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The impact of global value chains on wages, employment, and productivity: a survey of theoretical approaches

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Abstract

This study presents a systematic literature review to provide a collection of theories explaining the impact of global value chains (GVCs) on labour market outcomes. Due to the complex nature of GVCs and the interconnectedness of wages, employment, and productivity, many direct and indirect effects are at play. To ensure a transparent and systematic flow of the review process, I follow the PRISMA guide. Eventually, 36 records out of 1221 results from Scopus database were selected. This review may be useful for theorists, empirical economists, and policy makers as an overview of theoretical developments and convenient map of potential outcomes expected from involvement in GVCs. It identifies and systematizes a number of effects existing in the literature under various names. The results show that the predictions from the theory are ambiguous. The positive effects which may emerge regardless the characteristics of the GVC are the productivity-enhancing effect and the cross-effect, especially important considering growing servicification of manufacturing. Here lies the critical role of the state and policies to assure that the losses will not exceed the gains in the aggregate terms. One of the main factors shaping the outcome is the power distribution among the GVC's firms. Additionally, this paper shows the shortcomings of the existing theories. Less aggregated levels of analysis could be a great input to the discussion, as well as addressing different GVCs' dimensions and types of organisation. The understanding of relation between GVC position and labour market is especially worth exploration as the existing evidence adopt different and even contradicting perspectives on the definition of upgrading the GVC position.

Keywords Systematic literature review, Global value chains, Wage, Employment, Productivity

JEL Classification F16, F60

1 Introduction

1.1 GVC trade relevance and its consequences for labour markets

Global value chains (GVC) reports published in recent years (WTO, 2019; WBG, 2020; WTO, 2021) as well as other studies (e.g. Timmer et al. 2016; Taglioni & Winkler 2016) confirm a rapid growth of the GVCs' trade since the 90 s, interrupted by the global financial crisis of 2008, for which one can observe a sudden drop. According to Miroudot et al. (2009), trade in intermediate goods was over half of the goods traded between developed economies, and trade in intermediate services was about three-quarters of the services trade. It explains why GVCs are called the world economy's "central nervous system" (World Economic Forum, 2013, p.4). In the recent post-crisis period, the GVCs' trade somewhat slowed and stabilised (Timmer et al. 2016). Despite the documented slowdown in its expansion and the recent impact of the global pandemic, it still defines how a huge part of the production of goods and services in the world is taking place. As the

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data on intermediate flows come with a significant delay, it is still early to assess how COVID-19 changed the picture (WTO, 2021). What is certain, though, is that the global pandemic raised awareness about risks related to international production networks (WTO, 2021).

The focus of this literature review is put on a particular subtopic related to GVCs, namely its impact on labour market outcomes like wages, employment, and productivity. Much attention was dedicated to this topic in theoretical and empirical studies. Among the motivations, one could mention, on the one hand, the general view popular in economics on the benefits of openness to trade, which could be traced back to the Ricardian model or even earlier. Trade in intermediates, which is the centre of attention of this review, was shown by the theory to be even more beneficial than trade in the final goods (Markusen 1989). On top of the simply better use of the production factors the main gains stem from the learning by importing/exporting, management know-how (Antràs & Yeaple 2014), various technology spillovers (Smarzynska-Javorcik 2004; Baldwin & Lopez-Gonzalez 2015), and access to better inputs (Amiti & Konings 2007; Halpern et al. 2015). This advantages of GVCs participation were particularly important for the developing countries, as a faster way to industrialisation, better productivity, and wages. The empirical evidence suggests that GVC integration support inclusion of certain groups of workers to formal labour (McCaig & Pavcnik 2018; Maertens & Swinnen 2009) and promotes gender equality (see broad review of evidence in WTO, 2023).

On the other hand, the emergence of GVCs raised many concerns about, e.g. the threat it may cause to selected types of workers. Especially the situation of low-skill workers from developed countries was perceived to worsen due to GVCs emergence. One of the most influential empirical evidence was Autor et al. (2013) who showed significant unemployment rise and wage reduction in US caused by the import competition from China. Another common concern was how the asymmetric power distribution between GVCs' participants modifies the possible gains from global production sharing (WTO, 2023). The question asked is whether the leading companies do not consume all profits while the low-end workers are hurt with indecent working conditions (Herkenhoff et al. 2021) and the least advanced participants are trapped at low productivity production stages, where the learning channel cannot thrive (Pietrobelli et al. 2018). The concerns related to GVCs reach even to e.g. the gender gap in mental well-being of employees of GVCs' companies (Arnarson et al. 2023).

What makes the picture even more complicated is that it is not enough to study only the direct channels of impact. The three examined aspects: wages, employment, and productivity are interconnected, and changes in one may alter another (Meager & Speckesser, 2011). Moreover, in the interconnected production systems, there is no shock that would impact only its target. Instead, shocks are distributed through the whole production system, affecting its various participants: countries, sectors, firms, and workers (empirical evidence by, among others, Tintelnot et al. 2018; Connell et al. 2017) and causing insecurity on the labour markets connected through trade (Crouch 2010). Recently, the COVID-19 pandemic and the war in Ukraine reminded us how strongly linked are global production structures these days (WTO, 2021, 2023).

Moreover, the role of services in GVC increased (WBG, 2017) also indirectly through the effect of "servicification" or "servitisation" of manufacturing, understood as the growing importance of services as inputs for manufacturing, as activities within firms, or as output bundled with goods (Fuster et al. 2020; Miroudot 2017; Cheng & Xiao 2021; Kordalska & Olczyk 2021). Some hints about the supportive role of services in production fragmentation, leading to the increased geographical dispersion of production, were provided already by, e.g. Jones and Kierzkowski (2005). In this new reality, it is crucial to devote more attention to so called cross-effects between sectors, explaining how GVC participation effects of labour market can be transferred between services and manufacturing, or between services sectors. Only then one can see the full picture of who is gaining and who is losing.

To summarise the above motivation, GVC impact on labour markets is not only a hot topic in economic literature, fuelled by improvements in trade measurements but also a point of interest of policy makers and society concerned about threats and gains of globalization.

1.2 Variety of notions regarding GVCs

The phenomenon of globally dispersed production appears in the literature under many names. During the years, it was referred to as, among others: international fragmentation (Jones & Kierzkowski 1990), global commodity chains (Gereffi & Korzeniewicz, 1994), international outsourcing (Feenstra & Hanson 1996a, b, c), offshore sourcing (Arndt 1998b), vertical specialisation (Hummels et al. 2001), trade in intermediate inputs (Feenstra & Hanson 2001), global production sharing (Feenstra & Hanson 2001), global value chains (Gereffi et al. 2001), global sourcing (Antràs & Helpman 2004), second great unbundling (Baldwin 2006), trade in tasks (Grossman & Rossi- Hansberg, 2008), offshoring (Feenstra 2010), trade in value added (Johnson & Noguera 2012), global production networks (Coe & Yeung, 2015), and others.

From now on, this study will refer to this phenomenon mostly by the term "global value chains" (GVCs).[1] The emergence of literature widely using the concepts of value chains is dated to the 80 s (Sturgeon 2001; Henderson et al. 2002). One of the many definitions which can be found in the literature tells that the value chain consists of all the "*activities that are required to bring a product or service from conception through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use*" (Gereffi et al. 2001, p. 3). After Antràs (2020, p.3), a global value chain "*consists of a series of stages involved in producing a product or service that is sold to consumers, with each stage adding value, and with at least two stages being produced in different countries*". According to the World Bank Group (2020, p.17), GVC is "*the series of stages in the production of a product or service for sale to consumers*". At each stage some value is added, and the condition to call it "global" is that at least two of the production stages must be placed in different countries. In recent studies one can find a differentiation of GVC into simple and complex, depending on the number of borders crossed for production (Wang et al. 2017a, 2017b).

It can be argued that an even more accurate notion than GVC is a global production network, as production processes usually may have a more complicated structure than a linear one. This difference was pointed out, e.g. by Sturgeon (2001), who distinguish a value chain, understood as "*the sequence of productive (i.e. value-added) activities leading to and supporting end use*", from a production network, which is "*a set of inter-firm relationships that bind a group of firms into larger economic unit*" (Sturgeon 2001, p.11). Moreover, one can talk about a global production network if "*actors coordinate activities across at least two continents or trade blocs*" (Sturgeon 2001, p. 14). Another definition of global production networks (GPN) used in literature is the one given by Coe et al. (2008) or Henderson et al. (2002). After these sources, a production network is *"the nexus of interconnected functions, operations and transactions through which a specific product or service is produced, distributed and consumed"*, and it is considered to be global if its *"interconnected nodes and links extend spatially across national boundaries"*, so a GPN *"integrates parts of disparate national and subnational territories"*. In Ernst and Kim (2002) one can read that GPN are networks which "*combine concentrated dispersion of the value chain across firm and national boundaries, with a parallel process of integration of hierarchical layers of network participants*" (Ernst & Kim 2002, p.1).

Despite the above, both notions GVC and GPN are currently used interchangeably and referring to GVC does not need to imply the linear organisation of the process. When distinguishing the configuration of the production fragmentation process is important, some sources employ the terms "snake" or "spider" to describe the shape of this structure (Baldwin & Venables 2013; WBG, 2020; Tozo & Gong 2020; Antràs & de Gortari 2020). Snake regards a value-added creation process that is linear, sequential, and usually longer than the spider type of production organisation, which refers to a configuration of multiple units supplying intermediates to an assembling unit. One can expect that most of the GVC are hybrids of these two types, called "snikers" (WBG, 2017). In the literature one can find several examples of GVC related to the production of particular goods, specifying the dispersion of the production stages over geographical locations on a global scale. These examples are goods like bikes (WBG, 2020), Nutella (De Backer & Miroudot, 2014), Apple iPhones (Xing & Detert 2010; Kaplinsky 2015) or Boeing Commercial Airplanes (Kaplinsky 2015).

