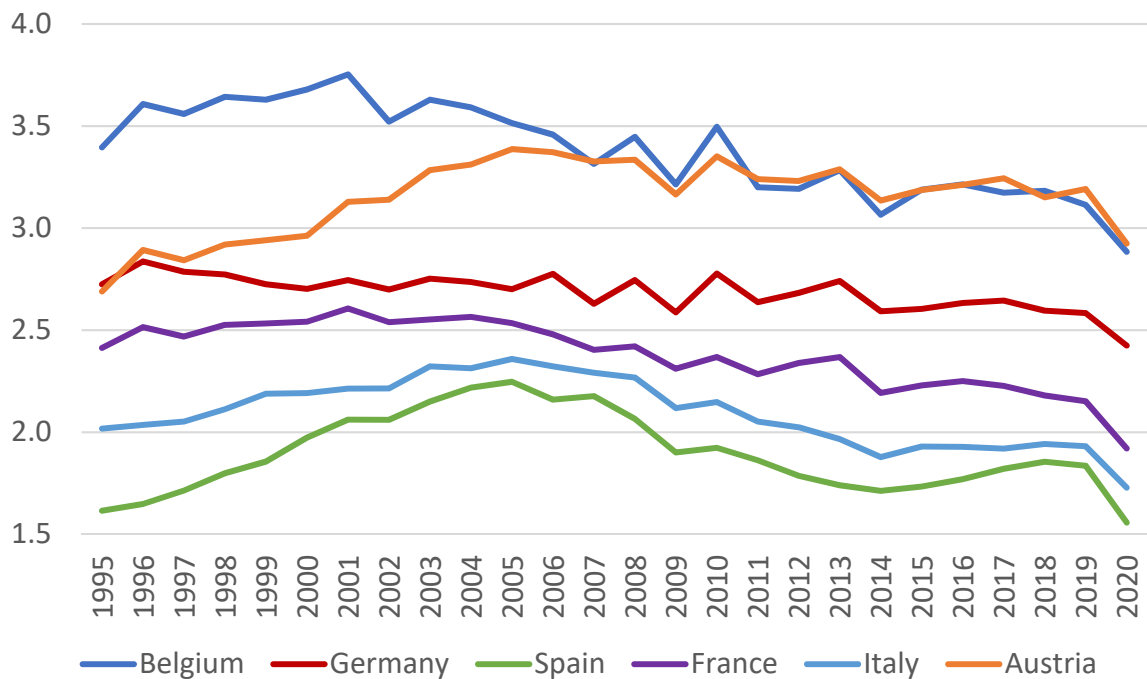
After the more precise identification of the growth regimes in the countries, the question can now be addressed as to whether the growth regimes are accompanied by specific patterns of ecological burden. Both indicators that depict inputs of the economic process and those that depict the output side are considered below.

In order to capture the extent to which growth regimes use resources, a selection of indicators can be found that provide clues as to what goes into the economic process (inputs). As Figure 4a shows, the energy consumption of industry, other sectors such as agriculture and fisheries as well as transport tends to increase in most countries until the end of the 1990s, but then falls again – the growth slump in 2009 and 2020 leave clear traces not only in real growth rates, but also in energy consumption due to declining production. The levels indicate that the more export-oriented countries Belgium, Austria and Germany have higher per capita consumption than the countries that rely more on domestic consumption. Italy lies between Spain and France in this respect.

