Decomposition of Supply, Demand, Trade and Value Chain Driven Determinants of Structural Change

Klemen Knez*

Abstract

There are contested theories describing different functional mechanisms leading to intersectoral restructuring and different effects of intersectoral specialisation and trade on growth. The contribution of this article is an empirical investigation of the country-specific determinants of structural change in an open economy. The two main research questions are: What are the country specific supply-driven, demand-driven, trade-driven and value-chain-driven determinants of long-term employment changes (1.) from manufacturing to services and (2.) from agriculture to the rest of the economy. We conduct a comprehensive multiregional input-output analysis using a structural decomposition by decomposing annual employment changes in each country-sector into real changes in labour productivity, real changes in the structure of supplier linkages, fabrication effects, and real changes in final demand. Using WIOD, we undertake a separate structural decomposition of employment changes for each of the 43 available countries to identify a unique set of determinants of structural change from manufacturing to services and from agriculture to the rest of the economy over the period 2000-2014. The main methodological innovation of the study is the systematic consideration of separate domestic and foreign real changes in supplier linkages and fabrication changes on the dynamics of structural change. The results show that the determinants of structural change are very heterogeneous and country-specific and strongly depend on the form of international integration.

Keywords: Structural change; Input-output decomposition;
JEL

*Centre of International Relations, University of Ljubljana, Ljubljana, Slovenia, mail: Klemen.Knez@fdv.uni-lj.si

Introduction

This article focuses on the empirical facts of structural change. There exist not only contested theories that describe various functioning mechanisms that lead to inter-sectoral restructuring, but also contesting theories describing different effects of inter-sectoral specialization and trade on growth. However, specific context, in which one theoretically described mechanism prevails over another, can be grasped only with empirical analysis of structural change determinants, which might be country specific and highly dependent on the form of international integration. The article aims to capture main determinants of structural change on country level, while taking into account supply driven and demand driven factors, as well as analysing the effects of changes in the international production fragmentation and trade. This empirical estimates contribute to the broader understanding of the structural change in different stages of development and how it is affected by the rising value chain fragmentation and international trade.

Structural change is defined as the reallocation of economic activity among a large group of sectors: agriculture, manufacturing, and services (Fisher, 1939). The most common empirical stylised fact of structural change is a long term decline of employment in agriculture, increase of employment in services and increase of employment in manufacturing in the early stages of development followed by a subsequent decline (Herrendorf et al., 2014). In this article we aim to empirically disaggregate the key determinants of the employment changes between these major sectors from the perspective of supply, demand, international trade, and domestic and global value chain structures.

The concept of structural change goes beyond mere redistribution of employment. In different stages of development, the structural re-employment between sectors is accompanied by long lasting cultural, political and institutional changes (Chenery, 1982). The research on structural change initially focused on the transition from the agricultural production to the manufacturing production - from low productivity to high productivity employment (Eberhardt & Vollrath, 2016). The benchmark approaches to this transition are the Lewis's (1954) dual sector model, expanded on different levels (Amano, 1980; Jorgenson, 1961; Ranis & Fei, 1961), and Kuznets' (1971) analysis which present basic theory that is often formulated as the stylised facts of the structural change and growth. Later research expanded and put extensive focus on the structural relocation of employment from manufacturing to services, characteristic for more developed countries (Baumol, 1967; Jorgenson & Timmer, 2011; Maddison, 1987).

Aggregate technological progress and productivity are not sufficient to define the economic system in a dynamic setting. To go beyond the aggregate expressions, the framework must be formulated in disaggregate terms. Structural change, inter-sectoral dynamics and economic development are linked and must be analysed concurrently (Pasinetti, 1983). However, almost all the approaches of structural change analysis, both theoretical and empirical, operate within the closed country setting. While the vast research on structural change demonstrates that there exist fundamental inter-sectoral heterogeneities on different levels, which induce important dynamics and complexities that shape the growth of individual economy, there are limited analyses that would apply the insights of this framework to the functioning of the globally integrated economy. The complex effects of inter-sectoral heterogeneities on the global division of labour, international specialisation and potential for technological upgrading remain largely unexplored. *Vice versa*, the effects of trade and international specialization on the structural change dynamics is also largely unknown. The importance of understanding the effect of inter-sectoral heterogeneities in the context of open economies is even further elevated due to the increasing fragmentation of the production process, which enables the inter-sectoral heterogeneities to function on an ever finer scale.

The two main research questions are: What are the country specific supply-driven, demand-driven, trade-driven and value-chain-driven determinants of long-term employment changes (1.) from manufacturing to services and (2.) from agriculture to the rest of the economy. We conduct a comprehensive

multi-regional input-output analysis using structural decomposition. We decompose annual employment changes in each country-sector into real changes in the labour productivity, real changes in the structure of supplier linkages, fabrication effects, and real changes in final demand. Using WIOD, WIOD in previous year prices, and SEA, we undertake a separate structural decomposition of employment changes for each of the 43 available countries. We construct two indices of structural change by summing the changes in employment from manufacturing to services and from agriculture to the rest of the economy over the entire period to identify a unique set of determinants of structural change for each country as well as for the world. The main novelty of the study is the systematic consideration of separate domestic and foreign real changes in supplier linkages and fabrication changes on the dynamics of structural change, which sheds new light on the country-specific determinants of structural change.

1 Theoretical Explanations of Structural Change

1.1 Supply Driven Theories

The theoretical explanations for the drivers of structural change are mostly either demand or supply driven. One of the earliest examination of supply side driven structural change is Baumol's (1967) two-sector model. The basic idea is that employment changes due to sector-specific productivity growth. In sectors with above-average productivity growth, employment declines and shifts to sectors with more stagnant productivity in the long run. The main assumptions are different technologies leading to different labour productivities. The first sector is stagnant in the long run and exhibits zero technology growth, while the second sector is progressive and exhibits exponential technological growth, similarly as in Solow-Swan model. Depending on the assumptions regarding the consumer preferences and substitutability of the commodities produced by the sectors, the employment and prices change. The most profound employment change happens if Leontief preferences are assumed, while if substitution between commodities is allowed, the effect is distributed between the price effect and the employment effect. In both cases either employment or relative price of the more stagnant part of the economy increases - the phenomenon labelled the Baumol's cost disease. Its main prediction is that structural change of this type leads to increasing employment and costs of the services relative to the manufacturing, diminishing further prospects of high growth rates in developed countries.

Ngai and Pissarides (2007) broaden the Baumol's framework by analysing m sectors charaterized by CES production functions with different TFP growth rates in a general equilibrium setting, arriving at similar results as Bauomol. Acemoglu and Guerrieri (2008) address the same issue with different type of differentiation between sectors. They assume that sectors differ with respect to sector-specific elasticities of capital productivity, which leads to sector-specific capital intensities and productivities. More capitally intense sectors are more productive, have lower employment and higher output and *vice versa*. Both intrasectoral heterogeneity in TFP and intrasectoral heterogeneity in factor marginal productivities affect structural change similarly.

Further expanding the supply driven approach, Alvarez-Cuadrado et al. (2017, 2018) generalize the heterogeneity of production constraint by using CES production function as opposed to Cobb-Douglass production function used by previous approaches. This enables them to assume inter-sectoral heterogeneity in the elasticities of substitution between factors of production, not only to derive similar pattern of structural change as previous approaches, but also to derive the effect of the structural changes on the factor income shares under neoclassical assumptions.

1.2 Demand Driven Theories

In contrast to the supply driven approaches, which derive the dynamics of the structural change as a consequence of the inter-sectoral heterogeneities of the production constraints, the demand driven approaches explore how sector specific consumption dynamics affect inter-sectoral changes in employment and output. The core idea is that the most common assumption of the non-homothetic preference function conceals the dynamics that might be driven due to the non-homothetic preferences. In other words, the consumers might change the proportion of the demand use for various goods and services with rising income *ceteris paribus* and this can be a factor in determining structural change.

The earlies examinations of non-homothetic behaviour can be attributed to Engel. His analysis demonstrated a relation between the consumption of the short term physical requirement goods (mostly food), other commodities and income. The main discovery, latter labelled as the Engel's law, was that the proportion of the income used for food is a good measure of the overall income. With income increases also the share of consumption for basic food declines (Zimmerman, 1932). The effect of Engel's law on the structural change and growth is crucial for explaining the long-term dynamics of economic growth according to the proponents of the demand driven explanations of structural change (Leon, 1967). One of the early approaches to demand driven structural change is Pasinetti's (1983, 1993) multi-sectoral macrodynamic analysis, where income elasticities for various goods are different and change with rising income. This creates unbalanced growth paths and different sectors expand based on the changing demand structure.

Laitner (2000) examines a two sector model of industrialisation with an endogenous savings and utility function based on Engel's law. It is used to analyse transition from subsistence agriculture to manufacturing. In this approach, the push creating employment relocation is driven indirectly by exogenous technology growth, which in turn rises incomes that are distributed more in favour of the manufacturing sector, due to the assumed preference structure. Gollin et al. (2002) present a similar variations of the Lewis' dual sector model. It conceptualises the early industrialisation as demand driven, with agricultural productivity as an essential feature in the early stages of development, while the model converges to the neoclassical exogenous growth model as the country develops and agricultural consumption becomes negligible.

