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Abstract

By studying the factors underlying differences in trade performance across European economies, this paper derives six different "trade models" for 22 EU-countries and explores their developmental and distributional implications. We first introduce a typology of trade models by clustering countries based on four key dimensions of trade performance: endowments, technological specialization, labour market characteristics and regulatory requirements. The resulting clusters comprise countries that base their export success on similar trade models. Our results indicate the existence of six different trade models: the 'primary goods model' (Latvia, Estonia), the 'finance model' (Luxembourg), the 'flexible labour market model' (UK), the 'periphery model' (Greece, Portugal, Spain, Italy, France), the 'industrial workbench model' (Slovenia, Slovakia, Poland, Hungary, Czech Republic), and the 'high-tech model' (Sweden, Denmark, Netherlands, Belgium, Ireland, Finland, Germany and Austria). Subsequently, we comparatively analyse the economic development and trends in inequality across these trade models. We observe a shrinking wage share and increasing personal income inequality in most of the trade models. The 'high-tech model' is an exceptional case, being characterised by a relatively stable economic development and an institutional setting that managed to counteract rising inequality.

Keywords: Trade policy, cluster analysis, European Union, trade models.

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1. Introduction

Differentials in trade performance and trade policy feature prominently in the public discourse as well as in the discussion about the simultaneous existence of different growth models in Europe. The literature argues that while most European countries experienced a decrease in domestic demand due to increasing inequality from the 1980s onwards (e.g. Stockhammer 2015), those with a competitive export sector were able to counteract this trend through an increase in exports (e.g. Baccaro and Pontusson 2016). Before the financial and economic crisis hit, countries lacking international competitiveness accumulated high levels of private (and, in few cases, public) debt, which proved unsustainable when the crisis started (e.g. Gräbner et al. 2017). Countries with a debt-led led growth model experienced protracted recessions with high socio-economic costs. Our paper complements this stream of literature by investigating the sources for differentials in international competitiveness, the role of policy, and the developmental and distributional implications in the context of different "trade models".

In the literature on growth models, typologies are a well-established instrument for analysing commonalities and differences across countries (e.g. Simonazzi et al. 2013, Gräbner et al. 2018). These typologies group countries according to some fundamental similarities and can go beyond simple classifications by capturing systemic aspects of policy or institutional arrangements. Hence, such typologies are useful when it comes to developing the "big picture" of how identified regimes work (Ebbinghaus 2012). In the present case, our main interest is to highlight the different strategies countries pursue to achieve success in international competition, and to study the implications of these strategies.

In this article, we contribute to the current state of research by relating such a typological approach to the analysis of trade performance and trade policy. We develop a typology of trade models among EU countries using methods from unsupervised machine learning: by applying hierarchical clustering tools to a theoretically derived selection of factors, which allow for describing different strategies for achieving export success, we identify six different country clusters in the European Union, with each cluster representing a different trade model. The factors used for the clustering were extracted from the existing literature and consist of *natural endowments, technological capabilities, labour market characteristics* and *the regulatory environment*. Given this selection, it comes as no surprise that the developmental and distributional implications of the various trade models are very different, as we will show below.

The rest of this paper is structured as follows: the next section reviews the existing literature on the use of country typologies in international economics and trade analysis. In section 3, we explain the selection of factors used to delineate trade models by referring to the relevant literature.

Section 4 introduces the cluster analysis and presents its results, which are related to overall patterns of socio-economic development patterns in section 5. Section 6 offers concluding remarks.

2. From welfare state regimes and growth models to trade models: the use of typologies in the literature so far

The analytical use of country typologies has a long tradition in comparative social sciences: Esping-Andersen (1990) was among the first to developed a prominent typology of welfare states, suggesting a distinction between 'liberal', 'conservative', and 'social-democratic' welfare states. Each type varies with regard to the way the working class coexists with private firms, the social rights it provides, the relationship between state and market, and the degree of de-commodification.[7] This typology was later extended by a category called "Latin" or "Southern" welfare state regimes (e.g. Bonoli 1997, Ferrera 1996, Leibfried 1992,) and by an East Asian welfare model (Aspalter 2006, Croissant 2004).

Such typologies are also a prominent tool in the comparative analysis of economic systems. An example is the Varieties of Capitalism (VoC) approach pioneered by Crouch and Streeck (1995) and Hollingsworth and Boyer (1997) which categorises market economies as a whole rather than only their welfare state apparatus. The most influential version of such a typology was proposed by Hall and Soskice (2001), who categorise market economies into "liberal market economies" (LME; e.g. Australia, Canada, the United Kingdom and the USA) and "coordinated market economies" (CME; e.g. Austria, Japan and Germany). Their typology is based on the interaction of private firms and non-market institutions, which are analysed across five spheres: industrial relations, vocational training and education, corporate governance, inter-firm relations, and relations with employees (Hall and Soskice 2001). Hall and Soskice (2001) triggered a vast number of further studies within the VoC framework (e.g. Aristei and Perugini 2015, Hope and Soskice 2016, Nölke and Vliegenthart 2009).

Another area in which typologies have been used extensively in the more recent past is the analysis of different 'growth models', where countries are classified according to the demand drivers of economic growth (Baccaro and Pontusson 2016, Hope and Soskice 2016, Regan 2017). Finally, country typologies traditionally play an important role in 'structuralist' theories, which take a more general political economy perspective and classify countries at least into a dominant core and a dependent periphery. Applications of such a reasoning to the European Union have become

7 The concept refers "to the degree to which individuals, or families, can uphold a socially acceptable standard of living independently of market participation" (Esping and Andersen 1990, p. 37).

more prominent in the recent past (see e.g. Celi *et al.* 2018, Iversen *et al.* 2016 or Simonazzi *et al.* 2013).

Typologies have similarly been used to study how different European countries benefit from trade in different ways and to a different extent. Although there was some economic convergence between core and periphery countries in the EU before the crisis, these convergence tendencies eventually proved to be unsustainable as the catch-up trajectory of Southern European countries was fuelled by increasing indebtedness (e.g. Gräbner *et al.* 2017). With debt deleveraging setting in, post-crisis years have been characterised by economic divergence between large parts of the EU. These developments can be related to different economic and institutional characteristics of core and periphery countries (Galgóczi 2016) and raise scepticism with regard to the argument that greater economic integration automatically fosters convergence.

A number of contributions use typologies in their analysis of the structure of international trade: Sepos (2016), for example, argues that core countries, like France, Germany and northern EU member states, tend to benefit more from free trade than periphery countries, such as Greece, Spain or the Baltic member states. According to Sepos (2016), these disparities are due to power asymmetries between core and periphery countries that translate into a form of economic imperialism. In turn, such increasing economic differences also feed back into the policy and institutional context by amplifying existing imbalances of power, e.g. between creditor- and debtor states after the financial crisis of 2007/2008 (e.g. Laffan 2016).

