Leadership and clusters' creation in employment and wages networks arisen from global production chains: an Input-Output analysis 1995, 2002 and 2009

(WORKING PAPER)

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This article aims to identify those countries and sectors worldwide leaders, who have been able to create clusters of employment and wages from global production chain in 1994, 2002 and 2009. This goal is sought by applying the input-output's methodology in order to obtain an employment by employment global matrix; later, clusterization techniques will be used and graphs will be associated to matrices of: employment by employment, induced employment by final demand, unit wages; and finally, total wages..

Key words: global production chains, employment, wages, matrix employment by employment, clusters.

Topic: Estimating, Measuring, and Balancing International Trade.

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Introduction

It is generally accepted that employment and wages, strengthen local and world markets' demand. And that the increase in international trade produces economic growth for the nation that engages in it. However, this positive effect of international trade may not necessarily show increment of the country labor's income, nor in the cohesion and integration of its labor market.

The purposes of this paper are: (i) to identifying, for the years 1995, 2002 and 2009, through the use of a matrix of employment by employment, those countries that rule - by means of their international trade activity - the major global production chains in terms of employment and wages; (ii) to determining which sectors produce directly and indirectly the higher levels of employment and wages in the same years and, (iii) the same as in (ii) but regarding clusters "sector-country".

This work is divided into four sections. In the first we review the tendencies of labor and the wages at world level in the years 1995, 2002 and 2009. In the second section, we develop the methodology for obtaining a world employment by employment matrix and the clustering techniques associated to graphs. In the third one, we show the evidence about, the results of the methodology applied and their interpretation. Finally there is a section of conclusions.

I. Trends in employment and wages at regional and sectorial levels

In the last two decades the dynamism of international production was characterized by two periods: one of significant growth, which covered 1995 to late 2007, and a second one of recession, which saw 2008 and 2009. This last phase was the result of collapse international trade and foreign investment after the financial crisis originated in the United States in September 2007.[4] This set of events caused that economic activity in advanced economies turned negative during 2009. However, this did not happen in those emerging economies where growth barely slowed.

The outbreak of the recent global crisis had major impacts on the behavior of production and employment that led worldwide companies to reduce their demand for labor. Workers were driven to join the informal employment with precarious conditions when better; otherwise, were suspended indefinitely from the labor market.[5]

 a) Evolution of employment at regional and sectorial level

The labor market's deterioration was reflected directly on a fall of global employment rate, which went from 60.2% in 1997 to 59.7% in 2009.[6] However, this same trend was presented by different economies and regions of the world i.g., at Developed Economies and the European Union is passed from 56.2% to 55.3%; in Central and Eastern Europe this decreased from 53.7% to 53.1%; in East Asia fell from 74.9% to 67.5%; in the South-East Asia and Pacific changed from 67.2% to 66.7%

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[4] According to statistics from short term trading World Trade Organization (WTO), world exports fell by 38 percent (in nominal terms). This went from a value of US $ 431,500 million in the first quarter of 2008 to US $ 268,500 million at its lowest level during the first quarter of 2009, (Global Wage Report, 2010).

[5] One advantage, result from the current importance of international trade, is that it allowed that countries formulate a strategy to exit the economic collapse coordinately; resulting in the development of an action plan, which aimed to agree on the participation of each government as a reactivador of consumption and invest. (International Labour Organization, 2010).[5]

[6] Figures obtained from the reports of the ILO *Global Employment Trends*, 2008 y 2014.

and in South Asia 58.2% to 54.4%. Otherwise, in Latin America and the Caribbean employment increased slightly and went from 59% to 60.7%.[7]

On the other hand it should be noted that during the preliminary years of the economic crisis, global employment provided an average growth rate of 1.7% during the period from 2001 to 2006 and in 2009 this was of 0.4% over the previous year; that is to say, a fall of 1.3% in employment happened. Regions where this indicator was decreased significantly were in the Developed Economies and the European Union in which employment variation rate was -3.44%. This trend was repeated in Central and Eastern Europe at a value of -2.08% (see Table 1).

Table 1. Annual employment growth, world and regions (per cent)

Region	2001–06	2007	2008	2009	2010	2011	2012	2013*		
								CI lower bound	Preliminary estimate	CI upper bound
World	1.7	1.6	1.0	0.4	1.2	1.4	1.4	1.3	1.4	1.5
Developed Economies and European Union	0.9	1.5	0.6	-2.2	-0.2	0.4	0.5	0.3	0.4	0.4
Central and South-Eastern Europe (non-EU) and CIS	1.2	2.0	1.1	-1.3	1.4	1.8	1.1	0.0	0.2	0.3
East Asia	1.0	0.9	0.0	0.4	0.6	1.0	0.8	0.6	0.7	0.7
South-East Asia and the Pacific	1.7	2.3	2.0	1.8	2.1	2.2	2.0	1.5	1.6	1.7
South Asia	2.3	1.0	0.5	0.6	1.0	1.1	1.0	1.8	1.9	2.0
Latin America and the Caribbean	2.6	2.3	2.6	0.7	2.4	2.2	2.3	1.7	1.8	2.0
Middle East	4.6	4.3	2.3	3.7	3.1	3.8	3.1	2.6	2.8	3.0
North Africa	3.3	3.6	2.9	2.0	2.4	0.6	1.9	1.6	2.0	2.4
Sub-Saharan Africa	3.0	3.0	2.9	2.8	2.9	3.0	3.1	3.0	3.1	3.2

Nota: Table obtained from *GLOBAL EMPLOYMENT TRENDS 2014*. *2013 are preliminary estimates; CI = confidence interval. Source: ILO, Trends Econometric Models, October 2013; see also source of table A2.

When analyzing the behavior of the distribution of employment by sector, a phenomenon of displacement of the workforce from agriculture and industry to services becomes clear. In 2007 the latter captured 42.7% of global jobs, while the agricultural and industrial sectors absorbed 34.9% and 22.4%, respectively. More recently, in 2013, the distribution of overall employment remained led by the services sector which accounted for 45.1%, agriculture with 25% and industry 23%.

Besides studying how distribution of global employment has behaved, another factor that adds elements to the study of labor markets is productivity and its relation to international trade. Thus,

during the years of 2012-2013 the rate of worldwide productivity growth decreased from 1.6% in the first year to 1.4% at the second. This downward trend of both, the employment rate and the global productivity, has been reflected in a fall in production of most economies.