As stated above, both GVCs and GPNs are quite broad concepts, which may cover different modes of engagement in global production sharing. It can be realised, for instance, as intra-firm trade (offshoring parts of production to foreign subsidiaries) or as international outsourcing (sourcing from the outside of the company). These terms are widely adopted in the empirical literature, as well as in the general reports annually released under the name *Global Value Chain Development Report* as a cooperative work of i.a. the World Trade Organization, OECD, and The World Bank Group (e.g. WBG, 2017; WTO, 2019, 2021, 2023). The list of keywords chose for the systematic literature search refers also to the term global commodity chains (GCCs, as it is an ancestor to the GVCs and GPNs) and international production fragmentation as another sufficiently broad concept. A commodity chain is defined by Hopkins and Wallerstein (1986, pp.159) as *"a network of labor and production processes whose end result is a finished commodity"*, while according to Jones and Kierzkowski (2005, pp.4) *"the concept of fragmentation refers […] broadly to the possibility that production blocks are separated by distance"*. The details regarding the choice of keywords and other restrictions imposed on the SLR procedure are explained more thoroughly in the Sect. 2. The key criterion regarding this part of literature selection was therefore to identify studies analysing case of at least two stages of production split between countries. It implies the trade in intermediates (differentiated from the trade in final gods and services), without assuming any particular mode of engagement

[1] In this work, I use most often the term "global value chains" (GVCs). However, when referring to literature, I use the terms used in the source.

(intra-firm offshoring vs international outsourcing; number of stages of fragmentation; etc.).

The roots of the theory connecting GVCs with labour market outcomes are sometimes traced all the way back to the Ricardian model of comparative advantage or the Heckscher-Ohlin (H–O) two-countries, two-goods, two-factors (2×2×2) model (see, among others, Milberg & Winkler 2010 for review). In the reality of globalised production, the explanatory power of, for instance, the H–O model was proved by empirical studies to be low. Among other factors, it could be due to a lack of accounting for heterogeneous firms or technology impact (Wang et al. 2021a). But importantly, none of these approaches allowed for trade in intermediates and the consequences of fragmentation of production of a particular good between countries. Therefore, the impact of fragmented production could have only been captured since the emergence of contributions introducing at least two components or production stages to the model. Later, many contributions have been made to the field, calling the growing phenomenon different names, as listed in one of the previous paragraphs.

1.3 GVCs' impact on labour markets – aim of the literature review

It is possible to find the literature (e.g. Milberg & Winkler 2011; Franssen 2019; Shingal 2015) providing some summaries of theoretical papers on GVCs' impact on labour market outcomes. However, according to my knowledge, no such summary is conducted with the rigour of a systematic literature review (SLR). There are plenty of recently published SLRs regarding GVCs. However, they usually tackle different problems and focus on collecting empirical evidence. For instance, there is De Marchi and Alford (2022) on state policies and upgrading; De Marchi et al. (2018) on learning and innovation opportunities for developing countries; Golgeci et al. (2021) on the environmental sustainability of emerging market firms; Khattak and Pinto (2018) on environmental upgrading; Nyagadza et al. (2022) on industrial innovation dynamics; Panibratov et al. (2022) on the Belt and Road Initiative; and Kano et al. (2020) who reviews multidisciplinary literature on GVCs.

This study answers the urgent call, motivated by all the above arguments, to conduct a systematic literature review on channels of GVCs' impact on labour market outcomes. It sheds light on the direct and indirect effects stemming from the complex nature of production systems itself and also from the interconnectedness of the three: wage, employment, and productivity. In the presence of variety of names referring to global value chains, it contributes to clear identification of theories concerning specifically fragmented production. To this end, it provides a comprehensive collection of such theoretical models and frameworks going beyond the few mostly cited papers yet including only high-quality contributions due to limiting the search to Scopus database. The method of systematic review assures the most objective and transparent procedure of selection of the relevant literature. Due to the nature of analysed records (theoretical papers) this review is of a descriptive type supported with some graphical summary. The results are presented emphasising the main insights for the developed and developing countries, as well as indicating the universal channels worth supporting to boost the gains from GVCs participation for labour markets. Additionally, this review informs about several external and internal factors shaping GVCs impact according to the various frameworks and lists some limitations of the current literature. Hence, this study may be useful for theorists (as an up-to-date overview of theoretical developments with identified gaps in existing theory), empirical economists (as a base for conducting an empirical research), and policymakers (as a convenient map of potential outcomes from international integration of trade).

Therefore, conducting an SLR to fill this gap most certainly constitutes valuable input to the literature. The research question is: What is the impact of GVCs on labour market outcomes: wages, employment demand, and productivity? The systematic literature review presented in further sections aims to identify relevant literature with theoretical contributions to answer this research question.

2 Systematic literature review methodology

To ensure a transparent and systematic flow of the review process, I follow the guideline by Xiao and Watson (2019) and the most up to date PRISMA (The Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement by Page et al. (2021). Table 1 summarises the review protocol developed for this study. Figure 1 presents the PRISMA flow chart reporting the number of literature records analysed at each review process step.

I chose Scopus as the database to use in this study, as it is one of the leading abstract and citation databases of peer-reviewed literature, often used in similar SLR studies (De Marchi & Alford 2022; Panibratov et al. 2022; De Marchi et al. 2018; Nyagadza et al. 2022). Moreover, it offers broader coverage than the Web of Science (Panibratov et al. 2022; Mongeon & Pauls-Hus, 2016). Some studies also consider Google Scholar, especially when searching through so-called grey literature, which could enrich the review. However, in my study, I was focused on theoretical contributions that are expected to be relatively higher-quality papers, so I limited my search to Scopus. Due to the same reason, the search was limited

Table 1 Review protocol table

Purpose of the study	
This literature review aims to identify theoretical contributions to answer the research question: What is the impact of GVCs on labour market outcomes: wages, employment demand, and productivity?	
Search strategy	
Keywords	1) GVCs-related: *gvc OR gpn OR gcc OR (global* OR international* AND "value chain*" OR "production network*" OR "commodity chain*" OR (production W/2 fragment*))* *AND* 2) related to labour market outcomes: *(labor OR labour) OR wage* OR salar* OR (cost* W/2 employ*) OR employment OR productiv* OR ((creat* OR destruct* OR demand OR los* OR new OR reduct* OR fall* OR declin* OR decreas* OR increas* OR expan* OR boost* OR gain* OR develop* OR grow* OR rise*) W/2 (job* OR work* OR employ*))*
Searched fields	title, abstract, and keywords
Database	Scopus
Language	English
Subject areas	Economics, Econometrics and Finance Business, Management and Accounting
Document type	Article, Book, Book chapter
Time period	No restrictions
Inclusion criteria	
To be included in the review, all of the following criteria must have been met: Ia) Does this report regard GVCs? Ib) Does this report regard at least one of the following labour market outcomes: wages, employment demand, or productivity? II) Does it regard the impact of GVCs on the labour market outcomes? III) Does it provide any theoretical contribution? (Does it extend the existing theory on the topic?) (Exception: theoretical literature reviews with no own theoretical contribution also included)	
Quality assessment	
No further quality constraints were forced. Limiting the search to the Scopus database was the initial quality restriction	

Additionally, I excluded records containing the phrase "Gulf Cooperation Council" (abbreviated as "GCC") to limit the number of off-topic search results

Source: own elaboration

to journal articles, books, and book chapters. I only considered documents in English. Subject areas covered "Economics, Econometrics and Finance" and "Business, Management and Accounting".

Based on the research question, I defined a set of keywords to build a search string. I divided the keywords into two concept domains: GVCs and labour market outcomes, and thus the searched document's title, keywords and/or abstract must contain at least one keyword/phrase out of each domain. The final list of keywords was decided after a few pre-review search attempts. In this way, it was possible to narrow down the topic and obtain a manageable number of search results in the first step while assuring a good coverage of all studies possibly related to the research question at the same time.[2] Finally, the Scopus database search resulted in 1221 records.[3]

The first screening was based on analysing titles and abstracts (alternatively, introduction snippets available in Scopus in case of books or book chapters if the abstract was unavailable). The record must have met all the inclusion criteria listed in Table 1 to be included in the review. Most of the excluded records are either unrelated to the topic (failed to meet condition Ia or Ib, please see Table 1) or not in the scope of interest of this review as purely empirical, methodological or policy papers (failed to meet condition III). I did not include documents which

[2] In the presence of many names used to describe the phenomenon of globally dispersed production (see a subsection in the Introduction), the GVCs-related keywords must be limited (see list of keywords in Table 1). With the focus on reviewing the literature capturing the growing complexity of production structures, the keywords referring to "chains", "networks", and "fragmentation" were chosen as a base. The exception was the term "supply chain", which was purposely omitted, as it doubled the number of results while it is a term used rather in logistics and management.

[3] Database accessed: 4 February 2023.

