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Investment in green economy as a potential source of value added

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Abstract

Purpose *- The hypothesis of the paper is that domestic value added created by exports in Croatia could be increased by investments in green economy.*

Methodology - *In the developed economies only specific products, processes and functions that outperform emerging economies in Global Value Chains are able to profit from the larger share of value added. Large portion of „green economy" is knowledge intensive, and if knowledge based economy (KBC) plays a significant role in determining the domestic value added created by exports, economies with a larger stock of KBC should have a larger difference in VAX between knowledge-intensive industries and less knowledge-intensive industries. Domestic value added embodied in exports can be proxied by attracted FDI.*

Findings - *The results seem to show some support to the hypothesis. In Croatia it has already been shown that sectors of economy with larger stock of intellectual capital measured by Intellectual Capital Efficiency (ICE) index attracted more FDI, which can also serve as a predictor for larger value added in exports due to higher productivity. Knowledge intensity of 18 industries in the US as the benchmark economy shows that „Electrical and optical equipment" has above average knowledge intensity of 0,53, and it can be matched with "green economy" in Croatian industries that attracted more FDI and have higher levels of KBC.*

Research limitations and implications *- Although this study is limited just to KBC, as an extension, the potential role of financial development could be included. Also, the length of time series for VAX measured by OECD does not allow for more thorough analysis.*

Originality/value *– Although not conclusive, this paper is an important first step giving direction to subsequent studies of effects of KBC on value added.*

Keywords: *value added, global value chains, electronics, green economy, competitiveness*

JEL Classification: F21, D24

1. Introduction

The separation between knowledge intensive industries and those that are less knowledge intensive has become even more important with globalization and has given countries with competitive advantage in knowledge capital in certain knowledge intensive industries to participate in Global Value Chains and reap the benefits through exports. In Croatia, it has been shown that sectors of economy with larger stock of intellectual capital attracted more FDI, and therefore it would be reasonable to conclude that those sectors are a potential source of value added in exports through Global Value Chains. However, in developed economies only specific products, processes and functions that outperform emerging economies in Global Value Chains (Kaplinsky and Morris, 2011) are able to profit from the larger share of value added, and Croatian economy has characteristics of both emerging and developed economies and due to higher wages, especially in workers with tertiary education, should be regarded as a developed economy. This is even more true in ICT sector (Kraemer, Linden and Dedrick, 2011), which is mostly service producing and where system integrators are the most productive segment with largest value added. As for green industries that are now emerging in Croatia, those can be seen as a two sector economy, where one employs higher skilled workers with higher wages, and the other lower skilled workers with lower wages. This makes them different from other electronics industries, as they present a potential for growth. It was already shown that in two sector economy skills-biased technological shocks may have an adverse effect not only on unskilled employment, but also on the employment rate of the skilled labor force, which can possibly explain why technological shocks of this type lead to an increase in wage dispersion between unskilled workers with 'good' jobs and those with 'bad' jobs. It was also shown that the higher the initial unemployment rate, the higher the likelihood that skills-biased technological shocks will further increase it. In case of participation in Global Value Chains this need not necessarily be so, as the exports could lead to new employment that would not be limited only to higher skilled workforce, but also to all workforce in green (ICT) industries. Knowledge intensity of 18 industries in the US as the benchmark economy shows that „Electrical and optical equipment" has above average knowledge intensity of 0,53 measured as share of labor compensation of personnel with tertiary education. We have tested the hypothesis on a sample of Croatian firms in different regions, in order to assess which types of knowledge based capital are most important for their competitiveness, value added and investments. The importance of financial development, measured as the amount of credit by banks and other financial intermediaries to the private sector as a share of GDP is also included in order to assess the potential of investments in green economy as a source of value added in Croatia.

