Assessing participation of CAREC countries in Global and Regional Value Chains[1]

Authors: Yaroslava Babych[2], Davit Keshelava[3], Giorgi Mzhavanadze[4]

ISET Policy Institute, Tbilisi, Georgia

Abstract

In a world of offshoring, outsourcing and vertical specialization, production of a single good may involve inputs from and manufacturing in many different countries around the world. The participation of developing countries in Global and Regional Value Chains (GVCs and RVCs) creates new opportunities for firms (and even countries) to specialize in tasks and business functions rather than specific products, fully employ their production potential and become a part of the international production networks. The exercise of mapping GVC and RVC participation of particular countries and/or country groups is therefore an essential tool for understanding the structure and the driving forces behind global and regional trade for particular countries, as well potential areas for policy interventions. While many studies measure the GVC and RVC participation indices for OECD and some non-OECD countries, the CAREC (Central Asia Regional Economic Cooperation Program) countries were until now never studied as a separate group. Nevertheless, the global growth slowdown forced many developing economies and emerging markets to look for growth opportunities beyond the traditional links with large developed countries' markets and seek out growth opportunities in regional production and trade collaboration. This policy paper is the first one to create a comprehensive mapping of the GVCs and RVCs for CAREC region by using the inter-country input-output matrices. It contributes to the empirical literature on RVC by assessing the trade linkages between countries in this group and empirically identifies policy factors that may be associated with RVC participation at the country level. The findings of the paper will be particularly useful for evidence-based trade policy of the CAREC countries.

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[2] Head of the Macroeconomic Policy Research Center at ISET Policy Institute. E-mail: y.babych@iset.ge

[3] Senior Researcher at ISET Policy Institute. E-mail: d.keshelava@iset.ge

[4] Deputy head of the Macroeconomic Policy Research Center at ISET Policy Institute. E-mail: g.mzhavanadze@iset.ge

Table of Contents

Introduction

The advent of globalization in recent decades has had a profound impact on the development path of countries around the globe. Rapid development of ICT technologies coupled with global tendencies to reduce tariff and non-tariff barriers since WWII made economic integration possible between countries on the scale never imagined before. Integration of production processes gave rise to the concepts of offshoring, outsourcing, vertical specialization and brought a new set of opportunities for developing economies. The participation of developing countries in Global and Regional Value Chains (GVCs and RVCs) created new opportunities for firms (and entire countries) to specialize in tasks and business functions rather than specific products, fully employ their production potential and become a part of the international production networks.

At the same time, participation in such value chains comes with own sets challenges. Modern VCs tend to be quite competitive and versatile; hence, developing countries often face challenges of fulfilling pre-conditions for integration into Global and Regional Value Chains. In recent years economic growth around the world has been slowing down, and leading emerging markets (China, Latin America, South-East Asia) along with European countries, were the first to feel its effects. Developing economies around the world, which historically rely on trade with larger, more mature market, started to look for growth opportunities outside their orbit, and the question of creating and integrating not only into global, but also into regional value chains became important for economic resilience and stability.

Moreover, participation in RVC can also be seen as the first step towards greater participation in GVC (Slany, 2017) for developing countries that have difficulties integrating into GVC due to less advanced technologies, production processes and skills sets. Whereas economic literature shows that participation in GVC in particular (both buying and selling activities) benefit developing economies (Kowalski, P. *et al.* (2015)) in terms of productivity, sophistication, and diversification of exports.

Yet, before policymakers can embark on designing and implementing economic policies which promote RVC and GVC participation, it is important to take stock of just how integrated their country in the regional and respectively global production and trade, and through the exercise of mapping RVC and GVC connections to understand where the opportunities for further integration lie. This paper is the first one to create a comprehensive mapping of the GVCs and RVCs for CAREC region countries by using the inter-country input-output matrices. It

contributes to the empirical literature on RVC by assessing the trade linkages between countries in this group and empirically identifies policy factors that may be associated with RVC participation at a country level.

Literature Review

The emergence of GVC, global value chains, around more than two decades ago transformed the way economists think about countries' comparative advantage and specialization in production. It has also transformed the understanding of what it takes for a country to be successfully integrated into world trade networks and derive maximum benefit from global trade. In the past, a country's comparative advantage was understood in terms of specific products (e.g. wine vs. cloth in the classical example of Ricardo). The "wine-for-cloth" approach led many policy-makers astray by shifting their focus towards import substitution and infant-industry protectionism, in hopes that their country would one day develop capacity for producing and exporting certain high value-added goods (e.g. the case of Brazil's failed attempt at protecting their nascent computer industry). The emergence of GVC and fragmentation of production meant that the share of manufactures intermediate goods imports in the total world imports was more than 50%, while 70% of services imports were intermediate services (De Backer, Miroudot, 2013). Participation in GVC became of crucial importance not only for larger emerging markets but also for smaller developing economies. For example, Kowalski, P. et al., (2015) find that higher GVC participation (measured as growing forward[5] and backward participation measures, imports of more sophisticated non-primary intermediate goods, etc.) benefits countries across all income groups along several dimensions: a) by increasing domestic per capita value-added embodied in exports, which means more gains from trade accruing to domestic capital and labor. b) by increasing sophistication of exports, the so-called 'product upgrading' and c) by increasing diversification of exports. Although the authors stress that there is no "one-size-fits-all" recipe for securing benefits from GVC participation, it is clear from the research that Global Value Chains are instrumental for development.

Other studies (Slany, 2017) emphasize that participation in GVC can be a stepping stone for developing countries towards higher trade integration with the rest of the world through access to markets, knowledge spillovers and technology transfers. The OECD 2013 synthesis report (OECD, 2013) additionally highlights the opportunities which GVC participation brings to

[5] Increased "forward" participation refers to the increased use of country's domestic value added in foreign exports. Increased "backward" participation refers to the increased use of foreign value added in the country's exports.

small and medium firms (SMEs) as they can exploit their speed and flexibility to carve a niche in the in the global market as a supplier of services or product components. Of course, as the report emphasizes, participation in GVC varies by industry as well as by country. Just as countries do not participate equally in international trade, not all countries are integrated into global production process. Size and openness of the economy may determine the degree of participation (with small open economies, e.g. Luxemburg, Belgium, Slovakia importing and exporting more in the VC than large economies like United States, Turkey, Canada). For developing countries, the impediments to GVC participation are often linked to institutional factors: contract enforceability, strength of business environment, degree of property rights protection. These factors along with quality of the labor force, lack of infrastructure, determine the degree to which a developing country can participate and benefit from GVC. (OECD, 2013).

Some studies (Slany, 2017) argue that, given the demanding and competitive nature of GVC, it may be more practical for developing countries to first build the trade linkages regionally, integrating into regional value chains (RVC), and use them as a sort of stepping stone towards integration into GVC (emerging European countries are often taken as an example, as they are currently more integrated into the intra-European value chain than in the global VC). This argument, seems quite logical and attractive in its simplicity, and this may account for the fact that policy practitioners are often puzzled why clusters of neighboring developing country groups (e.g. African countries, the countries of the South Caucasus, etc.) do not seem to trade enough with each other and are not more regionally integrated. An example of African countries given by Slany states that intra-African value-added trade is as low as 9%, while in Asia and Latin America it is 45% and 18% respectively. The problem with this argument is that it fails to account for the basic trade gravity model results, which predicts that countries will trade more with larger economies, even if these economies are further away. Moreover, as the study itself points out, the factors that are detrimental to establishing RVC as essentially the same factors that prevent the country from effectively integrating into GVC, namely the transaction costs and trade costs, lack of appropriate infrastructure, deficiencies in trade policies and institutional frameworks that facilitate the ease of crossing national borders. Thus, for any group of neighboring developing economies establishing functional RVC may be actually a more challenging task than plugging oneself into the existing GVC. The latter may be often more attractive in terms of market size, access and technology transfer, and would require less political effort to make necessary modifications in legislation. While the former

may be plagued by lack of coordination, national rivalry and competition considerations. Interestingly, the study on Trade Facilitation in the South Caucasus (SDC, ISET, UNDP 2019) found that the integration of the three South Caucasus countries (Azerbaijan, Georgia, Armenia) into the world economy is often hampered by high costs of moving goods across borders of the respective countries, poorly developed transport infrastructure and this tendency towards low regional VC participation may, unfortunately, hurt developing countries, especially as they miss valuable opportunities to benefit from proximity and natural resource endowments of each other. In the case of CAREC countries we have the anecdotal evidence of a similar pattern of low regional VC participation, which needs to be further studied and explained. Yet, before one can draw any conclusions about the opportunities for VC integration among the CAREC economies, the first step is to develop a comprehensive mapping of intra-region value chain participation based on the existing methodologies.

