

# IMPORT INTENSITY OF PRODUCTION, TASKS AND WAGES — EVIDENCE FOR WORKERS FROM 29 EUROPEAN COUNTRIES

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## Abstract

Using very rich individual level data on workers from 29 European countries and differing in task profile, we provide the first so extensive cross-country assessment of wage response to production fragmentation within GVCs in the post-crisis period (2008-2014). Unlike the other studies, we: (i) address the importance of backward linkages in globally integrated production structures (import intensity of production captures imports of goods and services needed *in any* stage of the production of the final product); (ii) measure occupational task profile of workers with new *country specific* indices of routinisation; (iii) compare the economic significance of fragmentation impact on wages between workers from Western, Central-Eastern and Southern Europe; employed in manufacturing and non-manufacturing sectors; (iv) account for direct and indirect dependence on inputs from low income and high income countries.

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## Extended abstract

Influential theoretical models have provided insights into the possible impact of production fragmentation on employment and wages in the trade-in-tasks world (Grossman and Rossi-Hansberg, 2008; Grossman and Rossi-Hansberg, 2012; Baldwin and Robert-Nicoud, 2014). Empirical literature built upon these theories has attempted to bring the analysis closer to the reality. The approach based on the division of workers into skilled/unskilled categories, commonly used in the first wave of studies on labour markets consequences of production fragmentation for different workers is no longer sufficient. In particular, it is clear that tasks differ from skills, especially when one wants to assess the offshorability potential of particular occupations (Blinder, 2006; Leamer and Storper, 2001; Blinder and Krueger, 2013; Baugmarten et al., 2013). Consequently, in order to evaluate the implications of globalisation for heterogeneous workers, the recent empirical international trade research has adopted the task setting, originally developed to analyse variation in skill requirements within occupations and the changing task composition of the labour markets due to the technological progress (among others: Spitz-Oener, 2006; Autor et al., 2003; Acemoglu and Autor, 2011; Autor, 2013).

The task-based evidence on microlevel consequences of fragmentation for the US workers is well documented. For Europe, the investigations on labor market effects of production fragmentation which take into account the task content of jobs are available for workers from just a few Western European countries. The overwhelming part of the evidence concerns Germany (Baugmarten et al., 2013; Becker et al., 2013; Becker and Muendler, 2015), Denmark (Hummels et al., 2014), UK (Geishecker and Görg, 2013) or these three countries altogether (Geishecker et al., 2010). Moreover, there is also no such evidence for other, less developed European economies (i.e. from Southern or Central and Eastern Europe, CEE). So far in offshoring-labor markets literature the CEE markets have been analysed mainly from the point of view of a potential threat to the Western European workers (Dauth et al., 2014). Within the task-based literature it has been shown that CEE countries, as other well developed economies, experienced an increase in non-routine cognitive tasks and a decrease in manual task content of jobs (Hardy, 2015; Hardy et al., 2016) but not much is known how production fragmentation affects wages in these countries.

Additionally, typically only the impact on workers employed in the manufacturing sector is analysed (as in Baugmarten et al., 2013) so the samples covered by these studies ignore a huge portion of the labor force employed in services or in other non-manufacturing sectors, and who are likely to be affected by cross-country production links as well. This is particularly important if one takes into account that the dependence on foreign production is indeed sector specific and is

non-negligible is come non-manufacturing activities. Timmer et al. (2016, p.25-26) reveal noticeable variation in the intensity of foreign inputs use in goods and services production: many services are of course locally produced (public services, education, recreation etc.) but for instance the production of construction works is as much dependent on foreign inputs as some manufacturing industries. In a recent paper Johnson and Noguera (2017) document that over time (1970-2009) the ratio of value-added to gross exports fell down within manufacturing (by 20 p.p.) but increased in agriculture and services. We thus do not limit our study to manufacturing only and in our dataset most of the workers are actually employed in non-manufacturing activities.

To the best of our knowledge, the production fragmentation-wages nexus on entire European labour market has not yet been analysed from the micro-economic task-based perspective. Given this fragmentary research (from selected countries and from selected sectors only) our aim is to check if wages on the broadly understood European labour market are really impacted by the dependence on foreign inputs. We limit our focus to the effects exhibited on wages, treating employment and labour demand effects of fragmentation as topics requiring a separate task-based investigation. Our main research question is thus the following: is the process of wage determination in Europe affected by globally measured dependence on foreign inputs? More specifically, can we state that the degree of involvement into the integrated system of production is a significant (also in economic terms) determinant of European wages, once the differences across countries, sectors, individuals and tasks are accounted for? If yes, workers from which European countries and performing what type of tasks are affected the most? What about the differences between manufacturing and the rest of the economy? Does the origin of imported inputs play a role?

