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Title: Unmasking social distant damage of developed regions lifestyle

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8. Localización de la actividad económica, clúster y cadenas de valor

Abstract: *(minimum 300 words)*

This paper faces the need to evaluate the contribution of international trade to the achievement of the Sustainable Development Objectives proposed by the UN. Undesirable impacts often arise as a consequence of international trade, and a right path to achieve a sustainable world would imply reducing these negative effects while



increasing economic output, which is referred in the literature as impact decoupling. This concept is usually discussed in terms of output and regarding the region or country of production. However, the increasing separation between consumption and production caused by globalization and the increasing relevance of international trade lead to an unprecedented displacement of economic, social and environmental impacts. The displacement occurs through international trade and makes crucial to analyse global value and supply chains to assess the connections between consumption (in affluent regions and countries) and production elsewhere. Hence, this article tries to determine if global production and consumption chains are currently on the right path from the decoupling point of view, focusing on harmful social impacts regarding labour conditions.

In this research, we employ a Multi-Regional Input-Output model, the last available release of World Input-Output database (WIOD_r2016) and an own-elaborated database of social impacts concerning undignified working conditions in terms of fatal injuries, non-fatal injuries and forced labour.

Main contributions of this research are two: we propose an own-elaborated database of social impacts concerning undignified working conditions by compiling data from international organisms and previous literature at country and sector level. Second, we provide a worldwide perspective on the evolution of those social footprints and their potential decoupling, paying special attention to two of the most developed and affluent regions, namely, the United States and European Union. First results indicate that most of the harmful social impacts occur beyond the frontiers of affluent regions. Up to 81% of fatal injuries linked to European Union consumption happen outside its borders, mainly



in developing regions. And, although the corresponding footprint decreases between 2000 and 2013, the share of the distant impact ends the period being a 75%.

Additionally, we determine the kind of decoupling observed through the calculus of social footprints' elasticities with respect to final demand for each region. In a global context, results show that during the period 2000-2008 the main modality of decoupling was the weak one, while in 2008-2013 the predominant kind was the recessive one. Regarding the main developed economies in the world, decoupling of their footprint with respect to their worldwide final demand occurs in occupational health impacts, while concerning labor slavery the decoupling is not so clear.

Keywords: Sustainability, Decoupling, MRIO model, Social Footprint, International Trade, Indecent Labor

JEL codes: C67, F69, J81



Unmasking social distant damage of developed regions lifestyle

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1. Introduction

Sustainable development is probably the hugest challenge to be faced up by humankind nowadays. This affair seems especially ambitious due to its transversal and long-reach nature. Development has been regarded traditionally as mere economic growth, but since the Brundtland Report changed its conception, social issues and environmental protection have been included as essential elements to materialise fair and future-guaranteed development (Brundtland & Khalid, 1987).

Such heterogeneous target drives two dichotomies along its achievement. Regarding social affairs, development through openness to international trade not always carries an improvement in working conditions. Huge flows of bad work embodied in trade are arising from developing regions to wealthy nations (Ali Alsamawi, Murray, & Lenzen, 2014; Simas, Golsteijn, Huijbregts, Wood, & Hertwich, 2014). Mosley and Uno (2007) claim that the quality of labour rights inside a region is negatively correlated with its openness degree in international trade networks. The most abject phenomena like labour slavery are still a reality all over the world, not only in developing countries in Asia, South America or Africa (ILO, 2001; Srivastava, 2005), where even children are involved in bonded labour, but also in developed regions like Europe (Datta & Bales, 2013), affecting specially the most vulnerable collectives –migrants and refugees- in host countries with weak institutions (Hernandez & Rudolph, 2015). In addition, the relationship between health and development is also a controversial binomial. Occupational injuries and fatalities are also a great concern when evaluating worldwide supply chains (A. Alsamawi, McBain, Murray, Lenzen, & Wiebe, 2017). Some emerging countries seem to feature a higher tolerance towards its citizen's health deterioration as a comparative advantage (Vargas & Dietzenbacher, 2015). When considering as well the pollution haven hypothesis (Copeland & Taylor, 2004) it is possible to explain why some countries back up their growth in pollution-intensive exportations despite its clear correlation with population's loss of welfare (Vargas & Dietzenbacher, 2015). Health risks linked to economic growth are a matter not only affecting developing economies: negative consequences over worker's physical and mental health triggered by an increase in exportations are also a fact in developed countries as Denmark (Hummels, Munch, & Xiang, 2015). Extending the social impact of work in a broad sense through a synthetic



indicator, (A. Alsamawi et al., 2017) claim that countries tend to import more negative impacts embodied in traded products as they reach higher development levels. Therefore, the efforts to achieve an environmentally-friendly and socially-desirable development seems to be displaced as responsibilities can be transferred to “less concerned” regions. However, as countries develop they also import more negative social impacts through global trade.

The analysis of these patterns in terms of decoupling constitutes a way of determining if the trends in which the economy is immersed lead to a more sustainable path or, on the contrary, drive us away from sustainable development. The concept of “decoupling” in a general sense refers to the phenomenon in which economic growth process continues its course while the undesirable consequences and externalities triggered by it are reduced (i.e. environmental damages, use of resources and generation of waste, etc.). In words of the OECD, the concept can be summarized as “breaking the link between ‘environmental bads’ and ‘economic goods’” (OECD, 2002). More specifically, there are two main kinds of decoupling: resource decoupling, which refers to increasing resource productivity, i.e. requiring fewer inputs per unit of economic activity; and impact decoupling, which is understood as reducing negative impacts per unit of economic activity – equivalent to an increasing eco-efficiency in the environmental case - (Fischer-Kowalski et al., 2011). In addition, the concept of “double decoupling” is applied when both types of decoupling coexist (Mudgal et al., 2010).

