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## A preliminary assessment of the effects of migration on the production structure in Europe: A labor task approach

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### *Abstract*

We assess the effect of migration on the production structure in a selection of European countries for the pre-Great Recession period 2001-2009. We propose a labor-task approach where the inflow of migrants raises the relative supply of manual-physical (or simple) tasks and therefore favors simple-task intensive sectors. We use the US O\*NET database in conjunction with European labor data to calculate the index of simple-task intensity at the industry and country level. The analysis confirms that a rise in employment migration rates has a generalized positive impact, but that value-added increases significantly more in sectors that use more intensively simple tasks. A traditional shift-share instrument is used to overcome possible endogeneity problems

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# 1 Introduction

The first decade of the twenty-first century has been a period of large inflows of migrants all over Europe. The rise and the composition change in the labor force have been rapid and very intense in some countries. The aim of this work is to investigate whether this occurrence has caused a change in the production structure as wages were not significantly affected – e.g. for the institutional characteristics of European labor markets (see for instance D’Amuri and Peri, 2014)

To achieve our research goal we use the so-called *task approach* where the change in the labor supply via migration is mapped into a change in the (relative) supply of tasks rather than an increase in labor units or in (low) skills. We combine the US-based O\*NET dataset and the European Union Labor Force Survey (EU-LFS) to obtain a measure of task intensity for each sector-country cell in Europe.

Our *a priori* is that the rise in the migrant-to-natives employment ratio caused a general positive effect, but that sectoral output increased differently depending on their task intensity. By aggregating general tasks into two categories as *simple* and *complex* tasks, simple-task intensive sectors are characterized by higher productivity of simple tasks. Therefore, as migrants have a comparative advantage in simple versus complex tasks, the increase in the migrant employment ratio raised output more in simple-task intensive sectors.

Our analysis focuses on the period 2001-2009 for two main reasons. First, we want to avoid the structural break of the 2009 Great Recession, which stretched in Europe till 2012-13. The second reason is more technical as the change in the occupation classification at the sectoral level that occurred in the EU-LFS in 2010 does not yet allow for an official crosswalk to extend the sample with more recent data. Alternative sources of task intensities at the sectoral and country level are discussed in the last section for future work.

We consider all major European countries (Belgium, Denmark, Spain, UK, Germany, Netherlands, Italy, France, Norway and Sweden) for which data available in the EU-LFS allowed both to build the mapping between occupations and tasks and to obtain detailed data on foreign-born workers for most of the period 2001-2009.

Being aware of the possible endogeneity problem, we constructed an instrumental variable, based on the traditional shift-share technique (similarly to Altonji and Card, 1991), in order to possibly interpret the sudden changes in migration stocks as due to a supply shock and not as driven by an increase in labor demand.

Our empirical estimates confirm a positive effect of the migration employment rate (i.e. foreign-born workers/natives) on sectoral output, but also that this increment is significantly higher for the simple-task intensive sectors. Value added rises by 2.5 per cent for an increase in the migration rate of 10 per cent and this is driven by the stronger positive effect in simple-task intensive sectors – i.e. in sector-countries where the measure of simple-task intensity is above the median, value added rises by almost 3.3 per cent.

The remaining sections of the paper are organized as follows. Section 2 reports our approach to obtain a measure of task intensiveness for industries in the European countries starting from the US O\*NET database. Section 3 presents the empirical model and the estimation method. Section 4

contains the empirical results and Section 5 concludes and proposes some future work.

## 2 A Measure of Task Intensiveness for European Industries

We use a three-step approach to obtain a measure of task intensiveness. First, the US-based O\*NET database provides measures of task intensity by occupation and we assign these values to individuals in the EU-LFS.

Second, from the EU-LFS we obtain the percentile of this task intensity by occupation in each European country. For instance, managers in Sweden with a percentile value of 24 for manual tasks indicates that only 24 per cent of the total employment in Sweden performs manual tasks less intensively than managers; for bricklayers the value for manual task could be 95.

Third, these measures for task intensiveness by occupation are used to obtain a measure of the task intensiveness for industries. For instance, the degree of manual task in Construction in Sweden is obtained by multiplying 24 with the weight of managers in the total employment of Construction in Sweden and adding 95 weighed with the employment ratio of bricklayers in the Swedish Construction sector. As we use employment variables in our empirical model, we detach these latter weighing employment ratios from the sample period by taking the 1998 values (first available year).

The 15 task measures are grouped into four categories – manual, organizing, interactive, cognitive.<sup>1</sup> The relative *simplicity index* is obtained by the ratio:

$$Simplicity = \frac{Manual}{Organizing + Interactive + Cognitive}$$

Sectors are considered as *simple-task intensive* according to the relative value of the simplicity index within each country. For instance, we can consider simple-task intensive all sectors with a simplicity index higher than the country median or, more compellingly, higher than the 75th percentile. We will use these thresholds to determine the value of 1 in the dummy  $\delta_{sc}$  in Equation (1).

