Global Value Chains from an Evolutionary Economic Geography perspective: a research agenda

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Abstract

The research agendas of Evolutionary Economic Geography (EEG) and Global Value Chains (GVC) have developed more or less independently from each other, with little interaction so far. This is unfortunate because both streams of literature have a lot to offer to each other. This paper explores how, looking at four strands in the GVC literature. Promising crossovers between EEG and the GVC literature are identified but also some missing links that need to be taken up in future research. These new research avenues, promoting the adoption of an evolutionary perspective on GVCs, are expected to enrich both literatures in mutual ways.

JEL codes: B52, F23, O19, O33, R10

Key words: Evolutionary Economic Geography, Global Value Chains, Global Production Networks, Global Innovation Systems, regional diversification, relatedness

1. Introduction

In a recent paper, Yeung (2021a) observed that two influential literatures in the field of Economic Geography, namely Evolutionary Economic Geography (EEG) and Global Production Networks (GPN), had been developing more or less in isolation to each other. Yeung argued this is a regrettable situation because both can mean a lot to each other. Yeung (2021a) explored how the Global Production Network literature could contribute to Evolutionary Economic Geography, so as to tackle a few limitations in the EEG literature. What Yeung did not discuss is what EEG could mean to the GPN literature.

This paper aims to take up this challenge but also goes beyond that. We discuss four strands in Economic Geography that developed in the last two decades and which all share a common research interest in Global Value Chains (GVC): the GPN literature (Ernst and Kim 2002; Hendersson et al. 2002 ; Coe et al. 2004, 2008), the literature focusing on the relationship between Clusters and GVC (Humphrey and Schmitz 2002; Giuliani et al. 2005; Pietrobelli and Rabellotti 2011; Morrison et al. 2008), the Global Innovation Systems/Networks literature (GIS/GIN) (Ernst 2009; Cooke 2013; Binz et al. 2016; Chaminade et al. 2016), and the literature what I will refer to as the Geography of Functions (Los et al. 2017; Timmer et al. 2019).

The objective of the paper is twofold. First, it aims to identify existing links between EEG and this broad GVC literature. We argue there is already some interaction but this has remained rather implicit and underdeveloped. Second, the paper aims to identify gaps and explore new promising research links between the two streams. In doing so, the paper outlines a few promising research avenues and challenges when adopting an EEG perspective on GVC.

The structure of the paper is as follows. Section 2 gives a very short introduction to EEG. The next sections (Sections 3-6) will introduce each of the four strands one by one (GPN, Clusters and GVC, GIS/GIN, and Functions), identify existing and missing links with EEG, and provide some suggestions for future research. Section 6 concludes.

2. Evolutionary Economic Geography

The theoretical foundations of EEG have been laid down in a number of publications in the first decade of the twenty-first century (e.g. Boschma and Lambooy 1999; Boschma and Frenken 2006; Martin and Sunley 2006; Boschma and Martin 2010). In a nutshell, EEG is basically concerned with the question how cities and regions evolve over time. As Boschma and Martin (2010) put it, EEG is concerned with "… the processes by which the economic landscape – the spatial organization of economic production, circulation, exchange, distribution and consumption – is transformed from within over time." (p. 6-7).

So far, four theoretical strands of literatures have associated themselves with an evolutionary approach in economic geography, each of them having a particular focus while sharing common evolutionary principles. These strands are: (1) Generalized Darwinism which focuses on population dynamics of heterogenous agents at the micro-scale and how processes of mutation, selection and retention impact on the evolution of the economic landscape (Rigby and Essletzbichler 1997; Klepper 2007); (2) Path Dependency, with a focus on how history matters in places, and how cities and regions follow specific trajectories and develop new growth paths (Storper 1997; Boschma and Lambooy 1999; Boschma 2004; Martin 2010); (3) Complexity Science, with its main focus on the evolution and adaptation of systems and networks (Martin and Sunley 2007; Hidalgo 2021); (4) Geographical Political Economy (McKinnon et al. 2009), with a focus on how politics and institutions affect the evolution of cities and regions. Apart

from these four strands, it is important to note that theoretical and conceptual debates in EEG are ongoing (e.g. see Kogler 2015; Martin and Sunley 2015; Henning 2019).

3. The nexus GPN and EEG

To start exploring potential cross-fertilizations between GVC and EEG, we first discuss the GPN literature that has been among the most successful literatures in Economic Geography during the last decades (Ernst and Kim 2002; Hendersson et al. 2002; Coe et al. 2004, 2008; Hess and Yeung 2006; Yeung 2009, 2015). In a nutshell, it focuses on the globalization of regional development (Dicken et al. 2001), leaving behind the VC framework of linear, vertical supply chain linkages. Instead, the GPN literature poposed a broader concept of networks (encompassing both firms and non-firm actors) around lead firms (often MNEs), focusing primarily on the process of strategic coupling of local actors and regional assets.