An alternative way to implement Engel's law in the utility function is by using Stone-Geary utility function, which is a generalized Cobb-Douglass utility function that emerged as a solution to the linear expenditure system and allows for non-homothetic shape (Geary, 1950; Klein & Rubin, 1947; Stone, 1954). Park (1998) introduced a subsistence consumption parameter in the Stone-Geary function for the agricultural sector, to differentiate it from the manufacturing sector, to derive a three-factor, three good endogenous model of growth and structural change. Introducing the non-homothetic preferences into the general equilibrium model comprising three sectors yields similar results (Echevarria, 1997). Similarly, Kongsamut et al. (2001) derive a model of balanced growth that conforms to the Kaldor stylised facts and exhibits sectoral relocation of employment, which is driven by the differences in the income elasticity of demand for the different goods implemented in the Stone-Geary form of utility. However, balanced growth in this model is achieved by assuming constant relative prices, which establishes a questionable link between preferences and the production constraints (Foellmi & Zweimüller, 2006).

In contrast to other approaches, Foellmi and Zweimüller (2006, 2008) assume that the utility function has a hierarchical structure in terms of sequential consumption preference in the form of generalised hierarchical Engel's laws. The approach creates a theoretical dynamic structure of consumption similar to Shumpeterian approach to technological progress. New goods are constantly introduced. Initially they are perceived as luxury goods, while through time, as new goods are added to the consumption, their income elasticity declines. Overall, the main mechanism that drives the structural change in the model remain the inter-sectoral differences in the elasticities of demand.

Both supply and demand driven approaches and mechanisms are rarely integrated into a single theoretical model, which include both non-homothetic preferences and inter-sectoral heterogeneities in production constraints simultaneously (Boppart, 2014; Comin et al., 2021).

1.3 Theories and Models with Open Economy

The vast majority of the theoretical approaches to structural change are limited to conceptualisations and models of closed economy. A less theoretically explored dimension of structural change is the impact of international trade and the integration into global value chains.

Matsuyama (2009) analyses a model of small and open economy and derives that, while the world manufacturing is in decline due to supply driven factors, concrete open economy and its inclusion in the international trade can often offset this effect. By integrating supply driven and demand driven conceptualisations of structural change with international trade, Uy et al. (2013) demonstrate on the case of Korea that the role of trade is important in explaining structural change. Mao and Yao make a dynamic general equilibrium model that encompasses three sectors (agriculture, manufacturing and services), of which only agriculture and manufacturing are internationally tradable. With it they not only reproduce the stylized empirical facts regarding employment changes in these sectors, but are also the first to demonstrate importance of the Balassa-Samuelson effect (Balassa, 1964; Samuelson, 1964) on the dynamics of the structural change in the international setting. The Balassa-Samuelson effect is shown to counteract the main supply driven effect due to productivity changes in a small and open economy (Mao & Yao, 2012). This stream of literature has shown that there exist direct effects of international trade on the patterns of structural change. *Vice versa*, the effects of structural change on international trade have also been studied and are non-negligible, contributing to the global trade growth slowdown (Lewis et al., 2021).

A stream of Post-Keynesian literature also analyses the effects of structural change in an open economy and focuses on how international specialization across countries, as it is determined and determines structural change, impacts cross-country growth differences and uneven development. The approach is predominantly demand driven. Araujo (2013) and Araujo and Lima (2007) merge, on the one hand, the balance-of-payments-constrained growth approach pioneered by Thirlwall (McCombie & Thirlwall, 2016; Thirlwall, 1979, 1983) and, on the other hand, the inter-sectoral analysis of structural change conducted by Pasinetti (1983, 1993). The main idea of this approach is that the demand driven inter-sectoral heterogeneities can create uneven benefits of international specialization and trade, as growth is constraint by the country specific trade elasticities and its sectoral specialization.

2 Methodology

Our approach to identifying the relative contributions of the various determinants to employment changes is structural decomposition analysis (de Boer & Rodrigues, 2020; Rose & Casler, 1996). Using WIOD and SEA (Timmer et al., 2015), we perform a separate annual decomposition for each country available in the data. By analysing the annual changes in the variables, the impact of the inability to clearly separate mixed effects (Dietzenbacher & Los, 1998; Sonis et al., 1996) is minimised to second-order of importance because the annual changes are small relative to the values and the mixed effect terms consist of multiplying two such small annual changes. We approximate decomposition with mid-point weights, which was calculated to minimise the errors (Muradov, 2021).

Decomposing employment changes into changes in the ratio of value added per worker (inverse productivity) for a given value added and into changes in value added for a given productivity is a common

practice in structural decomposition analysis. The same applies to the decomposition of changes in final demand into different components - from the level of household, government and investment demand to the level of domestic and foreign final demand components.

The empirical and methodological novelty of our structural decomposition lies mainly in the decomposition of changes in the structure of production, which consists of changes in value added coefficients and the international Leontief inverse. We draw on two important contributions in this area. The first is a new framework for measuring cross-border supply chain fragmentation (Timmer et al., 2021). The main innovation is the derivation of annual changes in each variable using values expressed in prices of the previous year. This leads to an assessment of real changes in the structure of supplier linkages and other variables as opposed to nominal effects. The second important contribution is the examination of the decomposition of the dependent variables, primarily the value-added coefficients and the Leontief inverse (Dietzenbacher & Los, 2000). We generalise this approach and apply it to an extended international IO setting. Thus, we do not only decompose changes in value-added coefficients and the Leontief inverse on fabrication effects and the changes in the structure of supplier linkages, but additionally decompose them on several elements, similarly as proposed by Avelino et al. (2021). In the end, we obtain a decomposition that includes, on the one hand, the real changes in the structure of domestic supplier linkages, the real changes in the structure of intermediate import linkages, the real changes in intermediate import propensity as well as real changes in foreign intermediate linkage structures, and, on the other hand, the real domestic and foreign fabrication effects.

3 Structural decomposition

There are 3 main parts of the structural international input-output decomposition of employment changes:
1.) Real sectoral changes in labour productivity;
2.) Real changes in supplier linkage structures and real fabrication effects;
3.) Real changes in the final demand structure.

We use the standard international IO notation, which is explicitly defined in the Appendix A. We begin our decomposition by decomposing employment changes on the effect of real sector-specific productivity changes and the changes in value added due to other effects.

$$\Delta EMP_t = \left(\hat{v}_t + \frac{\Delta\hat{v}_t}{2}\right)\Delta\Psi_t + \Delta\hat{v}_t\left(\Psi_t + \frac{\Delta\Psi_t}{2}\right) \tag{3.1}$$

While the first element contains the main supply driven effects of employment changes, the remaining effects of changes in supplier linkages, fabrication effects, and final demand effects remain captured in $\Delta\hat{v}$. The main identity of equation 3.2 presents a basis for further decomposition.

$$v = \hat{c}(I - A)^{-1}f \tag{3.2}$$

The decomposition of real changes in value added follows the idea proposed by Dietzenbacher and Los (2000) to separate the real changes in the structure of supplier linkages and fabrication effects by constructing a modified matrix of Leontief coefficients $\tilde{A}_t$. The basic idea is that each column of $\tilde{A}_t$ is defined to have the same distribution of coefficients as a column of $A_{t\ pyp}$, but is normalized to the column sum of A_{t-1}. This allows us to separate the effects of real changes, on the one hand, in the structure of supplier linkages and, on the other hand, in the value-added coefficients coupled with the changes in the column sums of A, often called fabrication effects.

$$\Delta v_t = \hat{c}_t L_t f_t - \hat{c}_{t-1} L_{t-1} f_{t-1} \tag{3.3}$$

$$\Delta v_t = \hat{c}_t L_t f_t - \hat{c}_{t-1} L_{t-1} f_t + \hat{c}_{t-1} L_{t-1} \Delta f_t \tag{3.4}$$

$$\Delta v_t = \left(\hat{c}_t L_t - \hat{c}_{t-1} \tilde{L}_t\right) f_t + \hat{c}_{t-1} \left(\tilde{L}_t - L_{t-1}\right) f_t + \hat{c}_{t-1} L_{t-1} \Delta f_t \tag{3.5}$$

The first element of the equation 3.5 represents fabrication effects and the second element represents real changes in supplier linkages. Both can be further decomposed. The last element represents the effect of changes in final demand.

3.1 Real changes in intermediate supplier linkages

For each country, we separate the effect of real changes in supplier linkages ($\hat{c}_{t-1}\left(\tilde{L}_t - L_{t-1}\right) f_t$) on the following elements:
1.) Changes in the structure of domestic linkages;
2.) Changes in the structure of intermediate imports by domestic firms;
3.) Changes in the intermediate import propensity of domestic firms;
4.) Changes in the structure of foreign supplier linkages (including changes in domestic linkages of foreign countries).

