**Regional Employment Patterns in a Globalizing World: A Tale of Four Italies**

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This paper presents the results of a first attempt to integrate sub-national Input-Output tables into the World Input-Output Database (WIOD), in order to assess the effects of changes in the structure of global value chains (GVCs) on regional employment patterns. As emphasized in recent literature concerning regional development, one of the paradoxes of globalisation is the enduring significance of subnational areas as centres of economic activity. A number of GVC studies explore how regional clusters are embedded into global production systems and how changes in this embeddedness (for example as a consequence of ‘upgrading’) affected development of these clusters. Usually these case studies cannot be generalised, however, as a consequence of which the effects on regional development cannot be studied.

This paper integrates data on four Italian regions (Northwest, Northeast, Centre and South) and WIOD data, to apply the new global value chain metrics introduced by Erumban et al. (2011) at regional level. Italy is an interesting country to study at subnational level, since it is characterized by a high degree of regional heterogeneity. Each region has peculiar geographic, social and economic features which are likely to influence the degree to which regional production systems contribute to GVCs. Furthermore, the mutual trade linkages between the four regions have intensified considerably over the period 1995-2006.

Using detailed labour force survey data, we analyse to what extent the varying degrees to which industries in the four Italian regions managed to capture stages in GVCs affected the level and composition of labour demand in the 1995-2006 period.

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**1. Introduction**

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This paper integrates data on four Italian regions (Northwest, Northeast, Centre and South) and WIOD data, to apply the new global value chain metrics introduced by Los et al. (2012) at regional level. Italy is an interesting country to study at subnational level, since it is characterized by a high degree of regional heterogeneity. Each region has peculiar geographic, social and economic features which are likely to influence the degree to which regional production systems contribute to GVCs. Furthermore, the mutual trade linkages between the four regions have intensified considerably over the period 1995-2006.

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**Figure 1: Differences in Magnitude and Structure of Regional Unemployment**

**(1995)**



**(2006)**



**2. Method**

We distinguish between low-skilled labour (LS, primary education and/or lower into changes in the demand for labour of a particular skill group. To disentangle these effects, we use “World Input-Output Tables” (WIOTs) and associated employment by skill group figures that were constructed in the WIOD project (see Timmer, 2012). The accounting method we adopt is known in the input-output literature as “Structural Decomposition Analysis” and bears similarity to more widely known index number approaches (see Miller and Blair, 2009).

We suppose that the use of labour inputs is driven by demand. For any secondary education completed, 1997-ISCED 1 and 2), medium-skilled labour (MS, upper secondary education and/or post-secondary non-tertiary education completes, ISCED 3 and 4) and high-skilled labour (completed tertiary education (ISCED 5 and 6). Our point of departure is that effects of globalization (as a consequence of which an industry in a country does not necessarily stay engaged in the same activities needed to produce a unit of final product), skill-biased technological change, the evolution of compositions of consumption bundles and differential consumption growth rates translated period, the scalar *xi* (which stands for the employment of skill group *I* in the focal country) can be written as

*xi* = $u\_{k}^{'}\hat{l}\_{i}$**q** (1)

The diagonal matrix $\hat{l}\_{i}$ contains the quantities of labor requirements of skill type *i* per unit of (gross) output in each of the *n* industries in each of the *m* countries.[[1]](#footnote-1) The *mn*-vector **q** stands for (gross) output levels in each of the industries in each of the countries. **u***k* is a *mn*-“selection vector”. It contains ones in the cells associated with the industries in the focal country. All other elements of **u***k* are zero.

Following Leontief’s (1936, 1941) insights, output can be seen as the result of the interplay between final demand levels (demand for final consumer products and capital goods) and the intermediate inputs required to produce these final products. In input-output tables for a single country, exports are considered to belong to final demand for the focal country as well. Intercountry input-output tables such as those compiled in the WIOD project allow for a distinction between exports of final products (such as consumer electronics exported by China to the US) and exports of intermediate products (such as electronic components exported by Japan to be used in assembly activities in China). This feature enables us to link all output (and employment) to demand for specific final products, sold by industries either inside or outside the focal country. Timmer et al. (2012) label this approach the “Global Value Chain perspective”.