The GPN literature evolved rather independently from EEG, but there have been at least two serious attempts to link the two literatures.

MacKinnon (2012) was the first to make an explicit link between the EEG and GPN literatures. He gave a critical appraisal of the GPN literature, accusing the GPN approach of being too static (Fuller and Phelps 2018). Instead, he proposed to relate the concept of strategic coupling to broader evolutionary thinking and the notion of institutional change. Building on Geographical Political Economy, MacKinnon referred to evolutionary notions like path dependency, lock-in and path development. Taking such a dynamic perspective, MacKinnon focused on the dynamic interplay between strategic needs of lead firms in GPNs on the one hand, and regional assets, with regional institutions as key players on the other hand. MacKinnon (2012) described those dynamics in terms of coupling, decoupling and recoupling between GPNs and regions (see also Yang 2013). While strategic coupling in GPNs may lead

to external path dependency and regional lock-in (Yeung 2015), a key question is whether local capabilities, resulting from previous rounds of investments, enable or not a process of decoupling and recoupling. Yeung and Coe (2015) and Coe and Yeung (2015) further explored this dynamic perspective on GPNs that consist of lead firms, subsidiaries, suppliers, customers and markets. Regional institutions such as state agents, labour unions and business associations are considered critical because they enable strategic coupling by shaping and transforming regional assets (such as local know-how, politics and social relations) to match the requirements of the lead firms in GPNs. This will generate a certain type of regional development, possibly resulting in value capture, and industrial and social upgrading.

Yeung (2021a) gave a second boost to link GPN to EEG. Yeung argued that EEG puts the main emphasis on the role of intra-regional capabilities rather than inter-regional linkages, in particular that part of EEG that focuses empirically on (related and unrelated) regional diversification[1]. This is a point well taken where it concerns the empirical literature on regional diversification[2], although recent papers on regional diversification in EEG have started to address empirically the role of non-local linkages (see e.g. Miguelez and Moreno 2018; Balland and Boschma 2021)[3], how relatedness might enhance regional spillovers from MNEs (e.g.

[1] Another critique by Yeung (2021a) was the prime focus of EEG on individuals and firms, rather than non-firm actors. While this may apply to papers in EEG that focus on the geography of firm dynamics and regional diversification, it does not apply to the general framework of EEG that also includes the role of institutions and the state (see e.g. Boschma and Frenken 2006; Martin and Sunley 2006; MacKinnon et al. 2009).

[2] This critique is applicable to the broader literature of EEG only to a limited extent. In its foundational papers, the role of networks and extra-regional linkages has been outlined (e.g. Boschma and Lambooy 1999; Boschma 2004, 2005). Boschma and Frenken (2010) connected the role of networks in EEG to the proximity literature and emphasized the crucial importance of inter-regional linkages to tackle regional lock-in. Empirical studies in EEG have also demonstrated the importance of inter-regional linkages for regional growth (Boschma and Iammarino 2009) and regional innovation (Breschi and Lenzi 2015; Grillitsch and Nilson 2015; Miguelez et al. 2015, 2018; Barzotto et al. 2019). There is also a big trunk of EEG on clusters and networks that has referred to gatekeepers who connect to actors outside the cluster that are considered crucial for cluster evolution (Giuliani and Bell 2005; Cantner and Graf 2006; Boschma and Ter Wal 2007; Giuliani 2007; Morrison 2008; Graf 2011), also in the context of the Global South (Pietrobelli and Rabellotti 2011; Iammarino and McCann 2013; Giuliani et al. 2005; Morrison et al. 2013).

[3] Kano et al. (2020) stated the need for GVC studies to shed more light on the complex interplay between local capabilities and inter-regional linkages. This shows ressemblance to ongoing debates in economic geography about the importance of places and their connectivity for innovation. Access to non-local capabilities is often

Ascani and Cagliardi 2020; Cortinovis et al. 2020), and whether related or unrelated diversification is promoted by MNEs in particular (Neffke et al. 2018; Elekes et al. 2019). Yeung (2021a) argued in favour of a 'trans-local network conception of regions' to understand processes of regional diversification. He connected the GPN concept of strategic coupling to the EEG concept of related and unrelated diversification proposed by Boschma et al. (2017). Yeung (2021a) stated that different types of strategic coupling dynamics can have an impact on the capacity of a region to diversify and make regions follow different development trajectories. A region can, for instance, decouple from low-value activities by means of unrelated diversification through transplantation, and recouple with more value-capturing activities as a result of related diversification by means of replication and exaptation.