2. Methodology

We use industry-economy difference-in-difference estimation. If KBC plays a significant role in determining the domestic value added created by exports, economies with larger stock of KBC should have a larger difference in VAX between knowledge intensive industries and less knowledge intensive industries. This is tested by estimating the following model:

$$VAX_{ijt} = \beta\,(h_{ij} \times KBC_{jt}) + \gamma X_{ijt} + \alpha_{ij} + \alpha_{it} + \varepsilon_{ijt} \quad (1)$$

The left-hand side is the VAX computed from OECD_WTO- TiVA (trade in value added) Database for industry i in economy j at time t. Since it is a ratio the value of which is constrained between 0 and 1, it is transformed to VAX (1-VAX) and uses a log value that better fits the OLS regression. The first term on the right-hand-side is the interaction of industry i's knowledge intensity and the stock of KBC of economy j

at time t. The KBC stock per hour worked by engaged personnel is expressed in log values. If the coefficient β is positive and statistically significant, it means that VAX is indeed higher in more knowledge-intensive industries and that the inter-industries difference is larger for economies possessing a larger stock of KBC. The second term is a vector of control variables that may influence both VAX and KBC. In the standard regression, only the economy-industry level physical capital per hour worked is included. The third and fourth terms represent economy-industry fixed effects and economy-time fixed effects. The former fixed effects control for unobserved heterogeneity specific to each industry in each economy. They control not only for the structural difference among industries in terms of level of value-added embodied in exports, but also for the unique historical or geographical conditions that enable an economy to create large value in specific industries. The latter fixed effects control for economy-specific shocks such as movements in the domestic business cycle and also for each economy's degree of integration into GVCs. As previously mentioned, an industry can have high VAX when its engagement in GVCs is low, because its use of imported contents in its exports is very small. Although VAX declined in many economies after 1990, with the rise of GVCs, the extent of this decline differed substantially across economies. Economies with fast income growth experienced the largest decline (Johnson and Noguera, 2012). Economy specific time fixed effects, therefore, control for such heterogenous trends in VAX. The last term is an error term assumed to be independent and identically distributed across economies and industries but potentially correlated across times. Hetoroscedasticity-consistent standard errors are used to correct for the potential effect of serial correlation. An important issue is the definition of industry level knowledge intensity hij. Because industry level estimates of KBC could not be obtained for the sample economies, they are proxied by the share of labour compensation of employees with tertiary education obtained from the EU-KLEMS database. This choice seems sensible given that advanced educational attainment is usually required for the creation and management of sophisticated knowledge. However, the knowledge intensity of an industry is likely to be influenced by the economy-wide availability of KBC. This may bias the estimated coefficient of the interaction term. Therefore, following Rajan and Zingalse (Rajan and Zingalse, 1998), each economy's industrial knowledge intensity is replaced by that of the United States as the benchmark economy. The Time-averaged value of US knowledge intensity between 1995 and 2005 is used as the knowledge intensity of each industry. Each h_{ij} is thus replaced by the time-invariant h_{ij}s. This approach requires excluding the United States from the sample for a final sample of 14 European countries. Table 1 lists the measure of knowledge intensity for the 18 industries in the TiVA database. Knowledge intensity is relatively higher in manufacturing industries such as electr4ical and optical equipment and in service industries such as financial intermediation and business services (OECD, 2013).

As an extension of the base model, the model may be estimated by incorporating the potential role of financial development. Efficient financial intermediation can facilitate risky and long-term investments in KBC and enable economies to achieve comparative advantage in high value-added GVC activities. An interaction term between each industry's financial dependency and each economy's financial development is included. As the measure of financial dependency, each industry's input coefficients of financial intermediation obtained from WIOD databases are used. The input coefficients are those of the United States, averaged over 1995-2009. The measure of an economy's financial development is the amount of credit by banks and other financial intermediaries to

the private sector as a share of GDP used by Manova (Man ova, 2012).

In Croatian case, as we don't have VAX data from a database, we used FDI per industry in a year t, as a fair estimate of VAX as FDI is correlated with ICE in industries for Croatia. For KBC, instead of share of labor compensation of employees with tertiary education obtained from the EU-KLEMS database, we used average salaries in sectors in the whole labor compensation for all sectors, for all Croatian regions and sectors, bearing in mind that higher labor compensation implies that higher education and skills in Croatia, and therefore also higher KBC. Thus, by approximation, we were able to determine which regions may have the largest stock of KBC for obtaining VAX from GVCs. Finally, we compared these results with results where only green industry sectors were included (J, D, E) to see whether green industry on its own has a better potential or larger stock of KBC for obtaining VAX from GVC than the whole economy. Also the share of credit provided to green industries in comparison with GDP (or economy in general) can be checked.