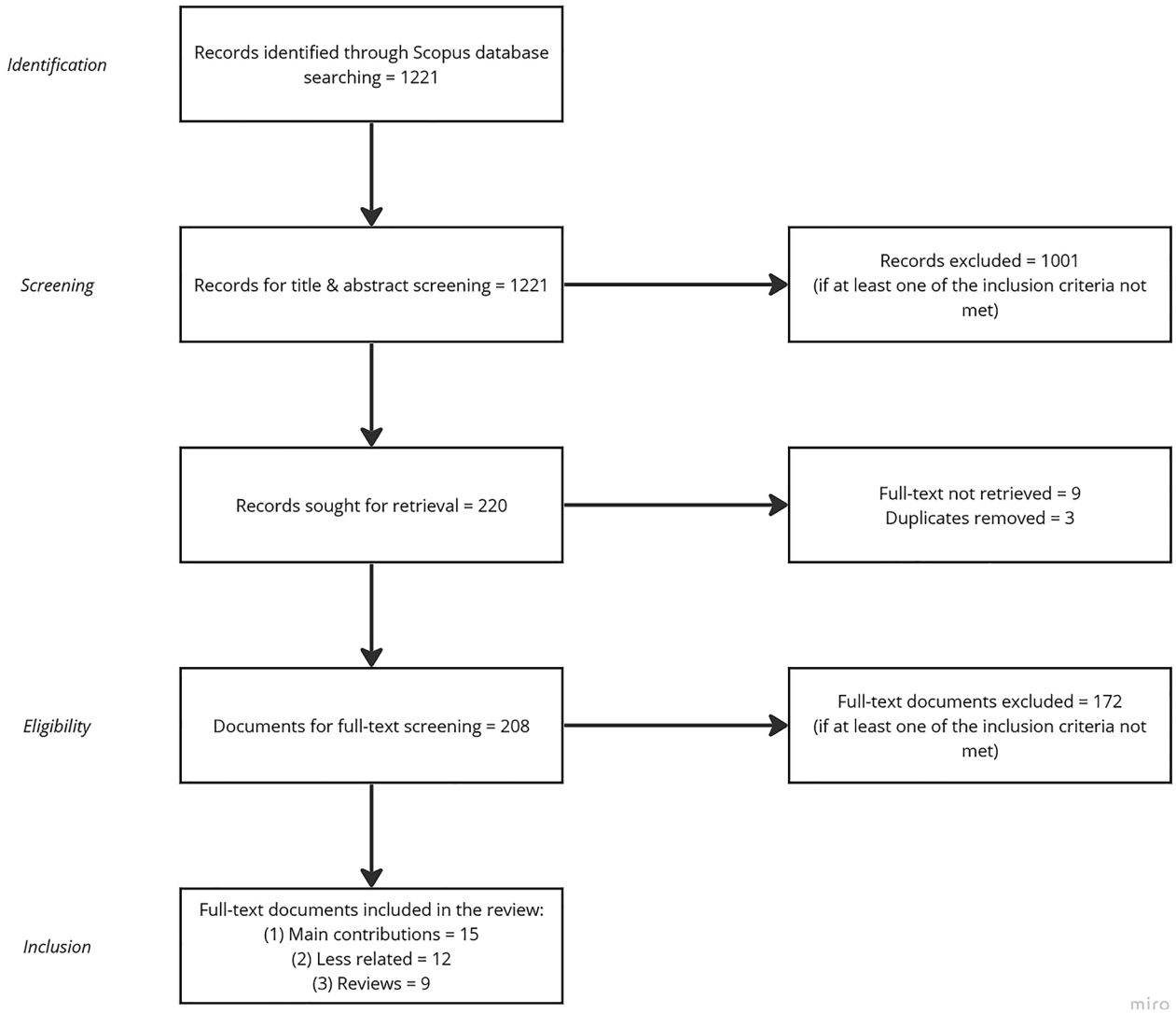

Fig. 1 PRISMA flow chart. Source: own elaboration

explained the relation between GVCs and the labour market, although in the opposite direction (failed to meet condition II), such as analyses on, e.g. labour costs as a determinant for GVCs participation. The one exception for the inclusion criteria was theoretical literature reviews, and they were also included in this review, even if they did not provide any original theoretical contribution. In case of any doubts about whether a record meets the inclusion criteria, it was included at the first screening stage to be further assessed at the full-text analysis stage, as it is recommended for the first screening to be inclusive (Xiao & Watson 2019). For instance, records regarded broadly, e.g. working conditions or economic/social upgrading were also included as these notions may cover issues related to wages or productivity and, therefore, could be relevant.[4] Another example could be empirical works for which it was unclear at the first screening stage whether they may also contain any extension of the theory. On the other hand, records with too narrow focus, including but not limited to, for instance, GVCs' impact on child labour or gender wage inequality, were out of the scope of this review. The first screening of titles and abstracts resulted in 220 records qualified for further consideration.[5]

[4] Murakami and Otsuka (2020) suggest that many studies even use the term "upgrading" (meaning economic upgrading) interchangeably with productivity. Milberg and Winkler (2010, p.251) provide a summary of proxies used in the literature for measuring economic and social upgrading, where wages, employment and productivity appear as examples.

[5] From this point I was using Mendeley Desktop (version 1.19.8) to collect and manage the selection of records.

The next step was screening full-text documents to select those that meet the inclusion criteria. There were a few duplicates and records for which full text could not be retrieved. Finally, 36 reports were selected as relevant to the analysed topic. Among them, 15 were classified as closely related to the topic and providing substantial theoretical contributions (Arndt 1998b; Venables 1999; Jones 2005a, b; Milberg & Winkler 2010; Dluhosch & Hens 2016; Egger & Kreickemeier 2017; Lee & Yi 2018; Li & Liu 2018; Ma et al. 2019; Mitra & Gupta 2020; Schröder 2020; Zi 2020; Cheng & Xiao 2021; Wang et al. 2021b; Cai et al., 2022). The collected studies are summarised in the Table 2. Another 12 were classified as less related or with smaller theoretical input (Kam 2013; Mukherjee 2017; Van Assche & Gangnes 2019; Brakman & Van Marrewijk 2022; Mehta 2022; Gammelgaard et al. 2009; Kühn & Viegelahn 2019; Yülek & Santos 2022; Nathan 2021; Barrientos et al. 2018; Gereffi & Lee 2018; Naqvi & Memon 2018). They are summarised in the Table 3. Lastly, 9 papers with a minimal own theoretical contribution were also included in the SLR, as they deliver reviews on literature connecting GVCs with implications for labour markets (Nathan & Sarkar 2011; Gries et al. 2017, 2018; Ernst 2018; Chor 2019; Franssen 2019; Wang et al. 2021a; Selwyn & Leyden 2022; Drapkin et al. 2022).

3 Results—systematic literature review report

The most general insight from the review is that there are two clear streams of GVCs studies. One stream pertains to strictly economic models, which stand for most of the works described below. The second stream consists of studies referring more to the organisational dimension and governance of GVCs and the social dimension of this phenomenon (like, among others, many works authored by Gereffi). These studies were included in this review to a much less extent, as they usually do not provide systematic evidence on GVCs' impact on wages, employment, and productivity. However, they may place the problem in a relevant context.

3.1 North–South models

Many studies found through this SLR were built as two economies models. Among them there are a few so-called North–South model, where particular assumptions regarding factor endowments on the two economies were included (Arndt 1998a, b; Venables 1999; Jones 2005a, b; Li & Liu 2018; Ma et al. 2019; Van Assche & Gangnes 2019). North is the developed country, described in the model as a high-wage (high wage-rental ratio) and more technology advanced economy, while South is labour abundant, low-wage (low wage-rental ratio) developing economy. Especially among the earliest theoretical works on the analysed topic, the outcomes were analysed mostly from developed countries' perspective (Arndt 1998b; Venables 1999; Jones 2005a, b; Van Assche & Gangnes 2019), for instance, motivated by perceived threats for low-skill workers due to offshoring of low-skill labour intensive parts of production. Therefore, in these models North is the Home country, while South is the Foreign.

3.1.1 Implications for the North

The predictions for wages for developed countries sourcing labour-intensive intermediates from abroad are not unequivocally pessimistic. Many studies found a potential positive response of wages in the North (Arndt 1998b; Venables 1999; Jones 2005a, b; Li & Liu 2018; and for the high-skilled also Van Assche & Gangnes 2019). This effect is due to specialisation in the type of production that ensures comparative advantage and brings costs savings, which under certain assumptions[6] may bring the increase in wages. Such assumptions regard to e.g. which of the production stages in a fragmented industry is more capital- or labour-intensive, what is the level of this intensity compared to the other industry, and how different are the factor endowments (capital vs. labour; or high vs. low-skill labour) between countries (Venables 1999; Jones 2005a, b; Egger & Kreickemeier 2017).

Therefore, the negative wage effect may occur if the offshored tasks were more labour-intensive than other domestic production, but they may still be less labour-intensive than the rest of the production in the destination country, so the advantage of factor endowments of each of the countries was not sufficiently used. The possible decline of wages of workers performing tasks that have been offshored if the relative price of produced good falls due to cost savings from offshoring is presented by Grossman & Rossi-Hansberg (2006, 2008) under the name of relative-price effect. Additionally, Jones (2005a, b) compares the wage effects of international outsourcing to the effects of technical progress: a country's labour-intensive activity improves the country's real wage rate, while technical progress in a capital-intensive activity reduces it. On top of that, the indirect channel of impact on wages (with both signs) may occur because fragmentation of production may change the composition and volume of exports and imports (Venables 1999; Schröder 2020).

The employment effects of labour-intensive production offshoring were studied by e.g. Arndt (1998b) but also in the more recent works (Egger & Kreickemeier 2017; Li & Liu 2018; Ma et al. 2019; Van Assche & Gangnes 2019). Notable similarity of most of the newer models is allowing for greater fragmentation of the production

[6] The main assumptions used in the theoretical models are listed in the summary Tables 2 and 3.