Despite these promising developments linking more tightly the two types of literature, there remain a few issues in the GPN literature that warrant further attention. We explain below how EEG can be helpful to address some weaknesses or blind spots in the current GPN literature.

First of all, there is very little understanding of how GPNs actually emerge, and how previous rounds of investments in places provide opportunities but also set limits to new GPN formations. This is exactly where EEG can step in and open this black box in the GPN literature (MacKinnon 2012; Blažek 2016; Van Grunsven and Hutchinson 2016; Dawley et al. 2019; MacKinnon et al. 2019; Barratt and Ellem 2019), as Yeung (2018) admitted himself: "… many empirical studies …. have taken for granted the initial origin and formation of GPNs, preferring to investigate their internal dynamics only in the past-establishment stage. There is a significant

considered important when local capabilities and networks are underdeveloped (Fitjar and Rodríguez-Pose 2011; Trippl et al. 2018). On the other hand, scholars suggest that both local and non-local linkages are crucial for regional innovation (De Noni et al. 2017; Ascani et al. 2020; Balland and Boschma 2021).

analytical merit in developing a truly evolutionary approach to GPNs that foregrounds the factors underpinning their initial formation and their subsequent reconfigurations"((p. 397).

Second, the GPN literature advocates a meso-level approach on networks (Yeung 2021a) but makes limited use of network theory and network tools. Doing so, it does not yet exploit its full potential. EEG has been more keen on examining network configurations and how they evolve over time, employing socal network methods (Giuliani 2007; Ter Wal and Boschma 2009; Boschma and Frenken 2010). GPN scholars could follow in their footsteps which would allow them to address relatively unexplored research questions such as: how do different network configurations of GPNs (in terms of centrality, bridging, proximities, etc.) affect regional development (Crespo et al. 2014), what types of network linkages (in terms of proximities) are needed to overcome regional lock-in (Rodríguez-Pose 2021), and how do these evolve over time and why (Yeung 2021b)? Also, which complementarities in inter-regional networks can be identified, what about inter-regional linkages that give regions access to new capabilities that are complementary to their own capabilities, and how do they affect coupling dynamics and diversification processes in places? Balland and Boschma (2021) have shown how crucial these can be for the development of new growth paths, especially in peripheral regions. Moreover, the GPN literature has an almost exclusive focus on networks around and driven by global lead firms (Parrilli et al. 2013) but what about other networks that might affect regional development. Do other types of networks than GPNs such as migration, knowledge, financial and political networks matter for regional transformations, what is the importance of GPNs relative to these networks, and to what extent there is overlap and interaction between them?[4]

[4] This would also shed light on another limitation of the GPN literature acknowledged by its proponents (Coe and Young 2019; Yeung 2021a). This concerns the limited use of the GPN approach to understand uneven development and inequalities in a global world (Phelps et al. 2018; Werner 2019; Scholvin et al. 2021).

Third, the GPN focuses almost entirely on single GPNs, and less so on the relationships with other GPNs. There is little attention for possible interactions with other GPNs, and what GPNs can mean to each other in terms of (positive and negative) externalities and spillovers. The EEG approach has a lot to offer here, as one of their core competences is to identify proximities and complementarities across activities in regions both within and between GPNs, and how that affect regional development and innovation. The theoretical and methodological toolbox of EEG could be useful to analyze GPNs not in isolation, but in relation to each other.

Fourth, there is a need to explore more explicitly the role of regional institutions and institutional change in GPNs (Rodríguez-Pose 2021). What kinds of institutions matter for GPNs? As Rodríguez-Pose (2021) mentioned, local benefits of participation in global networks are expected to be low in weak or unfavourable institutional settings. In a way, this same critique on GPN holds for work in EEG that studied diversification in the Global South from a relatedness framework[5], with little attention to the type of institutions in which the diversification process is embedded (Hassink 2017; Petralia et al. 2017; He et al. 2018; Alonso and Martin 2019; Françoso et al. 2021). Indeed, the relatedness framework is often applied as a general principle (Hidalgo et al. 2018), without considering too much the specific social, political and institutional context in which processes of regional diversification take place (He et al. 2017; MacKinnon et al. 2019). Boschma (2017) has referred to that as a 'lack of geographical wisdom'. Diversification in China is likely to be very different from diversification in Latin America because of prevailing policies and institutions, but there is still

