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Trade, FDI and income inequality: empirical evidence from CIS

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Abstract

Purpose – The purpose of this study is to examine the relationship between trade, foreign direct investment (FDI) and income inequality for Commonwealth of Independent States (CIS), using annual data from 1990 to 2016. The study attempts to answer a critical question: does openness affect income distribution?

Design/methodology/approach – The analysis of the model involves the examination of likely non-linear effects of both trade and FDI on income distribution. Therefore, system-generalized method of moments (SYS-GMM) estimator was applied to mitigate the problem of non-linearity and possible endogeneity. In the second stage, the model was extended to test the impact of education on income inequality. The hypothesis is that secondary school enrollment speeds up the process of adoption of contemporary technology and decreases inequality.

Findings – Trade and FDI have significant effects on income inequality when interacted with Gini-index; in case of trade, an inverted U-shaped curve holds as purposed by the trade theory. The components-wise effect of trade was held, except imports from advanced countries was found insignificant. Moreover, results were not found significant in case of human development index. Different results were found when trade and FDI interacted with education, which represents an important channel through which inequality is affected.

Research limitations/implications – The study implies that CIS needs to re-design trade and FDI policies by encouraging trade and FDI inflows into industries and sectors aligned with structural adjustments, domestic industries uplift and investment in social infrastructure.

Originality/value – This is the first study that has examined the impact of openness of income distribution in case of CIS.

Keyword FDI

Paper type Research paper

1. Introduction

The collapse of the socialist system in Central and South Eastern Europe, the Baltic republics and the Commonwealth of Independent States (CIS) witnessed a sharp contraction in output during the initial stages of transition. Twelve of the republics had decided to unite into a loose confederation of independent states, with the name of CIS. As a result of the growing integration with the world economy, income inequality has risen in these nations over the past three decades. However, output decline has now been completely or partially reversed in a number of transition economies, though they were severe and their impact on living standards was dramatic. The collapse of the entire socialist block can reasonably be described as the most dominant and stylized fact for rising income inequality (Ferreira, 1999; Ivaschenko, 2003; Milanovic, 1999). The emergence of newborn economies had a big and deep impact on the nature and course of the labor market. There is a growing amount of research that attempts to explain the rise in income inequality during transition. Many existing papers try to figure out the possible factors behind the changes in the distribution of income, using theoretical models of transition (Aghion and Commander,

1999; Ferreira, 1999; Milanovic, 1999). The debate about openness impact on income inequality was a matter of great concern in economic literature, namely, whether openness is related to broadening or narrowing of the income gaps. The global financial crisis of 2008 had a strong negative effect on global imbalances and trade (Blanchard and Milesi-Ferretti, 2009; Giannone *et al.*, 2011; Obstfeld, 2012; Reinhart and Rogoff, 2009). In fact, financial crises associated with a sudden slump in international trade were significantly larger than the fall in the world GDP (Gopinath *et al.*, 2012). The severe effects of the great global recession has renewed the interest of researchers and policymakers and paradigmatically changed the policy views about interconnections between openness and income disparities.

The commonly discussed driving forces of high income inequality are foreign trade, financial capital flows, technological changes, financial deepening, secondary school enrollment and legal and social justice (IMF, 2015). Trade facilitates diffusion of technology and knowledge (Baldwin *et al.*, 2005; Barro and Sala-i-Martin, 1997; Rivera-Batiz and Romer, 1991). Trade openness expands market size by producing innovated products at a cheap price, resulting in increase in purchasing power and living standards of people (Ades and Glaeser, 1999; Alesina *et al.*, 2000; Bond *et al.*, 2005; Romer, 1989). Foreign direct investment (FDI), as another channel of openness, is the investment made by multinational companies in the host country. FDI brings capital, technology, management skills, innovated production techniques, market information and competition. FDI may create employment in abundance in developing countries having unskilled labor, resulting in decline in income inequality (Chen, 2016). Absorptive capacity determines FDI. Countries having better absorptive capacity, such as infrastructure, human capital accumulation, air transport and telephone main lines, attract more FDI (Wu and Hsu, 2012).

This study examines the impact of trade openness and inward FDI on income inequality for CIS. CIS comprises a union of 12 countries; in our case, we have taken 11 countries' data, excluding Turkmenistan owing to unavailability of required information. The rest of the 11 countries (named alphabetically) are Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Ukraine and Uzbekistan. The observations span the period 1990-2016, and the data were collected from WDI (2016), WIID (2012), UNDP (2016) and UNCTAD (2016). Income inequality is measured by two proxies, namely, Gini-index and human development index (HDI). This study has analyzed overall impact of both trade and inward FDI on income inequality, and trade was further separated into its components – imports and exports – according to the area of origin and destination of flows because the overall trade impact on income inequality might be different from its components. The dynamic specifications have been used in the study, and the endogeneity problem is addressed by using generalized method of moments (GMM). This study adds to the literature by addressing the following questions:

Q1. Does there exist any impact of trade openness on income inequality?

Q2. Does there exist any impact of FDI on income inequality?

Q3. Does income inequality follow a non-linear trend owing to availability of new technology through trade openness and FDI?

The rest of the paper is structured as follows. Section 2 reviews literature on trade, FDI and income inequality. Section 3 discusses model, data and variables. Section 4 reports descriptive statistics, both at aggregate level and countrywide. Section 5 contains results and their discussion. Finally, Section 6 ends with conclusion and policy implications.