Methodology[6]

The indicators on global value chains presented in the paper are calculated with the simplified version of the Eora multi-regional input-output (MRIO) model[7]. The model consists of a balanced global MRIO table linking 4,914 industries across 189 countries[8] (included all of the CAREC countries[9]) estimated for 1990-2018 (results from 2016-2018 are nowcasted based on IMF World Economic Outlook).

Simplified version of the Eora MRIO (called Eora26) includes 26 sectors aggregated and harmonized across countries (this classification is consistent across all countries covered), as listed in Table 1. Eora also provides detailed input-output tables including different number of sectors for countries based on the availability of data. Moreover, Eora provides the data using different prices – basic (market) prices and purchaser's prices. For the purposes of this research, the basic prices have been used.

[6] Methodology is mainly bult based on the UNCTAD (2013), Koopman et al. (2011) and Aslam et al. (2017).
[7] Data source: https://worldmrio.com/
[8] Due to data errors, the following countries have been excluded from GVC analysis: Belarus, Benin, Burkina Faso, Congo, Eritrea, Ethiopia, Guinea, Guyana, Libya, Moldova, Serbia, Sudan, Yemen, Zimbabwe, Former USSR.
[9] CAREC region includes the following 11 countries: Afghanistan, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Mongolia, Pakistan, China, Tajikistan, Turkmenistan, and Uzbekistan

Table 1. Eora sector classification

1. Agriculture	14. Construction
2. Fishing	15. Maintenance and Repair
3. Mining and Quarrying	16. Wholesale Trade
4. Food & Beverages	17. Retail Trade
5. Textile and Wearing Apparel	18. Hotels and Restaurants
6. Wood and Paper	19. Transport
7. Petroleum, Chemical, and Non-Metallic Mineral Products	20. Post and Telecommunications
8. Metal Products	21. Financial Intermediation and Business Activities
9. Electric and Machinery	22. Public Administration
10. Transport Equipment	23. Education, Health, and Other Services
11. Other Manufacturing	24. Private Households
12. Recycling	25. Others
13. Electricity, Gas, and Water	26. Re-export & Re-import

Source: Eora MRIO Database (https://worldmrio.com/eora26/)

To illustrate the intuition behind intercountry IO tables, which are used to calculate the value chain participation index, a simple example of an Input Output table is presented in Figure 1. The example assumes that a world is made up of only two countries, each with 2 sectors. The input-output table contains three main components:

1. Intermediate goods demand (the *T* matrix in Eora and yellow cells in the Figure 1)

2. Final demand[10] (the FD matrix in Eora and green cells in the Figure 1), and
3. Value added or primary inputs[11] (the VA matrix in Eora and blue cells in the Figure 1).

The industry (e.g. industry A1) in a country A produces a good, which can be used as an intermediate input in the production of another good in the same country (e.g. good produced in the industry A1 or A2) or in the country B (e.g. exported and used to produce good in the industry B1 or B2) or serve as a final demand again in the same country or abroad (e.g. consumed by household). Thus, the output can be used domestically by country A or exported to country B, where it can be used as an intermediate input or a final demand. Analogously, the good can be imported from country B, and used in country A for production or as a final demand. Input-output analysis assumes that inputs used in a production process are related to the industry outputs by the linear and fixed coefficients of production.

The rows in a MRIO table show the use of gross output from a particular industry in a particular country. The gross output produced in an industry A1 of country A (first row of the Figure 1) can be used by country A itself (in the own industry A1 or another industry A2), or by the other country B, again as an intermediate input or a final demand. Thus, the measure of gross output ($X_i, where\ i = A1, A2, B1, B2$) can be retrieved by summing the intermediate and final outputs (e.g. summing yellow and green blocks in the first row to get X_{A1}).

[10] Final demand includes household final consumption, non-profit institutions serving households, government final consumption, gross fixed capital formation, changes in inventories and acquisitions less disposals of valuables. Source: http://unstats.un.org/unsd/nationalaccount/sna1993.asp

[11] Value added inputs include compensation of employees, taxes on production, subsidies on production, net operating surplus, net mixed income and consumption of fixed capital. Source: http://unstats.un.org/unsd/nationalaccount/sna1993.asp

Figure 1. Example of a MRIO table with 2 countries and 2 goods[12]

		Intermediate use				Final demand		Gross output
		Country A		Country B		Country A	Country B	
		Industry A1	Industry A2	Industry B1	Industry B2	Final Demand	Final Demand	
Country A	Industry A1	Intermediate use of domestic output	+ Intermediate use by A2 of domestic output from A1	+ Intermediate use by B1 of exports from A1	+ Intermediate use by B2 of exports from A1	+ Final use of domestic output from A1	+ Final use by B of exports from A1	= X_{A1}
	Industry A2	+ Intermediate use by A1 of domestic output from A2	+ Intermediate use of domestic output	+ Intermediate use by B1 of exports from A2	+ Intermediate use by B2 of exports from A2	+ Final use of domestic output from A2	+ Final use by B of exports from A2	= X_{A2}
Country B	Industry B1	+ Intermediate use by A1 of exports from B1	+ Intermediate use by A2 of exports from B1	+ Intermediate use of domestic output	+ Intermediate use by B2 of domestic output from B1	+ Final use by A of exports from B1	+ Final use of domestic output from B1	= X_{B1}
	Industry B2	+ Intermediate use by A1 of exports from B2	+ Intermediate use by A2 of exports from B2	+ Intermediate use by B1 of domestic output from B2	+ Intermediate use of domestic output	+ Final use by A of exports from B2	+ Final use of domestic output from B2	= X_{B2}
Value added		+ V_{A1}	+ V_{A2}	+ V_{B1}	+ V_{B2}			
Gross input		= X_{A1}	= X_{A2}	= X_{B1}	= X_{B2}			

Source: UNCTAD (2013), Yedan (2019)

The columns of a MRIO table provide information about production technology, as they indicated the amount of intermediate need of inputs for production of gross output. The production of the gross output of the industry A1 in country A uses domestic intermediate outputs from industry A1 and industry A2, and imported foreign intermediate outputs from industry B1 and industry B2 of country B. The difference between the gross output in each country and the sum of inputs (domestic and foreign) used in production process is the value added (primary input, V).

The simplified example of input-output analysis based on two countries and two sectors can be generalized to the multiple countries and industries:

[12] Yedan, A. Measuring value chains – Use of input-output tables, 2019, Presentation Slides: https://unctad.org/meetings/en/Presentation/aldc2019_ethiopia_servicestrade_yedan_UNECA_en.pdf

$$X = T + Y \Leftrightarrow X = AX + Y \Leftrightarrow (I - A)X = Y \Leftrightarrow X = (I - A)^{-1}Y \Leftrightarrow X = LY \quad (1)$$

Where X is a matrix of gross output (horizontal sum of rows presenting domestic and foreign intermediate inputs and final demand), T is a matrix of intermediate demand, Y is a matrix of final demand, I is the identity matrix, A is the technological coefficient matrix (where each element represents ratio of intermediate input and corresponding output $A_{ij} = {T_{ij}}/{X_{ij}}$, where i represents country and j industry). L is the Leontief inverse (the coefficients of the Leontief inverse conveys direct and indirect effects on output in one industry required by a unit of output from another industry). The equation (2) represents a MRIO table for n-country model, where each country has only one industry producing a single product.

$$\begin{pmatrix} x_{11} & \dots & x_{1n} \\ \vdots & \ddots & \vdots \\ x_{n1} & \dots & x_{nn} \end{pmatrix} = \begin{pmatrix} L_{11} & \cdots & L_{1n} \\ \vdots & \ddots & \vdots \\ L_{n1} & \cdots & L_{nn} \end{pmatrix} \begin{pmatrix} y_{11} & \cdots & y_{1n} \\ \vdots & \ddots & \vdots \\ y_{n1} & \cdots & y_{nn} \end{pmatrix} \quad (2)$$

Thus, the Leontief inverse was estimated based on the following matrix operations: $L = (I - A)^{-1}$. To calculate value chain participation indices, it is necessary to recover the matrix of value-added shares (or the matrix of the value-added coefficients) by diagonalizing a row vector of value added per unit of output by country (e.g. $v_1 = VA_1/x_1$, where VA_1 is the first components of the value added vector [e.g. the first element of the blue row in the Figure1] and x_1 is the first component of the gross output matrix). Then, it is essential to build a matrix of the gross export, which can be derived by diagonalizing a row of aggregate exports by countries (gross exports can be retrieved by summing intermediate inputs exported abroad [not used in the domestic production] and exports of final goods [again not included domestic final demand]). The value-added share matrix (the matrix of the value-added content of trade) can be obtained by multiplying (matrix multiplication) value added coefficients matrix, Leontief inverse and the matrix of gross exports.