[5] Most work in EEG has been engaged with research on Europe and the US. To an increasing extent, studies on regional diversification in the Global South are starting to emerge. Petralia et al. (2017) for instance, showed that related diversification is important, especially in countries at earlier stages of development. This is confirmed by other regional studies in the Global South, like China (Zhu et al. 2017; He et al. 2018), Brazil (Alonso and Martin 2019; Françoso et al. 2021) and Vietnam (Breul and Pruß 2021). Alonso and Martin (2019), for instance, confirmed that regional diversification is subject to a path-dependent process in Brazil and Mexico but also inter-regional and international linkages are playing a role.

little understanding of how. Studies in EEG have started to explore how national and regional institutions enable or impede diversification in certain places, and how varieties of capitalism and institutions affect the type of diversification in regions (Boschma and Capone 2015; Cortinovis et al. 2017) but more needs to be done, especially in the Global South (Pike 2020).

So in short, there are many potential research links between GPN and EEG that could enrich both fields of research but which are still in need of further exploration.

4. Clusters, GVC and EEG

There is an extensive literature on GVC that has focused on the role of global linkages to foster upgrading in clusters (Guerrieri et al. 2001; Pietrobelli and Rabellotti 2007; De Marchi et al. 2018a; Turkina and Van Assche 2018). In many of these studies, the main focus is on identifying opportunities for local producers to learn from the global leader in a value chain (Gereffi 1999). Humphrey and Schmitz (2002) were the first to recognize the importance of linking clusters (with a focus on local linkages) to GVCs (with a main focus on cross-border linkages). They set out a research program that linked opportunities of clusters to upgrade to different types of VC governance structures (Gereffi et al. 2005). Giuliani et al. (2005) and Pietrobelli and Rabellotti (2011) made seminal contributions in linking clusters and GVCs by building on the Schumpeterian literature and bringing in a perspective on learning and innovation. Pietrobelli and Rabellotti (2011) criticized the GVC literature for showing little interest in the geographical and institutional context in which GVCs are embedded, while they criticized the Innovation System literature for giving little attention to GVC (Lema et al. 2018).

Part of the literature on Clusters and GVC is rooted in evolutionary concepts, such as absorptive capacity (Giuliani and Bell 2005), innovation systems (Pietrobelli and Rabellotti 2011), and the role of knowledge networks (Giuliani 2007) and network brokers in particular (Morrison 2008).

In contrast to the GPN literature, EEG scholars have been quite active in this respect, focusing on knowledge networks in clusters since the 2000s. (Giuliani and Bell 2005; Cantner and Graf 2006; Boschma and Ter Wal 2007; Giuliani 2007; Hervas-Oliver et al. 2008; Morrison 2008; Menzel and Fornahl 2010; Broekel and Boschma 2012). They shared a critical view on the cluster concept, rejecting the claim by Marshall that 'knowledge is in the air'. They showed empirically that knowledge networks in clusters are selective, not pervasive, as Giuliani (2007) put it. In contrast to Marshall, firms in clusters are considered heterogenous agents, with different levels of absorptive capacity and different degrees of proximities (e.g. cognitive, social, institutional) with respect to other agents (Boschma 2005). This made that some cluster firms are more connected which gives them more access to local knowledge than other cluster firms. So, not all cluster firms benefit equally from local knowledge in clusters. They also considered inter-regional linkages crucial (Bathelt et al. 2004; Hervas-Oliver and Albors-Garrigos 2008; Lorenzen and Mudambi 2013), improving the performance of cluster firms, and avoiding clusters to become locked-in (Boschma and Ter Wal 2007; Menzel and Fornahl 2010; De Marchi et al. 2018). Especially gatekeepers were considered important to link clusters to the global economy (Morrison 2008; Graf 2011; Morrison et al. 2013)[6].

5. The nexus GIN/GIS and EEG

Partly related to the previous literature (but not focusing on clusters in particular) is the literature on Global Innovation Networks (Wagner and Leydesdorff 2005; Ernst 2009; Cooke 2013; Chaminade et al. 2016), with a similar focus on learning and innovation in global networks. There is an explicit focus on actors (firms and non-firms) organized in networks that are collectively engaged in knowledge production and that connect geographically dispersed

[6] Recently, attempts are made to establish conceptual links between clusters and GPNs through the notion of strategic coupling (Hassink 2020; Henry et al. 2021).

knowledge hubs. What they share is a common critique on both the GPN and GVC literature[7] (Parrilli et al. 2013; Ambos et al. 2021). First, the emphasis is shifted to globalization of knowledge exchange and innovation, rather than production. They argue that firms do not only produce or sell globally, but they also participate in knowledge creation and innovation on a global scale. Second, they acknowledge that actors from the global South are participating in innovation processes to an increasing extent (Plechero and Chaminade 2016; Horner and Nadvi 2018). That is, globalization of knowledge production and innovation is driven by MNEs in the global North as well as in the global South (Aoyama 2016; Horner and Murphy 2018).