Furthermore, there are different classifications of decoupling. First, the European Commission (2003) classifies it as either relative or absolute. On the one hand, relative decoupling of resources or impacts happens when the resources used or the negative impact analysed grow at a lower rate than a relevant economic indicator. Both variables grow, but the elasticity of the relationship is lower than 1 (Mudgal et al., 2010). On the other hand, absolute decoupling refers to the situation in which the use of resources of the undesired impact declines or remain stable independently on the pace followed by economic growth. While relative decoupling has been commonly observed in developed economies like the EU along the last decades, absolute decoupling is an older phenomenon that requires more complex actions and higher efforts of most countries to



increase resource productivity and efficiency faster than the growth rate of economy (Fischer-Kowalski et al., 2011; Mudgal et al., 2010; OECD, 2002). Second, following Vehmas et al. (2003) classification and its application to transport made by (Tapio, 2005), eight different situations can be distinguished as a function of the growth rate of the economic driver, the growth rate impact indicator of interest and the “social elasticity” concept developed as an extension of the environmental elasticity proposed by York, Rosa, and Dietz (2003). This classification will be discussed in a more detailed way in methods and results sections.

All these concepts have usually been applied to environmental concerns, but since the current idea of sustainable development is wider, they can be also applied to social affairs. In this article, we focus on social impact decoupling understood as reducing the social impact of any resources used or economic activities undertaken. Following Stiglitz, Sen, and Fitoussi (2010), the gap between economic growth and perceived well-being by the population seems to be enlarging, what makes an imperative to develop reliable social indicators that complement the current measurements to draw up a more human concept of development. Assuming the relevance of “decent job” as a decisive element of the quality of life, it is a fact that usual employment accounts are insufficient to reflect all qualitative dimensions that integrate the idea of the proper job (Stiglitz et al., 2010).

The structure of this analysis is the following: First, we analyse whether absolute or relative social impact decoupling is happening in the period 2000-2013 in the two main developed economies - European Union (EU) and United States (USA). It is usual to examine the performance of the most developed economies in their efforts to delink negative externalities from production (Wang, Yin, & Li, 2010), but it is not as common to do it in terms of consumption. In this article, we pay special attention to social decoupling evaluated in terms of the footprint to determine if the efforts in improving local production techniques are aligned with those focused on improving international trade relationships to achieve an effective worldwide decoupling. A graphical method as proposed by (OECD, 2002) is applied to determine, first, if decoupling can be claimed to exist and, if existing, the kind of decoupling corresponding to each social indicator (relative or absolute). In addition, these two economies are also analysed using a relative



indicator that allows to seek for decoupling and, at the same time, to zoom at the details in the imported part of each footprint.

Second, we will perform a worldwide analysis of the social footprint decoupling. As this is only a preliminary version of the paper, this study is not yet evaluated in this paper. However, we will work with the concept of social elasticity to determine which kind of decoupling in terms of footprint predominates in periods 2000-2008 and 2008-2013 according to the classification by Vehmas et al. (2003).

2. Methodology

The MRIO analysis

The standard extended multiregional input-output model (E-MRIO) is a well-established quantitative technique to measure the production requirements and the associated environmental and economic impacts, to meet a selected level of final demand across the whole supply chain (Davis & Caldeira, 2010; Steen-Olsen, Weinzettel, Cranston, Ercin, & Hertwich, 2012; Wiedmann et al., 2013). Given the increasing social concerns, the extension to the social dimension would be the natural next step (Hardadi & Pizzol, 2017). In the MRIO model framework, regions and countries are included with their own technology, and trade is divided into intermediate trade, with specific industry destinations, and final trade. The basic E-MRIO equation is as follows in expression [1]:

$$F = \hat{f}(I - A)^{-1}\hat{y}, \quad [1]$$

Where \hat{f} is the target factor (either environmental or social) as a diagonalized vector per unit of output, $(I - A)^{-1}$ is the Leontief inverse matrix, and \hat{y} is the diagonalized final demand per country (Miller & Blair, 2009; Monsalve, Zafrilla, & Cadarso, 2016). A is the matrix of technical coefficients in a MRIO context, providing a detailed sector-by-sector and region-by-region domestic intraregional structure and the trade matrices from one region to another. To work with matrix forms in footprint estimations, MRIO contexts provide more wide information. The extension of the model to compute different social impacts and footprints is estimated by pre-multiplying the Leontief Inverse Matrix by target factors provided by different satellite accounts. The diagonalization of those target factor vectors (\hat{f}) enables the estimation of multipliers and results, both, in matrix form



(Cadarso, López, Gómez, & Tobarra, 2012; Meng, Peters, & Wang, 2014; Skelton, Guan, Peters, & Crawford-Brown, 2011). The resulting matrix F can be analyzed in different perspectives. By row, the F matrix shows the distribution of the impact that occurs in one sector of a country when produced to attend all sectors and countries. This is the so-called production based-approach (PBA). Conversely, by column, the F matrix yields the impacts from across the world and across sectors required for the production of one unit of final demand in a country. This is the consumption-based approach (CBA) or factor footprint concept. We follow the CBA criteria to include the whole global production chains in order to calculate some social footprints related to the quality of labour and job conditions, using as factors data on non-fatal injuries, fatal injuries and forced labour by sector and country or region. As a result, we evaluate the existence of decoupling accounting for not only the quality of labour and job conditions at home, but also for these circumstances abroad along the global production chain of goods and services imported to meet the country final demand.

The decoupling analysis

The analysis of the labour footprints (A. Alsamawi et al., 2017; Gómez-Paredes, Yamasue, Okumura, & Ishihara, 2015) in terms of decoupling are implemented following the (OECD, 2002) recommendations. For the specific cases of EU and USA, two methods are applied. First, a graphical method is applied, where two-time series are plotted simultaneously: the economic indicator chosen as the driving force of development –final demand in this case- and the impact linked to it –non-fatal injuries, fatal injuries and forced labour - to detect the differences between the tendency of both series. The differences in the trends will allow detecting either relative, absolute or no decoupling. Second, and following the same report recommendations, these two economies are also analysed using as an indicator the ratio between each social impact variable footprint and final demand. A decline with time in this indicator can be taken as an evidence of decoupling. The most interesting feature of this second method is that it allows decomposing the imported part of each footprint according to the country of origin, which might be useful to determine possible sources of decoupling or specific areas in which no decoupling takes place. This kind of results can be very relevant for policymakers.

On the other hand, the second part of the analysis regards decoupling at worldwide level in two periods: an expansive one (2000-2008) and a recessive one (2008-2013). On each of these periods, a decoupling analysis according to the classification made by Vehmas et al. (2003) is developed by extending the concept of environmental elasticity proposed by York et al. (2003) to social elasticity.