In this sense, it is necessary to consider that if the countries' target is to accelerate the economic growth, it is required to take into account that the increase cannot only come from an increased use of production factors, but also, from an improved overall productivity. Given this, the challenge is to use capital and labor more efficiently in those higher value-added activities. This is the strategy followed in China, economy has grown at a remarkable pace in recent decades, moving from a less developed to a middle-income economies. In the last decade the proportion of agricultural workers in this country was reduced by half, about 70% in the early 1980s to 35% recently. These workers previously employed in agriculture were absorbed quickly in the manufacturing sector, which is now part of most international production chains.

b) Behavior of wages to regional and sectorial levels

Based on the deterioration of the labor market in the world, as a result of the financial crisis of 2008, it is necessary to analyze which have been the impacts that this had on the evolution of wages to regional and sectorial levels. Due to the increase of the population whose income is limited to two dollars a day in the years after the crisis; and also that the inequality in income distribution has worsened in recent years.

Despite the damage and repercussions of the economic collapse on production and employment, the growth rate of wages during the crisis only presented a slowdown but remained positive; 73% of countries in 2008 and 80% of countries in 2009. However, one must not ignore the fact that during the first years of the crisis the rising inflation, result of higher oil prices, deteriorated sharply in real wages. And that in 2009 inflation fell at a faster rate than the fall in nominal wages, which allowed, during the most acute phase of the crisis, real wages to recover slightly (International Labour Ortanizaton, 2014). The study of the wages at the regional level behavior shows evidence of heterogeneous growth. In advanced countries after showing a rise of around 0.8% in pre-crisis years, real wages dropped by -0.5% in 2008 and in 2009 grew at a rate of 0.6%.[8]

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[8] In general, the level of real wages fell in 12 of the 28 developed countries in 2008 and in 7 of the advanced countries in 2009(International Labour Ortanizaton, 2014).

Within the group of G-20, the United States presented a reduction in wage rate during 2008 and 2009; New Zealand maintained a real wage growth throughout the crisis. The United Kingdom remained the constant weekly wage level in 2008. However, in 2009 nominal wages increased but to a lesser extent the rise in the CPI, which resulted in a reduction in wages in real terms. In Japan, there was a fall in real wages of about -2.0% in 2008 and 2009 despite the process of deflation that occurred in this country, real wages themselves were affected.

The largest wages declines –in real terms- appear to be in Eastern Europe and Central Asia, where -according to official figures- the real wage growth fell from an average of about 17% in 2007, 10.6% in the 2008 and -2.2% in 2009. This also happened in Central and Eastern Europe where the variation of real wage passed from 6.6% in 2007 to 4.6% in 2008 and -0.1% in 2009. In contrast, there were regions where wages showed improvement. In Asia, the crisis was hardly noticed[9], real wages rose more than 7% during the period 2006-2009, with rates of 7.2% in 2007, 7.1% in 2008 and 8% in 2009. In this global trend the ILO reported that the behavior of regional wages is strongly influenced by the evolution of the Chinese economy. Since this represents more than half of total wage employment in the region. However, it is possible to consider these figures taking into account the experience of countries such as Thailand, Malaysia and the Philippines, where wages were strongly affected by the crisis.

 In Latin America and the Caribbean it is estimated that real wage growth fell from 3.3% in 2007 to 1.9% in 2008 and moved to 2.2% in 2009 (Global Wage Report, 2010).The sectoral analysis of changes in the share of wages can be done by highlighting three main sectors: manufacturing, construction and a wide service sector that includes: real estate brokerage, leasing services and other business services.[10]

Of these three sectors added, the most affected by the financial collapse were the manufacturing and construction, both in employment and production. However, due to the origin of the global recession−that began with the imbalance of the US financial sector−it is interesting to analyze how has been the behavior of wages in the service sector in recent years. In this regard, the study by the

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[9] Regarding to the weighted average of the countries of this region.

[10]This sector includes the sectors of financial intermediation, real estate, renting and other business services.

ILO indicates that a decrease occurred in the participation of wages at the sectors of manufacturing and the construction in all countries except France, Iceland and the United Kingdom. [11]

In addition, during the peak of the crisis period, the participation of wages in manufacturing showed countercyclical behavior. This indicates that an increase in the share of workers' compensation in the added value in times of crisis occurred. In behavior of wages in the service sector showed growth in most countries during the crisis. However, it notes that for the interpretation of this trend is necessary to note that the bonuses to employees are accounted for as part of the wages and not profit, an element that can skew the data behavior slightly. This warning may indicate that the increase in the wage bill, which is mainly reflected by higher revenue in services that really does not reflect an improvement in the share of wages, but a worsening in the distribution of national income in the last years.

So far, the analysis of the distribution of employment and the behavior of wages by region and sectors let us know the growing weakness of the global productive sector. The analysis in this section was focused on the years before and after the last global crisis, which was originated in the services sector, where a growth in this sector was observed, in terms of attracting jobs and wages volume at a regional and sectorial level. In this regard, it is premature to make a conclusion about the future effect that the concentration of jobs in services and in the development of international trade will show. However, it must not be overlooked that the vulnerability of the sector to any economic imbalance can trigger a financial collapse of such magnitude that even as the world economy would not recover.

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[11]For more detail about changing long-term share of wages at regional or country during the period 1990-2007, see the report of the ILO (Global Wage Report, 2010).

II. Methodology for the derivation of matrices employment by employment and wages

The methodology and theoretical scope for the construction of the matrix job by job and clusterization techniques, through the Vos-viewer software, will be presented in this section.

a) Matrix employment by employment.

Input-output tables (IO) describe the relationship of an inter-industrial system, if they are associated to employment data, it is possible to identify those economical activities that create more jobs, not only directly but also indirectly. That is, how a j industry through its intermediate consumption indirectly generates certain level of employment.