Interestingly, these scholars have been very active in applying evolutionary concepts when studying GIN/GIS, like capabilities and learning, network proximities, innovation systems, and complex systems. This is especially true in two research literatures, apart from relevant work in the International Business literature (Cantwell et al. 2010; Cano-Kollmann et al. 2016; Buckley et al. 2017; De Marchi et al. 2020[8]).

The first literature looks at the configurations and dynamics of global knowledge networks (Wagner and Leydesdorff 2005). It applies quantitative (network) approaches using global data sets to study dynamics in global networks of trade linkages (OECD 2017), research collaborations (De Rassenfosse and Seliger 2020), co-publications (Fitzgerald et al. 2021), co-inventorships and patent citations (Montobbio and Sterzi 2011). A key question concerns the extent to which R&D activities are increasingly offshored (OECD 2017). However, there is still little understanding of the effect of global knowledge networks on regional development

[7] In a comprehensive overview, Ambos et al. (2021) argued the GVC literature lacks a systematic discussion on innovation and global knowledge sourcing. Instead, its main focus remains on the study of vertical supply chain linkages in different VC stages.

[8] For instance, Crescenzi et al. (2014) and Crescenzi and Iammarino (2017) have investigated how MNEs make location decisions for their foreign activities at different stages of the VC.

(Parrilli et al. 2013) and the ability of regions to diversify and upgrade their value chains. Doing so, it would connect this literature more tightly to the regional diversification literature in EEG that has expanded in the last decade (Whittle et al. 2020; Balland and Boschma 2021).

The second concerns the emerging literature on multi-scalar networks in Global Innovation Systems (GIS) that employs descriptive case study approaches. Focus is on new path creation and system building that goes beyond a territorial (national, regional) system perspective (Binz et al. 2014; Binz and Truffer 2017)[9]. They investigate how firms and other actors mobilize and anchor resources for new industry formation in regions globally (Binz et al. 2016). The existing literature is criticized in a number of ways. First, they formulated a critique on conventional GPN/GVC literature that countries in the global South can only climb the GVC ladder by moving up into an existing GVC controlled by a lead firm from the global North. Instead, they argued that latecomers can construct new GVCs, by building local capabilities while mobilizing resources globally. Second, they leave behind a rigid conceptualization of space in terms of pre-defined territorial boundaries, and propose a multi-scalar perspective instead. And third, they take a broader view on new path creation, by focusing not only on knowledge production/acquisition but also on building legitimacy and institutions, for instance. In that sense, they complement the EEG literature on regional diversification by unpacking the broad notion of regional capabilities while adding an explicit focus on global linkages.

6. GVC, Geography of Functions and EEG

[9] Studies have looked at the relative importance of Global Value Chains versus Regional and Local Value Chains (Keijser et al. 2021). This acknowledges the fact that value chains are not necessarily global of nature which is especially relevant in the context of increasing South-South trade.

A key question in the GVC literature is which countries/regions are capable of developing or participating in new value chains, or upgrading existing value chains. Despite some previously mentioned examples in the GVC-Cluster nexus, it is fair to say that GVCs have not been a key unit of analysis in EEG research so far. While EEG has generated new insights on related diversification in regions (Hidalgo et al. 2007, 2018; Neffke et al. 2011), little knowledge yet exists of how GVCs contribute to regional diversification, and how GVCs evolve through (related) diversification in terms of upgrading and downgrading. We explore how that might be done, building on recent literature to what I refer to as Geography of Functions, pioneered by scholars from Groningen University using new World Input-Output data (Timmer et al. 2015).

This emerging literature argues that countries and regions are specialized in particular tasks or functions in GVC rather than particular products or industries, resulting in a fragmented structure of activities across space (Timmer et al. 2019). Functions not only differ in terms of their dependence on specific factor inputs but also in their propensity to be spatially sticky (Timmer and Pahl 2021). R&D activities, for instance, show higher spatial inertia while this is less so for assembly activities, with major consequences for uneven spatial development. It is important to note that this kind of thinking in terms of Geographies of Functions is not new at all. In fact, it has a long history in Economic Geography that has investigated the spatial division of labour (Massey 1994) due to locational strategies of multinationals breaking down the value chain into a range of discrete functions such as headquarters, R&D, design and production (Iammarino and McCann 2010, 2013) on the one hand, and in literature that has focused on the geography of occupations (and what people actually do in terms of tasks) rather than industries (Florida 2004; Markusen 2004) on the other hand. Also EEG has made contributions here, analyzing the dynamics of occupational structures in regions in a relatedness framework (Muneepeerakul et al. 2013; Farinha et al. 2019; Hane-Weijman et al. 2021), but EEG has made little progress to incorporate such an occupation-oriented approach from a VC perspective. A

crucial question for instance is the extent to which regions are able to capture value in VCs that become fragmented to an increasing extent. Following such approach, EEG would respond to critique that it hardly accounts for questions like "… who captures value from regional diversification and why such diversification might be good or bad" (Yeung 2021, p. 16).