$$T_v = vLe,$$

where T_v is the value-added share matrix, v is a value-added coefficient matrix, L is a Leontief inverse and e is the matrix of gross exports. The case of n countries with only one industry is presented in the equation (3).

$$\begin{pmatrix} T_{11}^v & \dots & T_{1n}^v \\ \vdots & \ddots & \vdots \\ T_{n1}^v & \dots & T_{nn}^v \end{pmatrix} = \begin{pmatrix} v_1 & 0 & 0 \\ 0 & \ddots & 0 \\ 0 & 0 & v_n \end{pmatrix} \begin{pmatrix} L_{11} & \cdots & L_{1n} \\ \vdots & \ddots & \vdots \\ L_{n1} & \cdots & L_{nn} \end{pmatrix} \begin{pmatrix} e_1 & 0 & 0 \\ 0 & \ddots & 0 \\ 0 & 0 & e_n \end{pmatrix} \quad (3)$$

The T_v matrix is a key matrix of value chain analysis. The matrix describes how the value-added export of each country (and industry) is generated and distributed across countries. Table 2 presents case of N countries and only one industry (the results can be easily generalized

Table 2. The matrix of the value-added content of trade

	Country 1	Country 2	Country 3	….	Country k	….	Country N
Country 1	T_{11}^v	T_{12}^v	T_{13}^v	….	T_{1k}^v	….	T_{1N}^v
Country 2	T_{21}^v	T_{22}^v	T_{23}^v	….	T_{2k}^v	….	T_{2N}^v
Country 3	T_{31}^v	T_{32}^v	T_{33}^v	….	T_{3k}^v	….	T_{3N}^v
….	….	….	….	….	….	….	….
Country k	T_{k1}^v	T_{k2}^v	T_{k3}^v	….	T_{kk}^v	….	T_{kN}^v
….	….	….	….	….	….	….	….
Country N	T_{N1}^v	T_{N2}^v	T_{N3}^v	….	T_{Nk}^v	….	T_{NN}^v

Domestic Value Added (DVA) content of export of Country 1

Indirect Value Added Exports (DVX) of Country 1

Foreign Value Added (FVA) content of export of Country 1

Source: UNCTAD (2013)

for the N country and M industry case).

- The term T_{11}^v denotes the Domestic Value-Added (DVA) content of export of country 1. Thus, the diagonal elements of the T^v matrix correspond to the DVA content of exports of corresponding country.
- The term T_{k1}^v denotes the Foreign Value-Added (FVA) content of exports of country 1 generated by country k (with $k \neq 1$). Hanse, this term represents share of value added generated in country k (v_k) and imported by country 1 (L_{k1}) in order to produce its exports (e_1). Thus, the sum of the green cells (the elements of the first column) in the

Table 2 gives total FVA for country 1 (total $FVA_{country\ 1} = \sum_{i=2}^{N} T_{i1}^{v}$). The sum of Domestic and Foreign Value-Added yields the total exports of country 1 (Gross Export = $DVA + FVA$ i.e. $Gross\ Export_{country\ 1} = \sum_{i=1}^{N} T_{i1}^{v}$). The other columns replicate the exercise for the other countries.

- The term T_{1K}^{v} denotes the Indirect Value-Added Exports (DVX)[13], which represents the share of exports of country k (e_k) that depends on the value added sourced by country 1 ($v_1 L_{1k}$). Thus, the sum of the blue cells (the elements of the first row) in the Table 2 gives total DVX for country 1 (total $DVX_{country\ 1} = \sum_{i=2}^{N} T_{1i}^{v}$). It is notable that at the world level, DVX should be equal to the FVA. In addition, part of the DVA exported and used in the third country, could return back home ("$re-imported\ DVA$") that creates double counting problem. However, the literature shows that the latter is relatively minor in the world level[14].

The Global Value Chain (GVC) participation index simply adds the FVA and DVX shares for country i and industry k and can be expressed the following way:

$$GVC_{ik} = \frac{FVA_{ik}}{Gross\ Export_{ik}} + \frac{DVX_{ik}}{Gross\ Export_{ik}} \quad (4)$$

The higher the ratio, the greater the intensity of involvement of a particular country in the GVCs. Moreover, the first component of the GVC index (FVA/Gross Export) measures "backward participation", given that it includes imported intermediate inputs used to generate output for export. The second component of the GVC index measures "forward participation", given that it includes exports of intermediate goods that are used as an input for export production of the other countries. Regional Value Chain (RVC) participation indices (calculated for CAREC region in this research) can be estimated by the same formula (4), restricting value chain participation and trade relations within the particular region (in the regional value chain, all of the players (importers and exporters) of the value chain must be from the countries belonging to the same region. For example, if the country imports intermediate good from the other country in the same region, adds some value and then exports it to the country not belonging to the same region, the value chain will not be considered as a regional value chain).

[13] The mane of this term comes from Koopman et al. (2011).

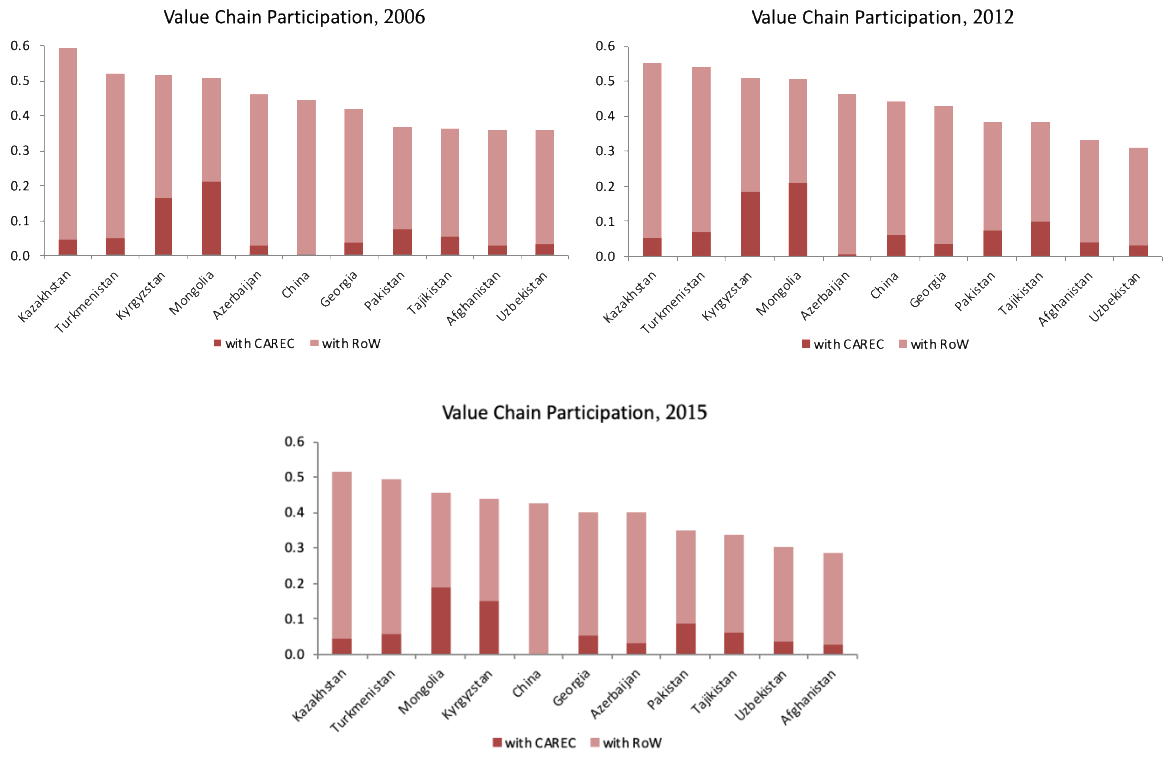
[14] e.g. Koopman et al. (2011) estimated 4% of gross export in 2004; Stehrer et al. (2012) 2.9% in 2009 [based on WIOD database], OECD-WTO initiative – 0.6% in 2009.

Results[15]

Patterns of GVC and RVC integration among CAREC countries

In the first stage of the study we set out to show how integrated are CAREC countries in one another's value chain production process (RVC) vs. how much they are plugged into the global value chains (GVC), and how these patterns may or may not have changed over time. The graphs below (Figure 2) and Table 3 trace CAREC countries value chain participation index at three crucial junctures: 2006 (before the global financial crisis of 2008), 2012 (the year after the global financial crisis but before the oil price collapse and regional currency crisis in the ECA region countries), 2015 (the year of regional growth and demand slow down driven by low oil prices, political instability in parts of the region, trade wars between US and China and the move towards higher protectionism on the global scale).

Figure 2. Value Chain Participation for CAREC countries.