Denoting the number of countries in a WIOT by *m*, we define **Z** as the *mn*x*mn*-matrix that contains all domestic and international deliveries of intermediate inputs. The corresponding *mn*x*mn*-matrix **A** of intermediate inputs requirements per unit of gross output can be obtained as $A=Z\hat{q}^{-1}$. The fact that the production of intermediate inputs often requires intermediate inputs itself is taken into account if the so-called *mn*x*mn*-“Leontief inverse” is considered. The typical element *bij* of this matrix **B** ≡ (**I** – **A**)-1, in which **I** stands for the *mn*x*mn*-identity matrix, indicates the output of each industry *i* that is required per unit of final demand for the products delivered by industry *j*. We can thus rewrite Equation (3) as

*xi* = $u\_{k}\hat{l}\_{i}$**Bf** (2)

in which **f** is an *mn*-vector with final demand levels for each of the *n* products delivered by each of the *m* countries.

In what follows, we will specify three determinants of intertemporal changes in *xi* that affect the product $\hat{l}\_{i}$**B** and three determinants that affect **f**. The former effects relate to changes *within* global value chains, whereas the latter are associated with changes in the relative weights of global value chains (*mix* effects).

We first look at demand for final products and trade in final products, which together define the mix effects. We consider three sources of change in **f**. First, total final demand as exerted by countries can change. Second, the composition of consumption bundles can change. If consumption demand in China grows faster than consumption demand in Japan, it is likely that product-specific income elasticities will also imply that the Chinese consumption bundle will change faster than its Japanese counterpart. Finally, market shares of countries in selling final products might change over time. Relocation of electronics assembly activities in the US to China will imply that market shares of Chinese final electronics products will increase at the expense of market shares of American final electronics products will be reduced. These three factors can be incorporated into the analysis by expressing the final demand vector as[[2]](#footnote-2)

$f=\left[T^{\*}°\left(S^{\*}∙\hat{c}\right)\right]u$ (3)

**c** is an *m*-vector. Its typical element *ci* contains total final demand exerted by country *i*. **S\*** is an *mn*x*m*-matrix constructed by stacking *m* identical *n*x*m*-matrices of final demand shares for each of the *n* outputs. The rows of the *n*x*m* matrices that together form **S\*** are obtained by aggregating over final goods supplied by each of the trade partners: if German consumers would spend 0.1 of their total consumption on German food and 0.05 of their total consumption on French food, the share of food in German consumption would amount to 0.15. **T\*** is an *mn*x*m*-matrix of final product trade coefficients. It is constructed by stacking *m* *n*x*m*-matrices **T**, of which the typical element *tij* represents the share of the country considered in final demand for product *i* in country *j*. **u** is an *m*-elements summation vector consisting of ones.

Equation (3) indicates how three factors together determine the relative importance of *mn* global value chains, a global value chain being defined as all activities required to produce the final product of an industry in a country. If skill-specific labour requirements would vary across global value chains, changes in relative importance of these chains could lead to changes in the relative demand for particular skills. Within such global value chains, however, (skill-biased) technological change and changes in the type of activities countries specialize into can also lead to differences in the amounts of labour of various skills that are deployed in the focal country. If Italy would contribute substantially to the value chain that ultimately produces British food products and the low-skilled labour requirements within this chain would decrease rapidly as a consequence of technological change, Italian low-skilled employment would decline, all other things equal. Alternatively, Italy could experience changes in the part of the value chain for British food products that it captures. Initially, it could contribute agricultural activities only, while Italy might also become responsible for some of the food processing activities in a later period. Generally, such changes also lead to changes in the extent to which labour of various skills is employed in the focal country.

**3. Data**

# Construction of the international Supply and Use tables for the Italian macro regions

In this section we summarize the various steps taken in the construction process of Italian Multi Regional Supply and Use table (MRSUT) and outline the main adjustments and hypothesis needed to integrate them in the system of WIOD international Supply and Use tables (SUTs).

### A. The MRSUT of the four Italian macro regions

The accounting structure of the Italian MRSUT is made up by two sets of accounts: 20 regional SUTs (one for each NUTS 2 region) and a multi regional trade flow matrix[[3]](#footnote-3).

Initial data are mainly taken from the national and regional accounts statistics (published by the Italian National Institute of Statistics, Istat) or from the competent Institutes and Authorities; data which are not available at regional level (e.g. foreign exports of services) or not significantly linked to the regional demand (e.g. imports from abroad) are imputed according to the local industry mix; only few of them are gathered through *ad hoc* surveys (e.g. Bank of Italy’s survey of industrial and service firms)[[4]](#footnote-4).