Such a decomposition is necessarily specific to each country c. We focus on the difference of the two Leontief inverses contained in the second element of the equation 3.5.

$$\tilde{L}_t - L_{t-1} = (I - \tilde{A}_t)^{-1} - (I - A_{t-1})^{-1} \tag{3.6}$$

$$\tilde{L}_t - L_{t-1} = \frac{1}{2} \tilde{L}_t \Delta A_t L_{t-1} + \frac{1}{2} L_{t-1} \Delta A_t \tilde{L}_t \tag{3.7}$$

The next step is to decompose the change in supplier linkages, captured within the ΔA.

$$\Delta A_t = \tilde{A}_t - A_{t-1} \tag{3.8}$$

Since we are working in a demand-driven Leontief model, the changes in the Leontief coefficient matrix ΔA_t represent real changes in downstream linkages that induce direct and indirect effects based on the given global final demand. From the perspective of a given country c, the matrix ΔA_t can be decomposed into two major parts. The first part ($\Delta_c A_t^D$) has all the columns that do not correspond to the country c equal to zero, and the second part ($\Delta_c A_t^F$) all columns corresponding to country c are equal to zero. A Leontief coefficient with indices (i, r, j, s) denotes the j-th sector and s-th country requirements for the production in sector i and country r. Note that each decomposition into country (c) is specific.

$$\Delta A_t = \Delta_c A_t^D + \Delta_c A_t^F \tag{3.9}$$

$$\Delta_c a_t^D(i, r, j, s) = \begin{cases} \Delta a_t(i, r, j, s) & \text{if } r = c \\ 0 & \text{otherwise} \end{cases} \tag{3.10}$$

$$\Delta_c a_t^F(i, r, j, s) = \begin{cases} \Delta a_t(i, r, j, s) & \text{if } r \neq c \\ 0 & \text{otherwise} \end{cases} \tag{3.11}$$

We want to further separate the effects of real changes in domestic intermediate linkages and real changes in the structure of domestic intermediate imports. To do so, we need to make additional definitions. Unlike the previous set of definitions, in this case we define total values as opposed to real changes, since further modifications are made by separate definitions of changes. In this way, we can separately assess the impact of changes in domestic supplier linkages, domestic intermediate import linkages, and domestic intermediate import propensity.

$${}_c a_t^{dom}(i, r, j, s) = \begin{cases} a_t(i, r, j, s) & \text{if } r = c \text{ and } s = c \\ 0 & \text{otherwise} \end{cases} \tag{3.12}$$

$$ {}_{c}a_{t}^{imp}(i,r,j,s) = \begin{cases} a_t(i,r,j,s) & \text{if } r = c \text{ and } s \neq c \\ 0 & \text{otherwise} \end{cases} \tag{3.13} $$

$$ {}_{c}a_{t\ pyp}^{dom}(i,r,j,s) = \begin{cases} a_{t\ pyp}(i,r,j,s) & \text{if } r = c \text{ and } s = c \\ 0 & \text{otherwise} \end{cases} \tag{3.14} $$

$$ {}_{c}a_{t\ pyp}^{imp}(i,r,j,s) = \begin{cases} a_{t\ pyp}(i,r,j,s) & \text{if } r = c \text{ and } s \neq c \\ 0 & \text{otherwise} \end{cases} \tag{3.15} $$

We define ${}_{c}\tilde{A}_{t}^{dom}$ as having the same distribution of coefficient as ${}_{c}A_{t\ pyp}^{dom}$, but having the column sum equal to the column sum of ${}_{c}A_{t-1}^{dom}$. Similarly, we define ${}_{c}\tilde{A}_{t}^{imp}$ with the same distribution of coefficient as ${}_{c}A_{t\ pyp}^{imp}$, but with the column sum equal to the column sum of ${}_{c}A_{t-1}^{imp}$. Using this, we define $\Delta_c A_t^{dom}$ in equation 3.16 and $\Delta_c A_t^{dom}$ in equation 3.17.

$$ \Delta_c A_t^{dom} = {}_{c}\tilde{A}_{t}^{dom} - {}_{c}A_{t-1}^{dom} \tag{3.16} $$

$$ \Delta_c A_t^{imp} = {}_{c}\tilde{A}_{t}^{imp} - {}_{c}A_{t-1}^{imp} \tag{3.17} $$

We can now further decompose the changes in supplier linkages and continue from equation 3.9.

$$ \Delta A_t = \underbrace{\Delta_c A_t^{dom}}_{(1.)} + \underbrace{\Delta_c A_t^{imp}}_{(2.)} + \underbrace{\left(\Delta_c A_t^{D} - \Delta_c A_t^{dom} - \Delta_c A_t^{imp}\right)}_{(3.)} + \underbrace{\Delta_c A_t^{F}}_{(4.)} \tag{3.18} $$

Since the ${}_{c}\tilde{A}_{t}^{dom}$ has the same column sum as ${}_{c}A_{t-1}^{dom}$, the first element (1.) represents real changes in the domestic supplier linkage structure. Similarly, the second element (2.) represents real changes in the import structure of domestic firms. The third element (3.) can be interpreted as the real changes in the intermediate import propensity. Since both ${}_{c}\tilde{A}_{t}^{dom}$ and ${}_{c}\tilde{A}_{t}^{imp}$ are defined with a column size predetermined by the previous year's domestic linkages and intermediate imports, the difference between the total effect of real changes in the structure of domestic firms' supplier linkages $\Delta_c A_t^D$ and the effect of changes in the structure of domestic linkages and the structure of intermediate imports includes exactly the isolated effect of changes in intermediate import propensity ${}_{c}\tilde{A}_{t}^{iip}$ - namely, the effect of substitution of domestic intermediate suppliers for intermediate imports or *vice versa*. The fourth element (4.) captures all the effects of changes in intermediate supplier linkages of foreign firms from the perspective of country c, i.e., changes in their domestic and global value chain structure and the foreign firm intermediate import propensities. Further decomposition of this element would not serve the purpose at this point, since the element from the perspective of country c captures only the overall effect of global changes in intermediate demand relevant to country c's sectors. Since we are working within demand-driven model, the fourth element captures the effect of changes in the inclusion of country c's domestic firms in global value chains due to changes in the structure of foreign intermediate supplier linkages, while the first three elements include the effects of changes in the structure of domestic firms' supplier linkages - namely, the effect of changes in domestic firms' domestic supplier structure (1.), international supplier structure of domestic firms (2.), or the relationship between outsourcing and domestic sourcing of domestic firms (3.).

To continue in more compact notation, we define changes in real domestic intermediate import propensity $\Delta_c A_t^{iip}$ with equation 3.19.

$$ \Delta_c A_t^{iip} = \Delta_c A_t^{D} - \Delta_c A_t^{dom} - \Delta_c A_t^{imp} \tag{3.19} $$

The four elements of our decomposition can thus be written more compactly.

$$ \Delta A_t = \Delta_c A_t^{dom} + \Delta_c A_t^{imp} + \Delta_c A_t^{iip} + \Delta_c A_t^{F} \tag{3.20} $$

Finally, we insert this result in the equation 3.7. Each decomposed element of ΔA_t accounts for both the direct and indirect effect of the real changes in the supplier linkages, when inserted in the equation 3.7.

$$\tilde{L}_t - L_{t-1} = \frac{1}{2}\tilde{L}_t\Delta_c A_t^{dom} L_{t-1} + \frac{1}{2}L_{t-1}\Delta_c A_t^{dom}\tilde{L}_t + \frac{1}{2}\tilde{L}_t\Delta_c A_t^{imp} L_{t-1} + \frac{1}{2}L_{t-1}\Delta_c A_t^{imp}\tilde{L}_t + \tag{3.21}$$

$$\frac{1}{2}\tilde{L}_t\Delta_c A_t^{iip} L_{t-1} + \frac{1}{2}L_{t-1}\Delta_c A_t^{iip}\tilde{L}_t + \frac{1}{2}\tilde{L}_t\Delta_c A_t^{F} L_{t-1} + \frac{1}{2}L_{t-1}\Delta_c A_t^{F}\tilde{L}_t +$$

With this intermediate result (equation 3.21), we have decomposed both the direct and indirect effects of real changes in supplier linkage structures on changes in value added.

3.2 Real fabrication effects

The first element ($(\hat{c}_t L_t - \hat{c}_{t-1}\tilde{L}_t)f_t$) of the equation 3.5, represents the fabrication effects. These include changes in the value added coefficients as well as the sums of the columns of the Leontief coefficient matrices. Thus, total fabrication effects account for changes in production procedures and techniques that alter the relationship between value added on the factory level and the use of intermediaries. One of the most important sources of fabrication effects at the international level is the changes in the share of outsourcing and insourcing of various tasks within the production process. Thus, this element of the decomposition helps us assess the impact of changes that primarily concern outsourcing. For each country c, we can decompose the whole element into the domestic fabrication effects ($\Delta_c FAB_t^{dom}$) and the foreign fabrication effects ($\Delta_c FAB_t^{for}$) by simply treating all columns

$$\Delta_c FAB_t = \hat{c}_t L_t - \hat{c}_{t-1}\tilde{L}_t = \Delta_c FAB_t^{dom} + \Delta_c FAB_t^{for} \tag{3.22}$$

$$\Delta_c fab_t^{dom}(i,r,j,s) = \begin{cases} \Delta fab_t(i,r,j,s) & \text{if } r = c \\ 0 & \text{otherwise} \end{cases} \tag{3.23}$$

$$\Delta_c fab_t^{for}(i,r,j,s) = \begin{cases} \Delta fab_t(i,r,j,s) & \text{if } r \neq c \\ 0 & \text{otherwise} \end{cases} \tag{3.24}$$

This decomposition allows us to consider the impact of changes in the outsourcing of domestic firms and the impact of changes in the outsourcing of foreign firms.

Having first separated real productivity effects from the remaining changes in value added (equation 3.1) continued with the decomposition of value added changes on fabrication effects, real supplier linkages changes, and final demand effects (equation 3.5), the remaining element that can be further decomposed is the effect of changes in final demand.