Source: Eora MRIO Database, authors' calculation

Figure 2 clearly shows that CAREC countries are not well integrated into production processes of the CAREC region. The countries which are the most integrated into the CAREC-RVC are Mongolia and Kyrgyzstan (18.9% and 15.2% RVC participation index respectively), followed by Pakistan and Tajikistan (8.8% and 6%) in 2015. The countries with the highest GVC –

[15] Results discussed here are preliminary

Kazakhstan and Turkmenistan (47% and 44% GVC participation index respectively) have one of the lowest CAREC-RVC participation. Moreover, China has the lowest RVC to GVC ratio with only 0.59% of the GVC participation coming purely from the CAREC countries. What is also notable is that CAREC countries are not integrated enough into GVCs, given their size. The average GVC participation index for CAREC countries is 40.1% in 2015. Georgia, for example, has GVC index of 40%, while OECD countries with similar relatively small populations (e.g. Lithuania, Latvia, Estonia, Finland, Norway), all have GVC index over 50% according to 2009 data and the same is true for non-OECD countries (OECD, 2013). Furthermore, countries in the CAREC region (except Kyrgyzstan, Tajikistan, and Turkmenistan) tend to have mainly forward linkages with the other countries in the global value chains (exporting intermediate goods in the other country that is processed and further exported in the third country), while the measure of the backward participation is relatively low (importing intermediate goods, adding some value and exporting in the third country). In addition, the gap between forward and backward participation in GVCs is especially pronounced for Afghanistan, Azerbaijan, Kazakhstan, Pakistan and Uzbekistan.

Table 3 presents the information about the dynamics of CAREC-RVC and GVC participation for all CAREC countries (the similar results are graphicly presented in the Figure 2). In particular, the CAREC-RVC participation has been increasing for nearly all CAREC countries from 2006 to 2012, but then in 2015 there has been a retreat both in RVC and GVC participation. The pattern between 2006 and 2012 can be explained in part by the global financial crisis effects. The crisis likely forced many countries to look for fresh opportunities in their own neighborhood rather than rely mostly on global trade networks. In 2015, however, both RVC and GVC participation was on a decline in nearly all countries. This can be explained by the global growth slowdown and regional economic and currency crisis affecting both oil-exporting and oil-importing groups of countries.

TABLE 3: GVC and RVC Participation Indices of CAREC Countries

Country	2006			2012			2015		
	RVC	GVC	RVC/GVC	RVC	GVC	RVC/GVC	RVC	GVC	RVC/GVC
Kazakhstan	4.69%	59.44%	**7.89%**	5.23%	55.25%	**9.46%**	4.53%	51.60%	**8.78%**
Turkmenistan	4.93%	52.10%	**9.47%**	6.86%	53.89%	**12.73%**	5.81%	49.60%	**11.72%**
Kyrgyzstan	16.38%	51.85%	**31.60%**	18.27%	50.89%	**35.91%**	15.17%	44.03%	**34.44%**
Mongolia	21.08%	50.76%	**41.52%**	21.05%	50.52%	**41.67%**	18.92%	45.62%	**41.47%**
Azerbaijan	2.85%	46.29%	**6.17%**	0.33%	46.62%	**0.70%**	3.27%	39.96%	**8.19%**
China	0.24%	44.47%	**0.53%**	6.21%	44.41%	**13.98%**	0.25%	42.73%	**0.59%**
Georgia	3.87%	41.80%	**9.25%**	3.47%	43.07%	**8.05%**	5.13%	40.01%	**12.83%**
Pakistan	7.38%	37.02%	**19.94%**	7.37%	38.48%	**19.16%**	8.81%	35.04%	**25.15%**
Tajikistan	5.22%	36.53%	**14.30%**	10.01%	38.27%	**26.16%**	6.00%	33.77%	**17.75%**
Afghanistan	2.74%	36.00%	**7.62%**	3.73%	33.43%	**11.17%**	2.75%	28.54%	**9.65%**
Uzbekistan	3.25%	35.89%	**9.05%**	3.09%	30.99%	**9.96%**	3.33%	30.39%	**10.96%**
Average for CAREC	6.60%	44.74%	**14.30%**	7.78%	44.17%	**17.18%**	6.73%	40.12%	**16.50%**

Source: Eora MRIO Database, authors' calculation

However, if we further consider longer time period (e.g. from 1992-2015) and study dynamics of the GVC participation index for all of the CAREC countries, we will find that the great majority of the CAREC countries (except Azerbaijan) are notably more involved in the GVCs during 1992-2010 period, but the participation rate plateaued in 2010 and did not change significantly since then. The abovementioned increase was mainly driven by improved forward linkages (upstreaming) rather than backward linkages (downstreaming). This finding is in line with Aslam, Novta and Rodrigues-Bastos (2017), which concludes that emerging market and developing economies (EMDEs) excluding China have begun to move more upstream, while advanced economies (AEs) to more downstream (for more details about the dynamics of the GVC participation in the region see Annex1).

A closer look at the RVC and GVC participation on the country level: the case of Georgia

Georgia presents an interesting case study among CAREC countries, because in some ways it illustrates important tendencies in the region. First, we construct the bilateral value chain participation index for Georgia and its top VC partner countries (abbreviated as CVC)

As Table 4 below shows Russia is the top VC partner country for Georgia, although it is not the topmost country in terms of the total volume of trade (in 2015 the top trade partner country for Georgia, based on gross trade flows was Turkey). Interestingly, between 2006 and 2012 Georgia's CVC (bilateral VC participation index) with Russia was growing (both forward and backward linkages), even though Russia has imposed trade restrictions on a number of

Georgian exports, including wine, mineral water, etc. As painful as this measure was for Georgia at the time, it did not much affect the value chain participation index with Russia.

Another interesting point is that with Turkey, another large and economically powerful neighbor, Georgia does not enjoy nearly as much integration as with EU countries like Germany and Italy. The explanation may be is that Turkey and Georgia are both integrated with EU countries through primary product exports (e.g. hazelnuts which are then exported to Italy for confectionaries) and their natural resources and capacities are mostly related to substitutes rather than complements in production.

Table 4: Bilateral Value Chain (CVC) Participation Indices for Georgia and top VC partner countries

Country	2006			2012			2015		
	CVC	Forward	Backward	CVC	Forward	Backward	CVC	Forward	Backward
Russia	**6.59%**	**3.79%**	**2.81%**	**8.42%**	**3.83%**	**4.59%**	**7.80%**	**3.64%**	**4.16%**
Germany	**4.76%**	**3.47%**	**1.28%**	**4.96%**	**3.28%**	**1.68%**	**3.83%**	**2.73%**	**1.10%**
Italy	**3.55%**	**3.03%**	**0.52%**	**3.37%**	**2.72%**	**0.65%**	**3.08%**	**2.58%**	**0.50%**
France	**3.44%**	**3.07%**	**0.37%**	**3.12%**	**2.65%**	**0.46%**	**2.94%**	**2.59%**	**0.34%**
Turkey	**3.05%**	**1.46%**	**1.59%**	**3.46%**	**1.43%**	**2.02%**	**2.93%**	**1.31%**	**1.62%**
Azerbaijan	**1.91%**	**0.32%**	**1.59%**	**3.54%**	**0.30%**	**3.24%**	**2.80%**	**0.26%**	**2.54%**
Ukraine	**1.49%**	**0.71%**	**0.78%**	**1.78%**	**0.80%**	**0.97%**	**1.53%**	**0.74%**	**0.78%**
USA	**1.49%**	**0.65%**	**0.84%**	**1.64%**	**0.60%**	**1.04%**	**1.34%**	**0.53%**	**0.80%**
Netherlands	**1.39%**	**1.15%**	**0.24%**	**1.38%**	**1.07%**	**0.31%**	**1.26%**	**1.01%**	**0.25%**
UK	**1.42%**	**0.81%**	**0.61%**	**1.36%**	**0.74%**	**0.62%**	**1.12%**	**0.59%**	**0.53%**
China	0.84%	0.57%	0.27%	1.25%	0.75%	0.50%	1.07%	0.61%	0.46%
Iran	0.82%	0.52%	0.30%	0.89%	0.45%	0.43%	0.98%	0.59%	0.39%
Belgium	1.01%	0.83%	0.18%	0.94%	0.72%	0.23%	0.85%	0.67%	0.17%
Spain	0.76%	0.59%	0.17%	0.73%	0.50%	0.23%	0.65%	0.48%	0.17%
South Korea	0.48%	0.40%	0.08%	0.64%	0.53%	0.11%	0.59%	0.51%	0.09%
Japan	0.73%	0.47%	0.26%	0.72%	0.40%	0.32%	0.57%	0.37%	0.20%
Singapore	0.56%	0.52%	0.04%	0.57%	0.51%	0.06%	0.56%	0.51%	0.05%
Kazakhstan	0.54%	0.33%	0.22%	0.64%	0.33%	0.30%	0.53%	0.29%	0.24%
Switzerland	0.46%	0.20%	0.26%	0.63%	0.19%	0.44%	0.52%	0.16%	0.36%
Austria	0.49%	0.32%	0.17%	0.52%	0.30%	0.22%	0.44%	0.26%	0.18%
Other	12.71%	8.48%	4.23%	13.96%	8.36%	5.59%	11.93%	7.47%	4.46%

Source: Eora MRIO Database, authors' calculation

Interestingly, among top 10 VC partner countries there is only one CAREC member – Azerbaijan. The rest are EU countries, USA, and larger neighboring countries like Turkey, Russia and Ukraine.