The general concept of elasticity refers to the percentage change in a dependent variable from a one-per cent change in an independent variable that has a causal influence on the former with other factors held constant. Relying on this concept, environmental elasticity is defined as “the proportional change in environmental impacts due to a change in any driving force” (York et al., 2003). In this work, we apply this idea to social impacts, defining social elasticity as the percentage change in social impacts produced by a one per cent change in an economic driving force. The economic indicator chosen is final demand if the social impact is measured in terms of consumers’ responsibility or value added if the social impact corresponds to producers’ responsibilities. However, as these magnitudes coincide at the country level, final demand is used in the denominator for both cases.

The social elasticity can be calculated for a single year as the ratio between the annual growth rate of the social impact (either in terms of footprint or in terms of producer responsibility) and the annual growth rate of the economic indicator chosen as expression [2] shows.

$$\varepsilon_t^S = \frac{GR_t^S}{GR_t^{FD}} = \frac{\frac{S_t}{S_{t-1}} - 1}{\frac{FD_t}{FD_{t-1}} - 1} \quad [2]$$

S =fatal injuries, non-fatal injuries, forced labour, final demand; $t \in [2001, 2013]$

Where ε_t^S is the elasticity of the social indicator S in year t with respect to final demand, GR_t^S stands for the annual growth rate of the social indicator in year t , GR_t^{FD} stands for the annual growth rate of the final demand in year t , S_t represents the social indicator value in year t and FD_t corresponds to the final demand value in year t .

However, when working with periods of time involving several years, the calculation requires additional steps. First, we calculate the growth index (GI_t^S) for each of the three social indicators and final demand in each year in the time series 2000-2013. Expression [3] shows the expression for one of the social indicators, it would be equivalent for the final demand.

$$GI_t^S = \frac{S_t}{S_{t-1}} = GR_t^S + 1 \quad [3]$$

Second, we calculate the geometric average of the growth index in each of the two periods selected (2000-2008 and 2008-2013) to obtain an average annual growth index ($\overline{GI}_{period\ i}^S$) of each social indicator and final demand as expression [4] shows. This method provides more accurate results than calculating a cumulative annual growth rate, which would assume growth every year in an unrealistic way. Notice that the reason of working with growth indexes instead of growth rates is to avoid indeterminacy when applying the geometric average.

$$\overline{GI}_{00-08}^S = \sqrt[8]{\prod_{t=2000}^{2008} GI_t^S} \quad ; \quad \overline{GI}_{08-13}^S = \sqrt[6]{\prod_{t=2008}^{2013} GI_t^S} \quad [4]$$

Using the average annual growth index, expression [5] provides the average annual growth rate ($\overline{GR}_{period\ i}^S$) in an immediate way.

$$\overline{GR}_{period\ i}^S = \overline{GI}_{period\ i}^S - 1 \quad ; \quad i = 2000-2008, 2008-2013 \quad [5]$$

Once known the average annual growth rates, elasticity for each period is retrieved in [6] using a similar procedure to that showed in [2]

$$\varepsilon_{00-08}^S = \frac{\overline{GR}_{00-08}^S}{\overline{GR}_{00-08}^{DF}} \quad ; \quad \varepsilon_{08-13}^S = \frac{\overline{GR}_{08-13}^S}{\overline{GR}_{08-13}^{DF}} \quad [6]$$

Using these elasticities and average growth rates, Vehmas et al. (2003) classification can be implemented according to the criteria exposed in Table 1. There are three kinds of desirable decoupling: strong, in which the social negative impact falls in average terms along the period while final demand increases ($\varepsilon_{period\ i}^S < 0$); weak, in

which both the social and economic indicator growth in average terms but the social impact does it in less than a proportional way ($0 < \varepsilon_{period\ i}^S < 0.8$); and recessive, in which both variables have a negative average growth but the social impact decline in a more intense way than final demand ($\varepsilon_{period\ i}^S > 1.2$). On the other hand, there are three kinds of situation in which undesirable negative decoupling arises: strong negative decoupling, which corresponds to the situation in which the negative social impact grows in average terms along the period while final demand falls ($\varepsilon_{period\ i}^S < 0$); weak negative decoupling, which implies that both indicators exhibit a negative average growth rate along the period but final demand's decline is more intense ($0 < \varepsilon_{period\ i}^S < 0.8$); and expansive negative decoupling, in which both indicator grow in average terms along the period but the negative social impact does it more than proportionally ($\varepsilon_{period\ i}^S > 1.2$).

Criteria		
DECOUPLING	Strong	$\varepsilon_{period\ i}^S < 0$ $\overline{GR}_{period\ i}^S < 0$; $\overline{GR}_{period\ i}^{DF} > 0$
	Weak	$0 < \varepsilon_{period\ i}^S < 0.8$ $\overline{GR}_{period\ i}^S > 0$; $\overline{GR}_{period\ i}^{DF} > 0$
	Recessive	$\varepsilon_{period\ i}^S > 1.2$ $\overline{GR}_{period\ i}^S < 0$; $\overline{GR}_{period\ i}^{DF} < 0$
NEGATIVE DECOUPLING	Strong	$\varepsilon_{period\ i}^S < 0$ $\overline{GR}_{period\ i}^S > 0$; $\overline{GR}_{period\ i}^{DF} < 0$
	Weak	$0 < \varepsilon_{period\ i}^S < 0.8$ $\overline{GR}_{period\ i}^S < 0$; $\overline{GR}_{period\ i}^{DF} < 0$
	Expansive	$\varepsilon_{period\ i}^S > 1.2$ $\overline{GR}_{period\ i}^S > 0$; $\overline{GR}_{period\ i}^{DF} > 0$

Table 1. Decoupling classification according to social elasticity.

Source. Own elaboration based on (Vehmas et al., 2003) and (Tapio, 2005).

The Data sources



The multi-regional database from which the MRIO model relies on is the World Input–Output Database (WIOD) in its 2016 release (Timmer, Dietzenbacher, Los, Stehrer, & de Vries, 2015; Timmer, Los, Stehrer, & de Vries, 2016). This source provides an annual series of multi-regional input-output tables from 2000 until 2014 built with data from diverse regions’ national accounts and international trade statistics. In our model, we work with 44 regions and 14 sectors derived from the ISIC-Rev. 3 classification. Regions and sectors are detailed in the supplementary information section.