3.3 Final demand changes decomposition

The structure of the national accounting that forms the basis of the international input-output data structure allows us to decompose real changes in final demand into changes in domestic final demand and changes in foreign final demand.

$$\Delta f_t = \Delta f_t^{for} + \Delta f_t^{dom} \tag{3.25}$$

We further decompose the effects of the changes in domestic final demand on the effects of household ($\Delta_h f_t^{dom}$) (including non profits serving households), government ($\Delta_{gov} f_t^{dom}$) and investment demand changes ($\Delta_{gov} f_t^{inv}$), as well as the residuum effect of the changes in inventories ($\Delta_{gov} f_t^{res}$).

$$\Delta f_t^{dom} = \Delta_h f_t^{dom} + \Delta_{gov} f_t^{dom} + \Delta_{inv} f_t^{dom} + \Delta_{res} f_t^{dom} \tag{3.26}$$

While the effects of government demand and investment demand appear to be relatively exogenous, theories of demand-driven structural change conceptualise non-homothetic changes in consumer taste as crucial to understanding the drivers of structural changes in employment. To adequately account for the demand-driven element of structural changes, we further decompose changes in domestic household final demand into a pure income effect ($\Delta\ {}^{i}_{h}f^{dom}_{t}$), changes in final household demand import propensity ($\Delta\ {}^{ip}_{h}f^{dom}_{t}$), and a residual that includes the effect of non-homothetic changes in consumer taste and potential price effects ($\Delta\ {}^{nh}_{h}f^{dom}_{t}$).

$$\Delta_h f^{dom}_t = \Delta\ {}^{i}_{h}f^{dom}_{t} + \Delta\ {}^{ip}_{ch}f^{dom}_{t} + \Delta\ {}^{nh}_{h}f^{dom}_{t} \tag{3.27}$$

The income effect is defined (equation 3.28) as an aggregate change in the final demand of domestic households, which is assigned proportionally to the consumption structure of the previous period.

$$\Delta\ {}^{i}_{h}f^{dom}_{t} = \left(\frac{\sum_{i,r}\Delta^{i}_{h}f^{dom}_{t}}{\sum_{i,r}\ {}^{i}_{h}f^{dom}_{t-1}}\right) {}^{i}_{h}f^{dom}_{t-1} \tag{3.28}$$

To decompose the income effect and changes in the import propensity we must first define domestic household demand in the domestic market and domestic household demand in the foreign market separately.

$${}^{i}_{h}f^{dom}_{t} = {}^{i}_{ch}f^{domD}_{t} + {}^{i}_{ch}f^{domF}_{t} \tag{3.29}$$

$${}^{i}_{ch}f^{domD}_{t}(i,r) = \begin{cases} {}^{i}_{h}f^{dom}_{t}(i,r) & \text{if } r = c \\ 0 & \text{otherwise} \end{cases} \tag{3.30}$$

$${}^{i}_{ch}f^{domF}_{t}(i,r) = \begin{cases} {}^{i}_{h}f^{dom}_{t}(i,r) & \text{if } r \neq c \\ 0 & \text{otherwise} \end{cases} \tag{3.31}$$

The difference between the sum of the income effect of domestic household demand in the domestic and foreign markets and the total income effect includes exactly the final demand import propensity, while maintaining the intersectoral structure of consumption consistent only with the income effect.

$$\Delta\ {}^{ip}_{ch}f^{D}_{t} = \left(\frac{\sum_{i,r}\Delta_{ch}f^{domD}_{t}}{\sum_{i,r}\ {}_{ch}f^{domD}_{t-1}}\right) {}_{ch}f^{domF}_{t-1} + \left(\frac{\sum_{i,r}\Delta_{ch}f^{domF}_{t}}{\sum_{i,r}\ {}_{ch}f^{dom}_{t-1}}\right) {}_{ch}f^{dom}_{t-1} - \Delta\ {}^{i}_{h}f^{dom}_{t} \tag{3.32}$$

The remaining element ($\Delta\ {}^{nh}_{h}f^{dom}_{t}$) captures the combined effect of non-homothetic taste and price effect when elasticities are assumed to be above 0. This element accounts to which extent does non-homothetic taste structure contributes to structural changes as suggested by demand driven theories.

3.4 The complete structural decomposition of employment changes on the country and sector level

We combine all our elements of structural decomposition into a single equation. We start by combining equations 3.1 and 3.5, continue by inserting equation 3.21 and 3.22, and finally the final demand decomposition equations 3.25, 3.26 and 3.27. The full structural decomposition, done separately for each country c, consists of the following real effects in the order of their occurrence:

1.) productivity effects;
2.) domestic fabrication effects;
3.) foreign fabrication effects;
4.) changes in the domestic structure of supplier linkages;
5.) changes in the domestic structure of intermediate import linkages;
6.) changes in domestic intermediate import propensity;

7.) changes in the structure of foreign intermediate supplier linkages;
8.) changes in the income effect of the domestic household final demand;
9.) changes in the import propensity of the domestic household final demand;
10.) effect of the non-homothetic domestic final household demand and price effects;
11.) changes in domestic government demand;
12.) changes in domestic investment demand;
13) domestic changes in inventories;
14.) changes in foreign final demand.

$$
\begin{aligned}
\Delta_c EMP_t = & \left(\hat{v}_t + \frac{\Delta\hat{v}_t}{2}\right)\Delta\Psi_t + \\
& diag\Big(\Delta_c FAB_t^{dom} f_t\Big)\Big(\Psi_t + \frac{\Delta\Psi_t}{2}\Big) + \\
& diag\Big(\Delta_c FAB_t^{for} f_t\Big)\Big(\Psi_t + \frac{\Delta\Psi_t}{2}\Big) + \\
& diag\Big(\hat{c}_{t-1}\left(\frac{1}{2}\tilde{L}_t\Delta_c A_t^{dom} L_{t-1} + \frac{1}{2}L_{t-1}\Delta_c A_t^{dom}\tilde{L}_t\right) f_t\Big)\Big(\Psi_t + \frac{\Delta\Psi_t}{2}\Big) + \\
& diag\Big(\hat{c}_{t-1}\left(\frac{1}{2}\tilde{L}_t\Delta_c A_t^{imp} L_{t-1} + \frac{1}{2}L_{t-1}\Delta_c A_t^{imp}\tilde{L}_t\right) f_t\Big)\Big(\Psi_t + \frac{\Delta\Psi_t}{2}\Big) + \\
& diag\Big(\hat{c}_{t-1}\left(\frac{1}{2}\tilde{L}_t\Delta_c A_t^{iip} L_{t-1} + \frac{1}{2}L_{t-1}\Delta_c A_t^{iip}\tilde{L}_t\right) f_t\Big)\Big(\Psi_t + \frac{\Delta\Psi_t}{2}\Big) + \\
& diag\Big(\hat{c}_{t-1}\left(\frac{1}{2}\tilde{L}_t\Delta_c A_t^{F} L_{t-1} + \frac{1}{2}L_{t-1}\Delta_c A_t^{F}\tilde{L}_t\right) f_t\Big)\Big(\Psi_t + \frac{\Delta\Psi_t}{2}\Big) + \\
& diag\Big(\hat{c}_{t-1} L_{t-1}\Delta\,{}^{i}_{h} f_t^{dom}\Big)\Big(\Psi_t + \frac{\Delta\Psi_t}{2}\Big) + \\
& diag\Big(\hat{c}_{t-1} L_{t-1}\Delta\,{}^{ip}_{ch} f_t^{dom}\Big)\Big(\Psi_t + \frac{\Delta\Psi_t}{2}\Big) + \\
& diag\Big(\hat{c}_{t-1} L_{t-1}\Delta\,{}^{nh}_{h} f_t^{dom}\Big)\Big(\Psi_t + \frac{\Delta\Psi_t}{2}\Big) + \\
& diag\Big(\hat{c}_{t-1} L_{t-1}\Delta_{gov} f_t^{dom}\Big)\Big(\Psi_t + \frac{\Delta\Psi_t}{2}\Big) + \\
& diag\Big(\hat{c}_{t-1} L_{t-1}\Delta_{inv} f_t^{dom}\Big)\Big(\Psi_t + \frac{\Delta\Psi_t}{2}\Big) + \\
& diag\Big(\hat{c}_{t-1} L_{t-1}\Delta_{res} f_t^{dom}\Big)\Big(\Psi_t + \frac{\Delta\Psi_t}{2}\Big) + \\
& diag\Big(\hat{c}_{t-1} L_{t-1}\Delta f_t^{for}\Big)\Big(\Psi_t + \frac{\Delta\Psi_t}{2}\Big)
\end{aligned}
\tag{3.33}
$$

4 Structural change index

The decomposition presented disaggregates the determinants of employment changes for each country and sector for each year. With the WIOD data, this amounts to 43 countries, 56 sectors, and 14 years (2000-2014). To show the impact of each of the decomposed elements on structural changes, we construct two separate indexes. One index covering employment changes from manufacturing to services (MvS_c) and one index covering employment changes from agriculture to the rest of the economy (AvR_c). To determine the contribution to structural change between manufacturing and services for each country individually (MvS_c), we sum employment changes across all years and service sectors and divide by average service

sector employment and subtract the sum of employment changes across all years and sectors divided by average manufacturing employment. The index reflects the difference between relative employment changes in services and manufacturing over the period. The higher the index, the greater the shift in employment from manufacturing to services. Similarly, for structural changes between agriculture and the rest of the economy (AvR_c), we sum employment changes across all years and nonagricultural sectors, divided by average nonagricultural employment, and subtract the sum of employment changes across all years and agricultural sectors, divided by average agricultural employment. Again, the index captures the difference between the relative employment changes in agriculture and the other sectors over the period. The indexes S represent service sectors, M represent manufacturing sectors, A represent agricultural sectors, and R represent nonagricultural sectors, and T represent all years available in the data.

$$MvS_c = \frac{T \sum_{i \in S} \sum_{t \in T} \Delta EMP_t}{\sum_{i \in S} \sum_{t \in T} EMP_t} - \frac{T \sum_{i \in M} \sum_{t \in T} \Delta EMP_t}{\sum_{i \in M} \sum_{t \in T} EMP_t} \tag{4.1}$$

$$AvR_c = \frac{T \sum_{i \in R} \sum_{t \in T} \Delta EMP_t}{\sum_{i \in R} \sum_{t \in T} EMP_t} - \frac{T \sum_{i \in A} \sum_{t \in T} \Delta EMP_t}{\sum_{i \in A} \sum_{t \in T} EMP_t} \tag{4.2}$$

This leads to two country-specific indices of structural change. For each index and country, a full structural decomposition provides an estimate of the country-specific determinants of the type of structural change under study.