So far, the regional diversification literature in EEG has focused on new activities (industries, products, technologies, occupations, scientific fields) rather than new tasks/functions within GVC (Boschma 2017). Here, we argue EEG should do both, though there are still a few challenges that need to be tackled. One key challenge is data availability. Although the World Input-Output data are increasingly regionalized, providing information on value capture of regions in GVC, data restrictions are still huge, with little details in industrial and regional categories so far (Los et al. 2017; Timmer et al. 2019). Another key challenge is conceptual. We need to develop an EEG framework to explain the ability of a region to develop/participate in a new VC or upgrade an existing VC as a result of relatedness with existing VCs in the region (Ye 2021). This requires an assessment of possible externalities across different functions through the development of a new relatedness measure between functions that can be used as an input for the ability of regions to diversify in new functions. This would bring novel insights to the GVC literature and would also respond to the critique that the GVC literature has remained primarily qualitative (Ambos et al. 2021).

To explain GVC dynamics in regions from a relatedness framework, we need a new unit of analysis, i.e. region-industry-function, that accounts for potential combinations of horizontal and vertical upgrading (Ye 2021). Horizontal upgrading stands for the development of a new GVC (a new product or industry) in a region that is related to another GVC (a related product or industry) already present in the region, like going from mobile phones to laptops. This so-called inter-sectoral upgrading has been a key topic of the EEG literature on regional

diversification so far. Vertical upgrading has attracted little to no attention in the EEG literature. Vertical upgrading means the development of a new function (e.g. R&D, management, marketing, logistics, production) in an existing VC, such as moving from production to R&D in laptops. This has been the key topic in the GVC literature, while this literature has focused less attention on horizontal upgrading. A logical next step is combine horizontal and vertical upgrading by focusing on new industry-functions, and to assess whether these depend on related industry-functions, such as shifting from production in laptops to R&D in mobile phones.

Doing so, we have to think carefully what we mean by upgrading (Giuliani et al. 2005)[10]. In the GVC literature, the meaning of upgrading is more clear along the vertical dimension when shifting from low to high value-added functions, but it is less straightforward along the horizonal dimension. That is, moving from one industry to another is not necessarily accompanied by moving up the economic or technological ladder. One way of dealing with this is to differentiate between products or industries in terms of their complexity (Hidalgo and Hausmann 2009). Complexity captures the difficulty of mastering capabilities that are required to excel in a product or industry which is reflected by its non-ubiquity on the one hand, and the diversity of capabilities that need to be coordinated and combined on the other hand. In this context, horizontal upgrading would happen when the new product or industry is more complex than the average complexity of all products or industries in a region[11]. Alternatively, one could construct a new complexity measure for all industry-functions. Such measure would assess whether, for instance, R&D in laptops is more complex that management in mobile phones.

[10] Giuliani et al. (2005) referred to upgrading when: (1) it involves entering higher unit value market niches or new sectors; (2) undertaking new productive (or service) functions. In their seminal publication, Humphrey and Schmitz (2002) made a distinction between four categories: process, product, functional, and inter-sectoral.

[11] Colozza et al. (2021) investigated the impact of external linkages (as proxied by GVC participation index) on the economic complexity of regions. Using an input-output regionalized dataset of EU NUTS-2 regions, the study finds that more complex regions benefit from GVCs, especially in manufacturing sectors.

However, VCs can also be investigated as input to develop a new relatedness measure. In still unpublished work, Ye (2021) developed a relatedness measure between industry-functions, based on geographical co-occurrence analysis. In this way, Ye could construct a network of industry-functions or industry-function space, similar to the product space of Hidalgo et al. (2007). This measures the extent to which different industry-functions (such as R&D in automobiles, management in textiles, production in computers) rely on similar capabilities. Ye found that low-skilled functions were closely related across many industries, suggesting the relative easiness of re-allocating low-skilled workers across industries. Ye found a low degree of relatedness between low-skilled and high-skilled functions, even within the same industry, especially in more sophisticated industries. Using this network, one can position regions in this industry-function space (including information on the complexity of all industry-functions), and identify how many and what kind of diversification opportunities regions have in terms of upgrading. When a region would be specialized in many industry-functions in the core of this network, it would imply it has many options to diversify into new industry-functions related to existing industry-functions in the region. This would be in contrast to a region that is specialized in only a few industry-functions positioned in the periphery of the network, with little diversification opportunities for the region as a consequence.