Figure 1 shows the correlation between the simplicity index and the share of immigrants for each country-sector cell. We find a weak positive (nonlinear) correlation in favor of our a priori.

## 3 Empirical Specification and Estimation Issues

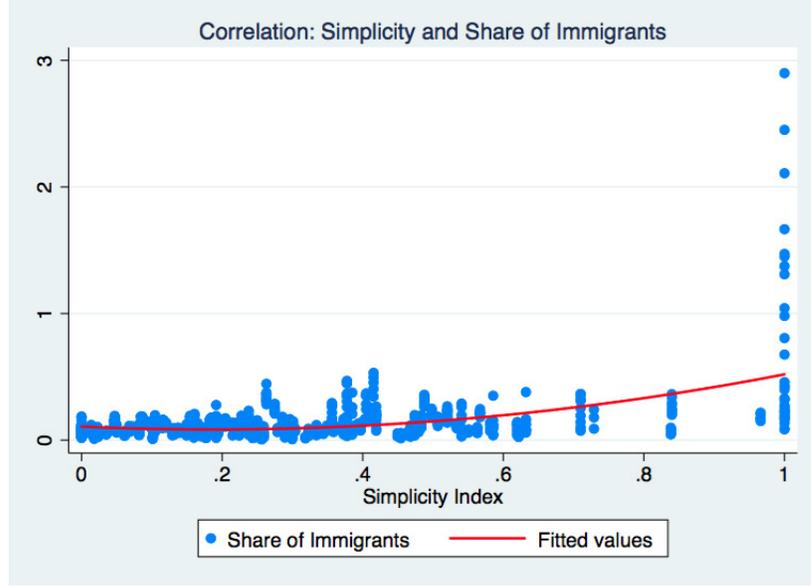
The aim of this work is to provide evidence that migration raises differently sectoral output (in terms of value added) depending on task intensiveness: more simple-task intensive sectors should experience a stronger positive effect from migration – what recalls a sort of Rybczynski effect.<sup>2</sup>

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<sup>1</sup>Details on the task measures and aggregations are available from the authors upon requests.

<sup>2</sup>For a theoretical presentation of this effect within the task approach in a framework similar to a factor-specific model see De Arcangelis et al. (2015), where it is provided empirical evidence but only for Italy.

**Figure 1:** Correlation between the share of migrants and the simplicity index



Source: Author's computation from O\*NET and EU-LFS.

The specification of the empirical model is as follows:

$$\ln VA_{sct} = \beta_0 + \beta_1 \ln \left( \frac{Mig}{Natives} \right)_{sct} + \beta_2 \delta_{sc} \ln \left( \frac{Mig}{Natives} \right)_{sct} + \text{fixed effects} + \epsilon_{sct} \quad (1)$$

where  $VA_{sct}$  is the value added of sector  $s$  in country  $c$  at time  $t$ ,  $\left( \frac{Mig}{Natives} \right)_{sct}$  is the migration rate in the labor market as the ratio of foreign-born workers to natives' employment. Fixed effects for sector, country and time are included in all specifications.

The parameter  $\delta_{sc}$  is a time-invariant dummy variable that takes the value of 1 for the most simple-task intensive sectors in each country. The index that evaluates the relative usage of simple tasks is described in Section 2. The selection of simple-task sectors is based on different degrees of simple-task intensiveness (i.e. above the country median or above the 75th percentile).

The OLS estimates may be biased and inconsistent because of endogeneity: the migrant rate on the right-hand side may be affected by the higher labor demand, approximated by the value added (i.e our dependent variable), and its variations would not represent labor supply shocks. Positive estimates of  $\beta_1$  and  $\beta_2$  can only be interpreted as evidence of correlation without any causal implication.

We propose an Instrumental Variable (IV) for the migration rate where the suggested instruments are inspired by the recent literature on migration. In particular, we elaborate an instrumental variable based on the shift-share strategy first developed by Altonji and Card (1991) and Card (2001), here

applied at the sectoral level.<sup>3</sup> In particular, the instrument is obtained by considering the initial migrants' distribution across destination countries and industries in 2000. This initial share is kept fixed and the number of migrant workers increases by the aggregate growth rate of the workers belonging to each specific immigrant origin group in the European Union. The stock of immigrants imputed with this method depends on the initial distribution of immigrants across countries and industries, and on the evolution of the total number of foreign-born workers in Europe by origin by avoiding that the changes in the migration rates are due to labor demand changes. Using the initial distribution of migrants across destinations and industries in 2000, we predict the current stock of migrants for each industry and country for years 2005-2009.

## 4 Data Description and Estimation Results

As discussed above, our analysis is restricted to 2001-2009 in order to focus on the period of rapid increase in migration before the Great Recession and not to incur in problems related to inconsistent measures of employment by occupation that could impinge the correct computation of the task index described in Section 2. We consider the following countries: Belgium, Denmark, France, Netherlands, Norway, Spain, Sweden, United Kingdom, Germany (2002-2009) and Italy (2005-2009).