5 Results and discussion

The results are presented at the global level and for the three major country groups - developed countries[1], developing countries[2] and new EU Central and Eastern European countries[3] to show the wide variability in the determinants of different structural changes. The results for each country can be found in Appendix B. The results for the determinants of structural change from manufacturing to services are shown in Table 1 and the results for the determinants of structural change from agriculture to the rest of the economy are shown in Table 2.

5.1 Structural changes from manufacturing to service employment

Sector-specific productivity growth is the main determinant of the shift of employment from manufacturing to services over the 2000-2014 period studied at the global level. On the other hand, the non-homothetic domestic demand structure of households seems to have a rather limited impact on the shift of employment from manufacturing to services. Broader social and economic determinants of domestic final demand, such as government demand and investment demand, have a much stronger influence on structural changes than patterns related to domestic consumer taste, as assumed by the demand-side theory of structural change.

Looking at the impact of domestic final demand, there are two main countervailing factors: public demand and investment demand. On the one hand, productivity growth in manufacturing allows for higher public revenues and thus higher public spending, which contributes more to employment in services than in manufacturing. Thus, one of the main channels of productivity spillovers in manufacturing lies in the active restructuring of the economy through the expansion of public service employment. On the other hand, productivity growth in manufacturing increasingly relies on new capital investment, which is manufacturing intensive and involves limited service value added. While domestic final demand contributes to

[1] Austria, Belgium, Canada, Switzerland, Germany, Denmark, Finland, France, UK, Ireland, Japan, South Korea, Luxembourg, Netherlands, Norway, Sweden, Taiwan, USA.

[2] China, Indonesia, India, Mexico, Turkey, Brazil, Russia.

[3] Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Slovakia, Slovenia.

Table 1: Structural changes from manufacturing to service employment

	World	Developing	CEEC	Developed
Productivity	0.5622	0.5387	0.5460	0.2502
Domestic fabrication changes	-0.0809	-0.0823	0.0395	-0.0654
Foreign fabrication changes	-0.0091	-0.0102	0.0197	-0.0113
Structure of domestic linkages	0.0006	0.0000	0.0000	0.0037
Domestic structure of intermediate imports	-0.0014	-0.0020	-0.0004	0.0009
Domestic intermediate import propensity	-0.0010	-0.0008	-0.0006	0.0005
Structure of foreign intermediate linkages	-0.1456	-0.1986	-0.3258	0.1152
Income effect of household domestic final demand	0.0539	0.1228	0.0260	0.0358
Household domestic final demand import propensity	-0.0016	-0.0015	-0.0099	-0.0028
Non-homothetic effects of household domestic final demand and price effects demand	0.0325	0.0105	0.0466	0.0726
Government demand	0.1154	0.1948	0.0946	0.0394
Investment demand	-0.1535	-0.1872	0.0043	0.0229
Inventories	-0.0189	-0.0304	-0.0006	0.0059
Foreign final demand	-0.1831	-0.1718	-0.2869	-0.0645
Total structural changes	0.1696	0.1819	0.1525	0.4031

structural change through various social and economic forms, the effect of foreign final demand is treated as a single effect because international trade is still predominantly manufacturing trade despite the recent increase in trade in business services. The result that increases in final foreign demand contribute more to world employment in manufacturing than in services should therefore have a straightforward interpretation.

The domestic fabrication effect contributes negatively to the structural changes studied. This means that, on a global average, changes in domestic manufacturing practises (outsourcing, insourcing, changes in production techniques that affect value added share and the share of intermediate goods) have contributed more to relative employment in manufacturing than to relative employment in services. The lengthening of value chains, particularly in developing countries, is a process that occurs predominantly within domestically integrated value chains. The impact of domestic fabrication effects indirectly measures the contribution of domestic integration in the downstream global value chains to structural changes. The foreign fabrication changes, on the other hand, have limited impact on structural changes. From the perspective of the specific country c, changes between foreign sectoral shares of value added and intermediate goods homogeneously distributed across all producers of intermediate goods can have little significant effect on the employment shares of country c.

The changes in the structure of foreign supplier linkages are the most important element of the global value chain integration through which employment in country c is affected. Changes in the structure of foreign supplier linkages involve changes in the intermediate suppliers of foreign firms (country c may benefit or lose manufacturing jobs), and the high global negative value of this decomposition element corresponds to the fact that the increasing importance of global value chain integration has contributed much more to global manufacturing employment than to services employment over the period studied. Interestingly, changes in the structure of domestic supplier linkages as well as intermediate import linkages and intermediate import propensity have limited impact on structural changes. What matters for employment in country c is not the domestic structure of intermediate suppliers, but mainly the domestic fabrication effects. In other words - the decision of how much a country outsources is more fundamental to the dynamics of its structural change than to whom it does so.

The dynamics of structural change vary considerably across countries. First, there is a difference between total employment relocation, which is almost twice as high in developed countries as in developing countries, and CEE countries. Nevertheless, the supply-side contribution to structural change is much lower in developed countries than in developing countries and CEE countries. The largest difference between country groups is seen in the impact of changes in foreign intermediate supplier linkages. On the one hand, this element contributed more to manufacturing employment in developing countries and even more in CEE countries by increasing both their GVC participation and their intermediate exports. On the other hand, the same element contributed more to service sector employment in developed countries, suggesting deindustrialization through offshoring. The contribution of foreign final demand to manufacturing employment is also very unevenly distributed across countries, with developed countries showing the smallest increase and CEE countries the largest. An interesting pattern can be seen in changes in domestic fabrication effects. While changes in domestic fabrication effects lead to increases in manufacturing employment in both developing and developed countries, the reverse is true in the countries of CEE. This is mainly due to the fact that the inclusion of CEE countries in GVCs has been driven by foreign direct investment, resulting in many domestic suppliers being replaced by foreign intermediaries.

Interestingly, the non-homothetic effect of domestic final household demand is irrelevant for developing countries, but more important for CEE countries and even more important for developed countries. This suggests that the demand-driven effect of non-homothetic consumer taste, while quite limited, increases with development and overall income, which is consistent with the assumptions of demand-driven

Table 2: Structural changes from agricultural employment to the rest of the economy

	World	Developing	CEEC	Developed
Productivity	0.2168	0.0685	0.1878	0.0066
Domestic fabrication changes	0.0548	0.0498	-0.1166	-0.1115
Foreign fabrication changes	0.0112	0.0125	-0.0175	-0.0104
Structure of domestic linkages	-0.0001	0.0000	0.0000	-0.0012
Domestic structure of intermediate imports	-0.0002	0.0002	0.0003	0.0001
Domestic intermediate import propensity	0.0000	0.0004	0.0001	0.0012
Structure of foreign intermediate linkages	0.2869	0.2852	0.1457	0.0115
Income effect of household domestic final demand	-0.4666	-0.3329	-0.1026	-0.0340
Household domestic final demand import propensity	0.0112	0.0128	0.0338	0.0028
Non-homothetic effects of household domestic final demand and price effects	0.3381	0.3233	0.2183	0.1322
Government demand	0.0714	0.1187	0.0587	0.0331
Investment demand	0.0990	0.2428	0.0309	0.0047
Inventories	-0.0441	-0.0295	0.0006	-0.0016
Foreign final demand	0.0124	0.0368	-0.0193	-0.0226
Total structural changes	0.5907	0.7884	0.4200	0.0110

approaches.

5.2 Structural changes from agriculture to the rest of the economy

The structural shift away from agricultural employment is more pronounced at the global level than the structural shift from manufacturing to services. The main difference is that supply-side effects are much less pronounced. Conversely, demand-related effects - both the income effect and the non-homothetic demand structure - play an important role in the transition from agricultural employment. This is consistent with the main idea of the Engel curve, which was originally derived for food consumption only.

Value chain structures and fabrication effects have much smaller effects on employment dynamics in agricultural sectors than in manufacturing sectors. The exception is the structure of the foreign intermediate linkages, which measures contribution of increasing GVC inclusion and the relative increase in the manufacturing employment, which increases the pace of structural relocation from agriculture to manufacturing. This effect is much more pronounced in the developing countries.

The most pronounced cross-country variability is in the extent of structural change - the shift out of agriculture is most pronounced for developing countries, it is still relevant for CEE countries, but the effect is not significant for developed countries, which have already reduced agricultural employment to a very small number of jobs.

6 Conclusion

In this article, we address the issue of long-term structural changes in employment between manufacturing and services and between agriculture and the rest of the economy. We conduct a multiregional structural input-output decomposition analysis to disaggregate the determinants of structural changes. We disaggregate the supply, demand, trade and value-chain related determinants for each country separately. One of the main innovations of the structural decomposition is the separation of domestic and foreign changes in the structures of supplier linkages and fabrication effects.