Introducing such an evolutionary approach in VC would have the potential to shed new light on regional diversification and uneven spatial development in an EEG framework. First, it could assess the ability of regions to develop a new industry-function, depending on the degree of relatedness with existing industry-functions in a region. Doing so, it would take up a type of regional capabilities that is different but complementary to the capabilities that have been

identified by patent, industrial or occupational data[12]. Ye (2021) pioneered this type of research at the national scale, showing that horizontal upgrading is less difficult than vertical upgrading, although that depends from industry to industry. Ye (2021) also showed this differs between countries. Such analyses at the regional scale are still missing. Second, it could provide new insights to the literatures on regional lock-ins (Grabher 1993) and development traps (Iammarino et al. 2020) which have identified a range of traps countries and regions might get caught in, such as the middle-income trap (Kharas and Kholi 2011; Bresser-Pereira et al. 2020), the low value-added trap (Phelps et al. 2003; MacKinnon 2012) and the low complexity trap (Pinheiro et al. 2021b). An evolutionary perspective on development traps would emphasize that path dependence in regional development might become an obstacle rather than an opportunity for innovation in regions (Arthur 1994). These self-reinforcing dynamics would limit the capacity of regions to move forward and diversify into new and complex activities (lock-in). Only in very recent papers, this topic starts to be taken up. Pinheiro et al. (2021a,b) demonstrated that lagging countries and regions might become trapped in low-complexity products because their diversification opportunities in high-complex products are very limited due to a low degree of relatedness with more complex products. Ye (2021) argued that a country may get stuck in low-skilled tasks due to low relatedness with more high-skilled tasks in GVCs. And third, it would enable us to assess entry and exit of industry-functions in terms of economic effects on regions, and how these could affect income inequalities in and between regions. This would be in line with recent studies in EEG (Pinheiro et al. 2021b), showing that potentials to diversify in more complex technologies or industries are not evenly distributed across regions. Indeed, there is a tendency in high-complex, high-income regions to diversify in more complex activities because these are related to existing high-complex activities in the region. By contrast,

[12] Studies have also calculated an indicator of relatedness between industries using input-output data. For instance, Essleztbichler (2015) measured similarities of supplier–buyer relationships between industries to capture possible input–output externalities across industries.

low-complex, low-income regions rely more on related activities of low-complexity when diversifying (Pinheiro et al. 2021b). Given the higher economic potential of complex activities (Pintar and Scherngell 2020), this implies income disparities across regions are more likely to be reinforced as a result of diversification processes (Pinheiro et al. 2021a,b).

This recent work also shows that EEG is starting to address topics of uneven regional development and to respond to critique that there is a tendency in EEG to focus primarily on the bright sides of regional economic evolution (such as entrepreneurship, knowledge production and diffusion, new entry and innovation), but less so to its dark sides, like inequalities, development traps, underdevelopment, and economic and intellectual monopoly power (Rikap and Flacher 2020; Feldman et al. 2021; Rikap 2021).

Finally, GVC can also be treated as an independent variable to explain economic upgrading (Pahl and Timmer 2020). There are papers that looked at what regions benefitted from GVC participation, like Colozza et al. (2021) who found that more complex regions, rather than low-complex regions tend to benefit from GVC participation. But we still have to assess systematically the effect of GVC participation (including changes in GVC due to digitalization, COVID or trade wars) on regional diversification (Tajoli and Felice 2018; Colozza and Pietrobelli 2021), let alone its relative importance alongside other mechanisms such as migration (Diodato et al. 2021; Miguelez and Morrison 2021), research collaboration (Giuliani et al. 2016; Balland and Boschma 2021) and labor mobility (Neffke et al. 2017). There also exists little work to date that examined through which channels knowledge flows within value chains and how these impact regional diversification (Bahar et al. 2019). In a comprehensive review of the GVC literature, Kano et al. (2020) argued this topic is still a black box in research on value chains. Such a research agenda would open the possibility, among other topics, to

assess the effect of relatedness between knowledge flowing into a region through these various channels on the one hand, and the existing knowledge base in the region on the other hand.

Concluding remarks

The aim of the paper was to identify existing crossovers between EEG and the GVC literature, and to explore new promising research links between them. To define the GVC literature, we distinguished between 4 strands of research: the Global Production Network literature, the literature focusing on the nexus Cluster-GVC, the literature on Global Innovation Systems/Networks (GIS/GIN), and the literature linking GVC to the geography of functions.