Gräbner *et al.* (2018) extend existing typologies of European economies that solely distinguish between core and periphery countries by adding two additional types: the finance hubs and Eastern European catch-up economies. Based on their analysis of trade data, Gräbner et al. (2018) further argue that Europe is currently characterised by non-convergence of technological capabilities, which further underlines that there is no overall economic convergence among European states.

Although typologies are an established tool in comparative economics and political economy, they are less widely used in macroeconomics, international economics and corresponding research on trade performance. One of the few contributions in this regard is Mahutga and Smith (2010), who analyse the effects of an economy's position in the international trade network on its gains from international trade. To do so, they conducted a network analysis to gain insights into the structure of the global division of labour. The resulting typology distinguishes between core (e.g. USA, France, Germany, UK), semi-periphery (e.g. Austria, Denmark, India, China) and periphery countries (e.g. Colombia, Morocco, Angola, Qatar); it implies that a country's economic development depends strongly on its position within the global value chain and its upward mobility. In a similar vein, Escaith and Gaudin (2014) derived a typology

of WTO member countries based on their value-added trade balance in the three major sectors (primary, manufacturing, and services) as well as economic and trade policy characteristics in 2008. The result is a categorisation into commodity exporters, manufacturing exporters (European and Asian), and service-oriented economies, which allows for a corresponding analysis of the drivers of domestic value added in exports (Escaith and Gaudin 2014).

The present paper aims to connect these different strands of literature by combining a typological approach towards economic development with an analysis of trade patterns across European economies. By doing so we shed light on the implications of trade models in different European countries for both economic development and distributional aspects.

3. From resources and laws to capabilities and institutions: determinants of export success

The development of any typology must start with a selection of variables according to which countries are classified. In line with the existing literature, we take into account variables from four dimensions: *natural endowments*, *technological capabilities*, *labour market institutions* and *regulatory environment* (see Figure 1).

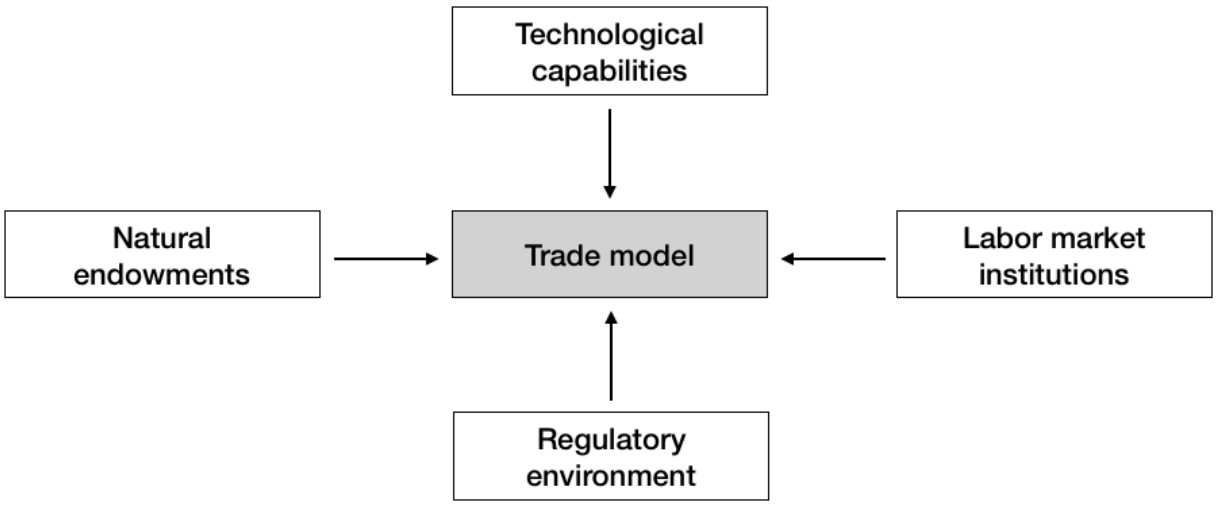

Figure 1: *Dimensions of trade models.*

Since Adam Smith's seminal contributions, natural endowments are seen as a key factor in coining patterns of trade and economic development (e.g. Barbier 2003, Dosi and Tranchero 2018, Wright 1990). Possessing scarce resources needed for further processing represents an advantage for a given country. The developmental implications of such resource endowments are, however, mixed: while countries such as Norway or Saudi Arabia have acquired considerable wealth due to their natural endowments, many other resource-rich countries remain poor, either because of

negative exchange rate effects (à la the *Dutch Disease*) or because of higher corruption, which often results from personal short-term gains related to resource appropriation.

The importance of technological capabilities for trade performance has been highlighted in a number of recent studies (e.g. Dosi *et al.* 2015, Gräbner *et al.* 2017, Storm and Naastepad 2015).[8] The accumulation of technological capabilities is usually also associated with positive developmental implications. Lee (2011), for instance, analysed 71 countries and showed that those countries exporting high-technology products grew more rapidly than countries exporting low or medium technology products. For Hidalgo (2015), technological capabilities are the ultimate source of economic development, a view motivated by recent contributions to the science of economic complexity (Cristelli *et al.* 2015, Felipe *et al.* 2012, Hidalgo and Hausmann 2009, Tacchella *et al.* 2013).

The third set of variables is concerned with labour market institutions and labour market outcomes. The relevance of institutions that ensure relatively low unit labour costs as a key source for international competitiveness is regularly highlighted (Chen *et al.* 2012, Cuñat and Melitz 2012, Lapavitsas *et al.* 2011, Samuelson 2004).[9] Consequently, boosting export-led growth is said to require more labour market flexibility, which implies the need to reduce employment protection legislation, unemployment benefits and the influence of trade unions. In more general terms, strong labour market institutions can be seen as a protection of employees from the uncertainty caused by globalisation. Rodrik (1996) and more recently (Manow 2018) argue that the well-developed welfare state is mainly a promise to compensate potential losers of international trade.

The final category of variables covers the regulatory environment of countries: the ability of a country to attract international investments and/or incentivize firms to migrate to this country is considered a major determinant for international competitiveness. A common line of argument relates this ability to low corporate taxes and loose regulations. Being aware of their significance for job creation and international competitiveness, firms influence the political discourse and try to avoid new regulations. In a highly interconnected global economy, however, politicians try to convince firms to stay in a respective country by relocating the tax-burden or by weakening regulatory requirements, especially for the financial sector. This setup can lead to a general race to the bottom in regulatory standards (e.g. Carruthers and Laboureaux 2016, Egger et al. 2019) and foster distributional conflicts (Baccaro and Pontusson 2016).