A matrix identifies employment by employment requirements in each industry i for each job in industry j. Based on the classic expression of Leontief model and following the development of (Hewings, 1895); modified by (King Dominguez, Parra Marquez & Pino Arriagada, 2012) you can get the employment by employment matrix for use as follows:

$$Zi + df = X \qquad (1)$$

Where:

Z is a matrix of inter-industry transactions
i is a column vector unit
df is a vector of final demand
X is a vector of production (Gross output)

If you defined e as an employment vector, $nx1$ whose entries indicate employment by sector; direct employment coefficient will be $\hat{e}$ That is, a matrix of order $n \times n$ whose elements from the main diagonal express labor requirements of industry j per unit of gross value production in the same industry

By multiplying each element of the expression (1) by $\hat{x}^{-1}$ we have:

$$\hat{e}\hat{x}^{-1}Z \cdot i + \hat{e}\hat{x}^{-1}f = \hat{e}\hat{x}^{-1}x \qquad (2)$$

If you $\hat{x}^{-1}\hat{x} = I$ then it is possible to similarly replace i by $\hat{e}^{-1}e$.

So:

$$\hat{e}\hat{x}^{-1}Z\hat{e}^{-1}e + \hat{e}\hat{x}^{-1}f = e \qquad (3)$$

Solving for $\hat{e}\hat{x}^{-1}f$ de (3), and where $\hat{e}\hat{x}^{-1} = H$ we have:

$$Hf = e - HZ \cdot \hat{e}^{-1}e = (I - H Z \hat{e}^{-1})e \qquad (4)$$

Clearing e (4), the vector of employment is finally obtained:

$$(I - HZ\hat{e}^{-1})^{-1}Hf = e \qquad (5)$$

O well:

$$(I - \Psi)^{-1}Hf = e \qquad (6)$$

Where:

$$\Psi = HZ\hat{e}^{-1}$$

Equation (6) can be read as the result of final demand employment (Hf) the employment multiplier $(I - \Psi)^{-1}$ (King Domínguez, Parra Márquez, & Pino Arriagada, 2012) , also offer an alternative analysis using equation employment vector Miller and said Blair (2009) which is defined as:

$$H(I - A)^{-1}f = e \qquad (7)$$

Matched equations (6) and (7) and using the equality determined in (3) for omega (Ψ) which is defined as:

$$\Psi = I - H(I - A)H^{-1} \qquad (8)$$

Thus:

$$\left(I - (I - H(I - A)H^{-1})\right)^{-1} Hf = (I - \Psi)^{-1} Hf = e \qquad (9)$$

The expression $(I - \Psi)^{-1}$, it is analogous to the Leontief inverse, in the latter's requirements to meet direct and indirect monetary unit of final demand inputs are defined by:

$$\sum_{i=1}^{n} l_{ij} \qquad (10)$$

In the inverse matrix job by job, the requirements of direct and indirect jobs in an industry j, now in physical units, are given by:

$$\sum_{i=1}^{n} \Psi_{ij} \qquad (11)$$

Thus obtaining $(I - \Psi)^{-1}$ it allows knowing how many jobs are generated in the industry i through the generation of employment in industry j; that is to say, employment required by the industry i for each job in industry j. Thus the matrix $(I - \Psi)^{-1}$ expresses the relative capacity requirements of direct and indirect jobs. Equation (10) shows the use induced by final demand, this is the job required a sector j induced by their respective final demand.

Diagonalizing the vector f from the following equation:

$$(I - \Psi)^{-1} H\hat{f} = E \qquad (9')$$

An array of employment induced by final demand in each sector is derived; that is, an array of employment in absolute terms, where each of the entries is the indirect or indirect jobs created in the sector i by final demand sector $j; j = 1 \ldots n$. **consequently, We can say that the matrix $(I - \Psi)^{-1}$ is an array of employment for employment in relative terms and the matrix $(I - \Psi)^{-1} H\hat{f}$ in absolute terms.**

b) *Unitary matrices wages and payroll*

Unitary matrices salaries and wages by sector are determined by the equation 12 and 13 respectively.

$$\widehat{w}(I - \Psi)^{-1} = UW \qquad\qquad (12)$$

Where:

$\widehat{w}$ is a vector of coefficients diagonalized wage per unit of gross value of production.

UW It is a unitary matrix wages sector.

$$\widehat{w}(I - \Psi)^{-1} \hat{f} = W \ (13)$$

Where W is a matrix of wages by induced by final demand sector? In the case of an array of world output input, obtaining matrices jobs by occupation, occupations induced by final demand, wages and payroll unit are similar to the derivation of these matrices for a given economy (see Annex) .

c) A matrix clusterization through VOSviewer

In order to synthesize as much information from input-output matrix to present visually, graphic techniques have been developed to allow to map each of the coefficients derived from a matrix. Examples of these representations are the influences' fields (Michael, Hewings, & Guo, 1996), network theory (Hanneman & Riddle, 2005), influence techniques centrality and power indexes. Thus the visualization technique that uses array software VOSviewer[12] applies the theory of networks with those of clusterization to map a graph associated with a matrix, which presents the clusters from the network. This program maps similarity matrices previously associated with the original matrix to be mapped. These matrices are obtained through a measurement index, associaton proximity or strength with which the relations between the coefficients based on the degree of proximity are mapped. If this is *low* the distance between two coefficients becomes larger and if the similarity is less *strong*. "The notion of the VOS mapping technique is to minimize a weighted sum of the squared Euclidean distances between all pairs of items." (Van Eck & Waltman, 2009, p. 12) making an optimization problem. The program then creates a list of ordinary density which generates a differentiated map colors assigned to each of the coefficients, which will derive one clusters series. Thus, a network associated with a network, which is mapped color and contains the individual weight of each factor on the network and the weight of its relations with the $n-1$ sectors is obtained.

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[12] This software was developed in the Centre for Science and Technology Studies, Leiden University.

III. Empirical evidence

This section is presented in graph representation of the behavior of employment and wages in global arrays: employment employment, employment induced by final demand, the unitary wages and finally the wage bill.