The data from this database has been complemented with a set of sown-compiled social indicators. One of the main goals of this analysis is to provide information about forced labour and occupational fatal and non-fatal injuries, which are some of the most hidden phenomenon concerning worldwide labour markets. After searching for reliable databases related which could provide some information about this issue, it was assumed that there is a huge absence of data about these facts, especially in the case of forced labour. The quantification of modern slavery is one of the current challenges of international labour statistics, some strokes have been traced by the International Labour Organization and other official Organisms (EUROSTAT, 2015; ILO, 2001, 2005, 2012; USBILA, 2016), Human Rights Associations (Fletcher, Bales, & Stover, 2005; Walk Free Foundation, 2014, 2015), and Academic Research (Datta & Bales, 2013; Hernandez & Rudolph, 2015; Lerche, 2007). However, problems arise when it is realized that these previous official reports don’t provide complete data –not only at a sectoral level, even at a regional level- since many countries feature a very high opacity and refuse to provide sensitive information to International Organisms. These countries are mainly emerging countries, which are precisely the areas into the spotlight when social sustainability is being analysed, so the usefulness of this reports is slowed down. Additionally, the information provided in all these documents has not been compiled in order to configure a complete dataset.

In consequence, the main contribution of this paper is the generation of a database about indecent labour –not only modern slavery, but also occupational injuries and fatalities- which gathers data with a regional and sectoral disaggregation suitable for the calculus of footprints in a MRIO model, following the path settled by Gómez-Paredes et

al. (2015) and A. Alsamawi et al. (2017). The process of creating the database implied joining and homogenizing all the information available and estimating the required values to achieve the level of detail required by an MRIO model. The process and the criteria followed along the generation of the database are summarized in Figure 1.

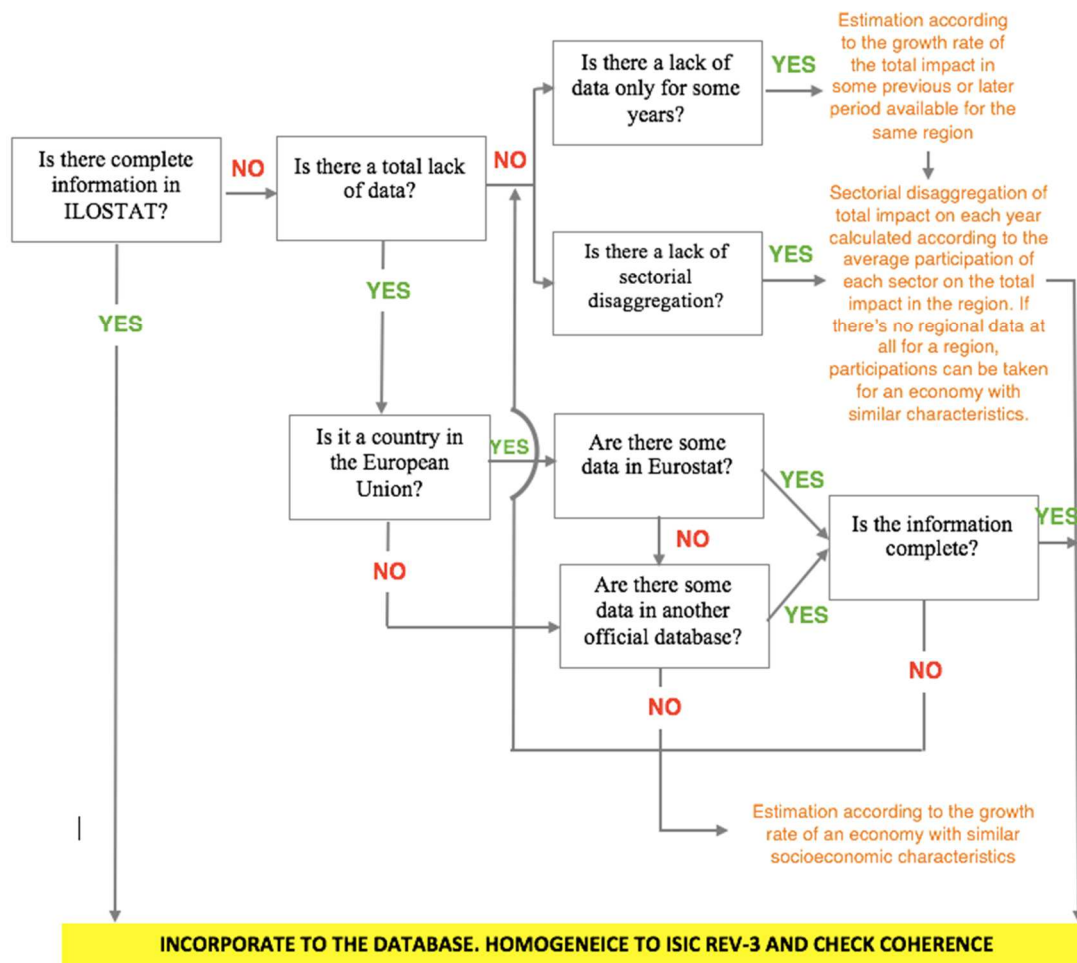


Figure 1. Process diagram for the generation of the database.

Source: Own elaboration

3. Results

European Union and United States social footprints and decoupling

The initial analysis of these two developed economies relies on a graphical and intuitive representation (Figure 2) of the evolution of both the footprint of the social



indicators of interest and the final demand made by the region, which is considered as the economic driver of the social impacts as they are measured in terms of consumers' responsibility.

Starting by the European Union (EU), the left part of Figure 2 shows that final demand sets two different periods to analyse: 2000-2008, where an economic expansive path was followed by this region, and 2008-2013, where final demand declined and oscillated around similar levels than those achieved in 2016. In the expansive period, fatal injuries, non-fatal injuries and forced labour footprint grew too but at a lower rate than final demand, so we can talk about relative but not absolute decoupling in terms of the three impacts. From 2008 onwards, when final demand falls, the evolution of the social impacts was diverse: fatal injuries footprint declined faster, which would imply talking about recessive decoupling in terms of (Vehmas et al., 2003) classification. Non-fatal injuries footprint seems to decline, but it is unclear if we can talk about decoupling or not as this fall in the footprint could be caused just by the recessive shock and not by an improvement in labour conditions in the regions supplying Europe. Forced labour footprint seems to remain stable in this last period, which suggests negative decoupling. Negative decoupling could be caused by a rise in the imports from developing regions that are less concerned about labour rights, motivated by a race-to-the-bottom fostered by price competition in a convulse period (Ali Alsamawi et al., 2014).