Table 1: Knowledge intensity of 18 industries
Share of labour compensation of personnel with tertiary education

01t05	Agriculture, hunting, forestry and fishing	0,21
10t14	Mining and quarrying	0,34
15t16	Food products, beverages and tobacco	0,29
17t19	Textiles, textile products, leather and footwear	0,26
20t22	Wood, paper, paper products, printing and publishing	0,38
23t26	Chemicals and non-metallic mineral products	0,42
27t28	Basic metals and fabricated metal products	0,22
29	Machinery and equipment, nec.	0,31
30t33	Electrical and optical equipment	0,53
24t35	Transport equipment	0,36
36t37	Manufacturing nec; recycling	0,29
40t41	Electricity, gas and water supply	0,34
45	Construction	0,17
50t55	Wholesale and retail trade; Hotels and restaurants	0,26
60t64	Transport and storage, post and telecommunication	0,28
65t67	Financial intermediation	0,62
70t74	Business services	0,62
75t95	Other services	0,37

Source: Supporting Investment in Knowledge Capital, Growth and Innovation, OECD, Paris, 2013

Table 2: FDI in million euros, 1993-2005, ICE I-IX 2005 and VAIC 2002

Sector	FDI	ICE 2006	ICE 2005	VAIC 2002
Financial intermediation	714,03	3,79	2,96	2,28

Wholesale and retail trade	589,37	2,37	2,39	2,64
Mining	354,92	3,16	2,2	2,78
Other business services	266,25	2,07	1,84	
Post and telecommun.	159,37	2,58	2,24	2,73
Construction	85,2	2,25	2,11	2,19
Hotels and restaurants	72,85	2,12	2,27	3,4
Other prod. of non-metal. pr.	79,3	2,2	1,44	2,3
Water	32,83	2,87	1,96	--
Other	322,18	--	--	--
Agriculture	1	1,56	1	1,59

Source: Croatian National Bank and CIK – Center for Intellectual Capital

Table 3: VAIC and ICE for chosen firms, ICT sector excluded

	VAIC 96-01	ICE 2003	VA96-01	VA 2006	ICE 2006
TDR	13,72	7,91	556	863	7,4
Tankerska plovidba	10,82	7,59	380	409	8,96
Plinacro	10,78	15.86	177	311	11,71
Končar- e.tr.	8,69	3,68	34	86 (2003)	----
DM	7,33	3,19	68	196	3,48
PBZ Am. Ex	7,32	4,81	154	305	5,96
Žito	7,31	4,37	81	155	5,62
Zagreb.piv.	6,54	6,34	453	----	----
HEP	3,0 (2002)	5,65	1494 (2002)	478	9,85 (2005)
TC Koromačno**	4,47 (2002)	5	---	---	---
Našicecement	5,49	4,64	158	198	5,06
PLIVA	5,47	2,75	2101	1084	4,11
Atlantic trade	4,66	2,71	39	97	2,43
Cedevita	4,49	1,84	93	74	2,97
Belupo	4,44	3,11	230	293	---
Privredna banka	4,17	4,31*	2767	---	5,65*

INA	4,13	3,51	3898	3892,6	3,77
Jamnica	4,1	3,1	175	254	2,04
Vindija	3,91	2,43	123	---	3,3 (2005)
Lura	3,73	2,07	405	375	2,03
Franck	3,71	3,11	201	200	3,25
Coca Cola	3,71	3,45	326	289	2,76
Ledo	3,6	3,61	163	194	2,52
Dalmacijacement	3,25	3,67	208	251	2,63
KONZUM	---	1,28	---	231	1,43
* PBZ Leasing **Holcim					