For each regional SUT two identities provide a link between the use and resources account and that of the formation and destination of industry output, that is:

[1] 

[2] 

where: **U** = Use matrix; **df** = domestic final demand; **er** = interregional export of products; **ew** = foreign export of products; **q**= product output; **mr**= interregional import of products; **mw** = foreign import of products; **x** = sectoral output; **Y** = industry value added matrix.

For each j-th product there is a trade matrix among the 20 Italian regions. The estimation of the multi regional trade flows – a key issue for the building of any MRSUT – is carried out through a gravity model using an *ad hoc* survey sampling data. The sum of the off-diagonal elements by row (export) and column (import) link the matrix **T** flows to the regional SUTs. At multi regional level the identity [1] becomes:

[3] 

where:

The MRSUT is estimated through a GLS estimator proposed by Stone, Champernowne and Meade in Stone *et al.* (1942), later developed by Byron (1978). The balancing structure of the multi regional table is specified according to according to four groups of constraints:

1. at regional level, both supply and demand of products and formation and use of output must be consistent;
2. constraints stemming from regional accounts statistics must be fulfilled;
3. interregional flows of imports must be equal to interregional flows of exports at national level for each product;
4. the sum of the regional SUT must be equal to the national one except for interregional trade.

The estimated MRSUT for the 20 Italian regions have been aggregated into 4 macro areas according to the NUTS 1 classification: North West, North East, Centre and South and islands (the so-called “Mezzogiorno”).

The final result is a MRSUT with 4 regions, 59 products (CPA classification) and 35 industries (NACE rev. 1 classification). Such a MRSUT is available for the years 1995, 2001 and 2006. All the resulting tables are at basic prices and expressed at current prices (euro); values have been converted to US dollars using same exchange rates used in WIOD.

### B. Integration of the Italian MRSUT into WIOD

The solution adopted to integrate the Italian MRSUT in WIOD international SUTs is to replace the tables for Italy as a whole with 4 Supply and 4 Use tables, a couple for each macro region (the “Four Italies”). As a result the final database, where each of the “Four Italies” is a country itself, has 44 countries (comprehensive of the Rest of the World) instead of the original 41.

The new SUTs are linked to each other and to the other tables of the WIOD through the trade flows. International trade flows now include interregional imports and exports of goods and services and the global trade flows value is, therefore, greater than in the original WIOD tables[[5]](#footnote-5).

In order to cope with this “enlarged world” some adjustments were needed to conform the Italian MRSUT to the WIOD format; also the original WIOD tables, and particularly the Uses, had to be modified to take into account the different origin of imports from Italy.

As far as the MRSUT is concerned, one preliminary change to the original data was concerned with some “extra-regional” values – that is, values which are not strictly attributable to any regions but are included in the national SUTs for Italy as a whole – which had to be attributed to regions[[6]](#footnote-6).

The most relevant difference is that the international WIOD Use tables separate domestic and imported from abroad goods and services, while the multi regional Use tables sum up imported and domestic values. Moreover, there’s no information about the country of origin of imports from abroad. A 3-step procedure has been used to adjust the 4 Use tables. Firstly, for each product the interregional imports and imports from abroad have been divided into intermediate, final and capital use of goods and services, according to the proportions observed for the imports in the international Use for Italy as a whole[[7]](#footnote-7). Secondly, intermediate use has been distributed among industries, final use into final consumption categories and capital use into gross capital formation categories, according to the regional proportions in each use group, as observed in the MRSUT. Thirdly, imports from abroad have been split by country of origin[[8]](#footnote-8): for each product the regional share of imports has been calculated on the basis of Istat trade statistics (available by product, region and country of origin); for services, where there’s no trade statistics available, the WIOD national share of imports (by service and country of origin) has been applied uniformly to every region.

The international transport margins (ITMs) of each of the 4 regions when trading goods with foreign countries, as they result from the international WIOD tables, have been distributed according to the proportion of the total regional imports from abroad of each product, as they result from the multi regional Supply tables. Since in WIOD the “domestic” ITMs for Italy as a whole are obviously null, the ITMs for each product between pairs of macro regions have been put to 0. The CIF/FOB adjustments of competence of each region have been calculated consequently.

When necessary, further adjustments for negative values in intermediate and final use categories have been performed[[9]](#footnote-9).

As for the international Use tables for all the other countries, the corrections are solely concerned with the imports from Italy, which now have to be split into “Four Italies”; in this case the sum of these values must be equal to the Italian national exports to that country.

Imports of Italian products by a single country have been split by region according to the regional shares of exports, calculated for products on the basis of Istat trade statistics (available by product, region and country of destination) and for services on the basis of the regional shares of exports observed in the MRSUT (supposed to be equal for any country of destination for the same service)[[10]](#footnote-10).