Looking at the right part of Figure 2, final demand in the United States (USA) suffered an eventual decline in 2008-2009, but after that, it started again its growth path. Fatal injuries footprint didn't show any decoupling until 2005, the year in which this magnitude started an intense fall while final demand was still growing. Therefore, absolute decoupling could be claimed to be happening in this variable. On the other hand, non-fatal injuries footprint and forced labour footprints exhibit an unsteady and soft decline along the whole period 2000-2013, which could be a sign of relative decoupling.

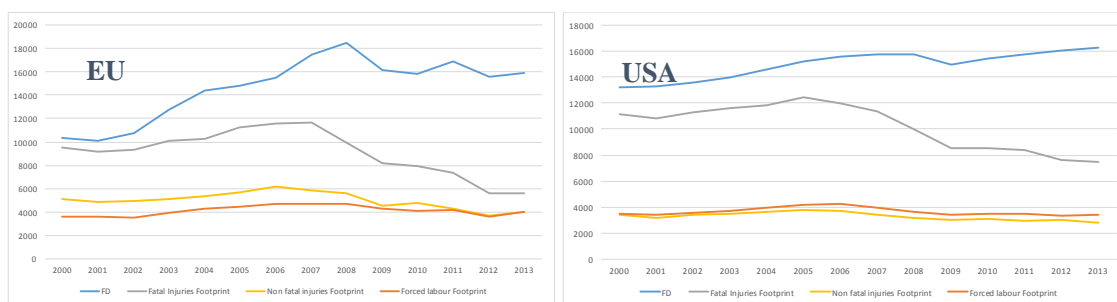


Figure 2. Fatal injuries, non-fatal injuries and forced labour footprints and final demand. EU and USA. Evolution 2000-2013
Source: Own elaboration

Looking at the sources of the social impact footprints will provide a deeper understanding of what's behind these paths. Figure 3 shows the contribution of each region of origin to each footprint –relativized according to final demand to obtain a comparable measure of decoupling- along the period considered. For the three impacts considered, the whole footprint and its domestic part, both in EU and USA, has been reduced along time, in a more intense way in the case of fatal injuries and more diffidently in the case of forced labour. The high participation of Eastern Europe in the EU's domestic part of the three footprints –especially in the forced labour case- constitutes a notorious detail.

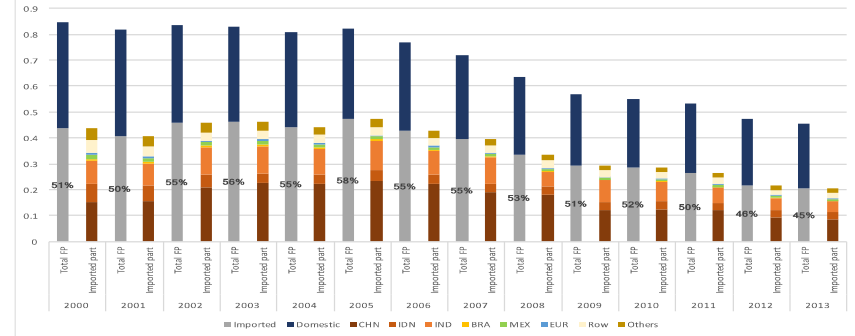
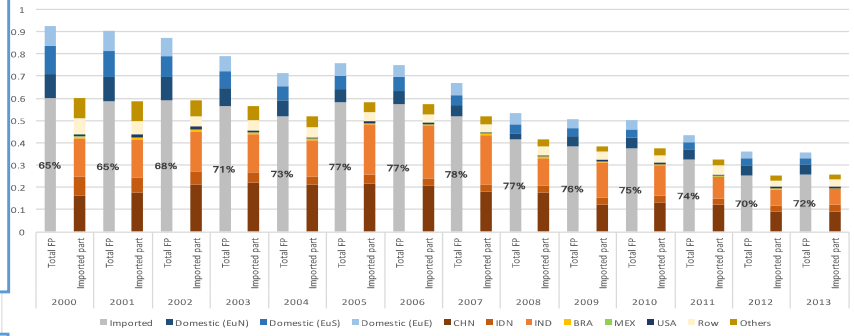
EU

USA

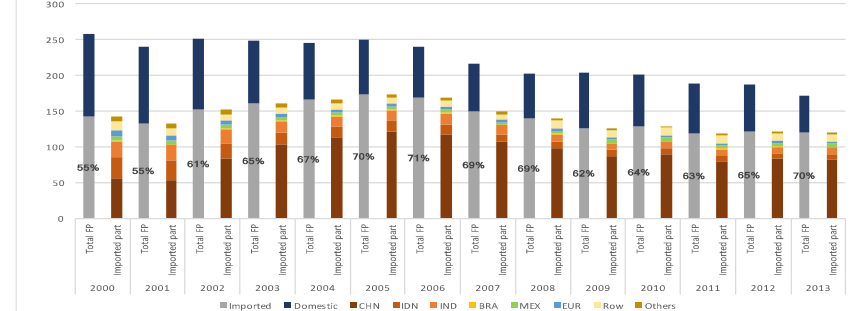
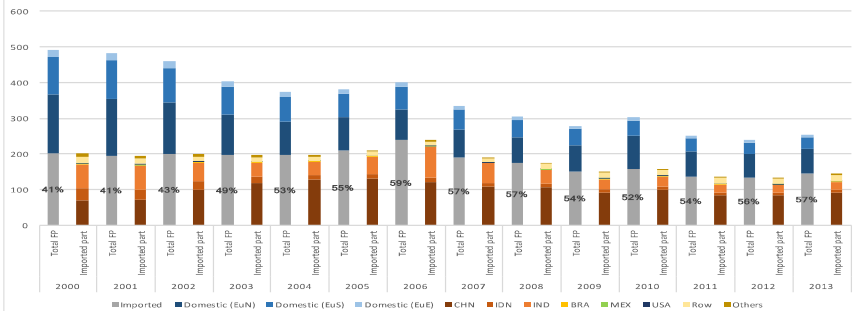
Cap a un model econòmic més social i sostenible