Figure 1. Graphs associated to matrices of employment by emplyment: 1995, 2002 & 2009
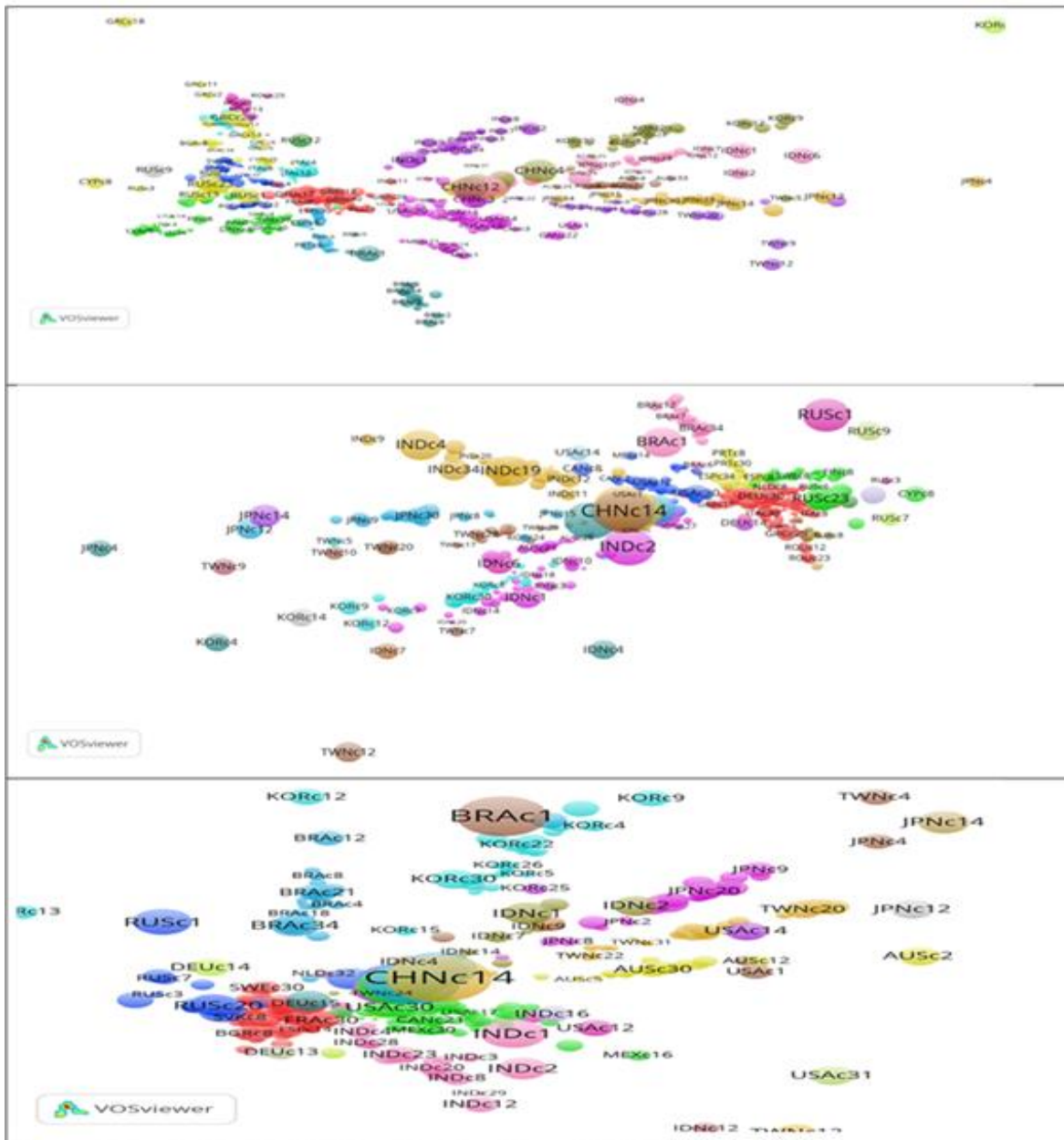
Source: Elaboration based on WIOD world trade matrices and the VOSviewer software.

Figure 1 shows the map of the employment by employment matrix shown by global employment and national chains that derive -through clusters- it. For the year of 1995 it could be observed ten top conglomerates, of which five are national and five international.

Among the countries whose industries, for each job created in them, demandating more work units directly and indirectly; therefore, to make national conglomerates are: Brazil (BRA), India (IND), Indonesia (IDN), Japan (JPN) and Taiwan (TWN). In these countries - except JPN- the primary sector c1. *Agriculture, hunting, forestry and fishing* are the leader of each cluster. Internationally sectors that lead the clusters are located: in the red cluster c12 sector. *Basic metals and fabricated metal*, of English and German economies; c30 sector. *Renting of m & eq and other business activities* of the economy of the United Kingdom; c8. *Coke, refined petroleum and nuclear fuel*, of the French economy, and combined economies of Germany (DEU), France (FRA), United Kingdom (GBR), Belgium (BEL), Netherlands (NLD), Ireland (IRL) and Luxembourg (LUX). Secondly we have the green cluster, led by industry appears c8. *Coke, refined petroleum and nuclear fuel* in the Danish economy (DNK), this integrates economies such as Luxembourg (LUX), Finland (FIL), Sweden (SWE), Lithuania (LIT) and Estonia (EST). In third place is the yellow -the European- led by c1 sectors.*Agriculture, hunting, forestry and fishing* and c23. *Inland Transport* Of Rusia (RUS) and associated inter-systems Bulgaria (BGR) and Greece (GRC). The Fourth, brown formed by the c4 sector.*Textiles and Textile products* of Chinese economy[13] followed by most of the industrial sectors of Korea. Finally, there is the Pink -formed by the economies of North America: United States (USA), Canada (CAN) and Mexico (MEX) led by c30 sector. of the US economy.

For 2002 European clusters are maintained without significant changes, the cluster led by DEU remains the main however are stuck in the region's economies. The second cluster led by c23. *Inland Transport* RUS and the US still led by USA. In the case of national clustes comes a strengthening−CHN, JPN, KOR, IND, IDN−and this year there is the sectoral grouping of BRA.

The trend of strengthening direct and indirect requirements of each sector nationwide increases in 2009.Where work is only apparent continuation of the European conglomerate led by DEU, therefore possible that inter-sectors and complete systems are incorporated to it's network . The graph shows that for this year the group -the red- compose economies: Germany (DEU), France (FRA), Spain (SPA), Italy (ITA), Greece (GRC), Portugal (PRT), Bulgaria (BGR), Luxembourg

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[13] It is important to note that in the case of China a strong course had only thousand employees by sector did. Since zero employment reports of the Asian economy.