It is notable that the sectorial value chain participation of Georgia can potentially identify industries that are already involved in the value chain participation or have a potential to increase integration at least in the regional level. Transport, petroleum, chemical and non-

metallic mineral products, wholesale trade, construction and metal products are the sectors with the highest RVC participation taking into consideration the size of the sector (e.g. the fishing sector has the highest participation rate, but the total value-added export in this sector is notably lower than the same measure in the other sectors). In all of the abovementioned cases, the main driver of the regional integration is having forward linkages rather than focusing on the backward linkages. This pattern is more or less shared by the GVC participation measures; however, there are still some sectors with large gap between regional and global value chain participation that creates some room for more regional integration in this regard (e.g. financial intermediation and business activities, hotels and restaurants, textiles and wearing apparel and etc. Detailed information is presented in the Annex 2).

A closer look at which industries are important for value-added trade in Georgia reveals the following insights: Italy is even more important than Russia as a destination country for wholesale retail value-added trade (i.e. Italy is importing more Georgia's value-added and using it in exports than Russia in the wholesale retail trade industry), even though Russia is more important overall as a value-added destination country. Forward linkages with Russia are maintained via metals, petroleum, motor fuel, mining products. As far as backward linkages (using foreign value-added in exports), Georgia by far relies mostly on Russia for imports of chemicals, basic metals, and even office machinery, computers and equipment. Turkey and Azerbaijan also very prominent source countries for VC participation, especially what concerns wholesale products, land and water transportation services, etc.

Table 5 Domestic value added (DVA) and Foreign value added (FVA) associated with forward and backward value-chain exports for Georgia, by industry and country.

Forward CVC Participation Indicies of Georgia, 2015										
Georgia	Russia	Germany	Italy	France	Turkey	Azerbaijan	Ukraine	USA	Netherland	UK
Wholesale trade and commission trade, except of motor vehicles a	14537.39	6827	17854	8277	1934	868	1313	1294	3555	1730
Manufacture of basic metals and fabricated metal products	10370.39	3879	4098	6934	4622	505	467	1477	1051	691
Retail trade of motor fuel	9231.199	1646	1978	1097	376	92	445	377	742	529
Mining and quarrying	9070.286	4052	3818	6845	4291	710	1463	1439	1529	839
Retail trade, including trade of motor vehicles and motorcycles	7392.577	3704	2854	3468	1694	343	923	756	1449	838
Manufacture of coke, refined petroleum products and nuclear fuel	5398.026	4096	3311	10330	2077	1334	1032	1624	3953	843
Real estate, renting and business activities	4671.894	5882	6048	5066	1926	449	947	933	2489	1602
Cargo handling and storage	4290.459	3464	3497	3494	1809	367	818	678	1281	817
Other land transport; sea and coastal water transport	3893.878	2602	1403	1575	3006	296	781	361	805	450
Growing of fruit, nuts, beverage and spice crops	3632.188	5679	1442	619	265	35	1966	225	570	252
Financial intermediation	3409.643	3212	2629	2937	2864	182	355	610	833	769
Other supporting transport activities	3388.402	4050	4321	4363	1433	417	718	707	1511	825

Backward CVC Participation Indicies of Georgia, 2015										
Georgia	Russia	Germany	Italy	France	Turkey	Azerbaijan	Ukraine	USA	Netherland	UK
Chemicals, chemical products and man-made fibres	18991.93	2713	1327	973	4881	4198	1496	1210	573	1203
Basic metals and fabricated metal products	13630.66	3033	1337	895	4777	7195	2807	2263	569	1568
Office machinery and computers; machinery, equipment and appa	10434.7	3102	1346	883	4440	4662	2213	2332	580	1467
Fruit, nuts, beverage and spice crops	8190.279	1727	765	617	2523	4518	1016	1006	585	785
Alcoholic beverages	6717.127	2726	1154	949	3088	2985	1065	1418	834	1132
Wholesale trade and commission trade services, except of motor v	5039.526	1731	767	488	2836	7445	1794	1653	346	873
Other land transportation services; water transport services	4028.804	922	393	268	1393	8035	1328	855	189	519
Transport equipment	3416.664	988	428	283	1366	1384	641	638	182	459
Coke, refined petroleum products and nuclear fuels; industrial gas	2974.923	434	211	155	773	657	245	212	92	197
Retail trade services of motor fuel	2711.03	289	137	106	398	3936	590	412	76	264
Mineral waters and soft drinks	2536.002	1247	558	414	1967	976	397	624	253	516
Reexport/reimport	2487.179	822	352	220	1543	92	1038	1580	172	444
Other food products	2429.618	514	240	154	723	622	214	264	181	155
Public administration and defence services; compulsory social sec	1982.251	420	226	122	816	2938	428	232	107	168
Wood and products of wood and cork (except furniture); articles o	1695.981	798	451	251	1406	1011	316	374	165	341
Collected and purified water; distribution services of water	1687.426	56	23	17	53	125	52	52	11	31
Air transport services	1610.521	836	323	213	911	3888	696	609	147	415

Source: Eora MRIO Database, authors' calculation

Further steps

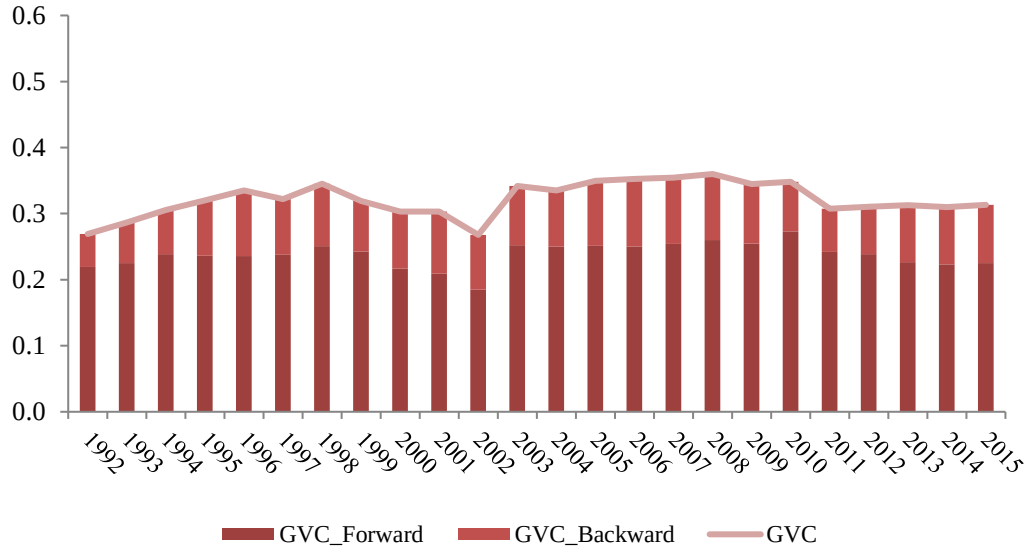
The results so far present a rather interesting if non-encouraging picture of regional cooperation among the CAREC countries. But in the same time, these patterns reveal that there are opportunities for closer cooperation and VC integration among these countries.

The next steps in our analysis would be taking the stock of forward and backward linkages between Georgia and other CAREC countries at the industry level. This exercise will reveal the opportunities for further trade cooperation and will serve as a backdrop for in-depth interviews with industry representatives.