Data on value added at the industry level (ISIC rev. 3) are obtained from the OECD Structural Analysis (STAN) Database. The European Union Labor Force Survey (EU-LFS) provides a multi-country comparable measure of employment for foreign-born workers and natives.<sup>4</sup> In particular, we obtain the immigrants' distribution across countries of destination and industries (NACE Rev. 1.1).

Table 1 confirms the general positive effect of migration. According to the OLS estimation there is a significant positive relationship between value-added and migration. When restricting the sample to 2005-2009 and using of the shift-share instrumental variable, the estimated coefficient of the migration rate can have a causal interpretation<sup>5</sup>. Sectoral value added increases up to almost 2.5 per cent when the ratio of migrant workers to native workers rises by 10 per cent.<sup>6</sup>

The economic impact of migration is different when considering the simple-task intensiveness of industries. In Table 2 we report the IV estimation of Equation (1) when the dummy variable  $\delta_{sc}$  identifies simple-task intensive sectors according to two measures: sectors with a simplicity index higher than the country median or higher than the 75th percentile in the country distribution. The migrant ratio has a general positive effect, but it is imprecisely estimated, whereas the differential effect in the simple-task intensive sectors is statistically significant. If we concentrate on the *very* simple-task intensive sectors (above the 75th percentile in the simplicity index) the differential effect is still positive, but significant at the 10 per cent level. The differential effect on sectoral output in

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<sup>3</sup>See Jaeger et al. (2018) for a critique on the shift-share instrument.

<sup>4</sup>In line with the previous literature, immigrants are all foreign-born workers who were not citizens at birth.

<sup>5</sup>The decrease in the number of observations occurs as a consequence of the construction of the instrument – the instrument is based on the initial value of the EU-LFS (2000) and we drop the years 2001, 2002, 2003 and 2004 in order to have a 5-years lag distance before predicting current stocks of migrants.

<sup>6</sup>The IV F-test rejects the null hypothesis and therefore the weakness of the chosen instrument for both Tables 1 and 2.

**Table 1:** The General Effect of Migration on Sectoral Value Added (OLS and IV Estimation)

Dep. Var.: $\ln(VA_s)$	OLS	IV
$\ln(Mig/Natives)$	0.117*** (0.0381)	0.249*** (0.0904)
Constant	21.62*** (0.105)	23.37*** (0.180)
Observations	1,084	381
R-squared	0.855	0.761
Fixed Effects	s, c, t	s, c, t
IV F-stat		397.4

Robust standard errors in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

simple-task intensive sectors ranges between 2.5 and 3.3 per cent for a 10 per cent increase in the migration rate.

In the last two columns of Table 2 we report estimates for the other segments of the distribution of industries by simple-task intensiveness. The migration rate still has an overall increasing effect on value added, but there is no additional positive (and significant) component coming from the selected low (i.e. simplicity index below the 25th percentile) and medium (i.e. the simplicity index between the 25th and the 75th percentile) simple-task intensive industries.

## 5 Conclusions and Future Work

The estimation results confirms our a priori that in Europe migration has affected differently not only countries, but industries within countries according to their task intensiveness during the first ten years in the 2000. More simple-task intensive sectors have driven the general positive resource effect resembling a sort of Rybczynski effect.

This preliminary evidence would need further analysis along two lines of research. The first obvious extension is to overcome the statistical problems related to the limitation of the data and estimate the model after the Great Recession with the proper adjustments for structural breaks. Second, it would be desirable to obtain fully country-specific measures of task intensiveness without recurring to the US-based O\*NET. Detailed data on task at the workplace as O\*NET are not available for all countries, but other datasets can provide comparable information. As an example, the OECD PIAAC databank could be a useful alternative, although the purpose of PIAAC was an individual survey (see OECD, 2013).

**Table 2:** The Differential Effect of Migration in Simple-Task Intensive Sectors (IV estimation).

Dep. Var.: $\ln VA_s$	High $Simplicity_{sc}$ range		Medium-Low $Simplicity_{sc}$ range	
	$> Med_c$	$> P75_c$	$< P25_c$	$[P25_c, P75_c]$
$\ln(Mig/Natives)$	0.0349 (0.160)	0.164 (0.109)	0.294*** (0.104)	0.383*** (0.126)
$\ln(Mig/Natives) * \delta_{sc}$	0.328** (0.164)	0.247* (0.141)	-0.211 (0.142)	-0.307** (0.132)
$\delta_{sc}$	-2.235*** (0.396)	-0.185 (0.416)	1.721*** (0.270)	0.306 (0.397)
Constant	25.39*** (0.369)	23.25*** (0.363)	23.29*** (0.199)	23.11*** (0.237)
Observations	381	381	381	381
R-squared	0.771	0.767	0.761	0.764
Fixed Effects	s, c, t	s, c, t	s, c, t	s, c, t
IV F-stat	141.8	272.4	338.8	295.1

$Med_c$ : median of the simplicity index at the country  $c$  level

$PXX_c$ :  $XX$ th percentile of the simplicity index at the country  $c$  level

Robust standard errors in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

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