Table 2 Main findings from the systematic literature review

Authors	Year	Impact of	On	References to previous theoretical models	Main characteristics of the theoretical model	Predictions from the model
Arndt	1998b	offshore sourcing	wages, employment	Heckscher-Ohlin (H-0) model; Arndt (1997, 1998a); Jones & Kierzkowski (2001b)	Advanced (high-wage) country perspective, two industries (one capital-intensive, one labour-intensive), two components of production, two factors of production (capital and labour) where labour is homogeneous and perfectly mobile, exogenous prices of goods; offshoring of labour-intensive part of production	When import-competing industries abandon the production of labour-intensive components, wages rise, and employment expands
Venables	1999	production fragmentation	wages	Helpman (1984, 1985); Markusen et al. (1996); Markusen (1997); Feenstra & Hanson (1996a, b, c)	Two economies (Foreign one with low- and Home with a high wage-rental ratio), two factors, and two industries, one of which can fragment into two components	The wage effects of fragmentation depend on the relative factor intensities of different stages of the production process and on the differences in factor endowments between countries. The effects may be either positive or negative for both countries
Jones	2005	international outsourcing	wages	Jones & Kierzkowski (2001)	Two factors of production, three goods produced with a possibility of fragmentation, offshoring of any type of production (labour- or capital-intensive) is considered	The wage effects of international outsourcing depend on the relative factor intensities of the production activities and on countries' factor endowments. The effects are similar to the effects of technical progress and they may be either positive or negative for both countries
Milberg & Winkler	2010	GVCs, offshoring	wages, employment, productivity	(broad literature review)	Narrative approach, asymmetric market power, static and dynamic gains from offshoring, institutional perspective (unions, bargaining)	The markup effect may lower the magnitude of positive productivity and scale effects. Furthermore, the institutional environment moderates the impact of offshoring on labour market outcomes

Table 2 (continued)

Authors	Year	Impact of	On	References to previous theoretical models	Main characteristics of the theoretical model	Predictions from the model
Dluhosch & Hens	2016	offshoring	employment, wages	Jones, Kierzkowski & Lurong (2005); Deardorff (2005); Melitz (2003); Tobal (2012); Grossman & Rossi-Hansberg (2012)	North–North model (same factor proportions), two factors (low- and high-skilled labour), two production sectors (where one fragmented) plus business services (high-skill intense, treated as intermediate inputs)	For the particular case of business services offshoring, the net effect on labour results from three mechanisms: traditional trade (threat to high-skill labour) vs technology impact (beneficial for high-skill labour) and additional productivity-enhancing effect (in favour of high-skilled labour)
Egger & Kreickemeier	2017	international fragmentation, outsourcing	employment	Jones (2000); Jones & Kierzkowski (2001); fair wage concept by Akerlof & Yellen (1990)	Small open economy, two inputs (skilled and unskilled labour), three sectors of production (fragmentation can occur only in the sector with intermediate skill intensity), allowing for labour market imperfections (efficiency wages, involuntary unemployment) and controlling for unemployment benefits	There is a critical value of the endowment ratio above (below) which the increase in international fragmentation decreases (increases) unemployment. In egalitarian economies, international fragmentation is more beneficial (in terms of unemployment level)
Lee & Yi	2018	GVCs	wages (skill premium)	Antràs & de Gortari (2020); de Gortari (2019); Lee (2020)	Multiple countries, multiple sectors (comprised of a continuum of final goods, each produced in a production chain), multiple factors of production (occupations), heterogeneous workers with Roy selection effect	GVC magnifies the effects of trade shocks on aggregate outcomes like wages, acting as an additional propagation mechanism for the Ricardian, Heckscher-Ohlin, and Roy channels, that all together affect skill premium
Li & Liu	2018	offshoring, production fragmentation	wages, productivity, employment	broad literature in three branches: offshoring, industrial cycles, learning-by-doing	North–South model, one good produced using a continuum of tasks which differ in technology requirements, efficiency of conducted tasks depends on the available technology, offshoring costs and routinisation of tasks considered	Offshoring to the South provides an opportunity for improvements through learning by doing, positively impacting productivity, and closing the technological gap. Rising wages diminish the incentive for offshoring. But as the technological capability of the South rises, an opportunity for other tasks to be offshored arises

Table 2 (continued)

Authors	Year	Impact of	On	References to previous theoretical models	Main characteristics of the theoretical model	Predictions from the model
Ma, Liang & Zhang	2019	position in GVCs	employment	Feenstra & Hanson (1996a, b, c); Maskin (2005)	North–South model, single final good assembled with a continuum of intermediate inputs differing in technology content, average skill level of unskilled workers in the North is no less than that of skilled workers in the South, North is the source of innovation (high-tech intense intermediates)	Through international fragmentation, the technology content increases in both countries and so increases the demand for high-skill labour. The closer to one of the ends is the GVC position, the greater the demand for skilled workers
Mitra & Gupta	2020	(international) fragmentation	wages (skill premium)	Marjit et al. (2004)	Small open economy (developing country), four sectors with some mobility of labour and capital allowed between them, international fragmentation possible for selected sectors, the possibility of skill formation, full employment assumption	For the developing country there is a positive relation between higher fragmentation and a lower wage gap
Schröder	2020	offshoring	demand-deficient unemployment	broad literature on models in the spirit of Keynes-Kalecki	Demand-constrained small-open-economy model, offshoring treated as labour-saving import-using technical change, constant sales prices case vs constant markups case considered	The net effect of offshoring on employment with the assumption of constant markups depends on the price elasticity of export demand, which needs to be sufficiently high for a positive change in employment to occur. If firms raise markups, employment drops
Zi	2020	GVCs	wage, wage inequality	Costinot et al. (2013)	North and (many) South(s), one factor of production – labour, one final good, iceberg trade costs, a traditional and fragmented way of production, where fragmented involves a continuum of sequential stages, the possibility of industrialisation in the South, snake vs spider GVC configuration considered	The effect on wages and the wage gap between North and South depends on the South's characteristics regarding the level of industrialisation, productivity levels, and potential technology spillovers

Table 2 (continued)

Authors	Year	Impact of	On	References to previous theoretical models	Main characteristics of the theoretical model	Predictions from the model
Cheng & Xiao	2021	GVCs	productivity	Francois (1990); Romer (1990); Young (2014)	One-sector economy, one production factor (labour), many product varieties, many technologies, where higher technology means higher fragmentation (higher specialisation)	Productivity of final production grows with the growth of producer services forced by GVC expansion
Wang, Thangavelu & Lin	2021b	GVCs (importing intermediates for the production of exports)	wages (skill premium)	Melitz (2003); Amiti & Davis (2011); Chen et al. (2017); Egger & Kreickemeier (2009); Akerlof & Yellen (1990)	Multiple countries with identical factor endowments (low- and high-skill labour), many firms facing different uncertainties of production, fair wage hypothesis for high-skill labour, minimum wages for low-skilled, GVC participation and GVC position considered (linear perspective for upgrading, i.e. moving upstream)	The profit effect of GVC increases wage premium (by the increase of high-skill wage). Additionally, substitution or complementarity effect may make the overall result ambiguous. The shift to more upstream sectors increases the wage premium
Cai, Zhang, Wang & Liu	2023	GVCs position	wages (skill premium)	Daudey & García-Peñalosa (2008)	Open economy of many countries, developing country perspective (low-skill- and capital-abundant), three factors of production (low-skill and high-skill labour, capital), production takes place in a continuum of stages, stages may be ordered by their value-added (VA) contribution: higher VA means a higher GVC position (upgrading)	Upgrading the GVCs position will increase the labour share in total output and also widen the wage gap between skilled and unskilled

Source: own elaboration

Table 3 Less related studies

Authors	Year	Impact of	On	References to previous theoretical models	Main characteristics of the theoretical model	Predictions from the model
Kam	2013	international production fragmentation	productivity	Grossman & Helpman (GH) (1992)	An extension of the GH model and its implications to the case when intermediate goods are traded between countries	The positive impact of international production fragmentation on productivity may be explained by: a) the FDI channel, or b) the international trade channel
Mukherjee	2017	trade in intermediate inputs	wages, employment	(broad reference)	Small open economy (developing country) with four sectors of various characteristics and different factors of production	Direct and indirect effects (for instance, observed in other sectors), e.g. dependent on the elasticity of substitution between skilled labour and capital
Van Assche & Gangnes	2019	GVCs, offshoring	employment, wages	Melitz (2003)	North–South model, developed country perspective, a continuum of firms with different productivities, headquarters services (only North) and manufacturing (upon offshoring)	The North perspective of low-skill manufacturing offshoring: negative for low-skill, positive for high-skill. Trade is beneficial with good policies helping to distribute the gains
Brakman & Van Marrewijk	2022	international production fragmentation	employment	Kremer (1993)	Many countries differing in technologies, sequential production consisting of a continuum of tasks, completion of a task requires a finite number of occupations (e.g. characterised by skills), case of costly fragmentation vs zero-cost fragmentation	With increasing international fragmentation, demand for certain occupations does not fall to zero for any country
Mehta	2022	GVCs, backward linkages, forward linkages	productivity (upgrading)	(broad reference)	It distinguishes the GVC involvement through backward- and forward linkages in the process of upgrading (i.e. moving to higher productivity and value-added positions)	Learning opportunities and technology spillovers stemming from GVCs participation are crucial in improving productivity and GVCs position
Gammelgaard, McDonald, Tüselmann, Dörrenbächer & Stephan	2009	international value-chains	employment (share of skilled labour)	Birkinshaw &Morrison (1995)	Subsidiary firms in GVC differ in the levels of autonomy and intra-organisational relationships (division into local implementers, specialised contributors, and world mandates)	Different roles taken by the subsidiary companies participating in GVCs may lead to different shifts in the proportions of employment of workers with particular skill level

Table 3 (continued)