One of the most important findings is that the determinants of structural change are very heterogeneous, country-specific, and specific to the concrete structural change under study. We obtained different results for the two types of structural change studied at the global level and very variable country-specific determinants. The structural shift from manufacturing to services is primarily supply-driven, while the structural shift of labour from agriculture to the rest of the economy is driven by both domestic demand structure and supply-driven factors. Our study shows that international trade, particularly international fragmentation of production and integration of global value chains, cannot be ignored in the analysis of structural change, as these factors significantly shape the pattern of structural change. Countries exhibit a high degree of variability in the resulting structural changes, due in large part to variability in the effects of value chain integration and international trade.

References

[1] Acemoglu, D., & Guerrieri, V. (2008). Capital Deepening and Nonbalanced Economic Growth. Journal of Political Economy, 116(3), 467–498. https://doi.org/10.1086/589523

[2] Alvarez-Cuadrado, F., Long, N. V., & Poschke, M. (2018). Capital-labor substitution, structural change and the labor income share. Journal of Economic Dynamics and Control, 87, 206–231. https://doi.org/10.1016/j.jedc.2017.12.010

[3] Amano, M. (1980). A Neoclassical Model of the Dual Economy with Capital Accumulation in Agriculture. The Review of Economic Studies, 47(5), 933–944. https://doi.org/10.2307/2296923

[4] Araujo, R. A. (2013). Cumulative causation in a structural economic dynamic approach to economic growth and uneven development. Structural Change and Economic Dynamics, 24, 130–140. https://doi.org/10.1016/j.strueco.2012.09.001

[5] Araujo, R. A., & Lima, G. T. (2007). A structural economic dynamics approach to balance-of-payments-constrained growth. Cambridge Journal of Economics, 31(5), 755–774. https://doi.org/10.1093/cje/bem006

[6] Avelino, A. F. T., Franco-Solís, A., & Carrascal-Incera, A. (2021). Revisiting the Temporal Leontief Inverse: New Insights on the Analysis of Regional Technological Economic Change. Structural Change and Economic Dynamics, 59, 79–89. https://doi.org/10.1016/j.strueco.2021.07.005

[7] Balassa, B. (1964). The Purchasing-Power Parity Doctrine: A Reappraisal. Journal of Political Economy, 72(6), 584–596. https://doi.org/10.1086/258965

[8] Baumol, W. J. (1967). Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis. The American Economic Review, 57(3), 415–426.

[9] Boppart, T. (2014). Structural Change and the Kaldor Facts in a Growth Model With Relative Price Effects and Non-Gorman Preferences. Econometrica, 82(6), 2167–2196. https://doi.org/10.3982/ECTA11354

[10] Chenery, H. B. (1982). Industrialization and growth: The experience of large countries. World Bank.

[11] Comin, D., Lashkari, D., & Mestieri, M. (2021). Structural Change With Long-Run Income and Price Effects. Econometrica, 89(1), 311–374. https://doi.org/10.3982/ECTA16317

[12] de Boer, P., & Rodrigues, J. F. D. (2020). Decomposition analysis: When to use which method? Economic Systems Research, 32(1), 1–28. https://doi.org/10.1080/09535314.2019.1652571

[13] Dietzenbacher, E., & Los, B. (1998). Structural Decomposition Techniques: Sense and Sensitivity. Economic Systems Research, 10(4), 307–324. https://doi.org/10.1080/09535319800000023

[14] Dietzenbacher, E., & Los, B. (2000). Structural Decomposition Analyses with Dependent Determinants. Economic Systems Research, 12(4), 497–514. https://doi.org/10.1080/09535310020003793

[15] Eberhardt, M., & Vollrath, D. (2016). The Effect of Agricultural Technology on the Speed of Development. World Development, 109. https://doi.org/10.1016/j.worlddev.2016.03.017

[16] Echevarria, C. (1997). Changes in Sectoral Composition Associated with Economic Growth. International Economic Review, 38(2), 431. https://doi.org/10.2307/2527382

[17] Fisher, A. G. B. (1939). Production, Primary, Secondary and Tertiary. Economic Record, 15(1), 24–38. https://doi.org/10.1111/j.1475-4932.1939.tb01015.x

[18] Foellmi, R., & Zweimüller, J. (2006). Income Distribution and Demand-Induced Innovations. The Review of Economic Studies, 73(4), 941–960.

[19] Foellmi, R., & Zweimüller, J. (2008). Structural change, Engel's consumption cycles and Kaldor's facts of economic growth. Journal of Monetary Economics, 55(7), 1317–1328. https://doi.org/10.1016/j.jmoneco.2008.09.001

[20] Geary, R. C. (1950). A Note on "A Constant-Utility Index of the Cost of Living." The Review of Economic Studies, 18(1), 65–66. https://doi.org/10.2307/2296107

[21] Gollin, D., Parente, S., & Rogerson, R. (2002). The Role of Agriculture in Development. American Economic Review, 92(2), 160–164. https://doi.org/10.1257/000282802320189177

[22] Herrendorf, B., Rogerson, R., & Valentinyi, Á. (2014). Chapter 6—Growth and Structural Transformation. In P. Aghion & S. N. Durlauf (Eds.), Handbook of Economic Growth (Vol. 2, pp. 855–941). Elsevier. https://doi.org/10.1016/B978-0-444-53540-5.00006-9

[23] Jorgenson, D. W. (1961). The Development of a Dual Economy. The Economic Journal, 71(282), 309–334. https://doi.org/10.2307/2228770

[24] Jorgenson, D. W., & Timmer, M. P. (2011). Structural Change in Advanced Nations: A New Set of Stylised Facts*: Structural change in advanced nations. Scandinavian Journal of Economics, 113(1), 1–29. https://doi.org/10.1111/j.1467-9442.2010.01637.x

[25] Klein, L. R., & Rubin, H. (1947). A Constant-Utility Index of the Cost of Living. The Review of Economic Studies, 15(2), 84–87. https://doi.org/10.2307/2295996

[26] Kongsamut, P., Rebelo, S., & Xie, D. (2001). Beyond Balanced Growth. The Review of Economic Studies, 68(4), 869–882.

[27] Kuznets, S. S. (1967). Modern economic Growth (7. pr; Authorized facs. of the original 1966). Yale University Press.

[28] Laitner, J. (2000). Structural Change and Economic Growth. The Review of Economic Studies, 67(3), 545–561.

[29] Leon, P. (1967). Structural change and growth in capitalism; a set of hypotheses. Baltimore : Johns Hopkins Press. http://archive.org/details/structuralchange0000leon

[30] Lewis, L. T., Monarch, R., Sposi, M., & Zhang, J. (2021). Structural Change and Global Trade. Journal of the European Economic Association, 1–37.

[31] Lewis, W. A. (1954). Economic Development with Unlimited Supplies of Labour. The Manchester School, 22(2), 139–191. https://doi.org/10.1111/j.1467-9957.1954.tb00021.x

[32] Maddison, A. (1987). Growth and Slowdown in Advanced Capitalist Economies: Techniques of Quantitative Assessment. Journal of Economic Literature, 25(2), 649–698.

[33] Mao, R., & Yao, Y. (2012). Structural Change in a Small Open Economy: An Application to South Korea. Pacific Economic Review, 17(1), 29–56. https://doi.org/10.1111/j.1468-0106.2011.00570.x

[34] Matsuyama, K. (2009). Structural Change in an Interdependent World: A Global View of Manufacturing Decline. Journal of the European Economic Association, 7(2/3), 478–486.

[35] McCombie, J., & Thirlwall, A. P. (2016). Economic Growth and the Balance-Of-Payments Constraint. Palgrave Macmillan Limited. https://public.ebookcentral.proquest.com/choice/publicfullrecord.aspx?p=5639007

[36] Muradov, K. (2021). Structural decomposition analysis with disaggregate factors within the Leontief inverse. Journal of Economic Structures, 10(1), 16. https://doi.org/10.1186/s40008-021-00245-5

[37] Ngai, L. R., & Pissarides, C. A. (2007). Structural Change in a Multisector Model of Growth. American Economic Review, 97(1), 429–443. https://doi.org/10.1257/aer.97.1.429

[38] Park, S. (1998). Transitional Dynamics of Structural Changes. 11(1), 75–100.

[39] Pasinetti, L. (1993). Structural Economic Dynamics. Cambridge University Press. https://doi.org/10.1017/CBO9780511551444

[40] Pasinetti, L. L. (1983). Structural Change and Economic Growth: A Theoretical Essay on the Dynamics of the Wealth of Nations. Cambridge University Press.

[41] Ranis, G., & Fei, J. C. H. (1961). A Theory of Economic Development. The American Economic Review, 51(4), 533–565.

[42] Rose, A., & Casler, S. (1996). Input–Output Structural Decomposition Analysis: A Critical Appraisal. Economic Systems Research, 8(1), 33–62. https://doi.org/10.1080/09535319600000003

[43] Samuelson, P. A. (1948). International Trade and the Equalisation of Factor Prices. The Economic Journal, 58(230), 163–184. https://doi.org/10.2307/2225933

[44] Sonis, M., Hewings, G. J. D., & Guo, J. (1996). Sources of Structural Change in Input–Output Systems: A Field of Influence Approach. Economic Systems Research, 8(1), 15–32. https://doi.org/10.1080/09535319600000002

[45] Stone, R. (1954). Linear Expenditure Systems and Demand Analysis: An Application to the Pattern of British Demand. The Economic Journal, 64(255), 511–527. https://doi.org/10.2307/2227743

[46] Thirlwall, A. (1979). The Balance of Payments Constraint as an Explanation of International Growth Rate Differences. BNL Quarterly Review, 32(128), 45–53.