FATAL INJURIES



NON-FATAL INJURIES



FORCED LABOUR

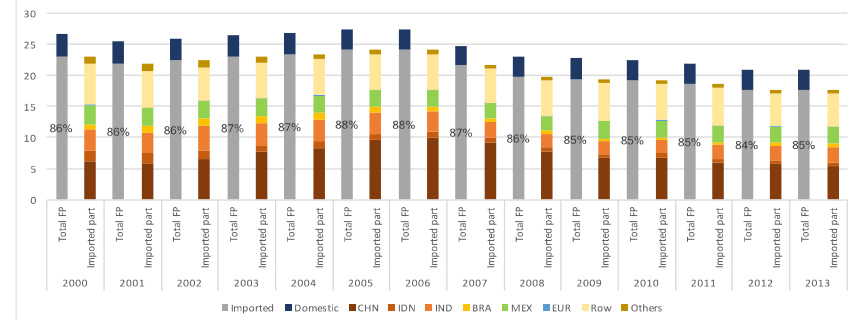
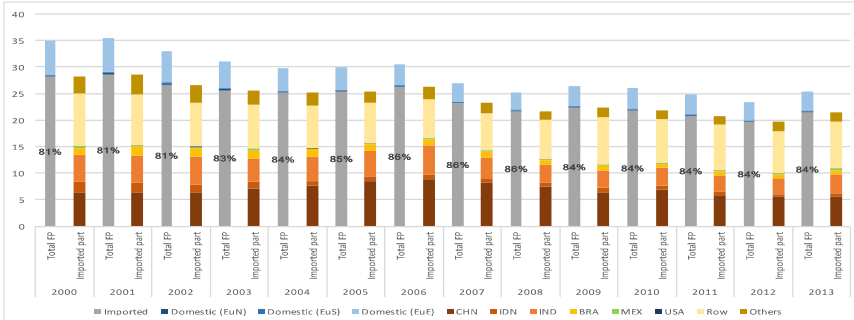


Figure 3. Fatal injuries, non-fatal injuries and forced labour footprints for EU and USA. Relativized using final demand. 2000-2013



Source: Own elaboration



The intensity of the footprint in relation to the final demand is similar for USA and EU except in the case of non-fatal injuries, in which this intensity is greater for EU in the first years of the time series, especially due to the high domestic values. Injuries at work constitute a special case in which, for both EU and USA in the case of non-fatal cases and for the USA in the case of fatalities, the participation of the domestic part is as high or even more than the participation of the imported part in the whole footprint. This phenomenon can be due to three facts: first, both areas are the most developed ones in social and labour terms, so the majority of workers are accounted for in the social security system and they are enabled to report their accidents and lesions at work. Second, these regions consider a wide spectrum of cases as an occupational accident that can lead to a time off work, including those related to psychological risks. According to an EU OSHA report (Milczarek, Schneider, & Rial González, 2009), a 20% of the workers in UE-15 and a 30% of workers in EU-10 claimed in 2009 to suffer some health problem related to stress. The (Matrix Insight, 2013) report under the EU 2008-2013 Health program states that mental illness represents a significant percentage of the overall health conditions affecting European workers. In contrast to areas as India, China or Indonesia, developing regions have a wide consciousness about these kind of conditions as disabling elements at work and report them in their statistics Third, WIOD data confirms that the expenditure of industrial sectors in the private sanitary sector per worker is much higher in developing economies like the USA or EU. Assuming that a vast part of this expenditure is due to provide medical attention to workers, the diagnosis of lesions and illnesses is more effective in those countries in which the mentioned ratio is greater.

Continuing the analysis of the imported part, China, India and Indonesia are the predominant suppliers of the fatal and non-fatal injuries footprint for both EU and USA as regions of destiny. Emerging countries from Africa, Latin-America and Asia included in RoW and other -countries (mainly Russia, Turkey and Taiwan) are also relevant when talking about fatal injuries footprint. For the USA, additional actors appear as relevant in comparison with EU: Mexico in the case of both kinds of injuries and EU in the first years of the series for non-fatal injuries. Concerning forced labour, RoW arises as one the most influential suppliers for the EU since most of this kind of work worldwide proceeds from the primary sector in Africa and Latin-America (ILO, 2001; USBILA, 2016).

Worldwide decoupling

The section is under evaluation. Forthcoming results commentaries.