Authors	Year	Impact of	On	References to previous theoretical models	Main characteristics of the theoretical model	Predictions from the model
Kühn & Viegelahn	2019	trade costs shock in global supply chains	employment (manufacturing, services)	Uy et al. (2013); Obstfeld & Rogoff (2000); Corsetti & Pesenti (2001)	Two countries, two sectors: manufacturing vs (tradable) services	Reduction in trade barriers leads to job creation in the targeted sector and weakly also in the other sector. The cross-effect is weaker when it stems from decreased barriers to trade in services (compared to manufacturing)
Yülek & Santos	2022	GVCs (position)	productivity	(broad reference)	Based on the smile curve concept of unequal value-added distribution along the production chain, asymmetric market power	High market power of leading firms may keep developing countries in low productivity and wages trap (increasing gap between economies illustrated by the deepening smile curve). The developing economy needs to enhance its technological capabilities to not stuck in a low value-added position in GVCs
Nathan	2021	GVCs	labour market	(broad reference)	Introduction of three different levels of monopsony power of lead firms on GVC	Monopsony power level corresponds to particular skill employment, pay levels, and working conditions
Barrientos, Gereffi & Rossi	2018	GPNs	economic and social upgrading (including wage level)	(broad reference)	Introduction of typology of workforce composition (required skills, knowledge and technology intensity, (in) formality, etc.)	Social upgrading is not always guaranteed by economic upgrading. Different types of economic upgrading may be related to different shifts in demand for different skills. Typology of work matters in achieving social upgrading in GVCs
Gereffi & Lee	2018	GVCs	economic and social upgrading	Puppim de Oliveira's (2008)	Types of governance of GVC, asymmetric market power, institutional environment (unions, policies)	Type of governance matters in achieving social upgrading in GVCs
Naqvi & Memon	2018	GPNs	upgrading	(broad reference)	A bridge between GPN theory and theory of innovations systems and industrial clusters	Knowledge links between GPNs and innovation systems create opportunities for upgrading

Source: own elaboration

process than in the older specifications, to reflect the growing complexity of the real trade in intermediates. It may be represented in the model by continuum of differing in technology content intermediate inputs (as in Ma et la., 2019) or tasks (as in the seminal works by Grossman & Rossi-Hansberg 2006, 2008, reviewed in Milberg & Winkler 2010; or in Li & Liu 2018, accounting for tasks' routinisation[7]), or by continuum of firms with different productivities (as in the model by Van Assche & Gangnes 2019, inspired by Melitz 2003 and enriched by the possibility of intermediate trade). One of the possible scenarios is that cost savings will make industry expansion possible, and this may lead to the rise of employment (Arndt (1998b). The most straightforward prediction is, however, that North will suffer from job loss in the offshored (low-skill) tasks (Li & Liu 2018; Van Assche & Gangnes 2019) and may also suffer from lowering the corresponding wages (Grossman & Rossi-Hansberg 2006, 2008). Van Assche and Gangnes (2019) and Ma et al. (2019) also illustrate the opposite effect for high-skilled labour. Demand for high skills will rise in the North since the offshored stages were relatively low technology intense for this country. Similarly, as when analysing wages, the sign of international fragmentation on employment level depends on relative factor endowment ratios (Egger & Kreickemeier 2017).

Considering the three labour market outcomes discussed here, productivity seems to be the least elaborated in the literature analysing the GVCs impact. The productivity effect coming from the simple fact that less productive tasks are offshored and thus the aggregate productivity rises is mostly known from Grossman and Rossi-Hansberg (2008). This effect is greater with a greater volume of intermediate trade and can be compared to an increase in low-skill labour productivity. Therefore, it may have an indirect positive effect on low-skill wages. At the same time, it may reduce labour demand (Amiti & Wei 2009), but if the sector expands due to productivity increase, the demand for low skills may also rise, which is not an obvious result at first glance. This mechanism is sometimes distinguished under a separate name of scale effect (Amiti & Wei 2009; Milberg & Winkler 2010). The scale effect indirectly impacts employment demand positively: lower intermediate prices due to offshoring lead to lower output prices, which boosts demand for final goods and, further, raises labour demand. The productivity effect is a notable example of how GVCs may affect simultaneously all three labour market outcomes (productivity, wages, employment) through number of direct and indirect channels.

[7] For a detailed discussion on definitions of skills, tasks, and their dimensions like routine, offshorability, etc. see Autor (2013).

3.1.2 Implications for the South

Despite the main focus on developed countries' response to international production fragmentation, some implication for the South can also be found in the North–South models. Part of the mechanisms work in the same way as in the case of North. The example of a positive response in wages in South is presented by Venables (1999) if the offshored production is still more labour-intensive than the rest of the production in the labour-abundant South and the comparative advantage is at play. Similarly, change in the composition of exports and imports may indirectly impacts wages in the South either positively or negatively. It is worth to mention that e.g. positive effect in one country does not need to mean a negative one in the other country. The effects with same sign may simultaneously appear in both economies participating in GVCs (Ma et al. 2019; Venables 1999; Jones 2005a, b).

A few works included in this SLR are particularly dedicated to the analysis of GVCs involvement consequences for a developing country (Li & Liu 2018; Mitra & Gupta 2020; Kam 2013; Mukherjee 2017). Certainly, the thing all these studies (and also Ma et al. 2019; Zi 2020 in extension to multiple Souths) have in common is that they all emphasise the importance of technology content in internationally produced inputs and its positive impact for the South. As more technologically advanced, the North is assumed to be a source of innovation, namely the new high-technology intense intermediate inputs. The parts of production offshored from the North to the South meet or slightly exceed the technological possibilities of the South. Especially those parts which create a technological gap, open for the South the opportunities for improvements through learning by doing, positively impacting productivity and wages. The stages offshored are relatively advanced in technology for the South. Therefore, it will boost demand for high skilled workforce in the South (also referred to as complementarity effect of technology advance and high skills). Either through direct or indirect channels, the befits are expected for all three: wages, productivity, and employment.

Kam (2013) further splits the positive impact on productivity, drawing from the Grossman and Helpman (1992) and the same two channels defined by them for the case of trade in final goods. The first one is called the foreign direct investment (FDI) channel, and it is explained by knowledge spillovers, linkages creation, and greater competition of local suppliers. The second one is called the international trade channel, and it is related to simple comparative advantage gains through specialisation, learning through importing/exporting, greater variety and quality of inputs, and increased competition that forces higher efficiency or else makes unproductive firms leave the market. It is easy to imagine, that these effects

(to greater or lesser extent) are not limited only to the developing economies, but all participants of the GVC (also the developed countries).

There are also far-reaching consequences of GVCs participation for the South predicted by these models, yet with different conclusions. The learning process, as pointed by Li and Liu (2018), eliminates the technological gap in time; the rising wages diminish the incentive for offshoring. The entire process slows down. However, as the technological capability of the South shifts upward, an opportunity for other tasks to be offshored arises, and the cycle may start again. These results accord with those obtained by Zi (2020) in multiple countries model (see Sect. 3.3). A partially contradictive results to the above are presented by Mitra and Gupta (2020) in their model allowing for skill formation. The authors discover a feedback mechanism between higher fragmentation and wage gap between high- and low-skilled workers in the South: fragmentation lowers the wage gap, but a lower wage gap lowers incentives for skill upgrading. This mechanism maintains unskilled labour endowment that is a driving force for fragmentation.

3.2 Other models of two economies

Another branch of two economies models, much less numerous, are models assuming intermediate trade between similar (or same) countries. Depending on the case, they may be explicitly North–North or South-South models. What is characteristic about this branch is that is much more recent and often tackles the problem of services offshoring. It addresses the need for appropriate theories in the presence of growing intermediate services trade.

One of the examples here is the work by Dluhosch and Hens (2016) and their model of the North–North trade. As mentioned by the authors, it is like Grossman and Rossi-Hansberg (2012) as the countries are assumed to be identical in factors proportions. Grossman and Rossi-Hansberg (2012) show that if they are also identical in size, the impact of offshoring on wages is ambiguous, with possible advantages for either of them or equal wages in both. When the two countries differ in size, the workers in the larger one will enjoy higher wages due to offshoring. The North–North perspective is relevant since it reflects the real data on business services offshoring, which is the focus of Dluhosch and Hens (2016). Business services are assumed high-skill intense and treated as intermediate inputs. The increased offshoring in this sector may be driven by advances in information and communication technologies (ICT) or by widening trade integration. Dluhosch and Hens (2016) argue that the effects on employment and wages of either of these channels are different. The net outcome may be ambiguous and determined rather by the prevailing channel and not simply by the amount of services offshored. While trade integration is perceived as a threat to high-skilled workers, and advances in ICT should benefit skilled labour, a third mechanism is also at play that is specific to the analysed case. It is the additional productivity-enhancing effect as business services help to manage a more fragmented production chain and thus to benefit more from a finer division of labour. Comparable results for productivity were delivered by Cheng and Xiao (2021) who covered even broader range of producer services in their study, including sectors like e.g. transportation or post and telecommunication. Productivity of final production grows with the growth of producer services (measured in terms of labour employed), which was forced by associated with GVCs expansion demand for services helping to coordinate multiple production stages.

3.3 Models of multiple countries: the structure of GVC

Several works included in this review propose an extension of the model to the case of multiple countries. Here one can find analyses of wages in terms of skill premium and inequality (Wang et al. 2021b; Lee & Yi 2018; Zi 2020) or employment demand (Brakman & Van Marrewijk 2022; Lee & Yi 2018). Except Wang et al. (2021b), who puts the focus on heterogeneous firms, all these studies assume countries differing in technologies. Lee and Yi (2018) additionally take the perspective of heterogeneous workers. Models of multiple countries are another way to address the complexity of GVCs (next to the continuum of tasks/inputs considered in the models presented in Sect. 3.1.1).

Additionally, this approach often implies assuming a particular structure of the production process, in the simplest case the sequential one (Brakman & Van Marrewijk 2022; Zi 2020; Lee & Yi 2018). Production on a given stage (in a given country) takes the production of a previous stage (previous country) as an intermediate input, accounting for the value chain structure. Another consequence of extending the model to many participants is implying some rules of entry for the new ones. While Lee and Yi (2018) model describes this process in more general terms, Zi (2020) operates on the setting with one North (initially, the only one capable of fragmentation) and many Souths (who may join fragmentation but only from the upstream end due to lower entry costs). In the case of incomplete industrialisation (a part of South labour is still employed in traditional production), wages in the South may not rise to sustain incentives for offshoring. The mechanism here is like the one obtained in North–South model by Li and Liu (2018). At the same time, the North benefits from international

fragmentation, particularly in terms of wage rise, and so wage inequality between North and South increases. When the South reaches full industrialisation, it starts to benefit in terms of wages due to a process similar to labour-augmenting technological progress. Learning-by-doing mechanism will eventually cause changes in technologies of the Souths who participated in GPNs: earlier participants will be of respectively higher productivities (yet, always below North productivity). There is a space for new Souths to join, what implies a "snake" configuration of GPNs.