The paper identified some promising connections that have already been made between the EEG and GVC literatures, despite recurrent claims there has been little interaction so far. In the last decade, a few initiatives in the GPN literature embraced an EEG perspective, linking the evolution of GPNs to the development of new growth paths (MacKinnon 2012) and regional diversification processes (Yeung 2021a). Parts of the research on the nexus Cluster-GVC have been firmly anchored in evolutionary concepts since the 2000s, bringing insights from Schumpeterian innovation studies into the GVC literature. At the same time, this body of literature on Clusters and GVC also gave a boost to the development of EEG itself, by connecting knowledge networks to cluster evolution (Boschma and Frenken 2010). We also found that the part of the expanding literature on GIN/GIS was embedded in evolutionary thinking, focusing on learning and innovation, as in the Cluster-GVC literature.

However, we also showed that EEG has remained relatively unexplored in the GVC literature. This applies to a dynamic perspective on GPNs and GVCs in which the origin and formation of new GPNs and GVCs still needs to be studied. The GPN literature has also shown some reluctance in making full use of network theory and network tools, which would allow to gain

more understanding of the dynamics in GPNs, to identify complementarities in global networks, and to asses their effects on coupling dynamics and diversification processes in specific territories. We also identified interesting ongoing research on the configurations and the dynamics of Global Innovation Networks, but this research area still needs to become more tightly coupled with the EEG literature to shed light on their relative importance for regional diversification and uneven spatial development. Finally, we set out a new research agenda that takes up GVCs as a new unit of analysis in EEG (i.e. region-industry-function), and to embed it firmly in the EEG framework of relatedness. This research agenda has the potential to shed new light in the GVC literature on the process of regional upgrading and diversification (see e.g. pioneering work of Ye 2021), to identify and determine the diversification opportunities of each region in terms of their potential to develop new industry-functions, to provide new insights on how lock-ins and development traps in regions can occur, and to gain understanding of their effects on regional development and inequalities within and across regions.

It seems there are no fundamental differences that would hamper the integration of the main theoretical ideas and perspectives in EEG and the GVC literature. Also global and longitudinal datasets are available to an increasing extent, due to open science, digitalization of datasets, machine learning techniques, and the enormous efforts of scientists to construct historical datasets such as the US historical patent dataset (Petralia et al. 2016) and the World Input-Output data (Timmer et al. 2015). However, a key challenge is the availability of detailed input-output data at the subnational scale (Los et al. 2017). A further obstacle to the integration of EEG and GVC is the almost separate worlds in terms of preferred methods (quantitative versus qualitative studies). It remains a challenge to convince scholars to appreciate the value of both research methods and to integrate them in research (Yeung 2021a). Moreover, there is a need to work on better methods and to explore potentials of cross-fertilization using mixed methods. Network analysis might have the potential to bridge both research traditions. For sure, there is

a need to integrate insights to get a more comprehensive understanding of new path development and uneven development in space. This would also give a boost to the research agenda of EEG which has a tendency to focus more on the bright rather than the dark sides of regional development, such as power asymmetries, negative spillovers, inequalities and uneven development (Phelps et al. 2018; Hassink et al. 2019).

A final research challenge is how the design of policy strategies inspired by an evolutionary perspective on GVCs in the global South might look like (Dannenberg et al. 2018). Much of the recent work on policy in EEG claims that Smart Specialization or innovation policies need to be adapted to place-specific capabilities (Freire 2013, 2017; Alshamsi et al. 2018; Uyarra et al. 2018; Balland et al. 2019; D'Adda et al. 2020). A challenge is how to link that to the literature of GVC (Brennan and Rakhmatullin 2015), and catching-up policies in particular (Lee 2013, 2019). Another challenging question is how to relate that to work in EEG on policy that focuses on regional lock-ins and traps (Boschma 2021), such as being trapped in low-complex and low-value added activities in GVCs (Phelps et al. 2003; Stöllinger 2019). As Hartmann et al. (2021) have argued, middle-income countries are often trapped in a low complexity state, and only few countries such as Taiwan have succeeded to overcome that. Pinheiro et al. (2021b) identified complexity traps at the sub-national scale studying the potential of low, middle and high-income regions to diversify in more complex technologies and industries. The question is still open how participation in GVCs plays a crucial role here, both as potential cause of such traps and as a way out, and what types of policies would make sense to avoid or tackle such regional traps.

In sum, there is much potential merit in exploring further the nexus of EEG-GVC, not only in terms of policy implications but also in terms of the many other open research questions outlined in this paper. Time has come to take up these research challenges.

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