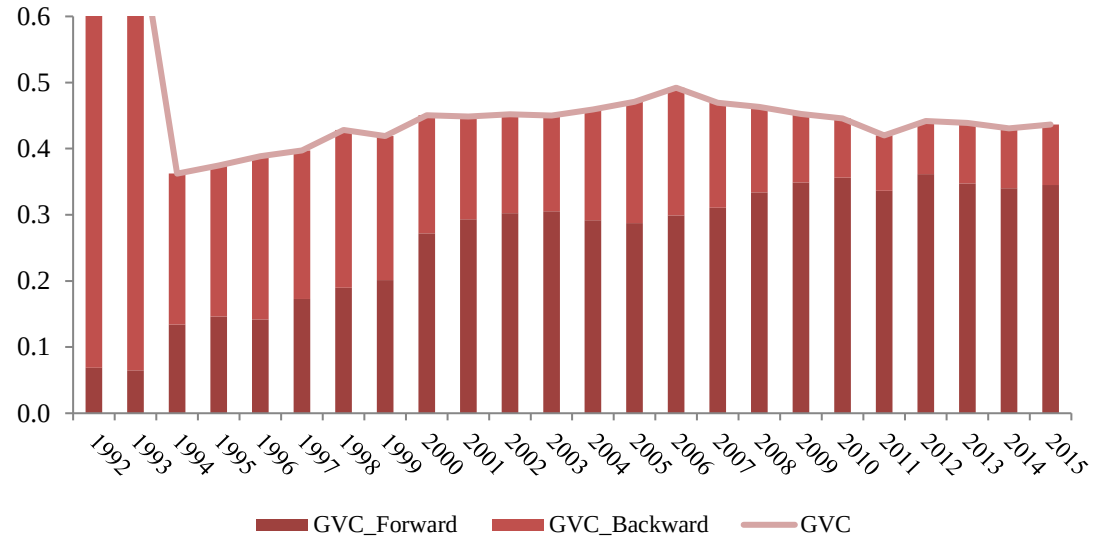
Another task would be to look at the industry by industry VC participation index in depth for CAREC countries. This would reveal how particular industries in CAREC countries are integrated on the regional level and in global value chains. It would be instrumental for understanding which industries may have the highest potential for intra-regional integration.

Annex 1

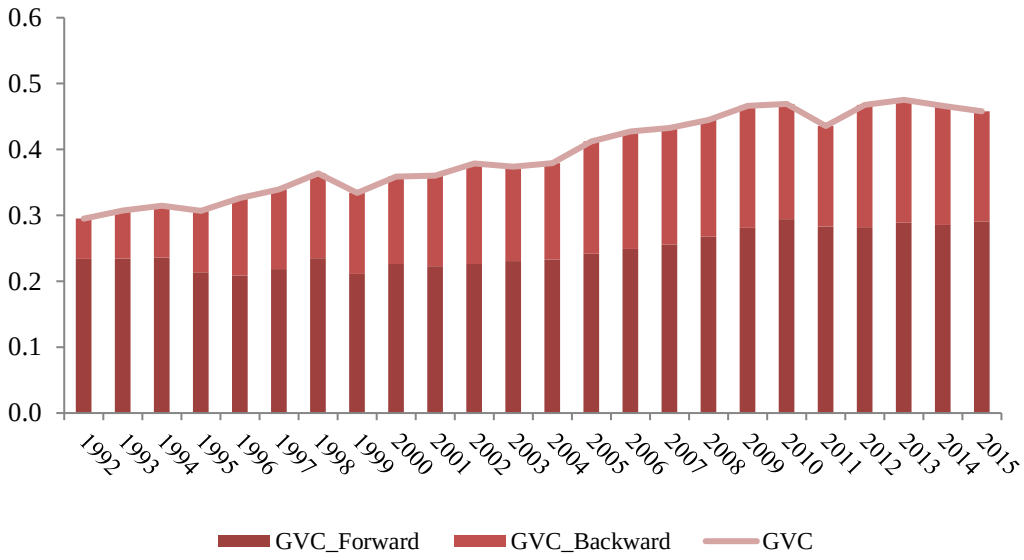
Global Value Chain Participation of Afghanistan



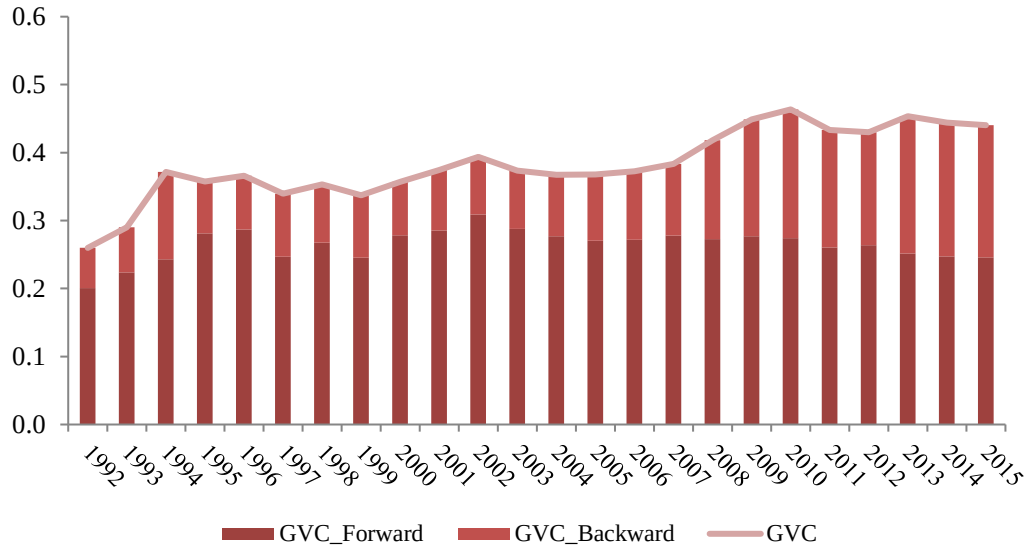
Global Value Chain Participation of Azerbaijan



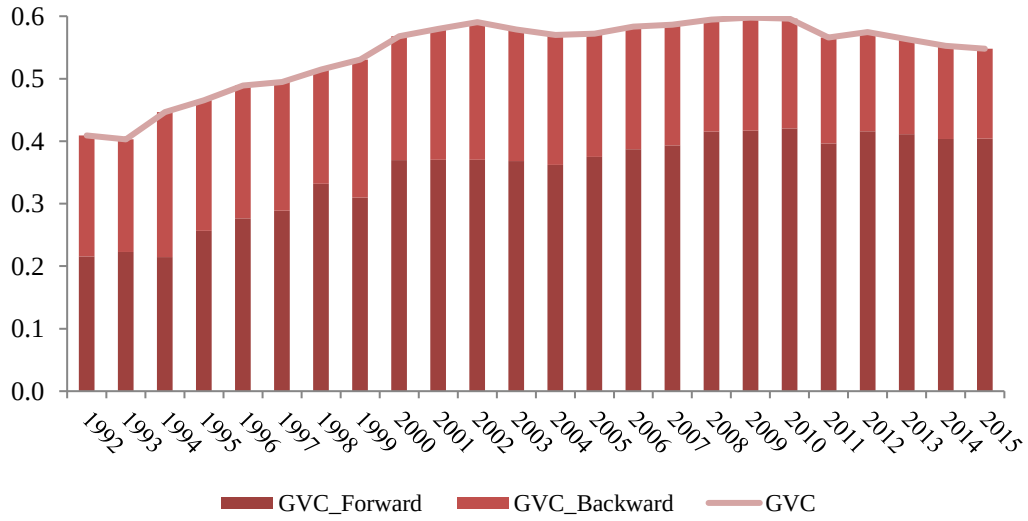
Global Value Chain Participation of China



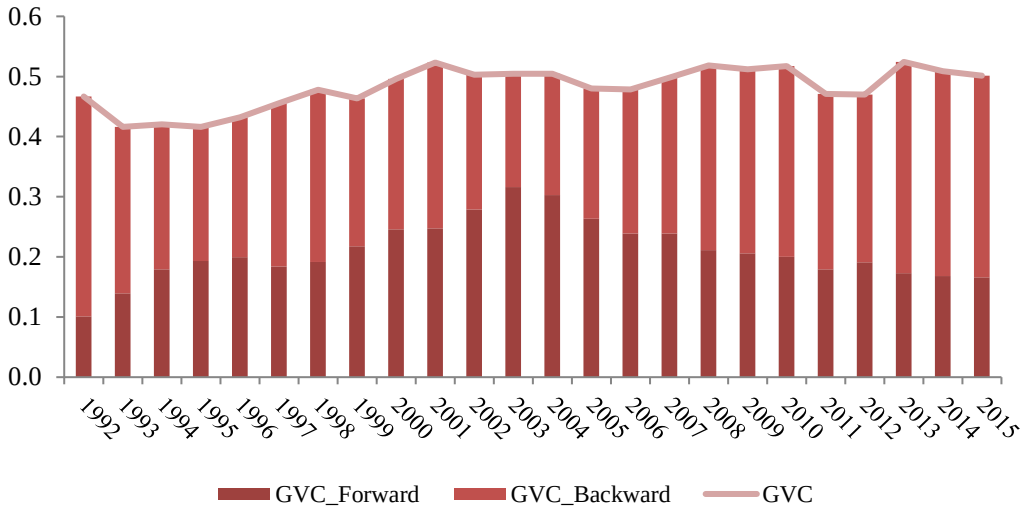
Global Value Chain Participation of Georgia