8 Storm and Naastepad (2015a, 2015b) also raise this argument in the context of Germany's export-success; they explain Germany's stellar export performance not by price competitiveness, but rather by its superior technological competitiveness.

9 The actual relevance of low labour unit costs for relative export-success, however, is surrounded by many doubts. A typical counter-argument is that labour market flexibility and low labour unit-costs are mainly reducing domestic demand as well as imports and thereby contributing to increasing trade surpluses (Dias-Sanches and Varoudakis 2013; Flassbeck and Lapavitsas 2013).

4. Identifying trade models in the EU

4.1. Data and Method

To develop a typology of trade models, we compose a data set for EU countries that comprises indicators for all four main dimensions of competitiveness highlighted in the previous section in the time period between 1994 and 2016 (see table 1). We operationalize the dimension of endowments via (a) the employment share in agriculture, (b) the share of oil in total exports, (c) the share of general primary goods in total exports, (d) the share of value added coming from manufacturing and (e) natural resources rents (in % of GDP).

Dimension	Indicator	Unit
Natural endowments	Employment in agriculture	Share of total employment
	Natural resources rents	Share of GDP
	Oil	Share of total exports
	Primary goods	Share of total exports
	Share of Value Added from manufacturing	Percent of GDP
Technological capabilities	Economic complexity index	Index
	Employment in the industrial sector	Percent of total employment
	Government expenditures on education	Percent of GDP
	Gross domestic expenditure on research and development	Percent of GDP
	ICT capital share in GDP	Percent of GDP
Labour Market	Adjusted wage share	Percent of GDP
	Average wages per year	PPP Dollar
	Coordination of wage-setting	Index
	Strictness of regulation on dismissals and the use of temporary contracts.	Index
	Unemployment Benefit Net Replacement Rates for single earner in initial phase of unemployment	Percent
Regulatory environment	Corporate Tax	Tax revenue as percent of GDP
	De jure component of the KOF econ index	Index
	Foreign direct investment (FDI)	Percent of GDP
	Share of financial sector in gross output	Percent of all sectors
	Taxes on estates and other wealth taxes	Tax revenue as percent of GDP
	Taxes on estates and other wealth taxes	Tax revenue as percent of GDP

Table 1: *Indicators and Dimensions of trade models.*

To address the complexity of technological capabilities, we refer to the gross domestic expenditure on R&D and government expenditure on education as indicators for how countries foster the development of high-technology products by education and research. The capital share

of Information and Communication Technology in relation to GDP (ICT) and employment in the industrial sector are used to proxy for the economic structure of countries. Finally, the index of economic complexity (Hausmann and Hidalgo 2009) is used as a proxy for the amount of technological capabilities accumulated within a given country.

To operationalize the dimension of labour market institutions, we consider the employment protection legislation and net replacement rate of unemployment benefits. We also include an index for the coordination of wage bargaining since the literature suggests that wage moderation – which is considered a major determinant for export success – requires a high degree of wage coordination (Traxler *et al.* 2001). As an indication of a low labour cost strategy, we use two indicators: the average national wages and the adjusted wage share. A low or a decreasing wage share would mean that employees benefit less from economic growth and from international trade than owners of assets.

Finally, with regard to the dimension of the regulatory environment, we use the revenues of three categories of taxes (as percent of GDP), which are relevant for companies' (re)location choices: corporate taxes, estate taxes and all other wealth taxes. Furthermore, the share of the financial sector in gross output and foreign direct investment (FDI) in relation to GDP are included as indicators for capturing deregulation strategies that are geared towards attracting foreign investments and the KOF de jure index measures the strictness of regulation with regard to economic openness.

Due to data limitations, particularly with regard to labour market institutions and tax revenues, our analysis is constrained to OECD countries. As tax data are not available for Lithuania we cannot consider this country. Thus, we end up with a data set for 22 EU countries for the time period between 1994 and 2017.

We then derive our typology via the use of a hierarchical clustering algorithm, a well-established tool from unsupervised machine learning. We chose to rely on hierarchical methods since the resulting dendrograms will allow us to further interpret the similarities and dissimilarities among members of the various clusters. In a first step, we remove all missing data points and average all variables for each country over time. Then variables are z-transformed and a clustering algorithm is applied. Here we use the (agglomerative) WARD-method (Everitt et al. 2001), which minimizes the variance within groups and maximizes their homogeneity. As indicated by table 2, the WARD algorithm is the most appropriate algorithm for the data we use.

	Algorithm	Clustering coefficient
1	Agglomerative clustering – Ward's method	0.98
2	Agglomerative clustering – Complete linkages	0.96
3	Divisive clustering	0.96
4	Agglomerative clustering – Average linkages	0.93
5	Agglomerative clustering – Single linkages	0.76

Table 2: *Comparison of the performance of different hierarchical clustering algorithms. The higher the clustering coefficient, the more appropriate the algorithm.*

4.2. Results

Based on our hierarchical cluster analysis, we identify six different types of trade models for the 22 EU countries (see figure 2). Their distinguishing characteristics are summarized in table 3.

The first cluster comprises the two Baltic countries Latvia and Estonia. Due to the importance of primary goods for exports and the total economy, we label this trade model the 'primary goods model'. Rents of natural resources amount to 1.4 percent of GDP, which is two or three times higher than in the other models. Primary goods are responsible for almost 24% of all exports, with oil alone accounting for 14%. Both values exceed those of the other clusters by several magnitudes. The importance of the primary sector in this cluster becomes also visible when comparing the employment share in agriculture, which is much higher in this cluster than the rest of the sample. In the dimension of technological capabilities, this trade model exhibits the lowest value of economic complexity and the smallest expenditure on research and development. At the same time, the industry sector plays an important role in the employment structure of these countries, most likely because of the important (but technologically inferior) oil industry. Government expenditures on education, on the other hand, are surprisingly high (6.2% of GDP). Interestingly, this cluster has the second highest ICT capital share. In the labour market dimension, this trade model is characterised by a very low degree of wage coordination, low average wages and a low wage share. The very low corporate, estate and all other wealth tax revenues are remarkable, pointing to the usage of tax arbitrage to attract foreign investments.

The second cluster consists only of Luxembourg, which distinguishes itself from all other countries by the vast size of its financial sector, which amounts to 34.7% of total gross output, at least 15-times more than in the other clusters. Therefore, an obvious label for this trade model is the 'finance-model'. The regulatory environment is attractive for foreign investors and companies, which can be seen from the largest share of FDI, the highest corporate tax revenues, and the highest degree of (de jure) economic openness. Luxembourg is therefore a prime example for weak regulation boosting the financial sector and attracting foreign investments (Zucman 2015). ICT technologies seem to be important in this case, while primary goods and natural resource rents do

not play a notable role. Interestingly, unemployment benefits are relatively high, which implies that the welfare state tries to compensate potential losers of globalisation in the case of unemployment.