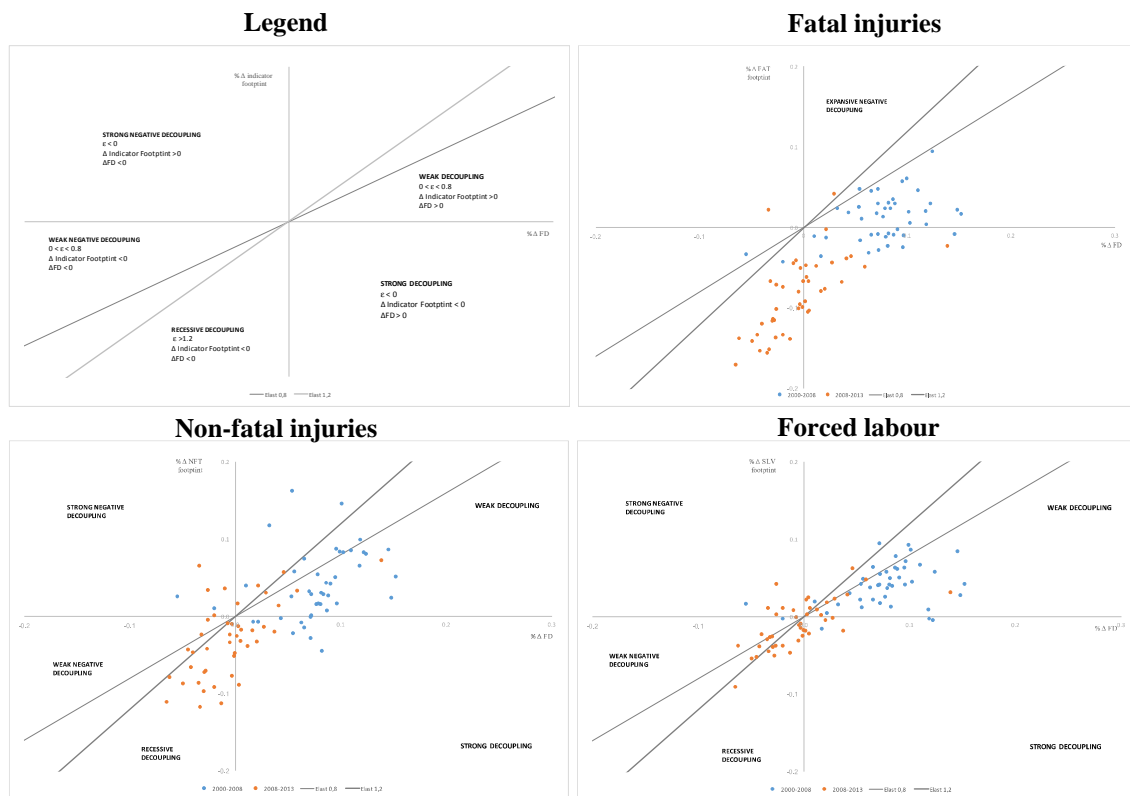


Figure 4. Fatal injuries, non-fatal injuries and forced labour footprints. Worldwide data (44 regions). 2000-2008 and 2008-2013.

Source: Own elaboration

4. Preliminary conclusions

In a globalized world, the path to sustainable development requires efforts that take into account not only developing conditions at home but also abroad. We assess in this paper how the global production chains and the consumption patterns affects the social impact decoupling in two rich regions as EU and USA. To accomplish this assessment we build a database on forced labour and occupational fatal and non-fatal injuries, which are some of the most hidden phenomenon concerning worldwide labour markets in order to calculate the corresponding labour footprints. In addition, we develop



the concept of social elasticity to determine which kind of decoupling in terms of footprint predominates in periods 2000-2008 and 2008-2013.

For EU we find relative but not absolute decoupling in terms of the three impacts analysed in the first period of economic growth. From 2008 onwards, the evolution of the social impacts was diverse, showing forced labour a negative decoupling, possibly caused by a rise in the imports from developing regions that are less concerned about labour rights. The USA shows absolute decoupling in fatal injuries, while non-fatal injuries footprint and forced labour footprints exhibit signs of relative decoupling, instead.

Splitting up the footprints according to the origin of the consumed products indicates how the domestic part, both in EU and USA, has been reduced along time, in a more intense way in the case of fatal injuries and more diffidently in the case of forced labour. Regarding the imported part, China, India and Indonesia are the predominant suppliers of the fatal and non-fatal injuries footprint for both EU and USA as regions of destiny. For the USA, additional actors appear as Mexico in the case of both kind of injuries and EU in the first years of the series for non-fatal injuries. Concerning forced labour, RoW arises as important. The analysis accomplished indicates that in domestic terms, considering only labour conditions at home, decoupling is closer regarding fatal and non-fatal injuries, mainly. But the limiting the analysis to the country borders hide the fact that the population at home is consuming products that treat workers very differently. The poor work conditions footprint of the affluent regions of UE and the USA not only expands beyond its borders but is higher abroad than at home. In addition, in some cases, this footprint is decreasing but the “imported part” share is not. This would indicate that affluent regions are blind to distant damage and consumers, producers, investors and policymakers need to be aware of these effects in order to be effective in the achievement of a sustainable world.

References

Alsamawi, A., McBain, D., Murray, J., Lenzen, M., & Wiebe, K. S. (2017). A Social Footprint of Nations: A Comparative Study of the Social Impact of Work *The*

- Social Footprints of Global Trade. Environmental Footprints and Eco-design of Products and Processes*. Singapore: Springer.
- Alsamawi, A., Murray, J., & Lenzen, M. (2014). The Employment Footprints of Nations. *Journal of Industrial Ecology*, 18(1), 59-70. doi:10.1111/jiec.12104
- Brundtland, G. H., & Khalid, M. (1987). *Our common future*. Retrieved from New York:
- Cadarso, M.-Á., López, L.-A., Gómez, N., & Tobarra, M.-Á. (2012). International trade and shared environmental responsibility by sector. An application to the Spanish economy. *Ecological Economics*, 83, 221-235. doi:10.1016/j.ecolecon.2012.05.009
- Copeland, B. R., & Taylor, M. S. (2004). Trade, Growth and the Environment. *Journal of Economic Literature*, 42(1), 7 - 71.
- Datta, M. N., & Bales, K. (2013). Slavery in Europe: part 1, estimating the dark figure. *Human Rights Quarterly*, 35(4), 817-829.
- Davis, S. J., & Caldeira, K. (2010). Consumption-based accounting of CO2 emissions. *Proceedings of the National Academy of Sciences*, 107(12), 5687-5692. doi:10.1073/pnas.0906974107
- European Commission. (2003). *Towards a Thematic Strategy on the Sustainable Use of Natural Resources*. Retrieved from <http://ec.europa.eu/environment/archives/natres/index.htm>
- EUROSTAT. (2015). *Trafficking in human beings*. Retrieved from Luxemburgo:
- Fischer-Kowalski, M., Swilling, M., Von Weizsacker, E. U., Ren, Y., Moriguchi, Y., Crane, W., . . . Hennicke, P. (2011). *Decoupling: natural resource use and environmental impacts from economic growth*: United Nations Environment Programme.
- Fletcher, L. E., Bales, K., & Stover, E. (2005). Hidden slaves: Forced labor in the United States.
- Gómez-Paredes, J., Yamasue, E., Okumura, H., & Ishihara, K. N. (2015). The labour footprint: A framework to assess labour in a complex economy. *Economic Systems Research*, 27(4), 415-439. doi:10.1080/09535314.2014.998173
- Hardadi, G., & Pizzol, M. (2017). Extending the Multiregional Input-Output Framework to Labor-Related Impacts: A Proof of Concept. *Journal of Industrial Ecology*, 21(6), 1536-1546. doi:10.1111/jiec.12588
- Hernandez, D., & Rudolph, A. (2015). Modern day slavery: What drives human trafficking in Europe? *European Journal of Political Economy*, 38, 118-139. doi:<http://dx.doi.org/10.1016/j.ejpoleco.2015.02.002>
- Hummels, D., Munch, N. J., & Xiang, I. C. (2015). *No Pain, No Gain: The Effects of Exports on Job Injury and Sickness*. Retrieved from
- ILO. (2001). *Stopping forced labour : global report under the follow-up to the ILO Declaration on fundamental principles and rights at work*. Retrieved from Geneva, Switzerland:
- ILO. (2005). *A global alliance against forced labour : global report under the follow-up to the ILO Declaration on Fundamental Principles and Rights at Work 2005 / International Labour Conference, 93rd session 2005*. Geneva: International Labour Organization.