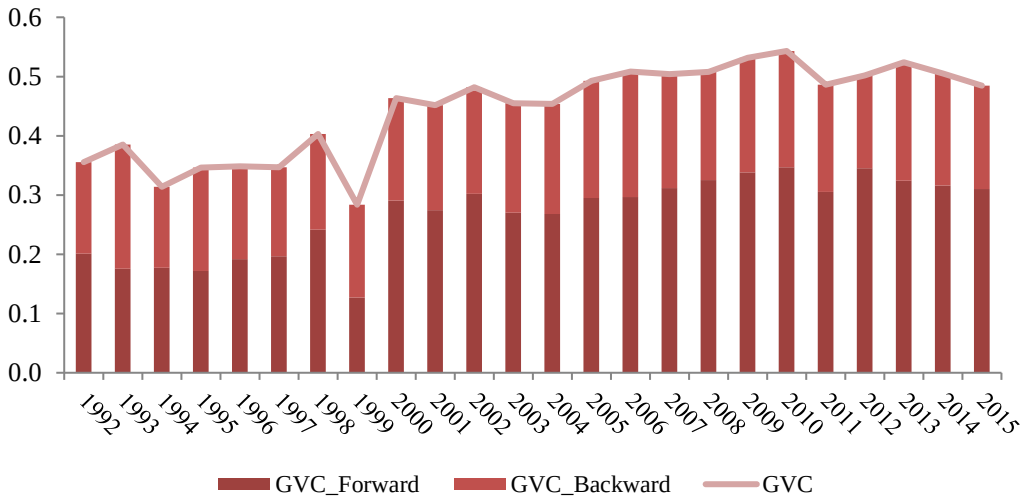
Global Value Chain Participation of Kazakhstan



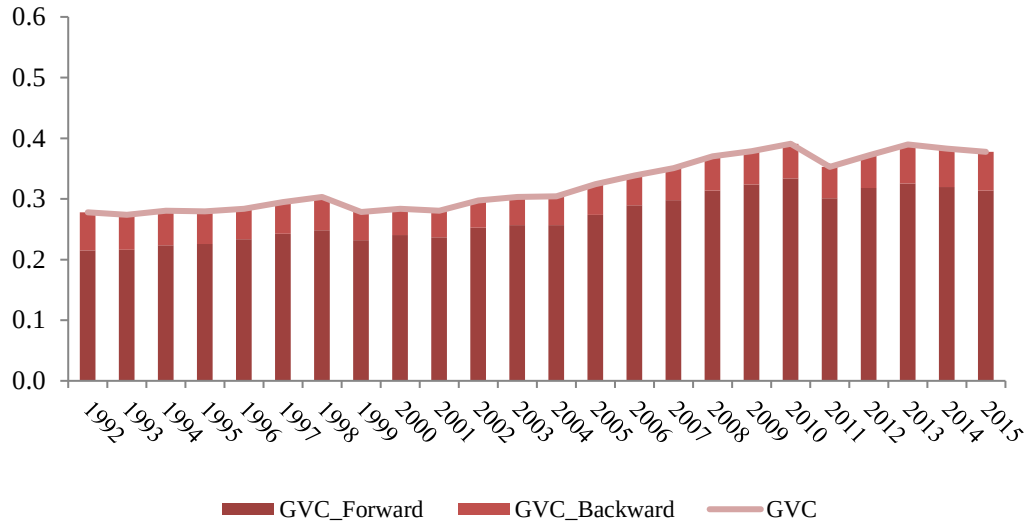
Global Value Chain Participation of Kyrgystan



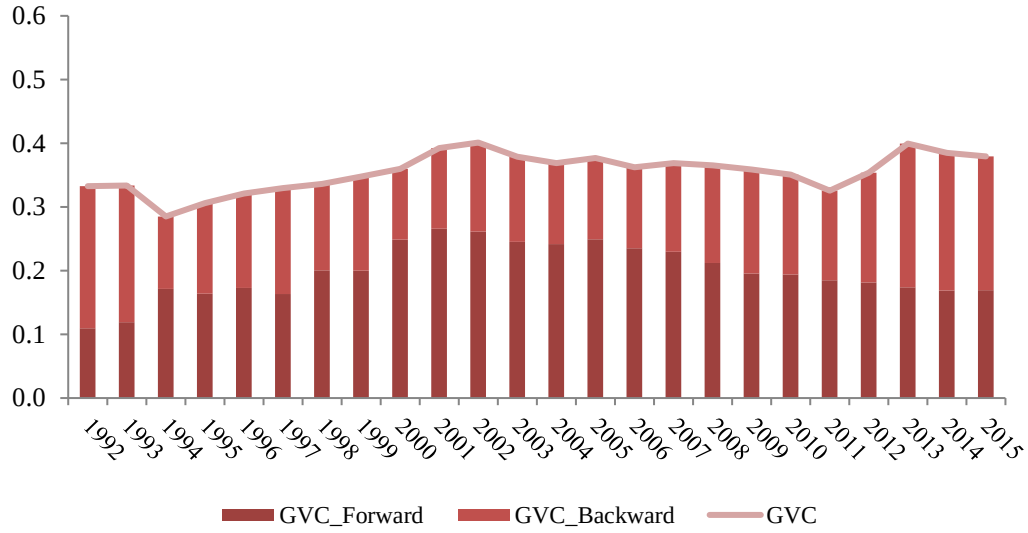
Global Value Chain Participation of Mongolia



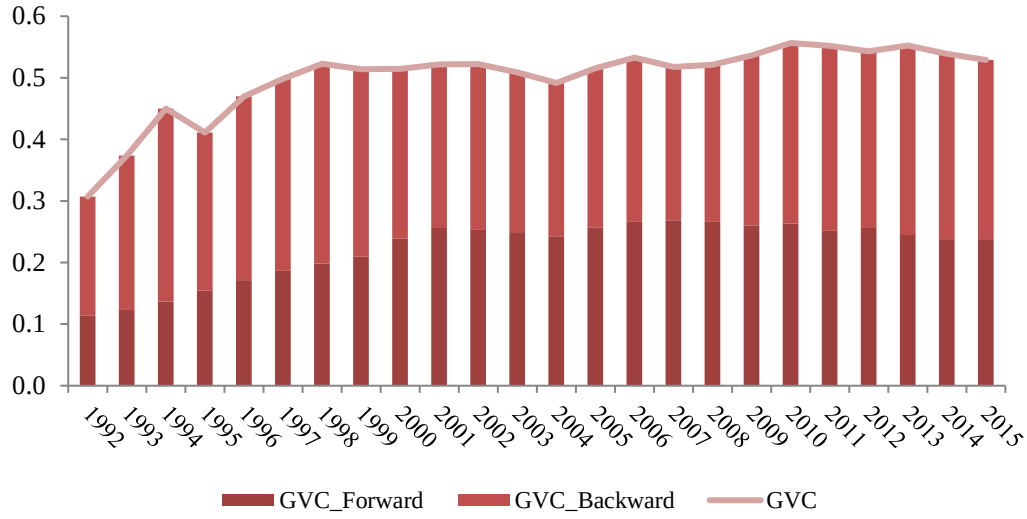
Global Value Chain Participation of Pakistan



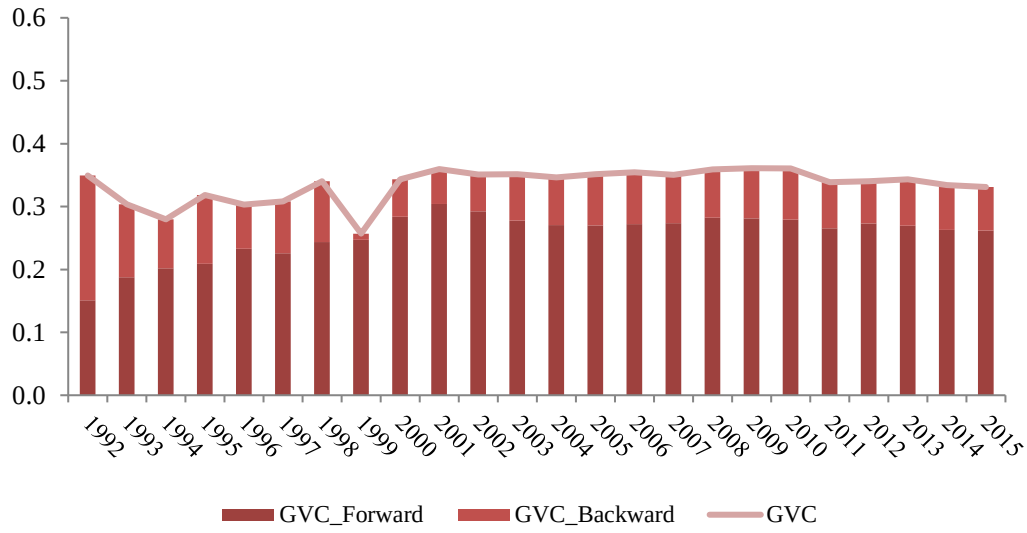
Global Value Chain Participation of Tajikistan