[47] Thirlwall, A. (1983). Foreign trade elasticities in centre-periphery models of growth and development. BNL Quarterly Review, 36(146), 249–261.

[48] Timmer, M. P., Dietzenbacher, E., Los, B., Stehrer, R., & Vries, G. J. de. (2015). An Illustrated User Guide to the World Input–Output Database: The Case of Global Automotive Production. Review of International Economics, 23(3), 575–605. https://doi.org/10.1111/roie.12178

[49] Timmer, M. P., Los, B., Stehrer, R., & de Vries, G. J. (2021). Supply Chain Fragmentation and the Global Trade Elasticity: A New Accounting Framework. IMF Economic Review, 69(4), 656–680. https://doi.org/10.1057/s41308-021-00134-8

[50] Uy, T., Yi, K.-M., & Zhang, J. (2013). Structural change in an open economy. Journal of Monetary Economics, 60(6), 667–682. https://doi.org/10.1016/j.jmoneco.2013.06.002

[51] Zimmerman, C. C. (1932). Ernst Engel's Law of Expenditures for Food. The Quarterly Journal of Economics, 47(1), 78–101. https://doi.org/10.2307/1885186

Appendix A - notations

$n_S \in \mathbb{N}$ number of sectors.
$n_C \in \mathbb{N}$ number of countries.
$n \in \mathbb{N}$; $n = n_S * n_C$ number of country-sectors.

$\mathbf{1} \in \mathbb{R}^n$ vector of ones.
$\vec{1} \in \mathbb{R}^{n_C}$ vector of ones.
$\vec{e_i} \in \mathbb{R}^n$; $e_{ij} = \delta_{ij}$ standard orthonormal basis of $\mathbb{R}^n$.
$I \in \mathbb{R}^{n \times n}$ identity matrix.

$EMP \in \mathbb{R}^n$ employment.
$\Psi \in \mathbb{R}^n$ is employment to value added ratio (inverse productivity).

$x \in \mathbb{R}^n$ total output vector.
$\hat{x} \in \mathbb{R}^{n \times n}$; $\hat{x} = diag(x)$ total output matrix.
$C \in \mathbb{R}^{n \times n}$ intermediate consumption matrix.
$F \in \mathbb{R}^{n \times n_C}$ final consumption matrix on country level.[4]
$f \in \mathbb{R}^n$; $f = F\vec{1}$ total final consumption vector.
$\hat{f} \in \mathbb{R}^{n \times n}$; $\hat{f} = diag(f)$ total final consumption matrix.

$A \in \mathbb{R}^{n \times n}$; $A = C\hat{x}^{-1}$ Leontief technical coefficient matrix.
$G \in \mathbb{R}^{n \times n}$; $G = \hat{x}^{-1}C$ Ghosh technical coefficient matrix.

$v \in \mathbb{R}^n$; $v^T = x^T - \mathbf{1}^T C = \mathbf{1}(\hat{x} - A\hat{x}) = \mathbf{1}^T(I - A)\hat{x}$ vector of total value added.
$\hat{v} \in \mathbb{R}^{n \times n}$; $\hat{v} = diag(v)$ total value added matrix.
$c \in \mathbb{R}^n$; $c^T = v^T\hat{x}^{-1} = \mathbf{1}^T(I - A)$ vector of value added coefficients - value added share in total output.
$\hat{c} \in \mathbb{R}^{n \times n}$; $\hat{c} = diag(c)$ value added coefficients matrix.

Δ denotes yearly real change in variable X, namely $\Delta X_t = X_{pyp\,t} - X_{t-1}$, where $X_{pyp\,t}$ represents variable X expressed in previous year prices based on the Laspeyres index.

C, A and G have block matrix structure $\mathbb{R}^{(n_S \times n_S) \times (n_C \times n_C)}$, while F has a block vector structure $\mathbb{R}^{n_S \times (n_C \times n_C)}$. Diagonal block elements with respect to countries represent domestic intermediate transfers and domestic consumption and off diagonal block elements represent transactions that crossborder either for intermediate use or final consumption.

$C = C_{CB} + C_D$
$A = A_{CB} + A_D$
$G = G_{CB} + G_D$
$F = F_{CB} + F_D$
$f_{CB} \in \mathbb{R}^n$; $f_{CB} = F_{CB}\vec{1}$ total final consumption by exporting.
$f_D \in \mathbb{R}^n$; $f_D = F_D\vec{1}$ total final consumption by domestic transactions.
$\hat{f_{CB}} \in \mathbb{R}^{n \times n}$; $\hat{f_{CB}} = diag(f_{CB})$ total final consumption by exporting matrix.
$\hat{f_D} \in \mathbb{R}^{n \times n}$; $\hat{f_D} = diag(f_D)$ total final consumption by domestic transactions matrix.

[4] In international I-O framework F is usually disaggregated on country level as well as in additional dimension of final consumption (household, government and non-profit consumption, fixed capital formation and changes in inventories), which is in our derivation irrelevant and left out. Disaggregation by countries is relevant to enable separation of domestic final consumption and export.

Appendix B - Country Level Results of Structural Change Determinants

In this appendix we present the determinants of structural change for every country available in the WIOD dataset and for the whole world (WRL).

Table 3: Legend

Indicator	Description
E1	Productivity
E2	Fabrication changes domestic
E3	Fabrication changes foreign
E4	Change in the structure of domestic linkages
E5	Change in the structure of intermediate imports
E6	Change in intermediate import propensity
E7	Change in the structure of foreign intermediate linkages
E8	Income effect of houshold domestic demand
E9	Income effect of domestic demand on foreign markets
E10	Non-homothetic changes and price effects of houshold domestic final demand
E11	Government demand
E12	Investment demand
E13	Inventories
E14	Foreign final demand
TOT	Total structural change employment relocation

Table 4: Country specific structural change determinants - manufacturing to service employment relocation

	AUS	AUT	BEL	BGR	BRA	CAN	CHE	CHN	CYP	CZE	DEU
E1	0.07	0.15	0.35	0.49	-0.17	-0.12	0.08	1.03	-0.25	0.52	0.15
E2	0.02	0.03	-0.09	-0.10	0.03	0.05	-0.01	-0.26	0.09	-0.08	-0.02
E3	0.04	0.05	-0.08	0.01	0.00	0.01	0.00	-0.03	0.02	-0.02	-0.01
E4	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E6	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E7	0.08	-0.02	0.14	-0.15	0.06	0.09	0.10	-0.43	0.13	-0.09	0.06
E8	0.04	0.05	0.02	-0.05	0.01	0.08	0.06	0.19	-0.03	0.04	0.02
E9	0.00	-0.01	0.00	0.02	0.00	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01
E10	0.11	0.04	0.05	0.25	0.18	0.00	0.05	-0.03	0.40	0.08	0.04
E11	0.08	0.03	0.06	0.04	0.07	0.07	0.02	0.28	0.05	0.05	0.05
E12	-0.07	0.03	0.00	0.01	-0.05	0.00	-0.03	-0.24	0.18	0.03	0.05
E13	0.01	0.00	0.01	0.00	0.01	0.02	0.01	-0.01	-0.15	0.01	0.02
E14	-0.05	-0.19	-0.01	-0.28	-0.05	0.03	-0.11	-0.29	0.01	-0.37	-0.18
TOT	0.51	0.17	0.44	0.23	0.08	0.21	0.18	0.19	0.43	0.15	0.16

	DNK	ESP	EST	FIN	FRA	GBR	GRC	HRV	HUN	IDN	IND
E1	0.23	0.20	0.43	0.26	0.25	0.27	-0.15	0.11	0.34	0.56	0.08
E2	0.00	0.02	0.03	-0.10	-0.09	0.03	0.26	0.08	0.08	0.01	0.11
E3	0.01	0.02	0.04	-0.01	-0.03	0.03	0.03	0.05	0.08	-0.02	0.02
E4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E7	0.16	0.05	-0.25	0.19	0.10	0.03	0.08	0.04	-0.07	0.10	-0.08
E8	0.03	-0.02	0.03	0.05	0.02	0.02	0.00	-0.02	0.01	0.15	0.13
E9	0.00	0.00	-0.02	-0.01	0.00	0.00	0.00	0.01	-0.02	0.00	0.00
E10	0.02	0.20	0.19	0.05	0.09	0.17	0.12	0.15	0.15	0.05	-0.02
E11	0.08	0.08	0.11	0.05	0.07	0.08	0.00	0.06	0.08	0.24	0.17
E12	0.01	0.01	0.02	0.03	0.05	0.00	0.12	0.01	0.01	-0.13	-0.21
E13	0.01	0.00	-0.01	0.00	0.01	0.00	-0.06	-0.02	0.02	0.00	-0.09
E14	-0.06	-0.07	-0.34	-0.09	-0.08	0.00	-0.01	-0.11	-0.32	-0.17	-0.07
TOT	0.48	0.49	0.23	0.43	0.40	0.62	0.38	0.36	0.35	0.78	0.02