2. Brief literature review on trade, foreign direct investment and income inequality

The effect of openness on income distribution was a matter of great concern in economic literature. Theoretical research has proved that long-term sustained growth can only be achieved through uninterrupted trade and FDI flows (Edwards, 1993; Frankel and Romer, 1999; Hermes and Lensink, 2003; Tiwari and Mutascu, 2011; Zhang, 2001). Globalization and its constituents, such as liberal market reforms, integration of countries, improvements in technology and economic development, have given rise to an increasing debate about their income distributional effects within and between countries. The starting point of the debate is found in the Heckscher–Ohlin and Stolper–Samuelson's theorem (HO/SS) (Stolper and Samuelson, 1941).The HO/SS theorem predicts that trade liberalization will shift income toward a country's abundant factor and suggests developing countries to adopt outward-oriented policies to benefit from their abundant factor, i.e. unskilled labor force. Many studies support the HO/SS theorem, such as Franco and Gerussi (2013) and Perera *et al.* (2014). However, it is not always true that trade liberalization policies benefit the developing nations. Several studies have identified many anomalies in the HO/SS theorem (Davis, 1996; Lee and Vivarelli, 2006; Mahesh, 2016; Meschi and Vivarelli, 2009). Lee and Vivarelli (2006) addressed critical questions related to the predictions of the HO/SS theorem and found that increase in employment and decrease in country income inequality were not tightly linked with the liberalized policies of trade and FDI. The positive impact of increased trade on poverty reduction is only achieved through economic growth mediation. The role of social infrastructure is crucial to optimize the positive employment and income distributional effects of increased trade and FDI. Wage inequality and profit to skilled labor increased in the underdeveloped countries that were opened to trade (Chiquiar, 2008; Cragg and Epelbaum, 1996; Davis, 1996). This indication also appears to be conflicting to the HO/SS theorem, which contends that if countries are abundant in unskilled labor, returns to skill are expected to decrease as they open up to trade with additional economies activities (Hanson and Harrison, 1999).

Empirical studies, on the other hand, suggest a negative impact of FDI and positive impact of trade on income inequality. In this respect, a study conducted by Faustino and Vali (2011) for a sample of 24 OECD countries over the period of 1995-2007 confirms that trade openness results in decline in income disparities, while FDI worsens income inequality. Asteriou *et al.* (2014) contends that trade openness reduces income inequality and financial liberalization through FDI, and capital accounts openness and stock market capitalization further deteriorates income inequality in EU states. Ehrhart (2005) investigated the impact for Latin American and East Asian countries and their results reveal positive impact of both trade openness and FDI on inequality. Kaulihowa and Adjasi (2018) confirm a non-linear relationship between FDI and income inequality, wherein, initially the flow of FDI reduces the inequality; however, this effect diminishes with further increases in FDI. Tiwari *et al.* (2013) and Sehrawat and Giri (2015) presented almost similar findings for India that financial development aggravates the income inequality in both the short and long run; however, trade openness reduces the gap between the rich and the poor. In another study, Sehrawat and Giri (2016) tested finance–inequality–poverty relationship for South Asia and their results suggest that financial development and economic growth reduce poverty but not rural–urban inequality. However, Shahbaz (2015) suggests that financial development improves economic growth and worsens income inequality in case of Iran. Helpman *et al.* (2017) found that around two-thirds of the overall wage inequality occurs within sector-occupations, and trade liberalization at first raises and later reduces income inequality. Rojas-Vallejos and Turnovsky (2017) illustrated that a permanent

reduction in tariff rates, during a period of high-trade liberalization from 1984 to 2010, increases short-run inequality, but improves economic growth. While their findings regarding the long-run effects of trade liberalization and income inequality were not robust, they presented similar findings. As a matter of fact, there exists sufficient empirical evidence about openness impact on income inequality reaching mixed conclusions (Asteriou *et al.*, 2014; Çelik and Basdas, 2010; Franco and Gerussi, 2013; Kai and Hamori, 2009; Mah, 2003; Majeed, 2016).

A smaller number of studies had disaggregated trade into imports and exports according to origin and destination of flows and argued that trade impact differs. For example, Meschi and Vivarelli (2009) estimated the impact of trade openness with respect to origin and destination on income inequality for 65 developing countries and found that inter-trade reduced the country income inequality through both imports and exports, while intra-trade had insignificant effects on income inequality. Further, a study by Mahesh (2016) on BRICS also suggested interesting results. Both imports and exports are positively related with income inequality. Franco and Gerussi (2013) examined the impact of openness on income distribution of 17 transition countries and argued that neither trade nor FDI was relevant in explaining the variation of income inequality.

Many studies have highlighted the impact of transition on income inequality (Ferreira, 1999; Ivaschenko, 2003; Milanovic, 1999); however, very few studies have been found that explore the impact of openness on income inequality. Franco and Gerussi (2013) examined the impact of openness on income distribution of 17 transition countries and argued that neither trade nor FDI is relevant in explaining the variation of income inequality. When trade is separated into its components according to its origin and destination, results show that imports coming from developed countries cause income inequalities in the short run because new technologies are skill-intensive. This phenomenon does not occur in the long run and income inequality declines. Campos and Kinoshita (2002) found a positive effect of FDI on economic growth in case of Central and Eastern European and the CIS transitional economies over the period 1990-1998. Jude and Levieuge (2013) contended that impact of FDI on financial development contingent on the institutional nature of recipient nations. The investigation covered 94 developing nations, including 5 nations from CIS – Armenia, Azerbaijan, Belarus, Kazakhstan and Ukraine – over the period 1984-2009. The results uncovered that FDI alone had no critical impact on development. Another study conducted by Azam and Ahmed (2015) on ten CIS countries found that FDI has a facilitating role in encouraging the growth of CIS and that human capital is key to economic growth.