(LUX), Austria (AUS), Poland (POL), Cyprus (CYP), Estonia (EST), Netherlands (NLD), Turkey (TUR), Great Britain (GBR), Romania (ROM) Malta (MLT) and Ireland (IRL); the cluster led by RUS only becomes a national conglomerate in Asia national clusters reaffirms USA and North America continues to lead the region with c.30 sector.

Figure 2. Graphs associated to employment induced by the global final demand matrices: 1995, 2002 & 2009
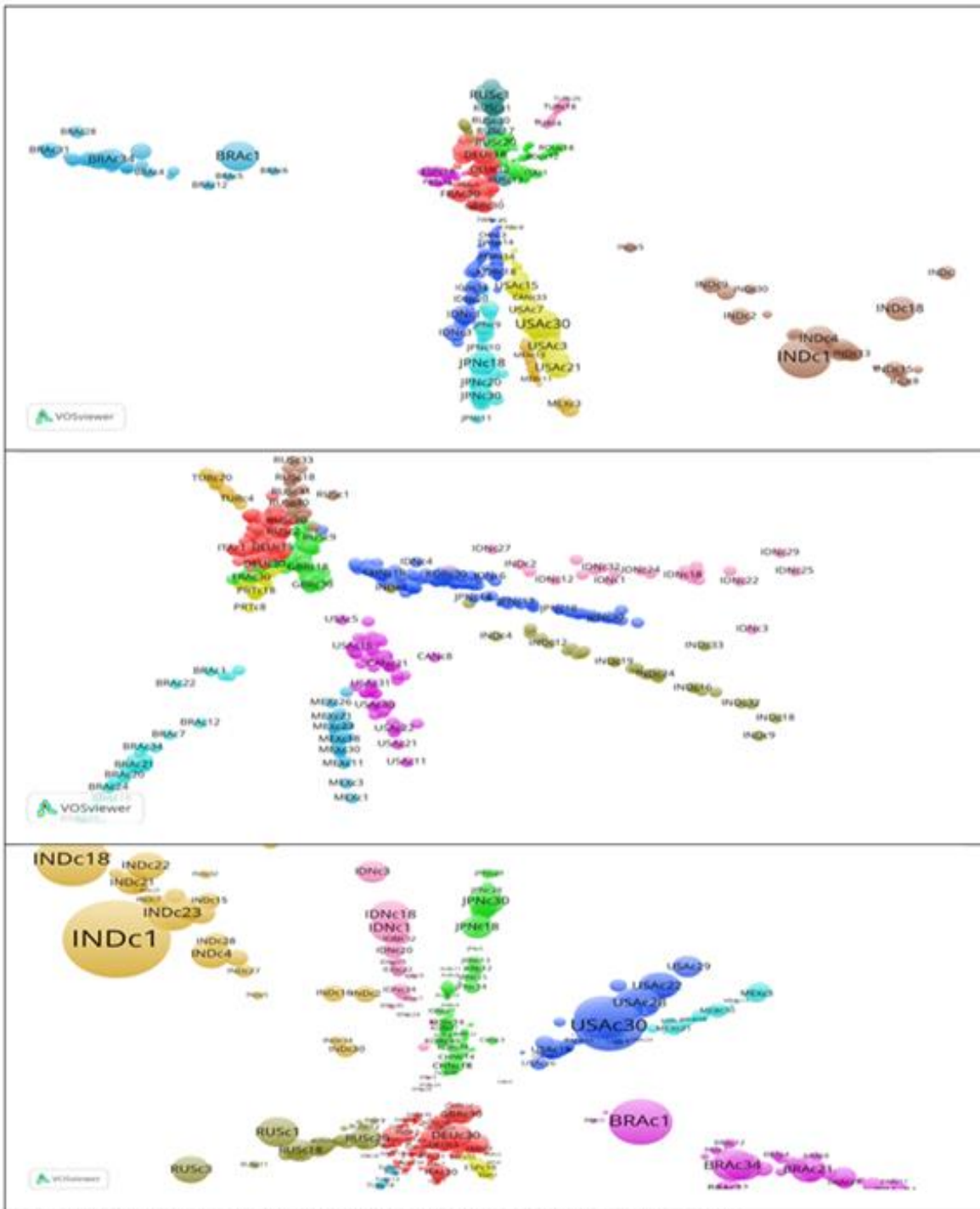
Figure 2 shows graphs of total employment at the sectorial level have induced their respective overall final demand for the relevant years.

In 1995 it is possible to identify a set of eight major clusters, of which four are national and international rest. In the first, the group ranks heavier elements (related to the size of the bubbles) is India (IND) led by the primary sector c1.*Agriculture, hunting, forestry and fishing,* followed by c4 sectors. *Textiles and Textile Products* and c18 *Construction.* The second led by c1 sectors. *Agriculture, hunting, forestry, and fishing* and c34. Other community, social and personnel services of BRA and followed by the rest of the economy. The third composed of Japanese industries (JPN) within which c18 sector. *Construction* seems to be more important. It follows the Russian economy led by c1 sectors. *Agriculture, hunting, forestry and fishing* and c17. *Electricity, gas, and water supply.*

In international conglomerates, most representative cluster - the yellow- consists of USA, CAN and MEX within which the American sector c30. *Renting of m & eq and other business activities* appears at the top and is followed by c21 . *Retail trade, except of Motor vehicles and motorcycles*; repair of household *goods* and c15. *Transport equipment* of the same country. The next international cluster - the blue- is made up of the economies of Indonesia (IDN), Korea (KOR), Taiwan (TAW) and China (CHN) and is led by c1.*Agriculture sectors, hunting, forestry and fishing* and c3.*Food, beverages and tobacco* belonging to Indonesia, and the Koreans c14. *Electrical and optical equipment* and c18.*Construction.* The third international conglomerate identified -the red- consists mainly by economies of DEU, FRA and GBR and is guided by c18 sectors.*Construction of DEU* and c30.*Renting of m & eq and other business activities* of FRA and GBR. Finally there is the sectorial group of countries as ITA and ROU within which the most dynamic sectors are c18.*Construction* and c12.*Basic metals and fabricated metal* of Romania.

