The primary purpose of this research task includes the construction of an Input-Output bi-regional model for the Portuguese Centro region, using 2010 data and taking into account the interactions between the Centro region and the rest of Portugal, hereinafter designated as the “Rest of the Country”.

The Input-Output model implemented is an application of the MULTI2C (Multi-Regional Multi-sectoral Coimbra model). This approach has been developed by a group of researchers of the EMSURE team (though the beginning of this methodology precedes EMSURE project), aiming at the construction of input-output tables with different geographical settings and for various methodological purposes. Although several studies stemming from the MULTI2C framework have been applied to other Portuguese regions, the EMSURE version focuses primarily on the NUT II Centro region. This region corresponds to 31% (28 405 km$^2$) of the total area of the country and has 2.3 million of inhabitants (22% of the national total). Furthermore, this region’s GDP is only about 18.5% of the national total. The proposed Input-Output model will allow for the estimations, by activity sectors, of the impacts on production, in both regions (Centro and the Rest of the Country), resulting from multiple methodological scenarios and exogenous shocks. Thus, in addition to the typical cross-sector interdependencies within each region, this bi-regional type model also focuses on the inter-regional inter-relations, i.e., on how the shocks, either positive or negative, occurring in each region, leak to the other region, and return to the initial one (feedback effects).

Typically, the goal of input-output is to model the economic interdependencies that are common of both national and regional economies, implying that when the economy of a region is hit by a positive or negative shock the entire economy is touched. In the regional case these impacts are shared by different regions, such that the region where the shock occurs is only able to seize part of the benefit, or carries only part of the burden. Assuming a positive shock, e.g., a new investment project that involves an
increase in "Construction" during a certain period in the Centro region, not only builders operating in the region arise as beneficiaries. These are beneficiaries on a first-wave analysis but, after the initial increase, the construction activity requires an increase in production of various materials such as cement, metal products, bricks, ceramics and services (engineering, architecture, etc.). This second wave of production activities can occur in the Centro region, or be satisfied by supply from other economic spaces, i.e., other regions or countries. A third and fourth wave, and so forth, follows this second wave as those materials and services consumed by the construction will have to be produced, in turn, with other products. These successive waves can also be met by regional production, or imported from other regions or countries. Finally, the stimulus in the local economy resulting from these successive additions of demand effects is usually known as backward linkages.

In addition to the inter-industrial relations described above, a positive shock in a region, such as the one we are suggesting, also generates more revenue distributed to the regions’ resident households. This higher income allows greater consumption, which must be satisfied by the supply of more goods and services, which however will be only partially produced within the region. A share of these consumer goods is imported, and these imports may be inter-regional or international.

In the jargon of input-output models, the first type of interdependence, which has to do with the increased demand for raw materials and services as intermediate consumption, corresponds to the indirect effect of the shock to the economy of the region where, in this example, the initial impulse took place. The second type of effects, which involves the growth of households’ income, is termed induced effect. The point, however, is that both the indirect and the induced effects from a shock hitting a specific region can be felt within the region itself, or overflow the regional borders rippling to other regions or countries.

This research task follows Sargento, Ramos and Hewings (2011) and adopts a rectangular model approach\(^1\) combining background information collected primarily from Supply and Use tables for 2010 by the Portuguese National Accounts (2006 base). Thus, this model considers 431 products, which are produced by 125 sectors in two

\(^1\) The Input-Output model major reference is Miller and Blair (2009). In this book the rectangular type models are discussed in Chapter 5.
different regions (or are imported internationally). In general, this model also admits that a sector can produce more than one product (either primary products, if they are products traditionally produced in that sector itself, or secondary ones, if they are the main product of other industries). Furthermore the model considers, both for the Centro region and for the Rest of the Country, different types of households, according to their main source of income, namely: labor (employees or self-employed work), capital, real estate rents, pensions and other social transfers. Finally, it should be noted that the model is closed with respect to the household’s consumption of those who live predominantly from labor income (being self-employed or others), thus implying that labor income determines their consumption (and is influenced by), according to an endogenous process.