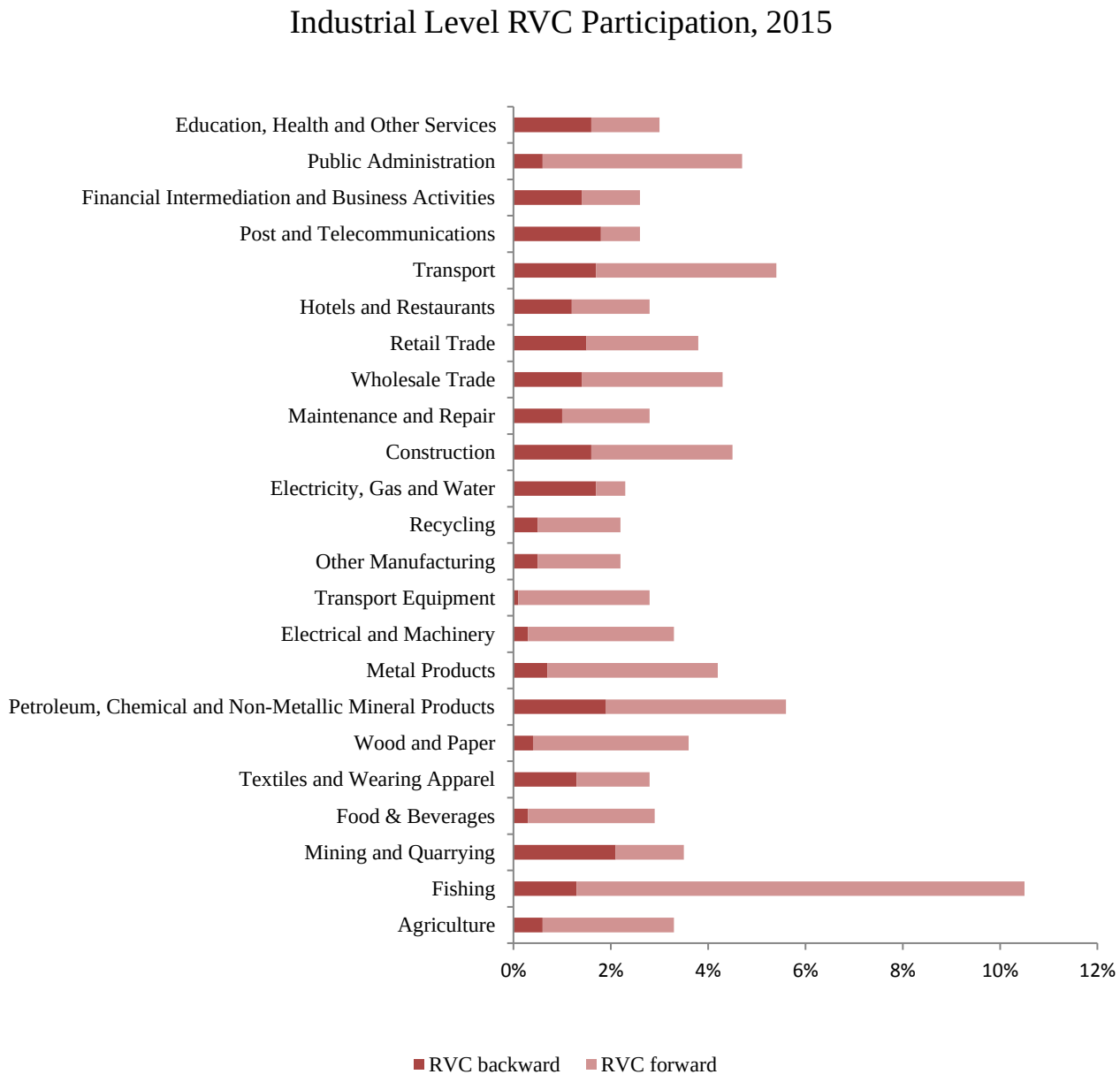
Global Value Chain Participation of Turkmenistan



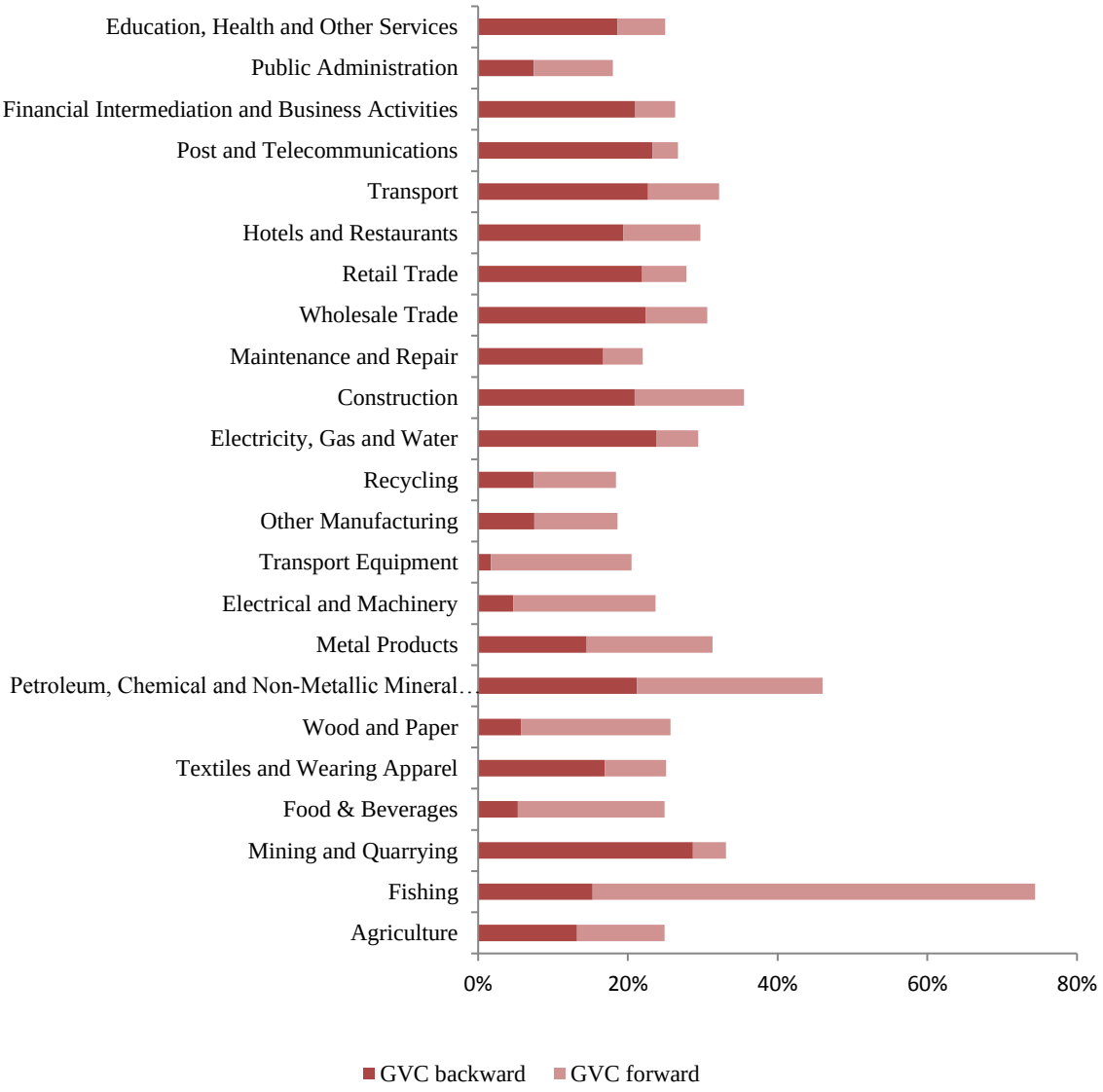
Global Value Chain Participation of Uzbekistan



Annex 2


Industrial Level RVC Participation, 2015
Education, Health and Other Services
Public Administration
Financial Intermediation and Business Activities
Post and Telecommunications
Transport
Hotels and Restaurants
Retail Trade
Wholesale Trade
Maintenance and Repair
Construction
Electricity, Gas and Water
Recycling
Other Manufacturing
Transport Equipment
Electrical and Machinery
Metal Products
Petroleum, Chemical and Non-Metallic Mineral Products
Wood and Paper
Textiles and Wearing Apparel
Food & Beverages
Mining and Quarrying
Fishing
Agriculture
0%
2%
4%
6%
8%
10%
12%
RVC backward
RVC forward

Industrial Level GVC Participation, 2015



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