2002 national cluster identified in the chart above, we see that only remain relevant to countries like: RUS, IND and BRA; and international Asian and European groups. But this year comes the national cluster of the Mexican economy -MEX-, within which are strongly linked the c23 sectors. *Inland transport*, the c18. Construction and c30 *Renting of m & eq and other business activities*. However compared to the previous year it shows that this integrated economy is decoupled from the economies of North America -NAFTA international cluster. Finally, the graph gives evidence that European economies composed of clusters change their composition. This year it is verified that the economies of RUS, FRA GBR and form a new group in which sectors c20. *Wholesale trade and commission trade, except of vehicles and motorcycles engine*, c1.*Agriculture, hunting, forestry and*

fishing and c15.−*transport equipment belonging* to the RUS, ITA DEU−economies respectively, from another cluster.

Finally for 2009 national clusters IND, BRA and RUS, led by the agricultural sector remain c1. The cluster of Indonesia (IDN) commanded by c18.*Construction* industry consolidates. MEX sectoral grouping remains detached from the cluster of NAFTA. Integrated by different economies clusters, grouping of Asian countries continues,KOR, JPN, TAW and CHN. In addition, an increase in the degree of integration of the sectors of European origin, which caused a fusion of the two clusters identified in previous years, is identified; this new set is essentially led by c30 sector in the countries of GBR, DEU and ITA.

In addition, Table 3 it can be inferred that a growing trend in employment levels has occurred in the sectors related to services specifically in the c30−sectors.*Renting of m & eq and other business activities* and c31.*Public admin and defense*;−comulsory social security. This indicates that with the growth of the global final demand sectors are related to services which, for most of intersectoral linkages, generating an increase in employment of−directly and indirectly in other sectors within the clusters. Another sector that keeps its importance is the c18 sector. *Construction* along the study period, drawing attention to whether there is a positive change in the global final demand, this sector is one of the main drivers of employment growth mainly in Asian countries composed of clusters in India and in Indonesia.

Figure 3. Graphs associated to unit wages matrices: 1995, 2002 & 2009
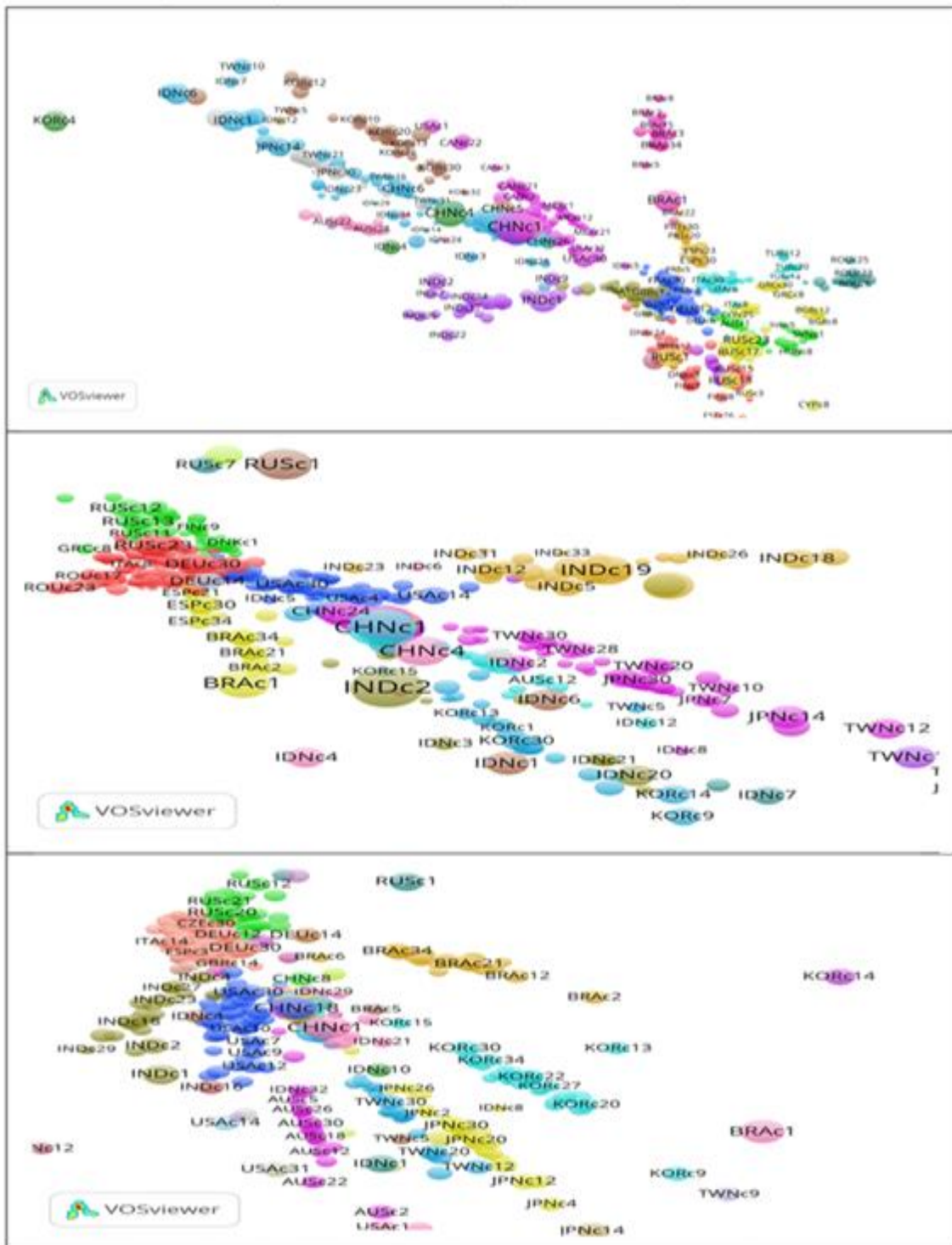
Source: Elaboration based on WIOD world trade matrices and the VOSviewer software.

Figure 3 the map of unit wages associated with global production chains are presented. By 1995 it is possible to identify eight major clusters of which three are national and six international. In the first group, sectors of the economies of BRA -the Pink- and IND - the Purple- c_1.Y both commanded by c_1 sector and a third party represented by c_{12}. of KOR.