Exception to the sequential structure setting is presented by Zi (2020). If one assumes that all Souths share the same technology, then the global production may form a "spider" configuration (also called "hub-and-spoke") with headquarters in the North. In this case, the whole group of South countries may be treated as one economy, so the implications from the two-countries model apply. Moreover, a new South country joining the GPNs worsens the wages for earlier participants, as this situation is equivalent to if the labour supply of the South increased. The wages increase only after all participating South countries are completely industrialised (as in the simple model).

The main conclusions stemming from the multi-country approach is that GVCs magnify the effects of trade shocks on aggregate outcomes like wages due to the higher connectedness and dependence of production stages internationally. Therefore, the intensity of sectoral GVCs participation is crucial in determining the shifts in labour demand and wages across sectors and production stages (Lee & Yi 2018).

In the presence of concerns that progressing specialisation and international division of tasks may wipe out certain occupations from certain countries, Brakman and Van Marrewijk (2022) tests this possibility. In their model, production is performed sequentially in a continuum of tasks, and each task requires input from a specific subset of occupations (with more detailed classification possible than just high- and low-skill division). They show constraints on minimal and maximal demand for each occupation in a given country. Therefore, the concern mentioned above is groundless.

3.4 Position in GVC

The problem of structure and configuration of GPNs brings the discussion closer to the question about position taken in the production process by a country/sector/firm. Theoretical, as much as empirical studies, most often capture GVC in terms of intensity of involvement and rarely focus on the position in GVCs. This SLR finds a few exceptions. The most important division here is whether the theory adopts linear (Zi 2020; Wang et al. 2021b) or non-linear perspective on the distribution of value added and, consequently, gains/losses along the production chain.

Some hints about the importance of GVC position for productivity were already mentioned in the above section when referring to Zi (2020) model: moving from upstream (far from final demand) to downstream (close to final demand) stages meant an increase in productivity. Hence, this work was among those adopting linear perspective on what it means to improve one's position (i.e. to move downstream) and where the more productive and profitable production stages lie (i.e. on one of the ends of the production chain, here: downstream). Interestingly, Wang et al. (2021b) describes moving upstream (not downstream) as improving the firm's position and shifting to production tasks of higher productivity. The difference between these approaches is driven by the definition of costs. Regardless the assumption about the costs, the linear perspective presented in these studies contradicts the alternative one: the smile curve concept.

Accordingly to the smile curve concept by Shih (1996) the more technology-intense, higher value-added production stages (like, e.g. R&D, design, marketing) are placed at the ends of the value chains, while less sophisticated stages (like, e.g. assembly) are those in the middle of the production chain. Other words, the distribution of value added along the chain takes the shape of a smile. Hence, higher GVCs position (higher value added) would be close either to upstream or downstream end. Most of the studies considering GVC position included in this review allow for such specification (Cai et al. 2023; Mehta 2022) or explicitly assume it (Ma et al. 2019; Yülek & Santos 2022).

Once again, the importance of enhancing the technological capabilities and a good utilisation of the learning opportunities and technology spillovers offered by GVC participation is argued to be crucial on the way from an initially low position in GVCs (with a low productivity level) to achieving higher position and productivity (Mehta 2022; Yülek & Santos 2022). In this matter, the possible hardship for developing countries to obtain greater gains from participation in GVCs may stem from the power distribution among firms and countries in the GVC, as noted by Yülek and Santos (2022). Leading firms and countries are usually located at the most value-added generating production stages (high ends of the smile curve). Developing countries, on the contrary, may be stuck performing production parts at the bottom of the smile curve where little value added is generated. It may lead to low productivity and wages trap for developing countries and an increasing gap between advanced and emerging economies, which is illustrated by the

deepening smile curve (greater difference between high ends and the middle of the chain).

The GVCs position and its implications for low- and high skilled labour was studied by Cai et al. (2023) in terms of wage gap in the developing economy, and by Ma et al., (2019) in terms of demand for skills in both developed and developing countries. These theories suggest that upgrading GVC position (other words: mowing closer to one of the ends the GVC) will increase the demand for skilled workers and widen the wage gap between skilled and unskilled.

3.5 Upgrading

Partially related studies are also those tackling the phenomenon of economic and social upgrading in relation to GPNs. This matter is most often discussed with a focus on developing countries. Economic upgrading, regarding GPNs, may be defined[8] as "a move to higher value-added activities in production, to improve technology, knowledge and skills, and to increase the benefits or profits deriving from participation in GPNs" (Barrientos et al. 2018, p. 232). Therefore, this branch of studies naturally connects to those incorporating the dimension of a position in GPN to the analysis of labour market outcomes, described in the previous section. However, in a broad meaning of upgrading covers many different and quite specific aspects of improvement, and hence it deserves a separate discussion.

In the literature one may find four types of economic upgrading: process upgrading, product upgrading, functional upgrading, and chain upgrading. Barrientos et al. (2018) point out that each may bring different implications for workers. For instance, process upgrading means increased efficiency of the production process due to, e.g. automation, which may reduce the demand for some types of workers. The general conclusion in this matter would be that any type of upgrading may be related to some shifts in demand for different skills. Therefore, changes in employment and productivity are embodied in the analysis of economic upgrading in GPNs. Social upgrading refers to "improvement in the rights and entitlements of workers as social actors, which enhances the quality of their employment" (Barrientos et al. 2018, p. 233). One of the measurable standards of social upgrading is wage level, which also makes social upgrading a relevant topic for this literature review. There is an expected pass-through from economic to social upgrading. However, many sources (e.g. Milberg & Winkler 2010; Barrientos et al. 2018) argue that economic upgrading does not necessarily lead to social upgrading. Again, the relevance of a more or less advantageous position in GPNs appears as one of the influencing factors. Based on the typology of work performed (characterised by required skills, knowledge and technology intensity, (in) formality, etc.), Barrientos et al. (2018) sketch different upgrading paths. For instance, if economic upgrading relies on high quality (of product, but also production standards) and rising productivity, it may lead to a rise in workers' wages (social upgrading). Social downgrading is possible if, e.g., competitiveness is achieved through cutting costs with simultaneous harm to working conditions (including wage level).

Other studies contributing to the understanding of connection between GVCs and upgrading emphasise the role of other factors shaping the final effect. The factor that stands out the most in the literature is about the great role of technology spillovers, often generated together by the GPNs participation and the local innovation systems, in supporting the upgrading in GPNs in developing countries (Gereffi & Lee 2018; Naqvi & Memon 2018; Mehta 2022). GPNs and knowledge networks mutually reinforce the learning potential leading to upgrading and potentially positive labour market outcomes. Among other factors one may found the power of the leading firms to shape the relations within the company, in the production network, and with other actors like e.g. unions and policy makers (Gereffi & Lee 2018).

3.6 Cross-sectoral effects

An important lesson drawn from this review regards to the GVCs effects on labour market appearing between sectors or workers' groups, and not only in the sector directly participating in GVC or in a group directly targeted by it. The cross-sectional effects are discussed mostly in the context of job destruction and creation (Arndt 1998b; Jones 2005a, b; Van Assche & Gangnes 2019; Mukherjee 2017; Kühn & Viegelahn 2019), much less often in the context of wages (Mukherjee 2017).

Arndt (1998b) points out that, except the loss of jobs in production that now is offshored, the overall change in employment will consist of new jobs created in the assembly of the imported components as well as in other industries not directly involved in offshoring. Similarly, Jones (2005a, b) emphasises that in a world open for cross-border production sharing, international outsourcing in one industry may occur simultaneously with 'insourcing' in another one. Therefore, job destruction may be balanced with job creation. Here labour mobility between industries is a principal issue for the overall employment effect to be positive. Trade liberalisation will be fully beneficial if critical role of the state and policies will be fulfilled in helping the displaced workers to adjust and assuring that the losses will not exceed the gains in

[8] For a review of economic and social upgrading definitions and types, see, e.g. Salido and Bellhouse (2016).

the aggregate terms (Van Assche & Gangnes 2019). The cross-effect of intermediate trade on wages is also of an ambiguous sign, as proved by Mukherjee (2017). The indirect effects spread to other sectors and transmitted through the demand–supply forces regarding produced goods depend e.g. on the elasticity of substitution between skilled labour and capital.

The amplitude of such cross-sectoral effect is most thoroughly investigated in the work by Kühn and Viegelahn (2019) who consider two sectors: manufacturing and private services (as public services are said to be less tradable, if tradable at all). Reduction in trade barriers to exports from a given sector (manufacturing or services) leads to job creation in that sector, and through so-called cross-effect also (but to less extent) in the other sector that is assumed to be input supplier. Additionally, the cross-effect that is a response to trade cost reduction directly regarding services is weaker than the cross-effect caused by similar shock directly targeting manufacturing. Therefore, this work, similarly to e.g. Lee and Yi (2018), emphasises that when production is organised in GVCs, any shock, e.g. trade cost shock impacts not only the targeted country-sector but also other GVCs' participants. Through the particular examination of cross dependencies between manufacturing and private services it contributes also to the literature on servicification of manufacturing, namely the significant share of inputs to manufacturing production being the intermediate services, which is a growing phenomenon now (Cheng & Xiao 2021).