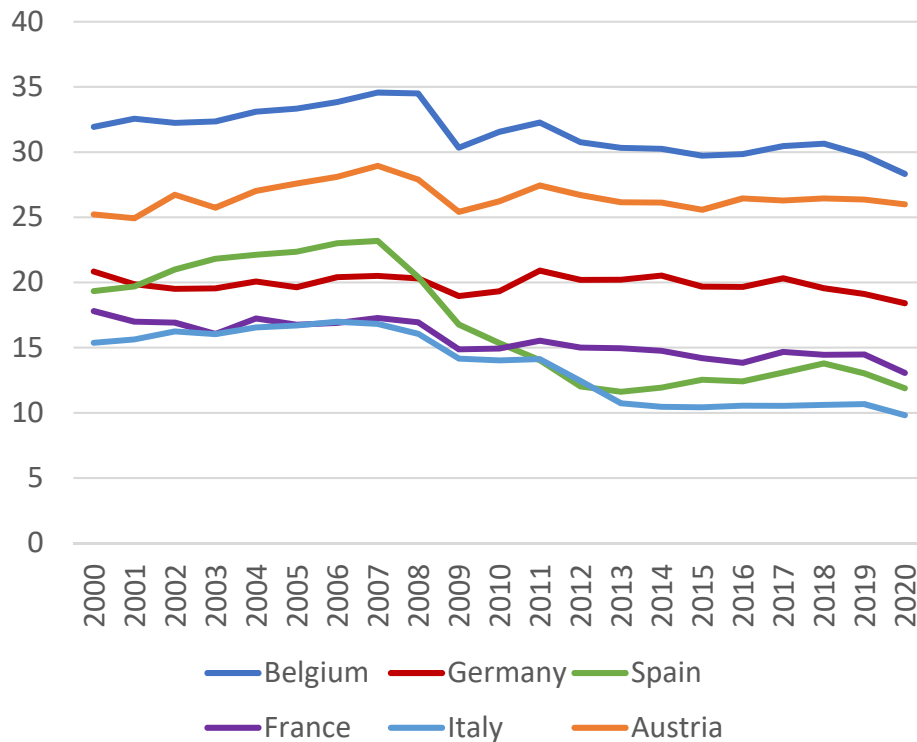
The economy’s resource consumption can be measured by direct material input (cf. Figure 4b), which captures imported and domestically extracted resources that flow into the economic process.

Figure 4a, b: Ecological input indicators, selected countries, different time periods

a) Domestic energy consumption in oil equivalent tonnes per person, 1995-2020



b) Direct material use in tonnes per person, 2000-2020



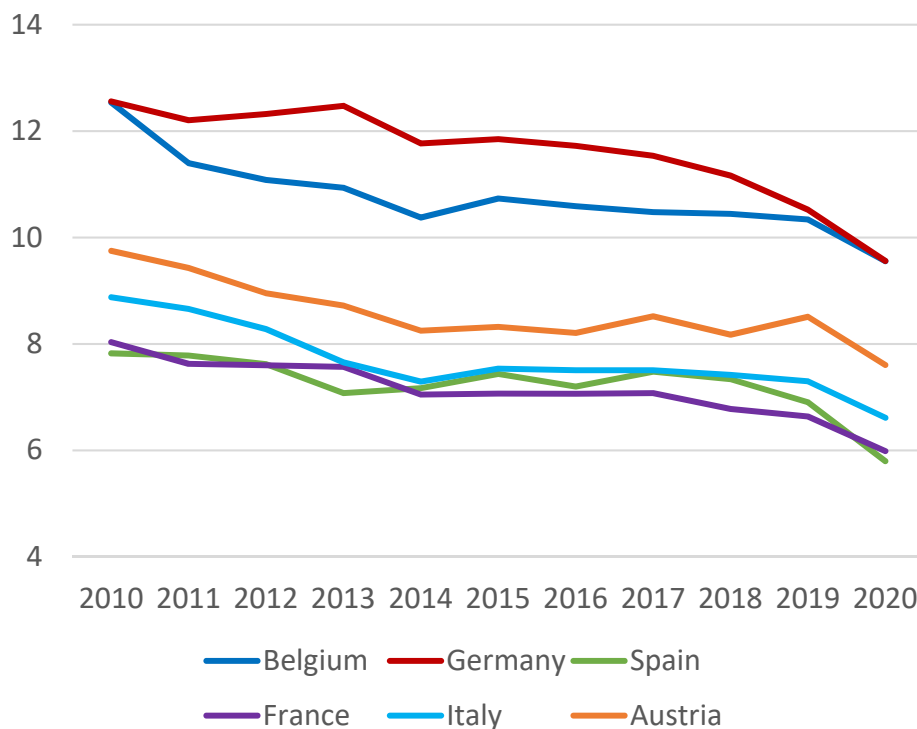
Source: Eurostat, own calculations and own presentation

With the exception of Austria, material use decreases over time; as with energy consumption, the crisis years 2009 and 2020 lead to a reduction in material use. The levels show higher material use in the export-oriented countries Belgium, Austria and Germany. Italy, together with France, shows relatively low material inputs, while Spain shows a significant decrease in per capita material input after the 2007/8 crisis.