3. Empirical model, data and variables
3.1 Empirical model
The empirical approach was aimed at investigating the impact of trade openness and FDI on income inequality. The analysis also involves the examination of a likely non-linear effect of both openness measures on income distribution. The baseline of the empirical specification is given as below:

$$Gini_{it} = \beta_0 + \beta_1 OPEN_{it-1} + \beta_2 OPEN_{it}^2 + \Sigma \beta_k X_{ikt} + u_i + e_{it}$$

Where, Gini is the income inequality in country i at time t. OPEN represents FDI and trade alternatively. To dig out our analysis, trade is further split into imports and exports with respect to their starting and ending points. To estimate the non-linear relationship of openness variables with Gini-index, open square is added in the model. X_k is a vector of controlled variables, which are GDP per capita, secondary school enrollment, inflation and

service sector, u_i is the distinctive component that measures time-invariant country-specific effects and e_i is the traditional error term. The panel data were helpful to explain individual country heterogeneity or at least minimize probable misleading estimates

In the first step of empirical analysis, all the variables were taken in lag terms in the model, which enables to control previous effects, also mitigating a possible problem of endogeneity. The dependent variable is lagged in the model, which controls the fact that inequality may be continual across time, and it depends on various factors that change slowly. The estimated model is the following:

$$Gini_{it} = \beta_0 + \beta_1 Gini_{it-1} + \beta_2 OPEN_{it-1} + \beta_3 OPEN_{it}^2 + \Sigma \beta_k X_{ikt} + u_i + e_{it}$$

However, owing to the insertion of lagged dependent variable, endogeneity problem is confronted. The method to handle the endogeneity problem was the System-GMM (SYS-GMM) estimator, proposed by Blundell and Bond (1998).The log of all the variables was taken to lessen the likely impact of outliers. The square terms of all variables were taken to estimate non-linear trend. System GMM was applied following David Roodman (2009).

After the estimation of the second model, the analysis further extended to test the impact of education on income inequality. For this purpose, the secondary school education was interacted with all openness variables. The hypothesis was that secondary school enrollment speeds up the process of adoption of contemporary technology and decreases inequality, as proposed by many authors (Arshed *et al.*, 2017; Franco and Gerussi, 2013; Lin, 2007).

3.2 Data and sample
The choice of countries included in the sample is dictated by the availability of data. As far as time duration is concerned, the observations are taken from 1990 to 2016 as many of the CIS countries had announced independence in the 1990s. To check the robustness, the alternative proxy used instead of Gini was HDI. A brief description of all the variables based on WDI, WIID, UNCTAD and UNDP is given in the following Table I.

3.3 Variables
3.3.1 Dependent variables. The income inequality was computed using both Gini and HDI for each country-year. The income inequality was analyzed using both proxies. The Gini-index value ranged between 0 and $1 - 0$ when the income distribution was perfectly equal and 1 when the level of inequality was the highest. A perfectly equal income distribution does not exist because individuals are different from one another in aspects of expertise, capabilities, education attainment, etc. Pereira and Salinas (1978) pointed out that Gini coefficient is the most popular measure of inequality among other contending measures. The factors such as human capital, trade with other countries, economic growth, inflation, unemployment and political factors have an effect on distribution of income. In this study, Gini-index was reported in percentage points. The extensive use of Gini-coefficient in literature has strongly influenced the use of Gini-coefficient in the current study (Basu and Guariglia, 2007; Çelik and Basdas, 2010; Chaudhry and Imran, 2013; Choi, 2006; Franco and Gerussi, 2013).

HDI is an amalgamation of life expectancy, education and per capita income indicators, which are used to mark countries under four tiers of human development. To check the robustness, the alternative proxy used instead of Gini is HDI. Likewise, HDI is viewed as an index of "potential" human development. When there is perfect distribution of income in society, the HDI value is the maximum. On the other hand, unequal distribution of income

Variables	Variable name	Explanation	Data sources
Dependent variables	Gini-index (%)	Gini coefficient measures unequal distribution of national income among members of society	[3]
	HDI-index	HDI as proxy for income distribution	[4]
Independent variables	Trade openness	Trade openness, calculated by the ratio of the sum of exports and imports to GDP	[1]
	FDI	The stock value of inward FDI as % of GDP	[2]
	X.adv	Exports to advance countries as % of total merchandise	[1]
	X.dev	Exports to developing countries as % of total merchandise	[1]
	M.adv	Imports from advance countries as % of total merchandise	[1]
	M.dev	Imports from developing countries as % of total merchandise	[1]
Control variables	GDP	GDP per capita, PPP (US constant Dollars, 2011)	[1]
	Sec	School enrollment, secondary (% gross)	[1]
	Inf	Inflation, GDP deflator (annual %)	[1]
	Ser	Services as value added (% of GDP)	[1]

Sources: [1] World Bank, World Development Indicators online database, 2016; [2] UNCTAD, 2016; [3] World income inequality database, WIID Version2.0c, 2012; [4] United Nations Development Programme, UNDP 2016

Table I.
Data sources and variables description

leads to lower HDI value. The value of HDI ranges from 0 to 1.The country scores the highest value of HDI when the life expectancy, the education level and the GDP per capita are higher. Conversely, the country scores 0 when the life expectancy, education level and GDP per capita are quite low.

3.3.2 Independent variables. The variable measuring openness (OPEN) involves data on trade openness, imports and exports and inward FDI stock. Trade openness is represented by the sum of imports and exports as percentage of GDP and is taken from WDI. The measure of trade openness is considered to capture the direct impact of trade openness on income inequality and is used extensively in literature (Dollar and Karry, 2002; Celik and Basdas, 2016; Chaudhry and Imran, 2013; Mah, 2003; Sylwester, 2005).

The trade was further separated into its components, imports and exports according to the area of origin and destination of flows because the overall trade impact on income inequality might be different from its components. The technological level implanted into the products causes differentiation in products; goods that come from advanced countries might be different from goods from developing countries. Likewise, the technology from advanced countries are different from that from developing countries. The technology from advanced countries are more skill-intensive while that from developing countries are less skill-intensive. The same logic can be applied to exports. Data on imports and exports are taken from WDI.

FDI was another channel of openness. Foreign investments can be FDI and portfolio investments. Following common practice (Chintrakarn *et al.*, 2012; Figini and Gorg, 2006; Franco and Gerussi, 2013; Herzer and Nunnenkamp, 2011), in the current study, the stock value of inward FDI was used, which was the total amount of capital by foreign investors in the receiving country. The stock value of inward FDI was used rather than inflows because the stocks are permanent investments and their impact on income inequality is quite different from that of temporary investments. The data on inward FDI stock are calculated from UNCTAD, 2016.