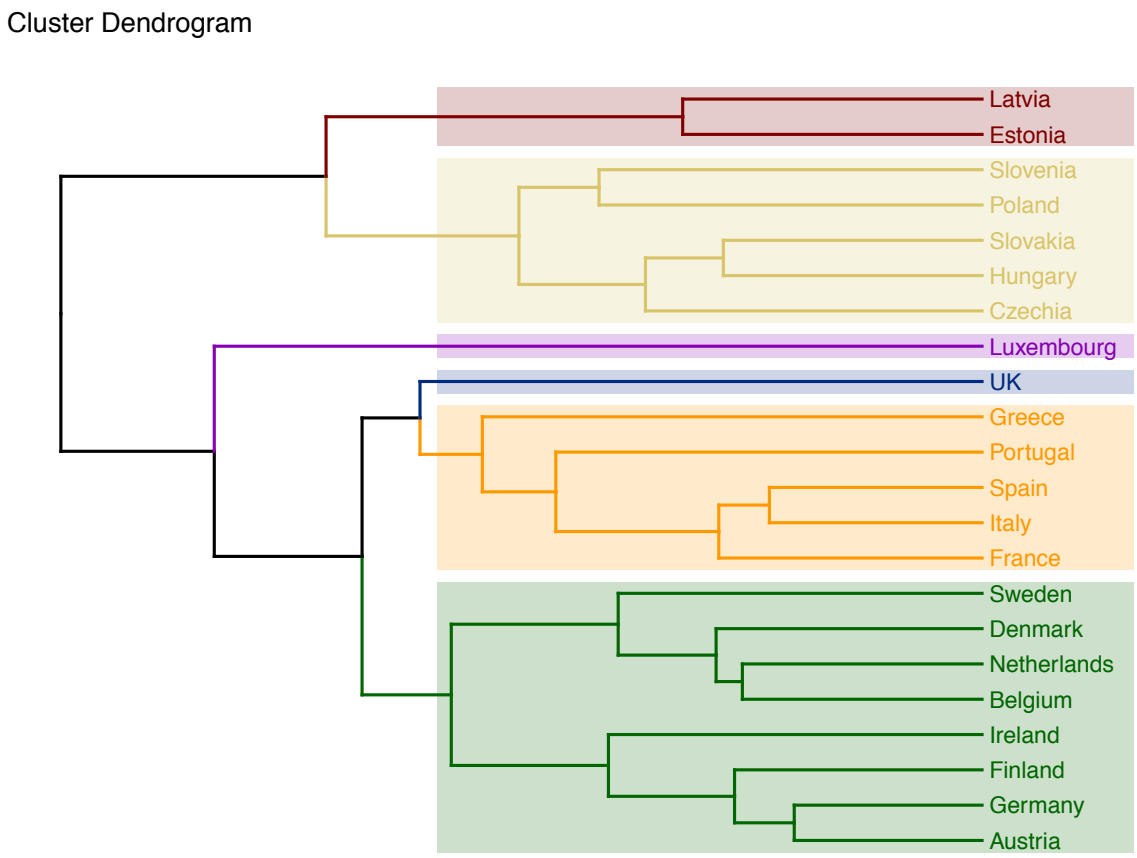

Figure 2: *Result of the hierarchical clustering.*

The trade model of United Kingdom (UK) seems to be a particular case with little similarities to the other trade models as well. The UK is mainly characterised by a highly deregulated labour market and high economic complexity. Therefore, we call this cluster 'flexible labour market model'. On average, people only get around 19.4 percent of their former net income in case of unemployment and the employment protection is very low. The coordination of wage settings is underdeveloped, indicating a fragmented wage bargaining structure confined largely to individual firms or plants. This trade model is obviously geared towards a deregulated labour market strategy in favour of firms, with little job security and benefits for employees. Against this backdrop, the observation that both, average wages as well as the wage share, are quite high seems to be surprising at first. These high values are mainly due to employees in the financial sector in London, who obtain extremely high incomes (and, therefore, contribute to the high estate and wealth tax revenues), a fact that manifests itself in very high levels of income inequality (e.g. Denk 2015).

	Cluster 1 Primary goods (LV,EE)	**Cluster 2 Finance hub** (LUX)	**Cluster 3 Flexible labour market** (UK)	**Cluster 4 Industrial workbench** (SI, PL, SK, HU, CZ)	**Cluster 5 Periphery** (GR, PT, ES, IT, FR)	**Cluster 6 High tech** (SE, DK, NL, BE, FI, DE, AT, IE)
Endowments						
Employment in agriculture	**13.71**	1.94	***1.41***	8.34	8.08	3.89
Share of oil in total exports	**0.14**	***0.00***	0.08	0.02	0.03	0.03
Share of primary goods in total exports	**0.24**	0.09	***0.08***	0.09	0.17	0.14
Natural resources rents in % of GDP	**1.44**	***0.05***	0.75	0.56	0.11	0.39
Share of manufacturing in % of GDP	13.71	***7.57***	11.19	**19.79**	12.97	17.23
Technological capabilities						
Economic complexity	***0.60***	1.27	**1.80**	1.37	0.94	1.67
Employment in industry	**29.14**	***17.77***	22.69	35.41	26.34	24.79
Gross domestic expenditure on research and development in % of GDP	***0.85***	1.48	1.63	1.08	1.20	**2.37**
ICT capital share in GDP	3.85	**3.88**	3.22	3.30	***2.82***	3.36
Government expenditure on education in % of GDP	**6.21**	4.98	5.31	5.17	***4.96***	5.58
Labour market institutions						
Coordination of wage-setting	1.19	2.38	***1.00***	2.12	2.75	**4.08**
employment protection legislation	2.40	2.25	***1.20***	2.45	**2.92**	2.30
Unemployment Benefit Net Replacement Rates in %	69.18	**82.93**	***19.40***	62.37	65.17	66.92
Average wages per year PPP Dollar	***15,950***	**55,570**	40,390	21,640	33,400	43,720
Adjusted wage share in %	***56.50***	58.17	63.20	57.78	62.19	**62.57**
Regulatory environment						
Corporate tax revenue as % of GDP	***1.70***	**5.88**	3.12	2.65	3.41	3.06
Estate tax plus all other wealth tax revenue as % of GDP	***0.55***	2.26	**2.95**	0.55	1.27	0.77
Foreign direct investment (FDI) to GDP	6.17	**41.03**	3.95	6.46	***1.95***	8.11
Share of financial sector in gross output	***1.83***	**34.65**	4.93	1.87	2.59	2.96
De jure component of the KOF globalisation econ index	80.47	**88.99**	88.26	***67.66***	82.17	85.47

Table 3: *Mean values of the identified Trade models.*
Note: *highest values are bold; lowest values are italic.*

The fourth model comprises the remaining Eastern European countries (Slovenia, Poland, Slovakia, Hungary, Czech Republic). This trade model shows the highest share of manufacturing in GDP and employment relative to all other clusters. At the same time, primary goods play a minor role for the exports in this trade model. This trade model, which we call the 'industrial workbench model', is obviously specialized on manufacturing and processing of industrial products. Especially the Visegrad countries are strongly integrated into global value chains and the European industrial core around Germany (Stöllinger 2016). This significant position becomes also visible in the dimension of technological capabilities as indicated by these countries' high scores in terms of economic complexity. This cluster seems to have an intermediate position between the 'primary goods' model (cluster 1) and the 'high tech' model (see cluster 6 below), also with respect to the level of wages. The lowest value of economic globalisation (de jure component of the KOF index), is remarkable given the relevant role of this cluster for the European industrial production chain.