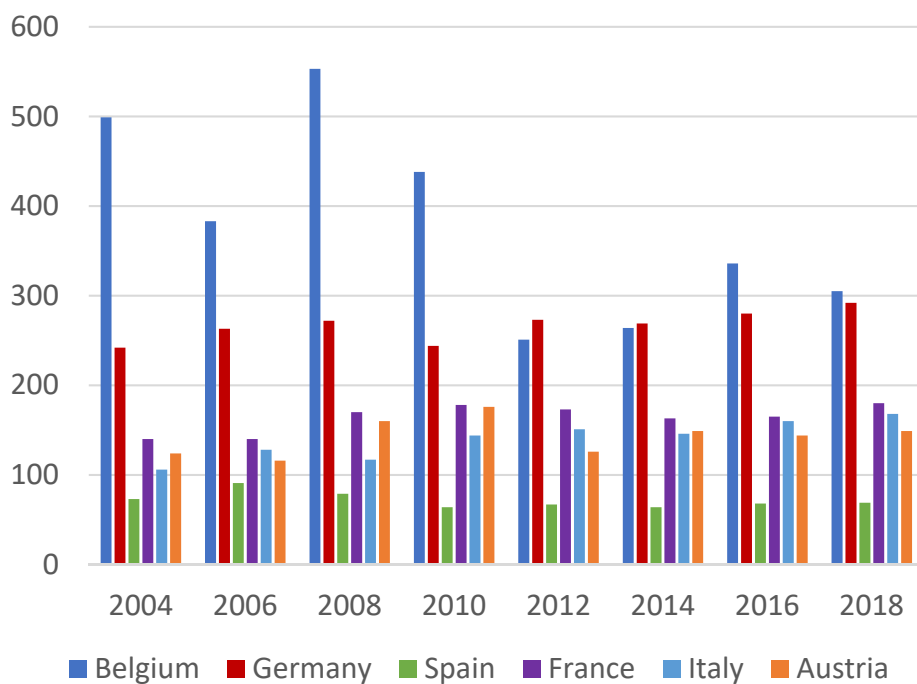
In addition to the input perspective, the output perspective is also relevant for the discussion of the ecological consequences of growth regimes (cf. Figure 5). Economic processes lead to waste products that pollute the environment. A key indicator here is CO₂ emissions or, more generally, all gases that promote the greenhouse effect. The country comparison shows that the export-oriented growth regimes have higher emissions than the more domestic demand-oriented countries. At the same time, all the countries considered show a downward trend, which is likely to be due to the use of more environmentally friendly energy sources and technologies, but also to crisis-related restrictions on production – such as in the pandemic year 2020. The picture for waste is not quite as clear. Here, the export-oriented countries are again ahead, although France, as a domestic demand-led growth regime, also shows relatively high values in comparison.

Figure 5a to d: Ecological output indicators, selected countries, different time periods

