



Human capital and the structure of regional export flows

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A B S T R A C T

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This paper presents an empirical analysis of the influences of human capital endowments on the structure of regional export flows. Since the development of each export product is assumed to be associated with innovation activity requiring human capital inputs, the core hypothesis tested in this paper is that cross-regional variations in endowments of human capital influence the extensive margin (number of export products) rather than the intensive margin (average export value per product). The hypothesis is tested in a cross-regional regression model applied to aggregate and within-industry export flows from Swedish regions. The empirical results confirm the theoretical prediction that the response of regional export flows to cross-regional variations in human capital increases the extensive margin. To the extent that the regional human capital endowment affects the intensive margin, the effect is a higher average price per export product.

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1. Introduction

This paper analyses the relationship between the structure of export flows from different municipalities (local urban areas) and spatial variations in human capital endowments. The analysis considers how the internal geography of human capital in a country shapes the trade flows to foreign markets from its different locations. The approach of the study may be thought of as an analysis of a country's export taking into account spatial heterogeneity. The national export flow is the sum of firms' export activities, and firms are located in different places.

Knowledge is a core variable in many modern theories of international trade, and its role for exports and comparative advantages have been emphasized at least since the 1960s [1–3]. According to this view, comparative advantages are dynamic and develop over time as knowledge accumulates through, for example, investments in and absorption of knowledge and information from different sources. It should be clear that the spatial distribution of human capital—defined as the knowledge, competencies,

and skills embodied in people in different locations—influences the spatial pattern of comparative advantages as well as the structure of specialization and trade across regions.

Traditional perspectives in the international trade literature tend to disregard the regional distribution of a country's export since human capital and investment capital are typically assumed to move freely between locations within a country. This free mobility wipes out factor price differentials and subsequent differences in specialization across regions. Unless for spatially 'trapped' factors, such as natural resources, the composition of export flows to foreign countries from different regions of a country should be similar.

Although human capital is essentially mobile, its spatial distribution is highly persistent and invariant over time. One reason is that the choice of spatial location of individuals is largely dependent on individual and regional characteristics, such as education, age, regional quality-of-life factors, and local labor market attributes [4]. Such regional characteristics change very slowly. Another reason is that human capital tends to be attracted to places with already high levels of human capital [5]. Johansson and Wigren [6] use the term "production milieu" to denote slowly changing and spatially sticky features of a region

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that influence production and specialization opportunities. Human capital in a region is one such feature.

It may be obvious that the geographic distribution of human capital plays a fundamental role in shaping spatial patterns with regard to comparative advantages, specialization, and export market performance [7]. Less clear, however, is what way regional endowments of human capital influence regional export. What components of regional export flows reflect the fact that human capital endowments differ between regions?

This analysis focuses on supply-side influences on export flows and asks the question *how* export flows from municipalities that are well endowed with human capital differ from export flows from other municipalities. With the objective of analyzing this question, the study contributes to the literature in two respects: (1) focusing on human capital, it presents empirical evidence of the role of regional supply-side factors for understanding the internal geography of a country's aggregate exports; and (2) the paper contributes to the literature on how different margins in trade flows adjust to variations in supply-side factors.

This study follows Hummels and Klenow [8], who inquire into how large countries export more than small countries, by distinguishing between different margins of trade flows. Specifically, we make a distinction between intensive margin (exports per product) and extensive margin (number of products). The intensive margin is further divided into one price and one volume component.¹ The empirical analysis is designed to reveal the contribution of each margin to the overall relationship between exports and human capital across regions.

Theoretical arguments from the literature on innovation and product life cycles stress that the level of human capital in a region and the potential for knowledge flows should be associated primarily with the extensive margin of trade, i.e., the number of exported product varieties and the average quality of the exported goods. The extensive margin of a region's aggregate export flow is assumed to reflect the number of product varieties developed by firms located in that region. The development of each is assumed to be associated with innovation activity that requires input from human capital. The basic conjecture is that environments with a richness and density of human capital are conducive to ideas for product varieties (e.g., through knowledge flows). Thus, at any point in time, the product varieties of a region reflect the stock of realized "innovation ideas" [9]. Regions with abundant human capital can also offer accessibility to sufficient human capital to realize such ideas. Moreover, high-quality products can be assumed to include more knowledge content and human capital than other products. Therefore, we expect that regions that are well endowed with human capital can specialize in and export high-quality products. For a given sector in a region, this is assumed to apply to the influence of the human capital employed in the given sector and other sectors.

¹ For aggregate exports, Hummels and Klenow [8] find that the extensive margin accounts for about 60% of exports from larger economies. Within product categories, they show that richer countries export larger volumes at somewhat higher prices.

Making use of detailed export data, cross-tabulated on sectors and municipalities, our empirical results confirm both hypotheses.

The remainder of the paper is organized as follows: The next section presents the theoretical background and discusses previous empirical results in related research. Section 3 presents the empirical strategy for analyzing how regional variations in human capital endowment affect the structure of regional export flows. The results of the econometric estimations are presented and discussed in Section 4, followed by conclusions in Section 5.

2. Human capital and the structure of export flows

An analysis of how the internal geography of human capital affects the structure of export flows is related to three veins in the economic literature, which are reviewed briefly below.

2.1. Human capital and export performance

A vast body of theoretical and empirical work emphasizes the role of human capital, R&D, and innovation in international competitiveness and export performance at the level of nation, regions, and firms. Fagerberg [10], Greenlough [11], and Gustavsson et al. [12] (among others) conclude that technological factors are important for countries' international competitiveness and trade specialization. Grossman and Helpman [7], Fagerberg [13], and Braunerhjelm and Thulin [14] show that investments in R&D create comparative advantages in high-tech sectors, which increase the share of high-tech goods in a country's aggregate export. Regional studies on R&D and export performance have shown that regional R&D activities amplify the diversity of export sectors [15], stimulate regional export specialization in technologically advanced goods [16], and increase firms' export market participation [9]. At the firm level, several studies have shown that R&D investments stimulate export market participation and export intensity [17–21]. Taken together, these empirical findings indicate that knowledge and R&D investments have a positive impact on firms' competitiveness in international markets, which stimulates export market performance in several dimensions. In more explicit terms, previous studies show that knowledge and R&D have a positive effect on export volumes, export prices, and the size of the export base. However, few studies have analyzed the importance of knowledge and R&D on these three components of export flows simultaneously.

2.2. Product variety and human capital inputs

Lancaster [22,23] defines products having the same set of characteristics as varieties belonging to the same product group. If varieties in the same product group have different proportions of characteristics, but none has a larger amount of every attribute, they are horizontally differentiated. Horizontally differentiated product varieties have similar but not identical attributes, implying that consumers and customers in general perceive such varieties as imperfect substitutes. The existence of many product varieties reflects

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