The fifth trade model consists of the Southern European countries Greece, Portugal, Spain, Italy plus France. Even though agriculture represents an important employment sector, the relevance of primary goods in this 'periphery model' is lower than in the 'primary goods model'. The technological capabilities in the 'periphery model' are less well developed than in the other trade models with the exception of the 'primary goods model'. Moreover, the 'periphery model' exhibits the smallest ICT capital share and the lowest government expenditures on education across all trade models. Also, the degree of economic complexity, the total output of industry and the gross domestic expenditures on R&D are very low. This combination of poor technology, low investments in education and strict employment protection legislation seem to provide an unattractive surrounding for foreign direct investments.

Finally, the sixth model comprises Sweden, Finland, Denmark, Netherlands, Belgium, Ireland, Germany and Austria. These countries distinguish themselves from the others mainly in the dimensions of technological capabilities and labour market institutions. These eight countries have the highest R&D investments and also show a high degree of economic complexity. Because of their international competitiveness, particularly with regard to complex products requiring a lot of technological capabilities, we term this model the 'high-tech model'. The high expenditures for R&D and education suggest that this trade model is characterized by an active role of the state in a mixed economy. Most prominently, Mazzucato (2013) has already pointed out the relevance of the interaction between the state and private firms when it comes to fostering innovation and technical developments. The 'high-tech model' also stands out from the others due to the highest degree of wage coordination and relatively high wage shares (e.g. Sorge and Streeck 2018). The

main trade strategy in this cluster is to produce internationally competitive complex products with high quality. To do so, not only high investments in research and development are necessary but also an environment that fosters education and research in a trustful bargaining relationship between labour- and capital-related institutions (e.g. Zhou et al. 2011; Kleinknecht et al. 2013). The links between a corporatist (Traxler et al. 2001) inclusion of the societal interests in public decision-making in coordinated market economies and its positive impact on productivity and innovation outcomes has been documented extensively (e.g. Hall and Soskice 2001, Storm and Naastepad 2009).

By focusing on the overall positioning of economies in globalized markets we find some similarities, but also differences, to previous studies. Our typology suggests that categorising Europe into core and periphery countries (e.g. Galgóczi 2016, Laffan 2016, Sepos 2016) could be too simplistic when it comes to trade models in the EU. Nonetheless, to some extent the distinction between core and periphery is also visible in our results, as the 'periphery' model and the 'high-tech model' resemble a series of features typically attributed to core and periphery countries. Nonetheless, our suggested typology is closer to the findings of Gräbner et al. (2018), who consider more than two groups. Taking a closer look reveals that countries with similar path dependencies in their development also share a similar trade model. Nonetheless, there are some differences in the composition of the group, which are most likely due to Gräbner et al. (2018) also considering more macroeconomic benchmark variables like debt per capita, GDP growth, unemployment, while our focus is more on trade patterns.

An interesting result is that the 'high-tech model' countries overlap more or less with the core countries from Gräbner et al. (2018) that seem to perform better regarding their technological capabilities, which is in line with insights presented in the VoC literature (e.g. Hall and Soskice 2001) concerning coordinated market economies. Another feature of these countries is the high degree of wage coordination, which makes wage agreements possible against the background of overall economic goals. This trade model is also similar to Manow (2018) who put the Scandinavian countries in the same group as the continental European countries. This is likely to be the case because the core countries in these groups are defined mainly with reference to their international competitiveness, and this classification shares similarities with our study.

5. Socio-economic development in different trade models

In what follows, we discuss the implications of pursuing a particular trade model for selected dimensions of socio-economic development. To this end we study how the different trade models have performed so far in terms of growth and employment (5.1), trade performance (5.2) and inequality (5.3).

5.1. Growth and employment

The highest growth rates in terms of GDP per capita can be observed in the Baltic countries, although these countries were hit particularly hard by the financial crisis in 2007ff (see figure 3). The only exception is Ireland; growth rates of Ireland are, however, hard to interpret because of statistical problems in national accounting that result from the restructuring activities of Irish based multinationals (e.g. Beesley 2017, Linsi and Mügge 2019). The average growth rate of the Baltic countries exceeds those of the other trade models considerably, with the two countries following the 'primary goods model' taking the unanimous lead - albeit with a relatively volatile development path. Given the importance of the primary sector in these countries this is rarely surprising. Countries following the "industrial workbench model" also experience exceptional growth rates, which can most likely be traced to the effects of increasing returns associated with accelerating industrialization in conjunction with a stable employment structure in these countries (see below). As figure 3b indicates, these high growth rates are, however, at least to some extent, also due to the low absolute values of their GDP per capita: the Eastern countries are still the poorest in our sample, and have so far only managed to catch up to the countries in the periphery, who have experienced the by far lowest growth rates among all countries.