3.3.3 Control variables. The variables GDP per capita, inflation, services sector and secondary school enrollment were chosen as control variables. GDP per capita is a measure of average income per person of the country. It tells us about the progress and growth of the country. The association between growth and income distribution was first given by Simon Kuznets (1955): in the early stages of development, income inequality rises, but later on it declines. The association between growth and income inequality depicts the inverted U-shaped curve. This inverted U-shaped association has been empirically tested by many authors and has produced mixed results (Choi, 2006; Meschi and Vivarelli, 2009; Ivaschenko, 2003). The inverted U-shaped curve, which signifies that as economy grows at an initial stage, income inequality worsens, but later on, it declines, was not confirmed by most of the literature. The GDP per capita is computed in the current study in terms of PPP. The data on GDP per capita PPP is taken from World Development Indicators (2016).

Secondary school enrolment was calculated as percentage of gross enrolment ratio. Gross enrollment ratio can exceed 100 per cent owing to the inclusion of over- and under-aged students because of early or late school admission and grade repetition, as in the case of Kazakhstan, where the gross enrollment ratio was 112 per cent in 2016. It was observed that the rate of literacy through its effect on the population of skilled labor over the years has improved the distribution of income. The secondary school enrollment ratio was added in the model to access the role played by education in shaping the labor market. It is expected that the higher the enrollment ratio, the higher is the supply of skilled labor. This in turn may reduce wage inequality by increasing the relative supply of skilled labor. The higher level of education can result in demand for skilled labor. The demand for skilled labor is linked with the decline of income inequality (Figini and Gorg, 2006; Basu and Guariglia, 2006; Mahesh, 2016; Jensen and Rosas, 2007; Mihaylova, 2015).

Inflation rate was measured using the annual growth rate of the GDP implicit deflator, which shows the rate of price change in the economy as a whole. Inflation is a macroeconomic unstable condition that may affect the income inequality positively by increasing wages (Franco and Gerussi, 2013; Meschi and Vivarelli, 2007; Ivaschenko, 2003). The data on inflation as GDP deflator are taken from World Development Indicators (2016).

Trade openness measure contributes toward the development of service sector. The service sector represents the share of a whole liberalized economy where skilled labors are paid higher wages (Bhandari, 2007). The service sector may be one of the determinants of income inequality. Based on previous research (Choi, 2006; Chaudhry and Imran, 2013; Franco and Gerussi, 2013), value added of service sector representing privatized share and the data have been taken from World Development Indicators (2016).

4. Descriptive statistics

Tables II and III report overall and country-wise descriptive statistics for the sampled countries of the CIS region. The average values of Gini-index and HDI are 22.95 and 12.82 per cent, respectively, indicating that CIS countries have relatively less income disparities and improved living conditions. This improvement may be owing to improved economic integration with the rest of the world. But, the openness being quite high implies that the CIS countries have extended trade and investment relations. Trade openness was observed to be 93.28 per cent of the GDP for the region as a whole, showing that countries have adopted and implemented open-trade policies. Similarly, percentage of inward FDI was 25.11 per cent of GDP, which is also fairly good as it reflects the linkages with the rest of the world. The region exported majorly to developing countries (47.82 per cent), while its exports to the developed world was 40.20 per cent. Similarly, the region is mainly importing from advanced countries as compared to developing countries. On the other hand, per capita GDP

Variables	Obs.	Mean	SD	Minimum	Maximum
Gini-index	324	22.95	16.73	0.52	48.38
HDI-index	297	12.82	16.45	0.59	57.9
Trade (% of GDP)	324	93.28	31.39	22.23	199.68
FDI (% of GDP)	324	25.11	22.22	0.1	118.1
X.adv (% of total merchandise)	323	40.20	19.43	3.87	99.87
X.dev (% of total merchandise)	323	47.82	18.39	5.13	89.03
M.adv (% of total merchandise)	324	33.13	13.38	2.67	74.79
M.adv (% of total merchandise)	323	48.32	16.78	2.76	92.66
GDP per capita	324	7,534.24	5,988.61	1,042.51	25,144.11
Sec	297	90.47	9.30	72.37	112.00
Inf	323	228.08	1,020.43	−20.86	15,444.38
Ser	324	45.37	12.77	16.56	77.5

Source: Authors' calculations

Table II.
Descriptive statistics

Country/ variable	GINI	HDI	Trade	FDI	X.adv	X.dev	M.adv	M.dev	Per capita GDP	Sec.	Inf.	Ser.
Armenia	35.96	0.67	77.38	50.02	27.49	39.36	39.89	41.54	4,806.85	40.17	249.68	36.87
Belarus	31.54	0.72	124.12	11.19	32.88	58.19	26.36	66.85	11,078.53	102.9	244.52	46.23
Azerbaijan	30.49	0.68	88.27	39.91	54.20	29.02	38.08	50.28	9,337.98	75.88	170.07	34.45
Moldova	34.24	0.64	124.38	29.77	27.65	32.54	55.40	50.69	3,239.03	85.92	14.80	55.27
Ukraine	28.37	0.71	92.52	19.22	36.64	40.72	41.95	45.57	7,025.13	97.81	258.44	50.82
Russia	41.88	–	54.64	14.09	66.60	61.83	18.48	18.48	18,769.93	91.89	124.86	56.47
Georgia	40.03	0.71	84.79	37.69	24.76	69.48	33.74	57.19	5,248.31	86.99	859.37	52.73
Kazakhstan	31.71	0.72	86.67	44.75	53.03	27.43	42.21	42.78	15,079.06	97.98	184.39	54.43
Kyrgyzstan	34.91	0.61	102.70	31.39	27.43	57.94	19.22	55.86	2,527.12	28.12	81.97	41.81
Tajikistan	31.07	0.59	99.43	12.89	45.69	40.02	22.64	58.12	1,911.26	84.09	123.39	40.19
Uzbekistan	38.55	0.63	7.53	60.54	35.73	47.78	44.06	44.55	3,396.25	93.53	152.14	42.54

Source: Authors' calculations

Table III.
Country-wise
statistics

is relatively on the lower side (US$7,534.24) for the region as a whole. Despite the high trade
and FDI openness, why per capita income has not grown with a faster speed is an
interesting question to investigate.