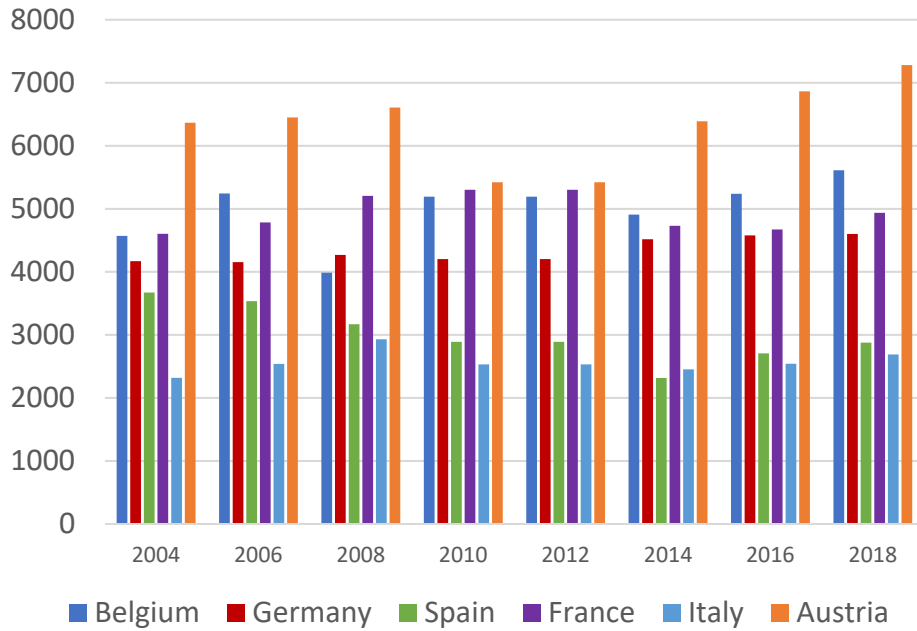
a) Greenhouse gases of all sectors and households in CO₂ equivalent tonnes per person and year, 2010-2020



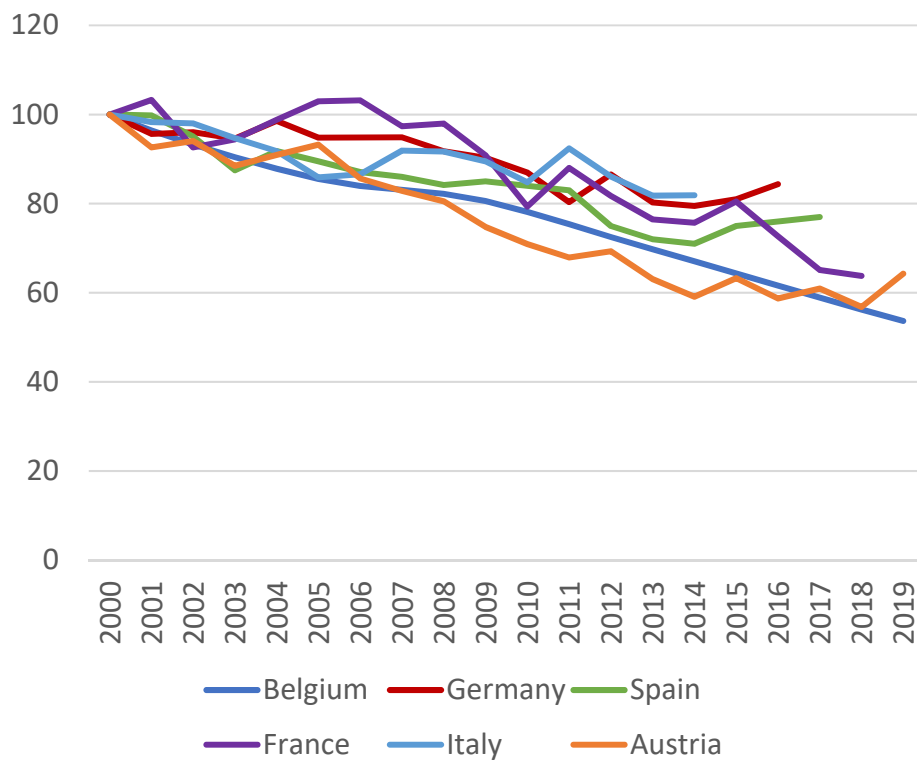
b) Hazardous waste in kg per person, all sectors and households



c) Waste in kg per person, all sectors and households



d) Index of common field bird species, 2000=100, 2000-2019



Source: Eurostat, partly with values estimated by Eurostat, own calculations and own presentation.

Impacts on biodiversity are measured by the index of common field bird species. A significant loss of biodiversity over a relatively small period of time (since 2000) can

be observed for all countries studied. No particular influence of the growth regimes can be detected.