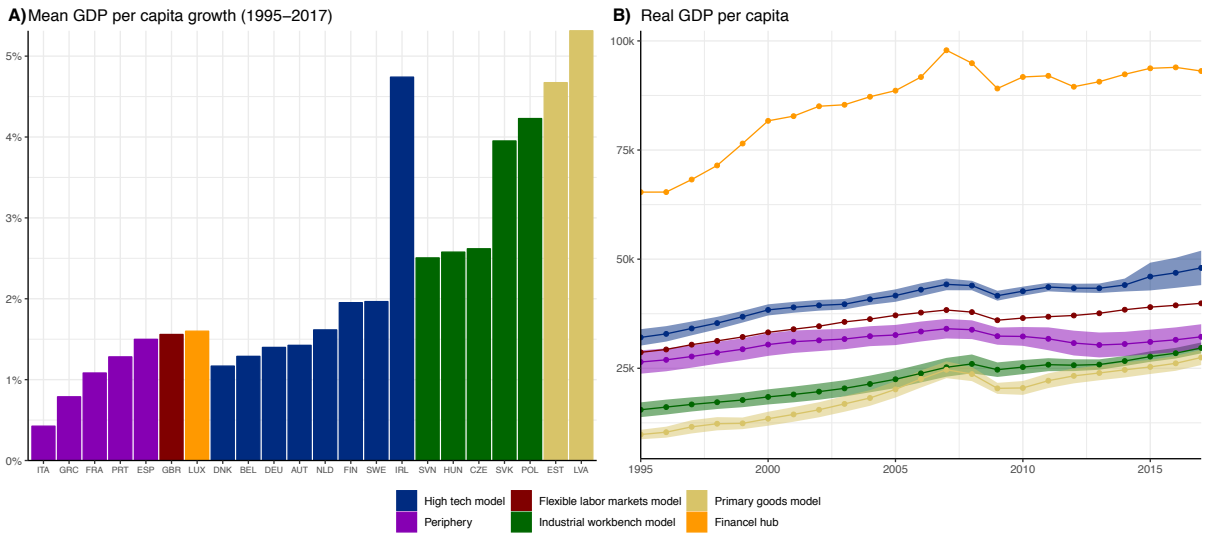

Figure 3: *Growth of real GDP per capita (PPP), source: World Bank; own calculations.*

Between these extremes, we find the countries following the 'high-tech model', as well as 'flexible labour market model' and the 'financial hub'. All these countries – despite following very different trade models – experienced similar growth rates since 1994, although the focus on finance in Luxembourg leads to a much more volatile development. When considering the levels of GDP per capita, the exceptional state of affairs in Luxembourg becomes obvious. In addition, we also

note significant higher per capita incomes in the 'high-tech cluster' as compared to the 'flexible labour market model'.

Given that labour market institutions played an essential role in delineating the different growth models, we might expect employment dynamics to be different between trade models. Figure 4a confirms this conjecture by suggesting a kind of dichotomous polarization across trade models: unemployment has fallen considerably in the countries following the "industrial work-bench model', indicating that they are harvesting the benefits of their successful industrialization (although regional differences continue to play a role). The 'flexible labour market model' and the high-tech countries also managed to reduce unemployment significantly, the former mainly through a very flexible labour market with strong incentives to accept work, the latter mainly through their competitiveness in terms of technological capabilities and a strong export industry.[10] On the other hand, unemployment was growing considerably in the 'finance model', but this is mainly the result of an exceptionally low unemployment in the year 1994, which was the lowest of all models. The high increase of unemployment in the countries following the primary goods model is more serious. This indicates that – despite rising incomes in the past - these countries do face a challenge of structural change towards more future-fit industrial sectors. The by far worst development of employment can be observed in the periphery countries, who not only face severe problems of international competitiveness, but above all suffered from harsh austerity measures and a continuing recession after the financial crisis.

The relevance of the crisis in shaping employment patterns becomes obvious when inspecting figure 4b: while there are some convergence tendencies of the unemployment rate until the year 2007, countries following different trade models showed very different reactions to the financial crisis: all countries experienced a spike in unemployment, but this effect was barely noticeable in Luxembourg, rather moderate in the high-tech and industrial workbench and the flexible labour market model, and extreme for the countries following the periphery and the primary goods model. Compared to the latter, the periphery barely recovered from this shock and still experiences the by far highest unemployment rates among all countries. The countries following the primary goods models managed to recover to some extent, but still record significantly higher unemployment rates than the rest, including the other Eastern European countries following the industrial workbench model, whose strong industrial sector seems to be a

10 At least Germany has also introduced restrictive labour market reforms (the "Hartz – Reforms", see e.g. Mohr 2012), which put high pressure on unemployed and led to wage moderation. Its superior technological competitiveness, however, still seems to be the main determinant for its export success (Storm and Naastepad 2015a, 2015b).

better job provider than the primary goods sector in Latvia and Estonia. The remaining clusters (high-tech, finance and the UK) now all experience similar levels of unemployment.

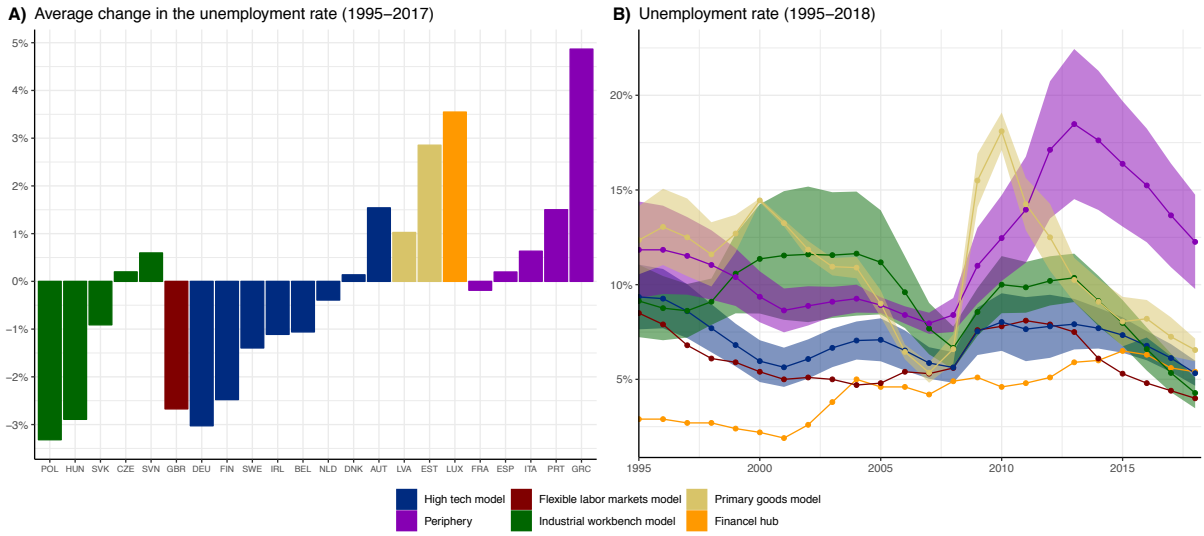

Figure 4: *Unemployment rate in percent, source: AMECO; own calculations.*

5.2. Trade performance

We now assess the various trade models in terms of their implications for the current account. As shown in figure 5a, only Luxembourg and the countries following the high-tech trade model (except Ireland) achieved a positive current account balance on average, although as the result of different dynamics (figure 5b): while the surplus in the high-tech countries was stable over time, Luxembourg experienced a considerable reduction of its surplus in the past 22 years, which was on an exceptionally high level in the year 1995. The constant current account surplus in the high-tech countries is most likely due to their advanced industrial sector with the capability to produce complex products for which they are confronted with fewer competition, but a stable demand, as compared to the technologically less sophisticated products produced by the periphery countries or those following the primary good model. The latter two groups show the worst average current accounts, with only Spain and Italy being the exceptions. This has to do with the regional polarization within those countries: in Spain, for example, companies in the North have a strong position in the world markets and contribute positively to the current account of Spain as a whole. But the Spanish South is rarely industrialized and the companies possess only few technological capabilities. A similar divide can be observed within Italy. The positive trend since the financial crisis (figure 5b) can be traced back to shrinking imports, which themselves are due to a considerable reduction of citizens' disposable income. The current account balance of the UK has worsened continuously since 1995, indicating the failure to manage structural change into a more technologically advanced direction. Given its focus on a strong service sector focused on financial

activities, and the lack of effective industrial policy in the North of the country, this is not barely surprising. The industrial workbench countries still show a negative current account on average, but the trend in recent years points towards continuous current account surpluses, indicating that their newly established industries are increasingly competitive on international markets.

