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# Dual-use products export multipliers with the indirect effects

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ABSTRACT

The micro–macro link is provided for the impact of the dual-use defence-civilian exports of products and services on the Slovenian economy. The unique firm-level data on the dual-use export is integrated in the symmetric 60 groups of activities input–output tables. The classification of the economic activities is used to integrate data on the firm-to-firm dual-use export transactions in the symmetric input–output coding system to avoid the double counting. The input–output modelling approach is used for the measuring of the direct input–output flows and the dual-use products export multipliers with the indirect effects. The direct and indirect effects are analysed by the economic activities, technological intensity of the products and services, and statistical regions in Slovenia. Comparisons with alternative non dual-use high tech are analysed by economic activities in terms of value-added and labour productivity. The dual-use export is associated with high technologically intensive suppliers and sub-suppliers of defence-civilian goods and services. The empirical estimations can serve as a guide in questions of comparing with alternative in economic policy design when investigating trade-offs between allocation of expenditures for defence equipment and their opportunity costs for non dual-use of high tech products and services.



## 1. Introduction

The dual-use products and services drag attentions from both, defence and civilian sides in terms of technology development, defence industrial and socio-economic policies. Defence and civilian industrial bases are strongly related to each other. It is important to develop quantitative methodological approach to investigate the defence-civilian industry structures and monitor directions of their changes and causalities in the economy.

This paper focuses on the unique enterprise-level data on foreign orders of the defence-civilian goods and services in compensation for buying of foreign military equipment, which is called dual-use export supply-in-return or offsets. The defence sector has a special form of barter trade supply-in-return chain organization, where defence imports can be covered by supply-in-return or offsets export chain activities of defence and civilian products. The term supply-in-return or offset means every export of goods and services of a national origin, which is in return for purchased goods, technology and services of foreign origin from the public procurement of confidential nature and is conducted by state institutions. As the subject of the dual-use export supply-in-return, in addition to the classical export of goods and services, can be also foreign direct capital investments, transfer of technology and technical knowledge to organizations, education abroad and scholarships, donations and tourist programmes, promotion of exporters on foreign markets, financial grants and other services abroad.

The present paper deals with the dual-use export supply-in-return effects in an input–output model with cross-sector relationships and measuring their direct and indirect cross-sector chain effects for the Slovenian economy. The main thesis is set that, within the existing EU policies and business practices in global economies, the dual-use export supply-in-return flows can have positive economic, technological and regional development effects (EDA, 2008), but with considering alternative opportunity costs from non dual-use high tech. This thesis is investigated for the dual-use export supply-in-return flows on the Slovenian economy. The developed dual-use technological and industrial base activities, which include both defence and civilian goods and services, can provide competitive market opportunities for medium–high and high-technological intensive industries.

Limited research is in literature on the role and importance of the dual-use technological and industrial base activities in the economies, particularly in dual-use export supply-in-return activities by using the input–output methodological approach. The study adds the analyses on the direct and indirect dual-use export supply-in-return cross-

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sector chain effects as a data tool for more effective dual-use export supply chain management and development of cross-sector networks as leverage for development of export capacity.

The rest of the paper is organized as follows. In the next section the starting point is the overview of related research and hypotheses development on cross-sector networks as leverage for development of export capacity, technological and regional development. After this, the methodology on application of the input–output data modelling is explained focusing on the dual-use export supply-in-return chain effects. The focus is on the dual-use export supply-in-return enterprise level data and its integration in the national accounts input–output tables in order to provide a data tool with policy implications. The following section describes the empirical results on the direct, indirect and total effects of the dual-use export supply-in-return chain effects. This is followed by discussion, findings and implications for the dual-use export supply-in-return chain relationships and data monitoring systems, while the final section derives main conclusions.

## 2. Related research and hypotheses

One of the interesting and challenging technological and socio-economic issues is assessment of the dual-use defence-civilian exports in the national economy during the cuts in the defence budgets (Hoffman et al., 1996; Turner, 2004; Günlük-Şenesen, 2009). Research argues on the issue of comparing with alternative between dual-use and non dual-use high tech, economic costs and benefits of defence-civilian exports (Chalmers et al., 2002; Fuhrmann, 2008) and on trade-off between international competitiveness and national defence and security objectives (Blom et al., 2013).