3.7 Governance of the GVCs

The distribution of power between several participants of a production network is crucial for determination of the character of so-called profit effect or markup effect (Milberg &Winkler, 2010; Gereffi & Lee 2018; Schröder 2020; Nathan 2021; Wang et al. (2021b); This concept uses the perspective of lead firms in GVCs and considers their business strategies, referring to the vast literature on GVCs' organisation and governance (see, e.g. Gereffi et al. 2018). It builds a bridge between the strictly economic branch of theory and the problem of successful GVC governance. The profit (or markup) effect is defined as raising markups over costs by the leading firms in the chain, not by raising product prices but through control of input costs. Further, the leading firms decide what share of the higher profits will be reinvested (leading to increase in employment or further productivity improvements), shared with the workers through increase in wages or, for instance, turn into shareholder returns, which may significantly lower the magnitude of positive productivity and scale effects.

The profit effect is perceived the one disturbing or enhancing other channels of GVCs integration impact: the productivity and scale effects (according to Milberg &Winkler, 2010), substitution and complementarity (in the sense of, e.g., complementarity between technology and skills) effect (according to Wang et al. 2021b), scale effect decomposed into the expenditure effect (domestic demand-induced) and competitiveness effect (foreign demand-induced) on employment (according to Schröder 2020). Most of these channels of impact were discussed in detail in the previous sections, only the two latter ones deserve a brief explanation. If the firms completely absorb the advantage of cost saving, except the negative productivity effect (in other words, technological unemployment), a negative case of expenditure effect is in action: reduced domestic labour income leads to a deficiency in domestic demand, further generating unemployment. The second scenario is when markups are held constant, meaning that gains from cost savings are entirely transferred into the lower price of good. Here additionally appears a positive competitiveness effect since lower price stimulates exports. The rise of foreign demand may overcome the domestic demand inefficiency by switching the sign of expenditure effect to positive if exports-led production improves domestic incomes, and consequently also domestic demand. However, the sign of the overall effect resulting from the opposing forces is ambiguous.

The abovementioned studies differ in the frameworks used to describe the GVC participants regarding their roles in the GVC. The asymmetry of value capture and its uneven consequences for developed and developing countries are discussed by Nathan (2021) from the perspective of GVCs as a form of monopsony market of lead firms having the power to shape the wages and prices of inputs. They deliver a classification of monopsony power levels related to particular skill employment, pay levels and working conditions. Gereffi and Lee (2018) propose different scenarios on profits and gains distribution in GPNs from the perspective of types of governance (Gereffi et al. 2018) and accounting for the lead firms' impact. Wang et al. (2021b) connect the GVC position with the firm's role. Improving the position (by moving to one where more value-added is generated) is costly, only relatively more profitable firms will achieve it, and those are the firms paying higher wage premium (by the profit effect).

In the topic of power distribution in GVCs there is also a work by Gammelgaard et al. (2009) who proposes a classification of three types of subsidiaries, according to their strategic role in GVCs: local implementers, specialised contributors, and world mandates. Local implementers are expected to have the lowest proportion of

skilled labour of all three, as they have the lowest autonomy and least complex linkages with other organisational units. Specialised contributors are much more involved in intra-organisational relationships. Therefore, they need a higher share of skilled labour to manage it. On the other hand, world mandates will also hire a relatively high share of skilled labour since this kind of subsidiary is characterised by higher autonomy, corresponding to, e.g. innovative activities. Summarising, specific roles taken by the subsidiary companies participating in GVCs may lead to different shifts in the proportions of employment of workers with particular skill levels.

3.8 Environment of the GVC

Finally, there are institutional, societal, and environmental factors shaping the relation between GVCs and labour market outcomes, or even explaining some new channels of GVCs' impact. According to Milberg and Winkler (2010) workers only anticipating the possible negative consequences of offshoring may lower their wage demands, which the authors call the threat effect. Other effects may also be moderated through an institutional environment. Therefore, considering factors like union density and power or types of bargaining coordination may be relevant in assessing the response to offshoring. Especially bargaining appears to be relevant in shaping the profit effect (Wang et al. 2021b), while the role of state and policies is of utmost importance for the cross-effect to be positive in the aggregate terms, thanks to effective mobility and adjustment of displaced workers (Van Assche & Gangnes 2019).

The role of institutional environment like regional- and national innovation systems in supporting the upgrading in GPNs in developing countries is emphasised by Naqvi and Memon (2018). GPNs and knowledge networks mutually reinforce the learning potential leading to upgrading and potentially positive labour market outcomes (Naqvi & Memon 2018; Mehta 2022).

The societal aspect is addressed by Egger and Kreickemeier (2017) or Wang et al., (2021a, b) who employ in their models the concept of efficiency wages, according to the fair wage theory by Akerlof and Yellen (1990). The critical value of the endowment ratio determining the sign of GVCs impact on employment may differ for economies differing in preferences towards the fairness of wages, with international fragmentation being more beneficial in the egalitarian economy. Egger and Kreickemeier (2017) also includes the level of unemployment benefits in the analysis, emphasising the role of labour policies in assessing the international fragmentation impact.

3.9 Conclusions from the review papers

While conducting the SLR, there were several papers identified with a lack or very limited own theoretical contribution but which deliver reviews on literature connecting GVC with implications for labour markets (Nathan & Sarkar 2011; Gries et al. 2017, 2018; Ernst 2018; Chor 2019; Franssen 2019; Wang et al. 2021a; Selwyn & Leyden 2022; Drapkin et al. 2022). One of the most insightful among them is the article by Franssen (2019) who, first, provides a systematic summary of findings regarding the demand for low-skill labour stemming from the early North–South models (up to the seminal paper by Grossman and Rossi-Hansberg 2008). Further, he lists the main channels of GVCs' impact on relative demand for skilled workers. Finally, he proposes a geometrical synthesis of the previous developments, illustrating several channels of offshoring impact on labour market outcomes (for instance, the three main channels separated by Grossman and Rossi-Hansberg 2008). The study by Chor (2019) provides an overview of models linking micro-level decisions of firms involved in international fragmentation with macro-level outcomes related to the labour market, inequality, and welfare (among others).

Just to comment on a few other studies, for instance, in Gries et al. (2017), one may find a review of, among others, the possible channels of how international value networks impact productivity in developed countries. This work is followed by a similar one focused on the same topic but from the perspective of developing economies (Gries et al. 2018). Ernst (2018), based on previous literature development, describes four scenarios of how integration in GPNs may bring productivity-enhancing innovations. Wang et al. (2021a) trace back theories explaining wage inequality between different skills, also including a branch of international trade theory. Selwyn and Leyden (2022) confront several trade theories with GVCs' reality. Among some additional subjects not raised in the works described in detail in previous sections, one could also mention: wage rise due to consumers demanding higher labour standards (Nathan & Sarkar 2011) or higher quality products (Wang et al. 2021a); jobs creation for those who so far only worked in the informal sector (e.g. higher woman participation in the labour market) (Nathan & Sarkar 2011); distribution of gains due to whether it is a buyer- or supplier-driven GVCs (Gries et al. 2018; Nathan & Sarkar 2011); wage inequality between firms (Wang et al. 2021a); smile-shaped total factor productivity curve of GVCs' firms (Drapkin et al. 2022).

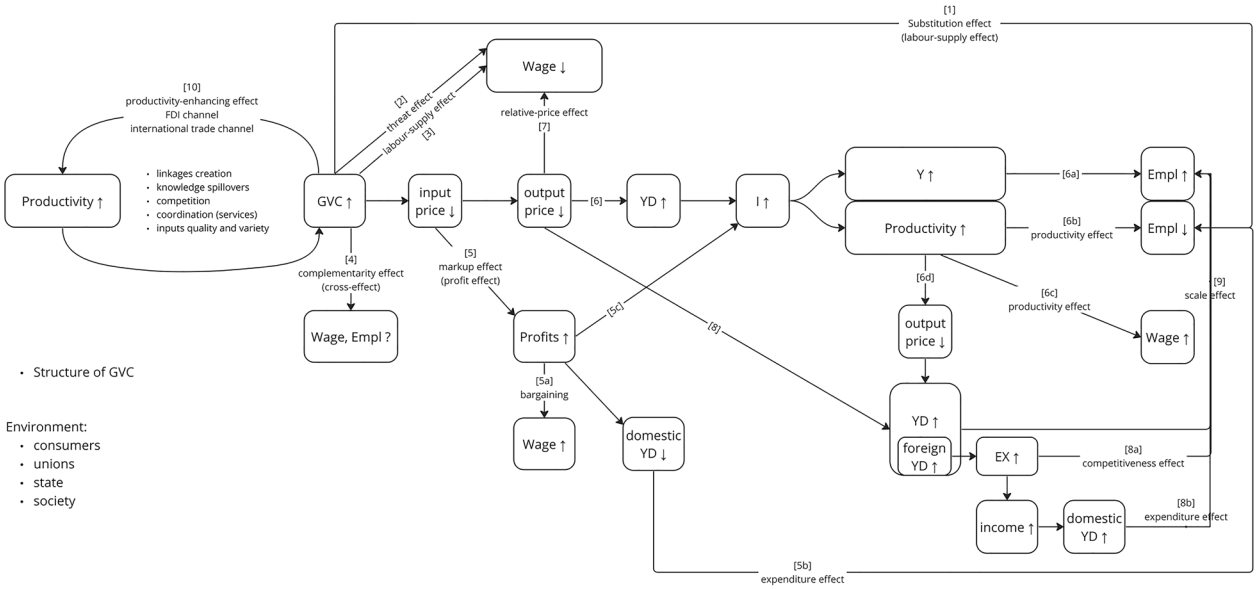

Fig. 2 Summary of possible channels of GVCs participation impact on wages, employment, and productivity. . For brevity, the graph does not specify the details and assumptions of theoretical models from which the presented channels of impact come from. For more details, please see Table 2 and 3 Source: own elaboration. *GVC*—GVC participation, *Y*—output, *YD*—demand for output, *I*—investment, *Empl*—demand for labour, *EX*—exports

4 Summary of the results and discussion

To summarise the results of this SLR, I propose a figure built in a similar manner as a graph provided by Milberg and Winkler (2010) where the authors presented four mechanisms affecting labour demand. Here, in Fig. 2 I present the main channels identified by this SLR showing the possible impact of GVCs participation on wages, employment demand, and productivity. For brevity, the details and assumption of the source models are not presented in the graph, but they can be found in the previous tables.