The region as a whole is doing well in terms of human capital. School enrolment ratio for
the region is more than 90 per cent, indicating an excellent performance. Inflation rate for the
region as a whole is on the high side owing to the existing diversity in the region. Lastly,
service value-added growth for the selected countries is 45.37 per cent, demonstrating that
the region is growing with a high focus on the service sector. Statistics for the whole region
are depicted in the following Table II.

In the next step, we have provided statistics on selected variables for individual
countries. The country-wise statistics showed that Russia was a country with relatively less
equal distribution of income based on the Gini-index, while Belarus topped the list based on
the HDI index. In terms of trade openness, the Republic of Moldova is the most open
economy in the CIS group, followed by Belarus and Kyrgyzstan. Similarly, Uzbekistan and

Armenia are receiving the highest FDI inflows. On the other hand, Tajikistan and Belarus are the countries where FDI inflows are the lowest in the region. Russia is noted to be the highest exporter to advanced countries, while Georgia is the major exporter to developing countries in the CIS region.

The statistics show that Russia is having the highest per capita income, followed by Kazakhstan and Belarus. All other countries in the region are enjoying a relatively lower per capita income. Georgia is experiencing the highest average inflation rate while Moldova is facing the lowest inflation rate over the years. In terms of human capital, Belarus and Kazakhstan are on top of the list in the region, followed by Ukraine and Uzbekistan. Georgia and Ukraine are the countries where inflation is the highest, while Moldova is facing a relatively low inflation rate over the study period. Lastly, Table III shows that service valued-added growth for all countries, except Armenia, is more than 40 per cent.

5. Results and discussion (regression analysis)

The empirical analysis was built around various models, including openness measures in broad terms and particular components of trade. Each model has been estimated by taking lags and square lagged variables. First, trade has been included separately and then square terms have been added to check the non-linearity of the openness and inequality linkage. Then FDI has also been included in the same way. After the estimation of FDI impact, trade has been separated into its components according to its origin and destination. The lagged values of all trade components and square terms have been included separately to estimate the inequality impact. Table IV represents different specifications of the models with respect to Gini-index.

5.1 Estimation with Gini-coefficient as dependent variable

When the specifications were tested with the SYS-GMM estimators, it was confirmed that the lagged dependent variable was always positive and highly significant in models 1-6 of Table IV, meaning that inequality was persistent. It was also noted that the coefficient of lagged trade was statistically significant in explaining the variation of the Gini-index in model 1 of Table IV. The coefficient of trade was negative and significant at 5 per cent, resulting in acceptance of null hypothesis. The results indicate that when trade openness in CIS increases, these countries indulge more in export production and try to increase their exports. The empirical findings were in line with the theoretical frameworks of HO/SS. The estimates confirm HO/SS predictions as findings reveal a negative association of trade and income inequality. These results are similar to other studies (Asteriou *et al.*, 2014; Faustino and Vali, 2011; Perera *et al.*, 2014). However, the quadratic term of trade shows significant and negative coefficient at 5 per cent, resulting in accepting the non-linearity of the relationship between trade and income inequality. It shows that inequality first increases through trade openness and raises demand of skilled workers but reduces later and follows the inverted U-shaped phenomenon as suggested by theory. Thus, trade openness in case of CIS stresses the existence of a non-linear trend.

On the other hand, FDI impact was also found statistically significant in model 2 of Table IV. Although the coefficients of lagged FDI is positive and significant at 1 per cent, showing that an increase in inward FDI stock results in an increase in income inequality. The econometrics estimates revealed that when inward stock of FDI increased in CIS, it brought such projects that demanded skilled labor. The most contemporary projects caused gaps between the firms that were able to upgrade their assets and the rest of the firms. The domestic firms tried to upgrade their production mechanism; it resulted in demand for only skilled labor. The empirical findings were not in line with the theory. However, similar

Variables	(1)	(2)	(3)	(4)	(5)	(6)
GINI(−1)	0.5957*** (0.0999)	0.6539*** (0.0697)	0.7239*** (0.0475)	0.6913*** (0.0588)	0.7542*** (0.0458)	0.6521*** (0.0524)
Trade (−1)	0.5735* (0.3001)					
TradeSQ (−1)	−0.1515* (0.7745)					
FDI (−1)		0.7588*** (0.2923)				
FDISQ (−1)		0.4879** (0.1651)				
X.adv (−1)			0.1151** (0.5696)			
X.advSQ (−1)			−0.4.881** (0.2091)			
X.dev (−1)				0.2627*** (0.1024)		
X.devSQ (−1)				−0.7399** (0.3408)		
M.adv (−1)					1.6519 (4.5991)	
M.advSQ (−1)					−1.0849 (1.8471)	
M.dev (−1)						−0.1226** (0.5850)
M.devSQ (−1)						0.3857** (0.2044)
GDP	1.2567 (1.8629)	0.6812 (1.5257)	0.1592 (1.2479)	1.6309 (1.4574)	1.2307 (1.2292)	1.5579 (1.3713)
Inf	0.6159* (0.3475)	0.7124 (0.8086)	0.3599* (0.2138)	0.4249 (0.2589)	0.3904* (0.2187)	0.4198* (0.2401)
Sec	−14.9344 (12.1223)	2.0708 (2.8681)	3.6300 (6.1946)	−8.2347 (8.0746)	−9.9191* (5.4601)	−12.1281* (6.6301)
Ser	−2.2831 (3.7817)	0.2982 (6.1602)	−4.9996*** (1.7766)	−5.1446** (2.3911)	−3.5215** (1.8517)	−4.4200* (2.6182)
Obs	264	233	264	264	264	264
Sargan test (p-value)	0.793	0.450	0.324	0.140	0.046	0.241
AR1 (P-value)	0.000	0.000	0.000	0.000	0.000	0.000
AR2(P-value)	0.722	0.167	0.675	0.688	0.540	0.426

Notes: Robust standard errors in parentheses; ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$; and SYS-GMM regressions (dependent variable: Gini-coefficient). In columns 1, 2, 3, 4 and 5, instruments are limited to (2 5) lags, while in column 6, instruments are limited to (2 9)

Table IV.
FDI and trade effects
on income inequality
in CIS, 1990-2016

results were drawn by Herzer *et al.* (2014), Mah (2012) and Mihaylova (2015). The coefficient of FDI with square term confirms the non-linearity of the FDI–income inequality relationship. This implies that knowledge spillovers through imitation cause an equalizing effect. Similar results were drawn by Figini and Görg (1999), Figini and Gorg (2006) and Ucal *et al.* (2016).