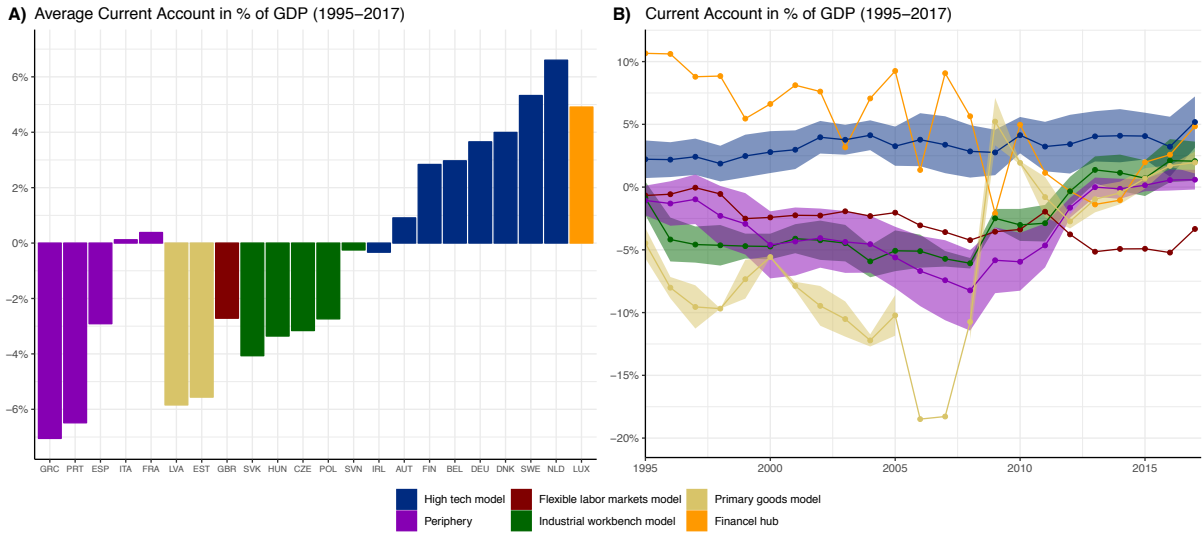

Figure 5: *Current account in % of GDP, source: AMECO.*

5.3. Inequality

The fact that trade comes with considerable distributional implications is implied by the vast majority of trade models and enjoys strong empirical support (e.g. Egger and Kreickemeier 2012, Baccaro and Pontusson 2016). Against this backdrop, it comes as no surprise that we observe an increase in inequality throughout all trade models. In what follows, we inspect whether the dominant trade model has any implications for the general trend towards increasing inequality of income.

Considering the functional income distribution, we observe a reduction of the wage share in all trade models except for the UK and the 'finance' model, indicating that in most trade models, employees did not benefit markedly from economic growth and increasing international integration (see figure 4a). The exceptional role of Luxembourg and the UK is most likely due to the many well-paid jobs in the large financial sectors of these countries. Because of their different economic structure, this does not imply a high level of personal inequality in Luxembourg, where the vast majority of the population enjoys high salaries, but it does so for the UK, where the well-paid employees are concentrated in the South, particularly the City of London, but especially the North is characterized by lower wages and higher unemployment. This becomes immediately obvious in the right panel of figure 4, where the UK belongs the group of very unequal clusters, while Luxembourg still enjoys moderate levels of income inequality, although it suffers from the most

pronounced increase in personal income inequality since 1995 and has surpassed the high-tech and industrial workbench countries, whose level of personal income inequality remains moderate as compared to the other trade models.

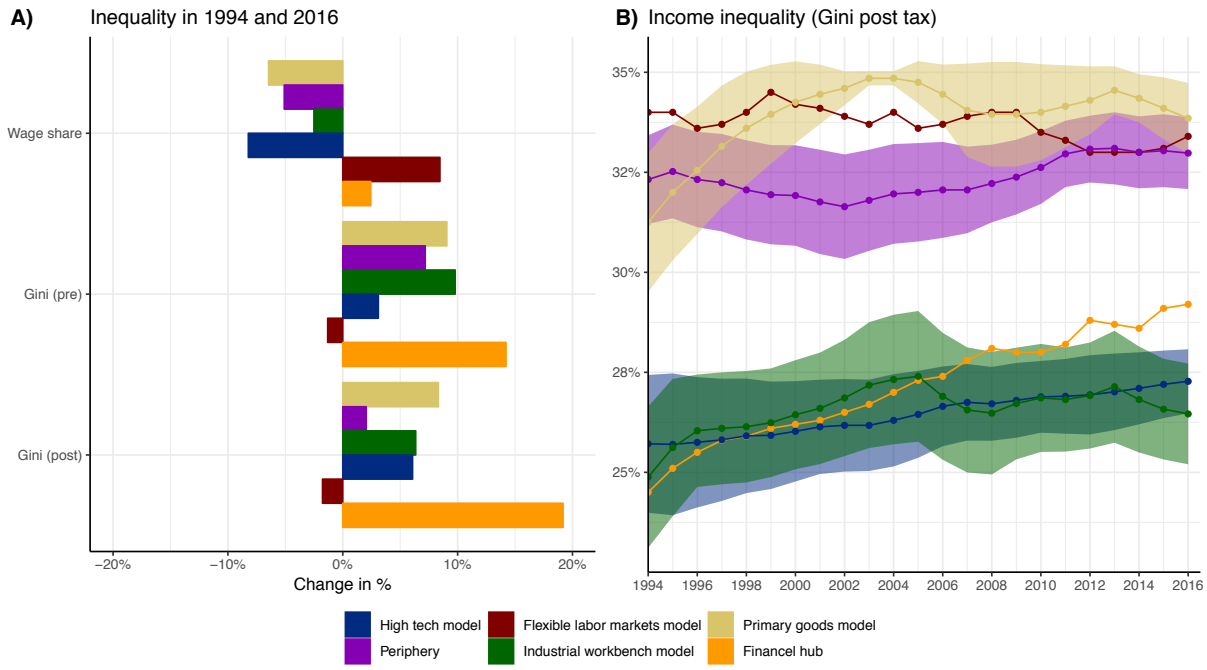

Figure 6: *Development of wage-share and Gini index between 1994-2016. Source: AMECO for the wage share and Solt (2019) for inequality data.*