In international conglomerates are: the cluster led by -red- c_{15} sector. RUS which are associated economies FIN, EST, DNK, SWE and LTU; Another, the green made by the countries of Cyprus, Austria, Hungary and Slovakia, we must emphasize that there is a major industry, ie that there is a sector in which their unit wages are higher in this group, suggesting the existence of a wage homogenization. The international cluster - the yellow- which is composed of sectors c_1, c_{13}, c_{17} and c_{23} RUS to countries like CYP, BGR and GRC are associated. A red- -the group is made up of the economies of DEU, FRA, LUX and BEL where sectors DUE c_{12} and c_{30} FRA are the leaders. However the unit wages in this group also differ substantially. The group of major Asian countries− CHN, JPN, TWN and IDN−up the fifth international cluster identified by the color blue. Finally, it integrated by the member countries of NAFTA highlighting the sectors c_{30} c_1 USA and CHN as a partner of this cluster.. In this case it appears that the wages of the Mexican economy are the lowest in the group.

By 2002 four international and two national clusters are located.Where the only national cluster is represented by the c_{19}. IND. In the case of the latter, the European economies are concentrated in three groups and change the composition of the network compared with 1995. The first is led by c_{30}. DEU RUS and c_{23} (unit whose wages are predominant in the cluster) and are grouped with the economies of: ROU, TUR, CYP, ITA, MLT, BEL, FRA and POL. The second is led by c_{12} and c_{13} sectors of economies followed by RUS EST, FIN, GRC and SWE. The third group shows a decoupling of ESP and PRT "European" group, partnering this year with the economy highlights the BRA where c_1. Finally, the group made up of the economies of the NAFTA and GRB, where you can highlight a unitary salary c_{30} sector in the USA and Mexico appears again with wages lower unit is located. Finally, the fifth international cluster consists of some sectors of Asian countries: TWN, JPN and CHN.

For 2009, the structure of clusters of unit wages associated with global production chains is unchanged for the euro zone. However, this year a regrouping occurred resulting in two subsets: the first commanded by c_{20} RUS sector and a second led by c_{30} DEU sector. The third international cluster consists of the NAFTA countries and CHIN, and is guided by the sector c_{18} latter. Regarding Asian countries, a separation that led to the formation of national clusters in the case of TWN, JPN, KOR and was encouraged CHN.

Figure 4. Graphs associated to matrices of total wages: 1995, 2002 & 2009
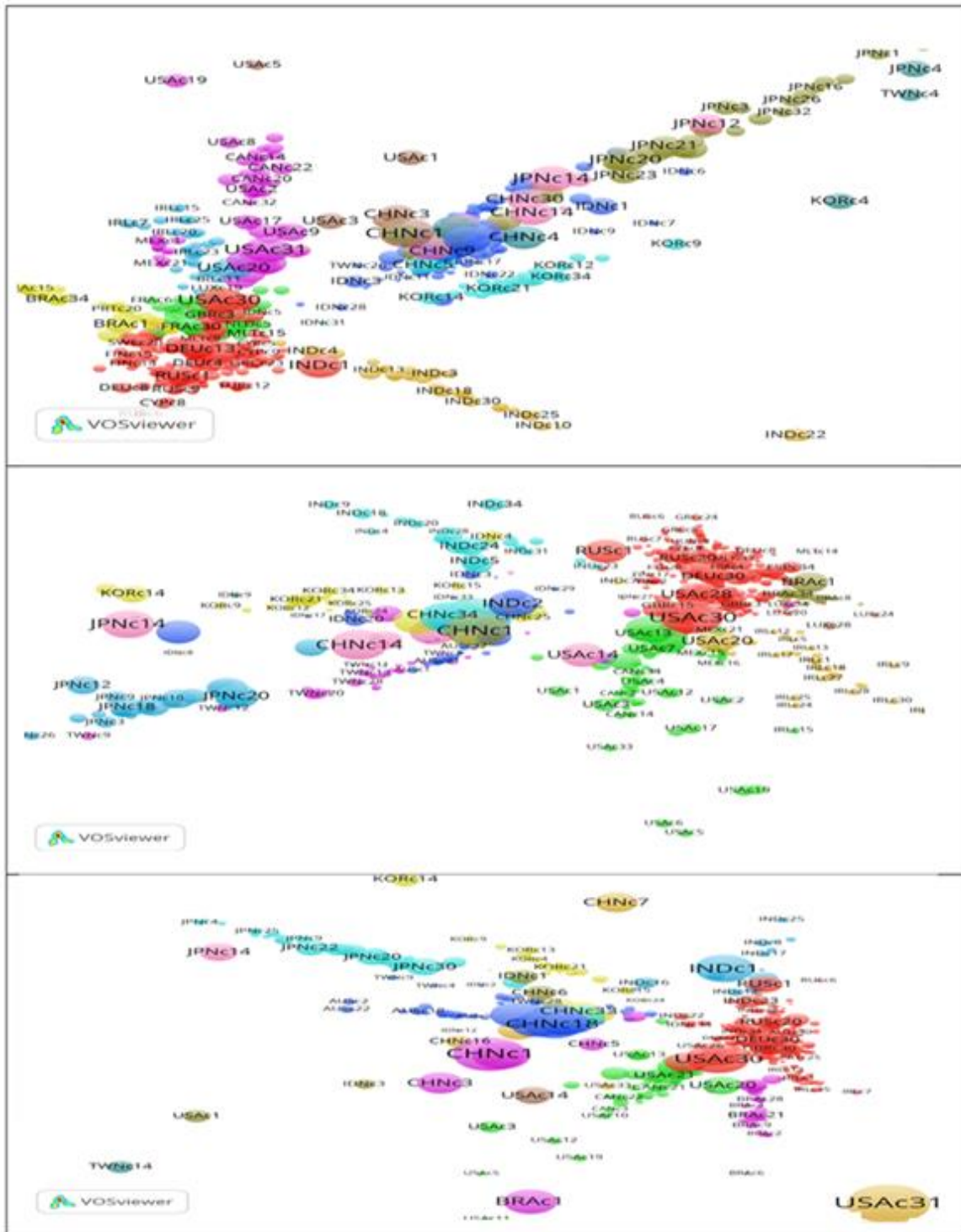
Source: Elaboration based on WIOD world trade matrices and the VOSviewer software.

Figure 4 shows graphs associated to total wages. In 1995, five national and three international clusters are identified. In the first group are economies IND, IDN, JPN, KOR and IRL. In the second, a red- led by US c30, c13 of the DEU, RUS c1 and integrates the economies of CYP, FIN, RUS and GB is identified. -The Other European cluster green- c6 led by sector.FRA and parts of NDL. Finally, the cluster of NAFTA is guided by c31 USA.