To extend the analysis, trade is further divided into imports and exports according to the origin and destination, and the estimation results are presented in models 3-6 in Table IV. With respect to exports to advanced countries, the coefficients with respect to single variable were positive and the square term is found negative and significant at 5 per cent. Similarly, the coefficients in case of exports to developing countries with respect to single variable were positive and with square term were found negative and significant at 5 per cent in model 3. The empirical findings were consistent with Mische and Vivarelli (2009). This stands for the fact that exporting firms in CIS were more indulged in upgrading their industry and tried to improve the technological level of goods when they were exporting to advanced and developing countries. They export mostly differentiated products. The income inequality first increases because of exports to advanced and developing countries, but later on this gap is filled.

The impact of imports was also isolated on the basis of the origin and destination; the results emerged insignificant in model 5 of Table IV. The absorptive capacity of CIS may enable firms to catch the positive spillovers coming from advanced countries. The imports from advanced countries require specific skills for operations. This highlights the need to accelerate the adoption of new technology owing to the specific skills needed. The speed of adjustment might be fast. It might be possible that imports coming from advanced countries are not sophisticated at the start. The benefits of imports from advanced countries become widespread among the population. Instead, the coefficient of imports from advanced countries with square term becomes negative but significant. The imports from developing countries with single variable appeared negative and significant at 5 per cent, providing job opportunities regardless of skills, while estimates with square term are insignificant.

Control variables, namely, GDP, secondary school enrollment and services sector, were not found significant determinants of income inequality in all the six models of Table IV. Insignificant relation of GDP with income inequality is consistent with some earlier studies (Azam and Mohammad, 2015; Franco and Gerussi, 2013). The secondary school enrollment was also found insignificant, which may indicate that in CIS, the literacy rate is already high and marginal changes in it do not affect the income disparities

5.2 Estimation with human development index as dependent variable
Robustness of results was checked using HDI, another proxy for income inequality. The specifications were tested applying SYS-GMM. Table V represents different specifications of the models with respect to HDI. The econometric results reveal that a lagged HDI variable is always positive and highly significant in all the six models of Table V. The coefficient of trade was negative and insignificant in model 1. The results were similar to Carneiro and Arbache (2003), Chaudhry and Imran (2013) and Edwards (1997).On the other hand, the estimates of FDI were statistically significant in model 2. The coefficients of FDI were positive and highly significant at 10 per cent, showing that an increase in inward FDI stock resulted in increment in HDI. The results match speculative expectations, and null hypothesis is accepted and consistent with the findings of Chen (2016), Chintrakarn *et al.* (2012), Herzer and Nunnenkamp (2011), Jenson and Rosas (2007) and TeVelde and Morrissey (2004). However, the quadratic term of FDI shows insignificant results.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
HDI(−1)	0.9842*** (0.0220)	0.7958*** (0.0963)	0.9658*** (0.0210)	0.9729*** (0.0161)	0.9732*** (0.0188)	0.9790*** (0.0150)
Trade (−1)	−0.5731 (0.5208)					
TradeSQ (−1)	0.1451 (0.1340)					
FDI (−1)		0.0197* (0.0104)				
FDISQ (−1)		−0.0035 (0.0071)				
X.adv (−1)			0.3317 (0.1117)			
X.advSQ (−1)			−1.0959 (3.9919)			
X.dev (−1)				−0.1083 (0.1205)		
X.devSQ (−1)				0.3318 (0.3917)		
M.adv (−1)					−0.1350 (3.0178)	
M.advSQ (−1)					0.4631*** (0.0985)	
M.dev (−1)						−0.1529 (0.2120)
M.devSQ (−1)						0.4854 (0.6549)
GDP	0.2970 (1.0547)	0.0103 (0.0173)	−0.8343 (1.0907)	−0.9636 (1.1012)	−0.2776 (0.4313)	−0.3008 (0.8620)
Inf	0.0813 (0.4895)	0.0004 (0.0034)	0.4995 (0.4406)		0.2137 (0.1581)	0.2284 (0.3562)
Sec	−5.6486 (9.3724)	0.0532 (0.0332)	2.3513 (8.4832)	1.9988 (6.5309)	2.3529 (2.8693)	−0.3493 (6.0031)
Ser	0.1958 (4.2958)	0.0365 (0.0253)	1.6232 (4.0099)	1.3329 (2.4119)	0.5627 (0.5287)	0.8381 (2.2958)
Obs	254	254	254	254	254	254
Sargan test (*p*-value)	1.000	0.56	0.961	1.000	1.000	1.000
AR1 (P-value)	0.000	0.000	0.000	0.000	0.148	0.001
AR2 (P-value)	0.161	0.698	0.120	0.202	0.245	0.164

Notes : Robust standard errors in parentheses; ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$; and SYS-GMM regressions (dependent variable: HDI-index) excluding Russia, in columns 1, 2, 3, 4 and 5, instruments are limited to (2-5) lags

Table V.
Trade and FDI
effects on income
inequality in CIS,
1990-2016

However, it was noticed that coefficients in case of exports to advanced and developing countries with respect to single and square term are insignificant in models 3 and 4 of Table V. This stands for the fact that export production for developed and developing countries does not deteriorate or improve the income. The countries under analysis mostly export primary products. Control variables, namely, GDP, secondary school enrollment and services sector were not found significant determinants of income inequality in all the six models of Table V, as in case of Gini-index.