In addition to the use of official data from the Portuguese National Accounts, this research task required a set of additional procedures, whose technical details are described throughout the Annex to this Report (only available under request and only in Portuguese). Specifically an initial step, presented briefly in the Annex’s Section 1, involves the conversion of a national table at purchaser prices and total flows into a national table at basic prices and domestic flows. This step is essential to allow the team to proceed with the derivation of the regional tables. The reason is that only domestic flows, e. g. driven to the Portuguese economy, may be split by the regions. On the other hand, the taxes and other flows included in the purchasers’ prices are national by its very nature and so no regionalizable.

The Section 2 of the Annex describes the process of tables’ regionalization and the hypotheses on inter-regional trade adopted to accomplish this procedure. In fact, the regionalization of matrices according to the MULTI2C approach is made, with very few exceptions, assuming the “equal technology hypothesis”, for all activity sectors and regions. In the EMSURE case it is planned (but still not accomplished) to consider different technologies to the Electricity Production and Distribution sector, because the weights of renewable sources, cogeneration and conventional thermal production are not the same in the Centro region and in the Rest of the Country (the same discrepancy is also relevant concerning the weight of the transmission, distribution and trade of electricity, and for the weight of ancillary activities as the management of the whole system and of the main corporations). The standard assumption of equal technology is often used in the literature when considering a “non-survey” method of regionalization
(Lahr, 1993; Hulu and Hewings, 1993; Eding et al, 1997; Schwarm et al, 2006). Indeed, as the official statistical regional data is scarce, and taking into account that generating own information can be unaffordable (for example launching business surveys have a cost, and involve a logistics, that is far beyond the EMSURE budget allocated to this task) the “equal technology hypothesis” is realistic, since it is applied at a considerable level of sectoral disaggregation (Ramos and Sargento, 2011). In the case of MULTI2C, the standard assumption of equal technology refers only to the equal weight of each input (raw material consumed or service), not in the total output (production), but in the total intermediate consumption, national and imported, at purchasers prices, since we had the direct information on GVA by activity sector, from Portuguese Regional Accounts\(^2\).

Beyond the Electricity sector case, the hypothesis of equal technology met a few other exceptions (already incorporated in the model) that are noted in the Annex to the report. On the other hand, this hypothesis exclusively concerns to the demand for products, particularly for intermediate consumption structure. Indeed, in case of supply, it was possible to gather the adequate statistical information to determine the location of production, at least with regard to the various primary commodities of different sectors (the traditional proper products of the sectors). Concerning the secondary products, which account with a negligible amount of production in the majority of the sectors, we resorted to proportional assumptions. In turn, the solution proposed to estimate inter-regional trade (by product) consisted in a first step of a judicious classification, product by product, according to a threefold typology: (i) non-tradable goods consumed locally, (ii) fully tradable goods and (iii) regionally tradable goods between certain regions for known reasons. Therefore, different kinds of assumptions were made according with such a classification. The construction of these multi-regional models, and the hypotheses followed as for the interregional trade, are also presented in Barata et al. (2011).

The methodology implemented, described in the technical Annex, is suitable for the treatment of Portuguese NUTS III regions, and has been applied to each of these spaces, which were then grouped into two major regions that comprise the model: Centro

\(^2\) In 2010, these data were provided with a breakdown of 38 sectors only, having been extended to the 125 sectors included in the model taking into account 2007 data.
Region and rest of the country. However, the full application of the MULTI2C approach, concerning the estimation of interregional trade, is only implemented to the two merged regions.

Once the procedures involving the completion of this bi-regional model Centro vs. Rest of the Country are completed, the model can be used in the analysis of various impacts from exogenous disturbances (“shocks”) occurring in one or all the regions. Indeed, according to this task research objectives, upon request, the research team involved in building this model meets the necessary conditions to analyze the impact on several economic variables, including the GVA / GDP, output, employment (in “full time equivalent”), and labor income (wages / mixed income earned by the self-employed) from various events or what if scenarios. This analysis has the potential to be extended to other variables, namely non-economic ones, e.g., environmental impacts and physical energy consumptions. To sum up, it is important point out that, considering a shock occurred in the Centro region, this analysis is able to isolate the effects retained in the region itself, and those who escape to the Rest of the Country. Likewise, the model allows us to analyze the impact on the Centro region from shocks in the Rest of the Country. Where relevant, the impacts can be disaggregated for each of the 431 products or the 125 activity sector contemplated in the model.

References