	IRL	ITA	JPN	KOR	LTU	LUX	LVA	MEX	MLT	NLD	NOR
E1	0.13	0.16	0.32	0.65	0.68	-0.19	0.11	0.12	-0.24	0.14	0.20
E2	0.02	0.01	-0.10	0.06	-0.08	-0.09	0.05	0.03	-0.03	-0.01	-0.03
E3	0.03	-0.01	-0.02	0.05	-0.03	0.01	-0.02	0.02	-0.07	-0.03	0.00
E4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E7	0.10	-0.02	0.09	-0.13	-0.22	0.52	-0.13	0.02	0.46	-0.01	0.07
E8	0.05	-0.02	0.01	0.11	-0.09	0.01	-0.03	0.02	0.00	-0.01	0.00
E9	0.01	0.00	0.00	-0.02	0.04	0.00	0.01	0.00	0.00	-0.01	0.00
E10	0.03	0.22	0.06	0.01	0.24	0.07	0.33	0.06	0.19	0.11	0.06
E11	0.09	0.02	0.04	0.11	0.05	0.09	0.04	0.08	0.12	0.09	0.11
E12	0.02	0.03	0.04	0.00	-0.02	0.00	0.07	0.02	0.11	0.00	-0.09
E13	0.06	0.01	0.00	0.00	0.03	-0.01	-0.02	0.05	0.05	0.01	-0.01
E14	0.06	-0.08	-0.13	-0.28	-0.30	0.13	-0.18	-0.11	0.34	-0.03	-0.09
TOT	0.60	0.31	0.31	0.56	0.30	0.53	0.24	0.32	0.92	0.27	0.22

	POL	PRT	ROU	RUS	SVK	SVN	SWE	TUR	TWN	USA	WRL
E1	0.61	0.28	0.25	0.60	0.83	0.39	0.24	0.44	0.45	0.30	0.56
E2	0.10	0.03	0.08	-0.06	-0.14	0.00	-0.08	0.00	0.06	-0.10	-0.08
E3	0.04	0.01	0.04	-0.01	-0.09	-0.01	-0.04	-0.01	0.10	-0.02	-0.01
E4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E7	-0.53	-0.01	0.10	0.13	-0.25	0.00	0.16	-0.07	-0.24	0.16	-0.15
E8	0.05	-0.01	-0.03	-0.12	0.00	0.00	0.04	0.04	0.11	0.05	0.05
E9	-0.01	0.00	0.00	0.01	-0.01	0.00	-0.01	0.00	0.00	0.00	0.00
E10	-0.05	0.14	0.08	0.16	0.07	0.11	0.06	0.02	0.03	0.07	0.03
E11	0.12	0.01	-0.04	-0.01	0.11	0.06	0.04	0.20	0.02	0.02	0.12
E12	-0.03	0.06	-0.01	-0.13	0.15	0.05	0.03	0.05	-0.02	0.02	-0.15
E13	-0.01	0.00	-0.02	0.00	-0.04	0.00	0.00	0.00	0.00	0.00	-0.02
E14	-0.23	-0.03	0.03	-0.03	-0.46	-0.19	-0.04	-0.36	-0.24	-0.04	-0.18
TOT	0.05	0.48	0.47	0.55	0.19	0.40	0.40	0.29	0.27	0.48	0.17

Table 5: Country specific structural change determinants - agriculture to the rest of the economy employment relocation

	AUS	AUT	BEL	BGR	BRA	CAN	CHE	CHN	CYP	CZE	DEU
E1	0.40	-0.23	-0.73	-0.32	0.62	0.20	0.02	-0.11	0.66	0.12	-0.40
E2	0.04	-0.11	0.13	0.08	0.00	-0.09	-0.05	0.11	-0.40	0.07	-0.03
E3	0.00	-0.03	0.10	0.00	-0.01	-0.03	0.00	0.03	-0.01	0.03	0.03
E4	-0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E6	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E7	0.14	0.05	-0.12	0.14	-0.11	0.05	0.16	0.46	0.05	0.13	0.16
E8	0.00	-0.03	0.00	-0.13	-0.03	-0.03	-0.05	-0.37	-0.04	-0.08	-0.01
E9	0.00	0.00	0.00	0.06	0.00	0.01	0.00	0.02	-0.02	0.03	0.00
E10	0.07	0.24	0.09	0.36	0.12	0.10	0.15	0.34	0.17	0.18	0.15
E11	0.08	0.02	0.05	0.03	0.05	0.06	0.02	0.16	-0.36	0.03	0.03
E12	0.05	0.03	0.03	0.06	0.07	0.04	0.03	0.33	-0.01	0.03	0.00
E13	-0.03	-0.07	0.02	0.00	0.00	-0.01	0.00	-0.07	0.04	-0.02	0.13
E14	-0.08	-0.09	0.03	0.06	-0.11	-0.06	-0.07	0.08	0.07	0.00	-0.02
TOT	0.65	-0.21	-0.41	0.34	0.60	0.24	0.19	0.99	0.14	0.51	0.04

	DNK	ESP	EST	FIN	FRA	GBR	GRC	HRV	HUN	IDN	IND
E1	0.10	-0.01	0.49	0.06	0.02	-0.06	0.59	0.16	0.66	-0.61	0.26
E2	-0.11	0.06	-0.12	-0.17	-0.06	0.11	-0.03	-0.02	-0.32	-0.03	-0.03
E3	-0.05	0.01	-0.03	-0.03	-0.01	0.02	-0.01	-0.04	-0.06	0.00	0.00
E4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E7	0.05	-0.18	0.03	0.06	0.03	-0.29	0.00	0.09	0.01	0.09	0.24
E8	0.01	-0.04	-0.08	-0.03	-0.05	-0.09	-0.03	-0.06	-0.06	-0.19	-0.41
E9	0.00	0.01	0.04	0.00	0.01	0.00	0.00	0.02	0.02	0.00	0.00
E10	0.04	0.29	0.13	0.04	0.15	0.20	0.13	0.16	0.20	0.23	0.40
E11	0.06	0.07	0.08	0.04	0.06	0.07	0.00	0.04	0.05	0.15	0.10
E12	0.00	-0.02	0.03	0.02	0.03	-0.01	-0.11	0.02	0.02	0.02	0.27
E13	-0.01	0.01	-0.02	0.01	-0.05	0.00	-0.06	0.01	0.09	-0.04	0.01
E14	-0.04	-0.11	-0.03	-0.05	0.00	0.04	-0.02	-0.02	-0.01	-0.02	0.05
TOT	0.06	0.06	0.51	-0.05	0.13	-0.01	0.46	0.35	0.63	-0.41	0.90

	IRL	ITA	JPN	KOR	LTU	LUX	LVA	MEX	MLT	NLD	NOR
E1	-0.09	-0.04	-0.17	0.30	-0.11	-1.21	0.41	0.02	0.26	0.00	0.52
E2	0.36	-0.01	-0.09	-0.12	0.39	0.23	0.02	0.03	-0.31	-0.02	-0.18
E3	-0.11	0.01	0.00	-0.02	0.07	0.17	-0.04	0.00	-0.01	-0.01	-0.03
E4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E7	-0.36	-0.26	-0.03	0.06	-0.05	-0.16	-0.02	0.15	-0.11	-0.11	0.18
E8	-0.01	0.01	-0.03	-0.17	-0.17	-0.06	-0.17	-0.13	0.04	0.00	-0.18
E9	0.00	0.01	0.01	0.02	0.07	0.02	0.06	0.01	-0.01	0.00	0.03
E10	0.06	0.33	0.06	0.25	0.23	0.33	0.21	0.08	0.19	0.01	0.10
E11	0.06	-0.02	0.03	0.07	0.03	0.07	0.03	0.05	0.08	0.08	0.09
E12	-0.09	-0.03	-0.03	0.04	0.08	0.01	0.04	0.06	0.05	-0.03	0.06
E13	0.11	0.01	0.03	-0.01	-0.03	0.08	-0.07	-0.03	0.03	0.01	-0.19
E14	-0.22	-0.02	0.04	0.13	-0.11	0.32	-0.09	-0.16	0.08	0.07	-0.03
TOT	-0.29	-0.02	-0.18	0.56	0.40	-0.21	0.37	0.08	0.30	0.00	0.37

	POL	PRT	ROU	RUS	SVK	SVN	SWE	TUR	TWN	USA	WRL
E1	-0.11	0.01	0.68	0.04	1.27	0.75	-0.36	-0.11	-0.37	0.14	0.22
E2	-0.16	0.06	-0.05	0.18	-0.24	-0.09	0.12	0.00	-0.06	-0.21	0.05
E3	-0.02	0.00	-0.01	0.02	-0.03	-0.01	0.02	0.01	-0.04	-0.03	0.01
E4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E7	0.26	-0.03	0.37	0.11	-0.05	-0.07	-0.06	0.20	0.24	0.04	0.29
E8	-0.12	0.00	-0.42	-0.46	-0.08	-0.05	-0.04	-0.19	-0.13	-0.03	-0.47
E9	0.02	0.01	0.06	0.06	0.10	0.06	0.00	0.00	0.01	0.00	0.01
E10	0.28	0.10	0.13	0.39	-0.04	0.14	0.14	0.09	0.17	0.16	0.34
E11	0.07	0.01	-0.02	0.00	0.07	0.03	0.03	0.12	0.02	0.02	0.07
E12	0.03	-0.06	0.10	0.10	0.05	0.02	0.02	0.07	0.04	0.01	0.10
E13	0.00	-0.02	0.04	-0.01	-0.06	-0.02	0.04	0.07	-0.02	-0.03	-0.04
E14	-0.03	-0.09	0.08	0.03	0.06	0.08	-0.04	0.00	0.14	-0.05	0.01
TOT	0.22	-0.01	0.96	0.45	1.04	0.86	-0.12	0.28	0.01	0.01	0.59