- ILO. (2012). *Global Estimate of Forced Labour*. Ginebra: International Labour Organization.
- Lerche, J. (2007). A Global Alliance against Forced Labour? Unfree Labour, Neo-Liberal Globalization and the International Labour Organization. *Journal of Agrarian Change*, 7(4), 425-452. doi:10.1111/j.1471-0366.2007.00152.x
- Matrix Insight. (2013). *Economic analysis of workplace mental health promotion and mental disorder prevention programmes and of their potential contribution to EU health, social and economic policy objectives*. Retrieved from https://ec.europa.eu/health/sites/health/files/mental_health/docs/matrix_economic_analysis_mh_promotion_en.pdf
- Meng, B., Peters, G. P., & Wang, Z. (2014). Tracing CO2 Emissions in Global Value Chains. *OFFICE OF ECONOMICS WORKING PAPER. U.S. INTERNATIONAL TRADE COMMISSION*(2014-12A), 77.
- Milczarek, M., Schneider, E., & Rial González, E. (2009). *OSH in figures: Stress at work – facts and figures*. Retrieved from Luxembourg:
- Miller, R. E., & Blair, P. D. (2009). *Input-output analysis : foundations and extensions* (2nd ed.). Cambridge: Cambridge University Press.
- Monsalve, F., Zafrilla, J. E., & Cadarso, M.-Á. (2016). Where have all the funds gone? Multiregional input-output analysis of the European Agricultural Fund for Rural Development. *Ecological Economics*, 129, 62-71. doi:10.1016/j.ecolecon.2016.06.006
- Mosley, L., & Uno, S. (2007). Racing to the Bottom or Climbing to the Top? Economic Globalization and Collective Labor Rights. *Comparative Political Studies*, 40(8), 923-948. doi:10.1177/0010414006293442
- Mudgal, S., Fischer-Kowalski, M., Krausmann, F., Chenot, B., Lockwood, S., Mitsios, A., . . . Steinberger, J. (2010). Preparatory study for the review of the thematic strategy on the sustainable use of natural resources. *Contract*, 7(2009), 545482.
- OECD. (2002). *Indicators to measure decoupling of environmental pressure from economic growth*. Retrieved from Paris, France: <http://www.oecd.org/environment/indicators-modelling-outlooks/1933638.pdf>
- Simas, M., Golsteijn, L., Huijbregts, M., Wood, R., & Hertwich, E. (2014). The “Bad Labor” Footprint: Quantifying the Social Impacts of Globalization. *Sustainability*, 6(11), 7514-7540.
- Skelton, A., Guan, D., Peters, G. P., & Crawford-Brown, D. (2011). Mapping Flows of Embodied Emissions in the Global Production System. *Environmental Science & Technology*, 45(24), 10516-10523. doi:10.1021/es202313e
- Srivastava, R. S. (2005). Bonded Labor in India: Its Incidence and Pattern. *InFocus Programme on Promoting the Declaration on Fundamental Principles and Rights at Work, and International Labour Office*.
- Steen-Olsen, K., Weinzettel, J., Cranston, G., Ercin, A. E., & Hertwich, E. G. (2012). Carbon, Land, and Water Footprint Accounts for the European Union: Consumption, Production, and Displacements through International Trade. *Environmental Science & Technology*, 46(20), 10883-10891. doi:10.1021/es301949t



- Stiglitz, J. E., Sen, A., & Fitoussi, J.-P. (2010). Report by the commission on the measurement of economic performance and social progress. *Paris: Commission on the Measurement of Economic Performance and Social Progress*.
- Tapio, P. (2005). Towards a theory of decoupling: degrees of decoupling in the EU and the case of road traffic in Finland between 1970 and 2001. *Transport Policy*, 12(2), 137-151. doi:<http://dx.doi.org/10.1016/j.tranpol.2005.01.001>
- Timmer, M. P., Dietzenbacher, E., Los, B., Stehrer, R., & de Vries, G. J. (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. doi:10.1111/roie.12178
- Timmer, M. P., Los, B., Stehrer, R., & de Vries, G. J. (2016). An anatomy of the global trade slowdown based on the WIOD 2016 release. *Groningen Growth and Development Centre (GGDC) Research Memorandum*(162).
- USBILA. (2016). *List of Goods Produced by Child Labor or Forced Labor*. Retrieved from Washington, D.C.:
- Vargas, R., & Dietzenbacher, E. (2015). *Economies to die for: Impacts on human health embodied in production and trade*. University of Groningen. The Netherlands.
- Vehmas, J., Malaska, P., Luukkanen, J., Kaivo-oja, J., Hietanen, O., Vinnari, M., & Ilvonen, J. (2003). Europe in the global battle of sustainability: Rebound strikes back?—Advanced Sustainability Analysis. *Publications of the Turku School of Economics and Business Administration, Series Discussion and Working Papers*, 7, 2003.
- Walk Free Foundation. (2014). *Global Slavery Index*. Retrieved from Broadway Nedlands, Australia:
- Walk Free Foundation. (2015). *Tackling Modern Slavery in Supply Chains: A Guide 1.0*. Retrieved from Broadway Nedlands, Australia: <http://business.walkfreefoundation.org/>
- Wang, F., Yin, H., & Li, S. (2010). China's renewable energy policy: commitments and challenges. *Energy Policy*, 38(4), 1872-1878.
- Wiedmann, T. O., Schandl, H., Lenzen, M., Moran, D., Suh, S., West, J., & Kanemoto, K. (2013). The material footprint of nations. *Proceedings of the National Academy of Sciences*. doi:10.1073/pnas.1220362110
- York, R., Rosa, E. A., & Dietz, T. (2003). STIRPAT, IPAT and ImPACT: analytic tools for unpacking the driving forces of environmental impacts. *Ecological Economics*, 46(3), 351-365. doi:[https://doi.org/10.1016/S0921-8009\(03\)00188-5](https://doi.org/10.1016/S0921-8009(03)00188-5)