6. Discussion

The literature on growth regimes includes a theory-based set of indicators to identify growth regimes and to track the development of such regimes over time. For the ecological consequences of growth, there is also a broad spectrum of indicators that describes the inputs and outputs of the production process and thus the consequences of economic activity. Nevertheless, the linking of economic regimes with their ecological consequences is still in its infancy. Therefore, and due to the rather short time series, no elaborate methodological approach was chosen here, but a descriptive attempt was made to identify possible correlations. Also due to the data situation, but also in order to establish a certain comparability of the countries, the focus of the growth regimes is on industrialised countries of the euro area. This gain in comparability is thus offset by a loss in generalisability. All indicators also only capture the ecological consequences of economic activity in the countries under consideration. The extent to which the growth regimes use resources elsewhere via their global value chains for domestic production and to which emissions are generated in supplier countries is left out of the equation. Due to the high degree of globalisation, this is likely to be significant.

With all these limitations, it can nevertheless be said that for the present selection of countries, export-oriented growth regimes tend to have higher resource consumption and higher emissions than those that are more domestic demand-oriented. It is interesting to look at whether this also shows up in the short term when the growth regime changes. The current account balances of Spain and Italy show surpluses as of 2013, which makes them more export-oriented in the sense of the growth regime perspective and thus, if there were a positive correlation between export orientation and resource use and emissions, should lead to increased consumption or higher emissions. This is not reflected in the data, but this does not necessarily mean that there is no positive correlation. For one thing, the current account surplus in the Spanish case is primarily due to falling imports in relation to exports, so that no increase in resource use and emissions was to be expected. On the other hand, the crises of recent years have also led to structural changes in the economies, which also have an influence on environmental use. For example, the decline in construction activity after the 2007/08 crisis, which had previously driven growth in the Spanish economy, should have had a dampening effect on energy and resource consumption in the country.

However, what probably limits the informative value of the indicators presented here even more clearly is the limited time horizon of the available data. The growth regimes presented here emerged after World War II. Herr (1994), for example, shows for Germany how the export-oriented model developed and established itself after the Second World War. In contrast, data for the indicators mentioned here are only available since the 1990s and in some cases only for the 2000s. In addition, consumption and emissions only have an impact on the environment at the present time, in some cases with a very

long delay; likewise, tipping effects must be taken into account, so that at least the biodiversity indicator only measures the effect of economic activity after a time lag.

Ultimately, the analysis presented here can only show that export-oriented countries tend to have a higher environmental impact per person, but it cannot directly say anything about the causes. Obvious candidates for such causes are the higher volume of production to serve the export surpluses, but also a different production structure. Germany, for example, is still strongly characterised by industries such as automobile, mechanical engineering and chemicals, while other countries are more involved in the service sector. Obviously, this can lead to different ecological consequences. Other factors, such as the energy mix, also play a role. Nuclear power plants, such as in France, do not emit greenhouse gases, but have other environmental impacts due to legacy pollution and radiation risks, which, however, could not be captured with the indicators presented here.

7. Conclusions

The economic growth of countries is not dominated by the same factors everywhere. At least for developed, Western economies, patterns emerge that can be classified. Economies are either domestic demand-led or export-oriented according to their sectoral balance sheets, growth contributions and current account balance, and they are characterised by weak or strong debt or the build-up of claims on the rest of the world. However, hardly any literature currently exists that sheds light on the ecological consequences of these growth regimes. For the present study, an exemplary country was selected for each growth regime and, for the type an export-oriented country, two other countries besides Germany were used for comparison in order to assess, in comparison with indicators on the ecological consequences of economic activities, whether environmental pollution corresponds to certain regimes. The results show that export-orientation is associated with a higher environmental impact – both on the input side (resources incl. energy used in production) and on the output side (emissions and waste). Here, the effect that an export surplus goes hand in hand with increased per capita production is likely to dominate countervailing effects. However, an increase in export orientation over the course of a few years does not directly lead to an increase in environmental pollution. Here, both lag effects and import restriction are likely to play a role as causes of the export surplus. Due to the limited data available and the purely descriptive approach, however, these results should not be over-interpreted. Further, more detailed research is needed to clarify whether economic regimes really do produce significant differences in environmental impacts or whether environmental impacts are not primarily dependent on deeper factors such as the technologies used, available resources and energy sources, the volume of goods produced or the sectoral structure of an economy, so that the environmental impacts could be explained directly via these factors without having to take a diversion via growth regimes.

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