For 2002 the evidence shows the integration of European clusters in one guided by sector DEU c30, c20 and RUS c1 and mainly associated with c28 and c30 sectors of USA and followed most of the European countries. The group also the NAFTA where the payroll is the predominant sector of USA is maintained. In the case of national clusters continue the CHN, IND, KOR, TWN and JPN. In the last year, the only clusters that can clearly perceive are those of the NAFTA and the European in the case of international group. In the national remain the CHN, IND, KOR and JPN, and it appears the BRA.

Finally, it is emphasized that this graph shows a difference with the figure of unit wages, as it can be inferred the existence of substantial differences in the total wages that can be seen in the size of the areas of the sectors that drive the clusters.

Conclusions

In the years of analysis (1995, 2002 and 2009) configurations global chains of jobs and wages have major restructuring around the clusters formed and the sectors that lead each of these clusters.

In the matrix employment by employment, ie, the direct and indirect requirements relating to 1995, employment global chains are formed top 10 clusters, of which 50 percent are national clusters and 50 percent international clusters; by 2011 there were 11 major clusters, however, 55 percent were domestic clusters and 45 percent international; in 2009, the year of the crisis, national structures are strengthened even more about international structures for international clusters accounted for only 29 percent of the seven major clusters of that year. As for the sectoral analysis were the services that have gained ground against manufacturing, however, the primary sector is still important requirements for 1995 and 2002 workers, this can be a boost to the high prices of materials premiums that took place during that period.

Should the chains of all employment ie, total employment induced global final demand, international clusters again decrease for two reasons: first the concentration of clusters and other international disengagement as well as increased the number of domestic clusters. By 1995, the 8 main cluster, 50 percent are national clusters and 50 percent international clusters; for 2002, of the 9 major clusters, 67 percent are represented by national clusters; Finally, by 2009 the proportion is repeated, and the fall in global demand that occurred in 2009 and therefore in exports led the domestic final demand and not overall play an important role in the national market job creation.

In the case of unit wage structure participation among national e international clusters was structured as follows: for 1995, 33 percent were domestic clusters and 33 percent international clusters; for 2002, 33 percent and 67 percent respectively; for 2009 the percentage change represented, of the 6 major clusters, the clusters 67 percent domestic and 33 percent international clusters. On the maps associated with matrices of unit wage regions which because of their commercial, economic, political and institutional integration have had a process of wage homogenization, for example, the European Union can be seen, while there may be located elsewhere , which, despite its trade integration have important gaps in unit wage sector, for example, the NAFTA region.

Finally, in the matrix of total wages - total wages for 1995, 2002y 2009, major clusters, representing 63 national, 71 international and 67 and 27, 29 and 33 percent respectively. However, unlike clusters unit wages in the case of payroll it is possible to locate important differences between each

country and each sector. In summary, it can be observed that despite the dynamic growth of world trade, the number of international clusters is becoming smaller, the above caused by two main reasons: first, the concentration of clusters, ie international clusters have merged to create a single set of inter-industrial systems, such as the European Union; the second reason is associated with the separation that countries have been forming isolated or national clusters, for example, Asian economies as Korea or Japan.

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In the case of an array of input-output worldwide, obtaining a job by job matrix it is similar to obtaining such a matrix for an economy. To illustrate the above discussion the following scheme represents a regional economy in three countries with two industrial sectors.

Figure 5. Example of a World Input-Output table (3 countries & 2 sectors)

		Exports →		Country II		Country I		F^W
		Country I						
Imports ↓ C. I		z^I_{11}	z^I_{12}	$z^{I,II}_{11}$	$z^{I,II}_{12}$	$z^{I,III}_{12}$	$z^{I,III}_{12}$	$f^{I,W}_I$
		z^I_{12}	z^I_{22}	$z^{I,II}_{12}$	$z^{I,III}_{12}$	$z^{I,III}_{12}$	$z^{I,III}_{12}$	$f^{I,W}_2$
C. II		$z^{II,I}_{12}$	$z^{II,I}_{12}$	z^{II}_{12}	z^{II}_{12}	$z^{II,III}_{12}$	$z^{II,III}_{12}$	$f^{II,W}_I$
		$z^{II,I}_{12}$	$z^{II,I}_{12}$	z^{II}_{12}	z^{II}_{12}	$z^{II,III}_{12}$	$z^{II,III}_{12}$	$f^{II,W}_2$
C. III		$z^{III,I}_{12}$	$z^{III,I}_{12}$	$z^{III,II}_{12}$	$z^{III,II}_{12}$	z^{III}_{12}	z^{III}_{12}	$f^{III,W}_I$
		$z^{III,I}_{12}$	$z^{III,I}_{12}$	$z^{III,II}_{12}$	$z^{III,II}_{12}$	z^{III}_{12}	z^{III}_{12}	$f^{III,W}_2$
		va^I_1	va^I_2	va^{II}_1	va^{II}_2	va^{III}_1	va^{III}_2	
		e^I_1	e^I_2	e^{II}_1	e^{II}_2	e^{III}_1	e^{III}_2	

Where z^{IJ}_{ij} flow represents the inter-sector demand j from the country J the sector i from the country I; $f^{I,W}_i$ final demand is that the world - including the international final demand makes the country I in the sector i; va^I_i is the value added in the country I in the sector i y e^I_i is the employment generated in the sector i from the country I. In turn, on the main diagonal matrices include domestic each country. Reading rows of the matrix inter-industrial Z they represent the inner intermediate consumption and import demand.

Following the above scheme, it can be inferred that the inter-industrial flows, as defined by the technical coefficients make possible the derivation of an array job by regional or global

employment will be similar to a given economy. Whose coefficients of direct and indirect employment are given by the expression:

$$\Psi\,_{ij}^{I,J} \tag{15}$$

This equation represents the matrix of global employment employment, indirect employment requirements that the sector j from the country J It occurs in the sector i from the country I per unit of employment in the industry sector j from the country J.

In the case of the employment matrix for global employment, employment requirements, direct and indirect sector they are determined by equation (16) is analogous to expression (11):

$$\sum_{i=1}^{n} \Psi_{ij} \tag{16}$$