Country’s ITMs with the “Four Italies” have been adjusted accordingly.

**4. Results (to be completed)**

**Figure 2: The decline of high-skilled employment in the South**



**Figure 3: Regional heterogeneity**



**Table 1: Most important value chains in terms of low-skilled jobs (1995). Top panel: interregional value chains; Bottom panel: international value chains**



**Figure 4: Jobs contributed to value chains (Top panel: NW; bottom panel: S)**



**5. Conclusions**

External dependency levels for regions are similar and declining, but S is much more susceptible to deteriorations in the national economic environment.

**References (to be completed)**

Byron R.P. (1978), “The Estimate of Large Social Accounting Matrices”, *Journal of the Royal Statistical Society*, series A, Part 3

Casini Benvenuti S. (editor), “Il nuovo sistema dei conti economici nazionali e regionali SEC 1995”, Franco Angeli, 2000

Casini Benvenuti S., R. Paniccià (2003), “A Multi-regional Input-Output Model for Italy: Methodology and First Results”, WP23, IRPET

Cherubini L., R. Paniccià (2011), “A multiregional structural analysis of a dualistic economy: the Italian regions over a decade (1995-2006)”, presented at the *19th International Input-Output Conference*, Alexandria (VA), 13-17 June 2011

# Ghezzi L., R. Paniccià, S. Rosignoli (2009), “The role of exports in the process of growth: an analysis of Italian regions using a multi-regional input-output model”, in *Energy Policy and International Competitiveness,* M.Grassini e R. Bardazzi (editors), Florence University Press

Los, B., R. Stehrer, M.P. Timmer and G. de Vries (2012), “Job Dynamics and Global Supply Chains”, Paper presented at the International Input-Output Conference 2012, Bratislava.

Stone R., D.G. Champernowne, J.E. Meade (1942), “The Precision of National Income Estimates”, *The Review of Economic Studies*, IX.

Timmer, Marcel P., Abdul A. Erumban, Bart Los, Robert Stehrer and Gaaitzen de Vries (2012) “New Measures of European Competitiveness: A Global Value Chain Perspective”. Paper presented at the High-level conference on Competitiveness, trade, environment and jobs in Europe: Insights from the new World Input Output Database (WIOD) (Brussels, April 2012).

1. A hat (e.g.$\hat{y}$) indicates a diagonal matrix, with the elements of the vector **y** on the diagonal. [↑](#footnote-ref-1)
2. The symbol ◦ stands for the “Hadamard product”, obtained by cell-by-cell multiplication (i.e., **W** = **X** ◦ **Y** means that *wij* = *xijyij*, for all *i* and *j*). [↑](#footnote-ref-2)
3. The original methodology of construction of the SUTs for the Italian regions is due to the Regional Institute for Economic Planning of Tuscany (IRPET) and is extensively described in Casini Benvenuti and Paniccià (2003); recent updates have been introduced as outlined in Cherubini and Paniccià (2011). [↑](#footnote-ref-3)
4. A description of the basic data sources can be found in Casini Benvenuti (2000) and Ghezzi *et al.* (2009). [↑](#footnote-ref-4)
5. Similar results are obtained for purchases abroad by residents and purchases on the country’s territory by non residents. [↑](#footnote-ref-5)
6. The “extra regional” values concern the mining sector (mainly offshore rigs) and the public administration (mainly embassies and military bases abroad); they have been attributed, respectively, to South and islands (by proximity criteria) and to the Centre (where the central offices of the public administration are located). Part of these values is also included in the interregional trade flows through re-exports to other regions; they have been adjusted accordingly. [↑](#footnote-ref-6)
7. For interregional imports some further amendments has been required in order to consider products not imported from abroad: “raw materials”, “public administration”, “health and social services”, “private households”. The last 3 products have been considered final, while “raw material” has been imputed in the same proportion to intermediate and final use. [↑](#footnote-ref-7)
8. Interregional imports are available, by construction, in the MRSUT. [↑](#footnote-ref-8)
9. In analogy with WIOD construction procedures, adjustments have been attributed to re-exports and all columns involved in the correction have been modified accordingly. [↑](#footnote-ref-9)
10. Further corrections have been made when the shares turned to be null for every regions. In all these cases, proportions of purchases by non residents on the regional territory (not available for single products but only as a total amount) have been used. [↑](#footnote-ref-10)