Previous analyses have indicated the presence of economic relations between the defence technological and industrial base activities with the civilian sector in the rest of the economy (Bar-Zaky, 1977; Ratner and Thomas, 1990; Bojnec, 2013a). From the macro-economic and cross-industry points of view (Chenery and Srinivasan, 1989), the impacts of the dual-use export supply-in-return are through aggregate direct and indirect demand linkages for products and services of different economic activities for the dual-use export, in which defence-civilian enterprises participate as suppliers and sub-suppliers. Hartley (2006) argued on inefficiencies in *European Union* (EU) defence markets. (Fuhrmann, 2008) investigated determinants of dual-use commodity exports that can be used in weapons of mass destruction programmes or in legitimate civilian applications.

To overcome the gap in literature, this paper aims to develop an input–output modelling approach to dual-use export supply-in-return cross-sector effects. These activities are associated with the important role of research and development (R&D) intensity, technical development and absorptive capacity in high technology intensive activities (Deeds, 2001). Among the challenging issues in dual-use export supply-in-return activities is to investigate the importance of cross-sector chain effects and their spread over different groups of activities in the economy, technological intensity of the products and services, and regional development issues. In a specific case of dual-use products and services, this input–output modelling approach might provide economic policy implications in trade-offs between enhancing the transparencies in benefits of a dual-use export supply-in-return chain, and questions of comparing with alternative opportunity costs. Relatively small economies, such as the Slovenian one, through the dual-use export supply-in-return flows, can carry out objectives in the areas of technological defence-civilian industrial base and higher technological and value-added economic activities, and more balanced regional development.

Dual-use export supply-in-return activities can provide opportunities for development of export capacity, specialization and utilization of economies of scale on the domestic market and on international markets. Domestic enterprises can be present as partners in consortiums with larger foreign enterprises on global markets. Through such partnerships and cooperation opportunities can exist for technological advancements and inflows of incomes for more balanced regional economic development within the framework of the dual-use export supply-in-return business activities. To investigate the hypotheses, the direct, indirect, and total effects of the dual-use export supply-in-return flows on the Slovenian economy are estimated by statistically classified economic activities, by technological intensity of the products and services and by statistically classified regions in *Slovenia*.

We hypothesize, therefore, that:

**H1.** Dual-use export supply-in-return flows can importantly contribute to the cross-sector networks for development of export capacity of civilian and defence enterprises.

Related studies on the impacts of the defence-civilian sector on the rest of the economy show predominance of the transfer of new high-technologies over the growth of the civil sector industries (Günlük-Şenesen, 2009; Chakrabarti and Dror, 1994; Ando, 2009; Günlük-Şenesen, 2007). Dual-use export supply-in-return flows are more likely to be oriented towards medium–high and high technologically intensive products and services. They can have also relatively high indirect multiplicative effects on the medium–high and high technological base of domestic enterprises and their sub-suppliers or partner enterprises for the civilian and defence industry. Alternatively, these activities with industrial policies can be restructured and switched from dual-use products to civilian ones. It is hypothesized that:

**H2.** Dual-use export supply-in-return flows can importantly contribute to the development of medium–high and high technologically intensive industrial bases and export capacity of enterprises and sub-suppliers for civilian and defence industry.

The defence-civilian sector can also provide significant effects with gains for local economy and regional development (Taylor, 1993; Barros, 2004). Bernauer et al. (2009) find a positive effect of defence spending on Swiss economic growth in the presence of an external threat (Cold War), but not to the dispersion of regional/cantonal growth rates. The limited impact on equitable regional development is explained by asymmetric allocation of national defence employment and spending, which is not uniform across regions/cantons. Cantons with a large share of military employment in total employment have enjoyed lower and more stable unemployment rates. In addition, Lau and Lo (2015) argue on the importance of regional innovation systems and absorptive capacity for innovation performance.

Therefore, dual-use export supply-in-return activities can be an important factor for setting up and strengthening of cross-sector networks as leverage for development of export capacity of enterprises, which are located also in more remote regional areas. This can provide opportunities for technology transfer, development of institutions and economic development (Costantini and Liberati, 2014). Because the conducting of these activities is situated in different statistical regions in *Slovenia*, dual-use export supply-in-return activities can have effects on more equitable and more balanced regional development with direct and indirect impacts also on less developed statistical regions in *Slovenia*. It is hypothesized that:

**H3.** Dual-use export supply-in-return activities can importantly contribute to more equitable and more balanced technological and economic development at the local regional level.

Dual-use export supply-in-return activities can contribute to the strengthening of export capacity of engaged enterprises and other linked organizations and economic activities, technological advancements, and to economic sector restructuring towards higher value-added and more productive products and services of civilian origin. Dual-use export supply-in-return activities in *Slovenia* are in a