The consideration of inequality highlights important differences between trade models that appeared to be similar with regard to their growth and employment dynamics (5.1) and foreign trade performance (5.2): for example, while the industrial workbench economies still enjoy comparatively low levels of inequality, inequality is high in those countries following the primary goods model, despite both models enjoying respectable growth rates of GDP per capita. Here, the low unemployment rates and the less volatile development dynamics associated with the focus on industrialization inherent to the industrial workbench model seem to be important parts of the explanation. Also, while the UK at first sight seems to be similar to the countries following a high-tech trade model, the focus on the production of high-tech products comes with significantly lowers levels of inequality than the focus on flexible labour markets and a concentrated financial sector in the UK.

5. Discussion

Building on the four theoretical dimensions natural endowments, technological capabilities, labour market characteristics and regulation, this paper has developed a typology of trade models in 22 EU countries. Based on 20 variables, we have used a hierarchical cluster analysis to identify six trade models in the EU: the 'primary goods model' (Latvia, Estonia), the 'finance model' (Luxembourg), the 'flexible labour market model' (UK), the 'periphery model' (Greece, Portugal, Spain, Italy, France), the 'industrial workbench model' (Slovenia, Slovakia, Poland, Hungary, Czechia), and the 'high-tech model' (Sweden, Denmark, Netherlands, Belgium, Ireland, Finland, Germany and Austria).

This typology aligns well with previous findings from the existing literature and adds a new perspective at the same time. Our results are close to the findings of Gräbner et al. (2018), who develop their taxonomy based on macroeconomic data, countries' reactions to increasing economic openness and theoretical considerations. Most importantly, the countries that follow the high tech model in our case are almost the same countries that Gräbner et al. (2018) consider as core countries. And the periphery in their study is almost the same as in our analysis of trade models. This suggests that trade models are an important determinant of the more general positioning of a country within the political economic environment of the EU. We also find some similarities to the results of Esping-Andersen (1990), although our focus on trade patterns differs from their focus on welfare regimes. The 'flexible labour market model' resembles the liberal regime (United States, Canada, Australia) in Esping-Andersen (1990) with regard to their composition and welfare state characteristics. Furthermore, the 'high-tech model' shares some similarities with the social democratic regime of Esping-Andersen (1990) but also includes conservative countries like Germany and Austria.

Our trade typology also complements to the literature on technological capabilities and regulation. A result that sticks out is that the 'high-tech model' does not only perform well in the dimension of technological capabilities, it also provides institutions and a political setting ensuring stability even in times of economic turmoil. This can be seen by relatively stable GDP growth and unemployment rates during and after the 2008/2009 crisis. At the same time, the 'high-tech' trade model shows one of the highest wage shares and the lowest income inequality of all trade models in Europe. Thus, lower inequality does not necessarily hamper economic performance and trade and there is an alternative to wage moderation when it comes to achieving international competitiveness and economic prosperity. A possible explanation is the relationship of economic growth and the economic complexity of a country. According to Hidalgo and Hausman (2009), economies that produce and export more complex goods also follow a sustained growth path that leads to higher prosperity than in countries that produce simpler products. In order to facilitate the development of a more complex product pool, the state has an essential role to play when it comes

to fostering collective knowledge, human capital accumulation and setting the legal and institutional framework in a way that allows for improving an economy's capabilities for innovation (Felipe *et al.* 2012, Mazzucato 2013). Our results indicate that labour market institutions, an active government and investments in R&D may play an important role in achieving these goals.

Finally, this paper leaves room for further research. One possible extension to this paper would be to analyse how trade patterns have changed over time. In developing our trade models in the EU, we have used data from 1994 to 2016. Due to the introduction of the Euro during this period, it is reasonable to assume that economies have changed their trading strategies as well as their institutional settings. Unfortunately, most of the relevant OECD data are only available after a country has joined the OECD club. Consequently, available data are very limited for new OECD countries. Further research on the development of trade models on the basis of improved data availability could provide a better picture about how trade models change over time. Another interesting task would be to analyse political developments in the context of trade models.

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There is no potential conflict of interest.

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Appendix

A. Data Sources

Indicator	Unit	Source
Employment in agriculture	Share of total employment	World Bank (Indicator: SL.AGR.EMPL.ZS)
Oil exports[11]	Share of total exports	The Atlas of Economic Complexity
Primary goods	Share of total exports	The Atlas of Economic Complexity
Natural resources rents	Share of GDP, current prices	World Bank (Indicator: ny.gdp.totl.rt.zs)
Share of manufacturing	Share of GDP	World Bank (Indicator: NV.IND.MANF.ZS)
Gross domestic expenditure on research and development	Percent of GDP	World Bank (Indicator: GB.XPD.RSDV.GD.ZS)
Government expenditures on education	Percent of GDP	Eurostat (Indicator: gov_10a_exp)
ICT capital share in GDP	Percent of GDP	Jorgenson and Wu
Employment in the industrial sector	Percent of total employment	World Bank (Indicator: sl.ind.empl.zs)
Economic complexity index	Index	The Atlas of Economic Complexity
Coordination of wage-setting	Index	Visser (2016) (ICTWSS Data base, version 5.1)
Strictness of regulation on dismissals and the use of temporary contracts.	Index	OECD
Unemployment Benefit Net Replacement Rates for single earner in initial phase of unemployment	Percent	OECD (Dataset: NRR)
Average wages per year	PPP Dollar	OECD (Indicator: AV_AN_WAGE)
Adjusted wage share	Percent of GDP	AMECO
Corporate Tax[12]	Tax revenue as percent of GDP	OECD
Taxes on estates and other wealth taxes[13]	Tax revenue as percent of GDP	OECD
Share of financial sector in gross output	Percent of all sectors	EU KLEMS
Foreign direct investment (FDI)	Percent of GDP	World Bank
De jure component of the KOF econ index	Index	Gygli et al. (2019)

The raw data has been published as Gräbner et al. (2019). The code used to create the results and figures in the paper is available upon request.

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[11] This comprises the products within the following SITC V2 categories: 28, 32, 35, 68, 97, 5224, 5231, 5232, and 5233.
[12] This comprises the following OECD tax codes: 1120, 1200, 6100, 1300 and 5125.
[13] Other wealth taxes comprise the following OECD tax codes: 4200, 4500 and 4600.

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