5.3 Estimation of trade and foreign direct investment effects on income inequality in Commonwealth of Independent States through education

In the case of Gini-index used as proxy for income inequality, the education variable was found significant only in case of imports, while the coefficient was found insignificant in case of HDI. On this basis, an in-depth study by focusing on the role of education in income distribution is conducted. The education variable was interacted with all the variables, both in case of Gini and HDI. By using system GMM, with respect to interaction terms, significant coefficients regarding exports to developing countries and imports from advanced countries were found in models 4 and 5 of Table VI. The interaction terms appeared insignificant in the rest of the columns. Exports to developing countries increase income inequality in the short run and decrease in the long run. The production of now high technology goods impedes the distortion through the channel of education because the countries under the study try to switch production form low- or medium- to high-quality products. The relationship between exports to developing countries and education is negative in the long run, which gives an indication of the decline in income inequality. The second interesting results are found with respect to imports from advanced countries in model 5. The secondary education escort to higher inequality at first but this effect vanishes when square term is taken. This could indicate that education may have an important effect when imports from advanced countries are brought. The foreign penetration exerts a negative redistribution effect by requiring only skilled labor. Later on, secondary education adds to decline in income inequality. Control variables, namely, GDP, secondary school enrollment and services sector were used, and GDP was found negatively significant consistent with the work of ZulfiuAlili and Adnett (2018) in models 3 and 5. Inflation was also found positively significant, except for model 3 in which it was negative and significant. Services sector was significant in case of models 2 and 5.

In case of HDI, when trade is interacted with education in Table VII, it is negatively significant at 5 per cent in the short run and positively and weakly significant at 10 per cent, denoting that through the education channel, inequality decreases in the short run and increases in the long run (model 1, Table VII). The coefficients in case of exports to advanced countries when interacted with education emerged surprising. In the short run, there is no confirmation of significant results, while estimates are negative and significant when interaction square term is taken in model 3. The education channel contributes to decrease in income inequality. Likewise, the interaction term in case of exports to developing countries is positive and significant in the short run and negatively significant in the long run in model 4. Furthermore, the interaction term with single variable and square term in case of imports from advanced and developing countries appeared significant in models 5 and 6 of Table VII. Imports from advanced and developing countries emerged negative in the short run and positive in the long run. This might be owing to the fact that in the short run, the education factor contributes to adoption of new technology because of specific skills needed, while in the long run, the education channel increases income disparity because the most contemporary technology requires only skilled labor to operate, which ultimately increases

Variables	(1)	(2)	(3)	(4)	(5)	(6)
GINI (−1)	0.7636*** (0.0690)		0.3540*** (0.0961)	0.7352*** (0.0586)	0.4527*** (0.0869)	0.4487**** (10.0786)
Trade (−1)	−0.2275* (0.1250)					
TradeSQ (−1)	0.4442 (0.2966)					
TradeSEC (−1)	0.2980 (0.2388)					
TradeSECSQ (−1)	−0.3135 (0.2987)					
FDI (−1)		−0.000 (0.0199)				
FDISQ (−1)		−0.0015 (0.0027)				
FDISEC (−1)		−0.0338 (0.0707)				
FDISECSQ (−1)		0.0223 (0.0317)				
X.adv (−1)			0.2303 (0.3306)			
X.advSQ (−1)			−0.6636 (0.6065)			
X.advSEC (−1)			−0.3615 (0.2848)			
X.advSECSQ (−1)			−0.2465 (2.3845)			
X.dev (−1)				−0.1209** (0.5392)		
X.devSQ (−1)				0.3361** (0.1503)		
X.devSEC (−1)				0.2332*** (0.1036)		
X.devSECSQ (−1)				−0.3056*** (0.1430)		
M.adv (−1)					−0.2797** (0.1358)	
M.advSQ (−1)					0.7970* (0.4571)	
M.advSEC (−1)					0.5829*** (0.3045)	
M.advSECSQ (−1)					−0.7856* (0.4478)	
M.dev (−1)						−0.1085 (0.7901)
M.devSQ (−1)						0.4094* (0.2370)
M.devSEC (−1)						0.1911 (0.1658)
M.devSECSQ (−1)						−29.4359 (22.9372)
GDP	1.0948 (0.97886)	0.0053 (0.0187)	−0.8479** (0.3359)	1.2603 (0.9840)	−0.1087** (0.4278)	−1.9639 (3.0333)
Inf	0.3556 (0.5821)	−0.0056* (0.0029)	1.5643** (0.6146)	1.1357*** (0.4376)	2.6388*** (0.8381)	0.8889* (0.48137)
Sec	−0.6944* (0.2907)	0.0128 (0.0657)	0.2486 (0.2780)	−0.2891 (0.2587)	−0.3401 (0.3808)	−2.3454 (22.3095)
Ser	0.27137 (4.72155)	0.0178 (0.0314)	0.1167* (0.6693)	0.6264 (3.9317)	0.2676*** (0.1009)	1.3363 (5.6033)
Obs	281	281	265	281	265	265
Sargan test (p-value)	0.840	0.395	0.101	0.694	0.630	0.976
AR1 (P-value)	0.000	0.999	0.000	0.000	0.000	0.000
AR2 (P-value)	0.415	0.754	0.236	0.357	0.352	0.204

Notes: :Robust standard errors in parentheses; ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$; and SYS-GMM regressions (dependent variable: GINI), in columns 1, instruments are limited to (2 4) lags, while in columns 3, 4 and 6, they are limited to (2 5) lags. In column 5, instruments are limited to (2 8) lags

Table VI.
FDI and trade effects on income inequality in CIS through education, 1990-2016

