

PRODUCTION STRUCTURE AND CO₂ EMISSIONS IN SPAIN: AN INPUT-OUTPUT ANALYSIS

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The EU agreements as regards the Kyoto Protocol involved a limit for Spain of 15% increase in greenhouse gases emission for the period 2008–2012 with respect to the reference year 1990. However, these emissions increased by 52.9% between 1990 and 2007. If we consider only CO₂ emissions the increase is even greater, a 61.2%.

There has been a relatively important cut back in emissions in 2008 and 2009, but emission is still far from the target for Spain. The increase in GHG emissions between 1990 and 2008 was 42.3% and 47.9% for the case of CO₂. A 10% reduction in one year (with respect to the base year emission). However, even considering the change in the energy mix due to the important increase of renewable energies, this reduction is mainly due to the reduction in economic activity that the country is experiencing, being 2007 the last data pre-crisis.

Policy measures of last years have not been effective to limit emission growth. Among these measures the National Plan of Emissions Allocation might be highlighted. This plan derives from the directive on emission allowances market, which, from the 1st of January of 2005, compels some sectors to control their CO₂ emissions. However, two of the sectors with most responsibility in the increase in emissions, the service sector and households, are diffuse sectors which are not regulated by any normative or measure limiting their use of energy or their emissions.

Therefore, it is quite relevant to analyze the relationship between these emissions and the Spanish economic structure. The design of policies oriented to reducing emissions might take into account the situation pre-crisis. In this sense, the identification of the productive branches more important as regards their CO₂ emissions, and their relationship with the rest of the productive system should inform energy and emission mitigation policies.

The input-output analysis seems the appropriate analytical tool to establish these relationships and to determine the particular responsibility of the different economic agents. Our paper will analyze CO₂ emissions. We use data provided by the National Institute for Statistics (Instituto Nacional de Estadística, INE) in the environmental accounts, elaborated following the NAMEA (National Accounting Matrix including Environmental Accounts) of CO₂ emissions for year 2005. We also use the symmetrical input-output table of Spain provided by INE for the year 2005. We choose the data for 2005 due to the availability of the symmetrical table, but both emission data and productive structure is similar to the last pre-crisis year (the increase in CO₂ emission in 2005, 60.7%, was similar to the one of 2007.)

We focus on the determination of key sectors in CO₂ emission. The technique for establishing the key sectors allows a first approximation to analyze the role played by the different productive sectors of the economy. Rasmussen's indicators technique is perhaps the most widely used and in some sense it permits the establishment of "key industries". This approach has been subjected to criticism and Rasmussen (1956: 132-144) himself pointed out some of them. Skolka (1986) is perhaps one of the main detractors of this technique. Such critics are made extensive in Chenery and Wanatabe

(1958) and Hirschman (1958). In any case, we believe that the complaints about this technique are well-grounded only with respect to the indicators used to measure the backward and forward linkages but not those that are essential to the entire input–output analysis, particularly when studying the vertically integrated effects.

In this paper we develop the analysis of the key sectors in CO₂ emission in Spain. The methodology proposed in our paper is based on the critic of Jones (1976), which we extend to environmental impacts. However, in our analytical development, we use an alternative approach of the determination of key sectors in emission, based on a perspective output to output.

We arrive at some important results. First, it becomes clear that among the 29 production branches analyzed only a reduced number are determinant in the emissions of CO₂, both from the standpoint of their final demand and their supply. The design of policies to control the emissions on these branches of production could help to reduce a substantial part of emissions in Spain. Of course, we must stress that the operation of many industries depends on these activities. Therefore the demand analysis and its pull effects have to be developed. The question to be asked is which demands are indispensable to cover certain needs and to what extent certain other could be substituted.