The most straightforward consequence of GVCs participation is the substitution effect (marked as [1] in Fig. 2) of lower demand for the workers who are now replaced by offshoring. Only because the possible threat of losing their jobs they may be willing to accept lower wages (threat effect) [2] but if one sees the international integration similar to additional supply of particular type of labour, then it may also bring their wages down (labour-supply effect [3]). Since the replaced skills and the imported inputs may be complementary to some other skills and products, by the complementarity effect (also called cross-effect [4]) other sectors may face jobs creation/loss and changes in wages, moderating or enhancing the direct effects of GVCs on the level of whole economy.

The main motivation for GVCs engagement is to seek cheaper inputs. It depends on market structure and chain structure whether lower input price will transfer into lower output price or to higher profits, enabling the profit- (or markup-) effect [5]. In the presence of sufficient bargaining power some of the profits may go to workers and bring a wage rise [5a]. If the extra profits turn to investment [5c], higher output will create higher demand for labour [6a], but on the other hand, increase in productivity will bring the labour demand down through productivity effect [6b]. The productivity effect, although may be positive for wages [6c]. If the extra profits [5] are not shared with workers, this together with other negative GVCs' consequences will reduce domestic income and create deficiency in domestic demand, deepening the negative effect on employment through the negative expenditure-effect [5b].

The other scenario is when the output price goes down. The negative relative-price on wages [7] is a mechanism like the Stolper-Samuelson effect. Lower output price will boost the demand for output, raising the investment, and further also output and productivity, leading to the known employment effects with opposite signs [6a,6b]. The increased demand for the output (stemming either from the initial drop of output prices [8] or from the secondary drop imposed by the further productivity improvements [6d]) may also come from abroad, increasing production for exports (competitiveness effect [8a]). Higher exports repair domestic incomes, and further also domestic demand, enabling a positive expenditure effect

[8b]. These two positive employment effects are components of scale-effect on employment [9].

There is also a group of positive direct effects of GVCs on productivity [10]. They are related to the challenges and opportunities offered by GVCs participation like increased competition, access to higher quality and variety of inputs, technology embedded in them, knowledge spillovers, linkages creation and cooperation, and many more. The important feature of these channels is the feedback they bring, as further GVCs involvement becomes easier when e.g. some linkages are already created, or coordination services are already employed to manage the international production. It is important to mention that most of these mechanisms are at play regardless of the situation we consider (North vs South perspective, which tasks are traded, etc.).

All these potential scenarios presented in the Fig. 2 happen in a particular environment. The review shows that external actors and institutions may also shape labour market response to GVCs. One could list the state (and various policies, like e.g. employment benefits), unions (with a great impact on e.g. labour standards in GVCs, including the level of wages), society (with its preference toward e.g. fair wages), and consumers (e.g. forcing environmental responsibility or decent work standards on GVCs' firms, with consequence for their employees). Among key factors shaping the final picture there is also the structure of GVCs. It may regard the type (snake, spider, mixed) of GVCs, the role of a particular participant and a power attached to it.

As the models relating GVCs position to labour market outcomes are much scarcer, there is no such summary provided for this part of the literature. Sufficient to say that there is no agreement on the characteristics of the various production stages along the chain, and therefore, on the definition of upgrading the position. For instance, both Venables (1999) and Wang et al. (2021a, b) present a linear definition of production chain but with rather contradictive assumption about which of the ends (downstream or upstream) means higher position. The linear perspective is also shared by Zi (2020). On the other hand, the models proposed by Ma et al. (2019) or Cai et al. (2023) allow for the production chain to take a shape of a smile curve, which may be more elastic approach and more realistic assumption. Upgrading the GVCs position would simply mean moving to stages with higher value-added. Hence, it would depend on the particular value chain whether it was moving upstream or downstream from the starting position taken by the given industry or firm.

Among the limitations of this review, there certainly is the one that some related topics had to be neglected to limit the number of records for screening reasonably. For instance, this study discusses the impact of GVCs on labour divided by skills, while also other dimensions and special cases could be explored, like gender dimension, formal vs informal employment, child labour, etc. The theory on the connection between GVCs, economic and social upgrading is also a vast subject and deserves to be a direction of further research.

One may ask about the consistency of main theoretical channels with the empirical literature. Some of the papers included in this SLR contain also the empirical part validating the proposed theory on the real data (Mukherjee 2017; Lee & Yi 2018; Kühn & Viegelahn 2019; Cheng & Xiao 2021; Wang et al. 2021b; Mehta 2022). In the literature, there are also several reviews and meta-analyses on previous empirical results obtained for GVCs' impact on employment (Carneiro et al., 2023; Hummels et al. 2018), wages (Cardoso et al., 2020; Hummels et al. 2018), productivity (Murakami & Otsuka 2020), or all the three (Radło, 2016; Shingal 2015). The empirical evidence support both the negative and positive prediction from the theoretical models. According to meta-analysis by Carneiro et al., (2013) the average employment effect based on 51 empirical studies was not statistically different from zero. Similar results were found for wages by Cardoso et al. (2021). It was exactly due to the different signs of effects obtained for different countries' development levels, sectors, skills, and levels of analysis. It supports the theoretical results in the sense that there are winners and losers of GVCs and that the overall sign of the aggregate impact may be flipped by e.g. policies supporting the positive effects.

To give an example of an empirical study distinguishing particular channels of employment effect, on the sample of 39 countries Jiang (2015) examines this effect related to international trade in intermediate inputs not only domestically but also in partner and third countries, going beyond the direct consequences of imports (substitution effect) and exports (competitiveness effect). For instance, country's participation in GVCs through exports may expand employment not only at home but also in supplier countries, thanks to the import content of exports. This is an example when there is a transmission of the consequences of increase in GVC participation of one actor to the other participants through the value chain. To distinguish between the response of wages, employment, and productivity to GVCs participation and separate the indirect channels (like e.g. productivity effect changing wages and employment demand) Szymczak and Wolszczak-Derlacz (2022) estimate a system of mutually related equations for 43 countries. Next to the undoubtedly positive relation between GVC's participation and productivity, the results for employment

and wages are mixed, depending on e.g. type of GVCs' integration or development of the countries.

Regarding the other factors considered in this review, for instance, Sly and Soderbery (2014) find that multinational US firms in automotive industry allocate their higher-markups production in the countries where the workers have lower bargaining power, purposely to avoid sharing part of the markups through the markup-effect. The WBG report (2023) is positive about the technology and innovation transfer through the GVCs to developing countries (productivity-enhancing effect), including positive spillovers for domestic parts of the chain (not directly involved in GVCs). On the other hand, the systematic literature review on empirical evidence in this particular subtopic provided by De Marchi et al., (2018) show that in about half of analysed cases these opportunities were not well used. Majority of studies linking GVCs position with productivity and wages adopt linear approach (for review see e.g. Fays et al. 2020) but the more recent show support for the smile curve concept (Szymczak et a., 2022; WBG, 2017). Interestingly, WBG (2017) provides also empirical examples of country-industries where the smile curve for wages is inverted (with the ends down), which is a case not covered by the theory.

5 Conclusions

This study presents a systematic review to provide fellow researchers and policymakers with a collection of theories explaining the possible impact of global value chains on labour market outcomes. The research question was: How do GVCs affect wages, employment demand, and productivity? The theory provides different mechanisms and channels leading to ambiguous overall results, as presented in the Fig. 2. The complexity of the picture stems from the fact that the three examined aspects: wages, employment, and productivity are interconnected, and changes in one may alter another. Due to the very nature of the analysed phenomenon—a complex structure of actors and relations—many additional indirect effects are at play. Considering all the above, a slight change in the assumptions of theoretical models may lead to different predictions, as shown in the review. The more, this study may be useful for theorists, empirical economists, and policy makers as an up-to-date overview of theoretical developments and convenient map of potential outcomes expected from involvement in international production sharing.

The study shows the shortcomings of the existing theories. Many models are built as North–South models, yet the conclusions are drawn only for the developed country. Originally it was motivated mostly by perceived threats for low-skill workers, whose jobs were offshored to developing countries. Models with settings like North–North are rare, and even rarer are South-South models, while nowadays the intermediate trade occurs in many forms, affecting various actors. This shows a clear research gap for theoretical studies to fill in. Moreover, only one study (Zi 2020) explicitly distinguishes different types of GVCs (spider vs snake) when analysing labour market response to GVCs. Less aggregated levels of analysis could constitute a great input to the discussion, as the labour market effects can be very specific. Among few exceptions there are: employing either a worker perspective (e.g. the fair wage concept in Egger & Kreickemeier 2017; or Roy channel in Lee & Yi 2018) or firm-level perspective (e.g. Wang et al. 2021b; or Van Assche & Gangnes 2019).

Furthermore, this review contributes to the understanding of different dimensions of GVCs, like participation or position, and the importance of distinguishing them in examining labour market outcomes. Theoretical literature analysing the labour market effects of both GVCs participation and position is relatively scarce and seems to lag behind empirical evidence on this topic. According to the results of this SLR, it is another research direction which seems to be underdeveloped. The understanding of relation between GVCs position and labour market is especially worth further exploration as the review showed that existing evidence adopt different and even contradicting perspectives on the definition of upgrading the GVCs position. This remark may be particularly relevant for policymakers to find an effective path toward improvement of industries' position. From the policy point of view, there are two issues appearing in the analysed studies most often as crucial for mitigation of negative GVCs' effects/enhancement of positive effects. One is labour mobility between industries which helps to enable the positive complementarity effect. The other concerns technology absorption and learning through participation in a network. These are the channels which should be supported.

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