Variables	(1)	(2)	(3)	(4)	(5)	(6)
HDI(−1)	0.8564*** (0.0410)		0.7753*** (0.0342)	0.8157*** (0.0274)	0.8244*** (0.0272)	0.9967*** (0.0672)
Trade (−1)	0.5758** (0.2289)					
TradeSQ (−1)	−0.1131** (0.0553)					
TradeSEC (−1)	−0.9042** (0.4644)					
TradeSECSQ (−1)	0.1027* (0.0584)					
FDI (−1)		0.0312 (0.0193)				
FDISQ (−1)		0.0007 (0.0029)				
FDISEC (−1)		−0.0019 (0.0507)				
FDISECSQ (−1)		−0.0079 (0.0445)				
X.adv (−1)			−0.0199 (0.0362)			
X.advSQ (−1)			−0.0331*** (0.0069)			
X.advSEC (−1)			−0.4459 (0.0326)			
X.advSECSQ (−1)			−0.0042* (0.0025)			
X.dev (−1)				−0.0924 (0.0793)		
X.devSQ (−1)				0.0537** (0.0226)		
X.devSEC (−1)				0.3918* (0.1694)		
X.devSECSQ (−1)				−0.0677** (0.0233)		
Madv (−1)					0.3397*** (0.0831)	
MadvSQ (−1)					−0.0934*** (0.0277)	
MadvSEC (−1)					−0.6867*** (0.1838)	
MadvSECSQ (−1)					0.0909*** (0.0269)	
Mdev (−1)						1.1648*** (0.3927)
MdevSQ (−1)						−0.2957** (0.1142)
MdevSEC (−1)						−2.3078*** (0.8767)
MdevSECSQ (−1)						0.2958*** (0.1192)
GDP	0.0422*** (0.0109)	0.0609*** (0.0196)	0.0582*** (0.0085)	0.0419*** (0.0071)	0.0432** (0.0070)	0.0223 (0.0143)
Inf	−0.0035*** (0.0009)	0.0065* (0.0037)	−0.0046*** (0.0007)	−0.0037*** (0.0006)	−0.0043*** (0.0006)	−0.0034*** (0.0013)
Sec	0.0129 (0.0349)	0.1273 (0.1555)	−0.0075 (0.0293)	0.0514* (0.0273)	0.0117 (0.0264)	−0.0948 (0.0634)
Ser	0.0069 (0.0081)	0.1331 (0.1526)	0.0236** (0.0066)	0.0179*** (0.0051)	0.0134** (0.0054)	−0.0186 (0.0188)
Obs	237	237	237	237	237	237
Sargan test (p-value)	0.181	0.000	0.000	0.000	0.000	0.000
ARI (P-value)	0.000	0.000	0.000	0.000	0.000	0.001
AR2 (P-value)	0.611	0.246	0.984	0.813	0.939	0.307

Notes: Robust standard errors in parentheses; ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$, SYS-GMM regressions (Dependent variable: HDI) excluding Russia, in columns 1, instruments are limited to (28) lags, while in column 3, instruments are limited to (2 9) lags and in columns 4 and 5, estimations are taken on all lags. In column 6, instruments are limited to (2 3) lags

Table VII.
FDI and trade effects on income inequality in CIS through education, 1990-2016

the period of taking hold of new technology, causing a wage gap. Control variables, namely, GDP, secondary school enrollment and services sector, were also used, and GDP was consistently found positively significant, except in model 1.Inflation was consistently found negatively significant, except for model 2 in which it was positive and significant.

6. Concluding remarks and policy implications

The current study has investigated the impact of trade openness and FDI on income inequality for CIS member countries, using an unbalanced panel over the period 1990-2016. It was hypothesized that both trade openness and FDI might be significant determinants of income inequality. Though 1990 marks the year of trade openness in CIS, the global financial crisis of 2007-2008 had a strong negative effect on labor market and trade openness. Two proxies are used for income inequality: the Gini coefficient and HDI index.

The results revealed that in case of Gini-coefficient, both trade openness and FDI seem to be relevant in affecting income distribution positively. The lagged square term of the trade openness was negative and significant, confirming the inverted U-shaped association between trade and income inequality. However, this was not proved in the case of FDI. Trade is further divided into imports and exports with respect to their origin and destination. Exports to advanced and developing countries show a positive and significant impact, while imports from advanced countries were found insignificant with single variable and square term, and imports from developing countries appeared negatively significant.

The impact of openness when checked with HDI showed surprising results . Trade openness was not relevant in explaining the variations in Gini-index as it was found insignificant as a single variable and square term. While FDI had a positive and significant impact on HDI, its squared term was found insignificant. Hence, a non-linear relationship does not occur in case of trade openness and FDI. Exports to advanced and developing countries reveal statistically insignificant results, while only the square term of imports from advanced countries appeared positive and significant.

The results in case of education interaction with trade openness were found negative and significant when the dependent variable was HDI; however, they were consistently insignificant in case of FDI. It could be deduced that already high average secondary school enrolment could not further reduce income inequality in case of CIS.

6.1 Policy implications

There are some important policy implications drawn from the results:

- The main findings reveal that CIS needs to re-design trade and FDI policies by encouraging trade and FDI inflows into industries and sectors aligned with structural adjustments and domestic industries uplift.

- The supply of skilled and educated workers may resist country to suffer from high levels of domestic inequality. This leads to the scope for active social interventions. The high-quality and training policies intended to increase the supply of skilled labor would be worthwhile.

- Trade openness could aggravate income distribution predominantly in surroundings where the poor are powerless to meet the contemporary technology because of low human capital. The problem could be owing to flawed credit markets, which fail to sponsor the cost of schooling for the poor. It is suggested that policies should be determined to invest more in public education, which not only results in narrowing wage gaps but also helps to attract more foreign investments.

For instance, educational subsidies could help the deprived reach the lowest amount of human capital essential to become entrepreneurs. In the long run, such policies could consent the poor to get closer to the rich.

This study is not without limitations. The first limitation is the use of proxies of income inequality that were not policy-induced. The future research may use trade policy-induced openness measures to produce more robust results. Second, this study considers only CIS countries; the future research may incorporate all transitional economies to improve the results.

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