To answer these questions we have constructed a very rich dataset, containing individual level information on wages, occupational task profiles, personal and job characteristics on over 900,000 workers from 29 European countries, employed in all economy and observed in the period 2008-2014. We use harmonised data from EU-SILC and adopt a proper weighting schemes, so we argue that our results shall be representative for the European labor market. We match our microdata with input-output measures of sectoral dependence on fragmentation, other sector characteristics and information on countries' labour market institutions, wage bargaining etc. As a result, relying on such a four dimensional data (with individual-sector-country-time identification) we are able to explore several dimensions of wage determination in Europe, involvement into global production structures being one of its potential determinants.

Apart from the wide country coverage, our analysis differs from the existing contributions in several other aspects. First of all, so far the effects of fragmentation were analysed as if the intensity of foreign inputs use was independent from previous stages of production (performed domestically or abroad). Conventional measures of fragmentation are based on the ratio of imported intermediates to the production value of an industry under consideration (Feenstra and Hanson, 1999). It means that they use the information on the last stage of production only and ignore the previous parts of the production chain. Contrastingly, we do take into account cross-country and cross-industry backward links along the whole sequence of production. We thus address the importance of backward linkages in globally integrated value chains: employing the newest release of the WIOD data and important methodological developments proposed by Timmer et al. (2016) we measure fragmentation with a novel index of *global import intensity of production* (from now on *GII*). *GII* captures imports of goods and services needed *in any stage* of the production of the final product and involves third-country trade. Our approach is thus closer to the global value chains and sequential production approaches rather than to the “classical” offshoring literature using information on imported inputs employed in the last tier of production chain in isolation from previous stages. *GII* measures all imports of intermediates by all countries in the value chain induced by a dollar of output of a final product, so its interpretation is also straightforward – contrary to the measures based on export decomposition (vertical specialisation, VS - domestic value added in exports: Hummels et al., 2001; Koopman et al., 2014 or the VAX ratio - value added exports: Johnson and Noguera, 2012).

Secondly, we verify if the impact of *GII* on wages in Europe depends on the source of imported inputs which are used along the production chain. Becker et al. (2013) find that offshoring of German MNEs to low income countries (except Central and Eastern Europe) has stronger onshore employment response. Wolszczak-Derlacz and Parteka (2016) use industry level wage information and decompose input-output offshoring measure by the source country, finding find negative (but small) downward pressure of offshoring to low-wage countries on wages in a worldwide 40-countries sample. Our further input is to thus to compute the variants of *GII* which measure the reliance of the value chain on intermediates coming from different subgroups of countries. At every backward stage of production, we use the information on the source of intermediates, and sum them over those coming from: high income countries only ( $GII^{HI}$ ) and from developing countries only ( $GII^{DEV}$ ). In particular, using the latter measure we will assess direct and *indirect* wage effects of production dependence on the South countries. Our approach is noticeably different from the aforementioned (and other) offshoring studies: we compare the effects of global dependence on foreign inputs (independently on their source) with

the dependence on inputs coming from less developed countries, measured at *all* backward tiers of production. Hence, in our setting we account for the direct (at last stage of production) and indirect (along the whole value chain) effects of dependence on intermediates' produced by less developed countries.

Thirdly, at all stages of our analysis, we take into account the occupational task profile of workers which *varies across countries*. Given our cross-country approach, another important feature of our data is thus the use of *country specific* routinization indices (Marcolin et al., 2016). Such an approach reflects the fact that, for instance, assemblers in Germany and assemblers in Romania should not have the same value of the routinization index because the tasks they perform differ due to technological and organizational differences between these countries. The previous studies either focused on one country only (for which the classification of tasks was available, e.g. USA) or were subjectively assuming that the task profile of workers from the analysed countries is the same as, for instance, the American ones. Of course it was a very simplifying assumption, even if some analysis argue in favour of the comparability of the results obtained with US occupation-based measures and non-US skill measures based on surveys (Handel, 2012; Cedefop, 2013).

The structure of our paper is as follows: in Section 2 we briefly describe theoretical background of our study and the key micro level empirical contributions on production fragmentation and wages in Europe, which our paper expands on. We then present our data, focusing on the novel measure of global dependence on foreign inputs, as well as on wages in Europe. The empirical strategy and results of the estimations of extended wage model are presented in Section 4. Section 5 provides the assessment of economic significance of our results, calculated across various subsamples of the data. The last section concludes. Numerous robustness checks are provided.