Source: Intellectual Capital 95-01, November 2002., 2004, 2007; Center for Intellectual Capital

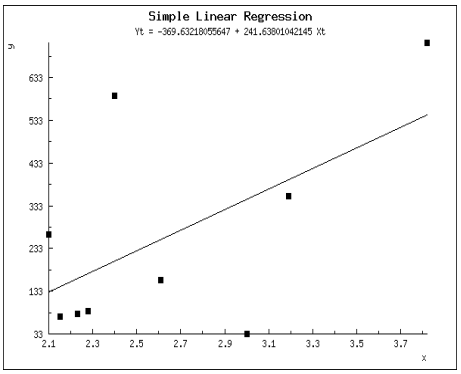
3. ICT industry, TiVA GVCs, KBC, FDI and green economy

One of the main problems of modern economies undergoing a prolonged adjustmet of their domestic markets is how to derive more value from firms international engagement by creaing or capturing value in GVCs. While some economies still focus on enhanicng their export market share, a growing number also focus on enhancing the value added earned per dollar of exports. Even China has shifted ist focus from market share alone, as its sees itself building its future prosperity on innovation in which everyone's creative potential is tapped, by increasing its ablity to produce more value, not more products, moving up the value chain and competing globally in the same product space as advanced countries. Croatia as an EU country is inferred to be closer to developed than to developing countries, and an economy's ability to create larger value in GVCs may be measured by observing the ratio of domestic value-added embodied in its exports to its actual exports. In the GVC literature this is known as „high value-added activity", which refers to activities that are better remunerated (have higher margins) and have higher entry barriers beacause the skills required are difficult to obtain. As it has already been shown by VAIC and ICE indexes that domestic value-added and knowledge based capital (KBC) in Croatia are both correlated to FDI, it follows that in Croatia FDI may be used as a proxy for high value-added activities, especially in case those acritivites are also directed towards exports. ICT sector is one of such sectors, which accounts for exports and high productivity withhigh value-added activities. Green industries may be considered as a special case of electrical and optic industries with higher knowledge intensity and higher skilled workers, but also of machinery nec and equipment and manufacturing industries, which employ lower skilled workers and have lower knowledge intensity. Therefore, green industries may be regarded as two sector economy under technological shock, with all consequences for unemployment that this entails. One important problem for analysis is likening TiVA and FDI Statistics, which is important for Croatia, as it doesn't have TiVA Statistics yet (as it has only recently joined the EU). Multinational enterprises (MNEs) are one of the main drivers of globalisation and of the creaiton of global value chains. FDI is important to many economices, and MNEs account for a substantial part of international trade flows.

Despite substantive and ongoing research on MNEs and on FDI and its economic impact, measures that quantify

the direct and indirect roles of FDI in GVCs ar not available for a wide range of countries and industries.Integrating FDI income receipts and payments into TiVA framework to adjust the TiVA data to better understand the impact of foreign ownership on a country's exports and imports of value added is necessary. This allows us to quantify the „stickiness" of value added produced by foreign owned firms. Sticky parts that are expected to remain in the economy include wages and taxes. However, the other part – the operating surplus or profits – is expected to be less „sticky" because it accrues to the foreign parent. OECD AMNE data indicate that around 45% of foreign produced VA consists of operating surplus and hence can potentially be repatriated. Simlarly, TiVA currently does not specify how much of a country's imported value added is actually produced by the foreign affiliates of a country's MNEs. To produce this link, we have to move to the foundations of TiVA and complement the ICIO with data on ownership and FDI.

Figure 1. Linear regression of FDI 1993-2005 and ICE 2006;
correlation coefficient = 0.67;



First it would be necessary to divide FDI income payments into the part that leaves the economy – distributed earnings and net interest payments – form the portion that potentially sticks in the economy – reinvested earnings. Incorporating FDI income into TiVA requires total FDI income payments and receipts and reinvested earnings by industry at the two-digit level and by partner over time.

One of the main challenges is not only in measuring income flows, but also in linking the FDI income data with the „real" economy (value added or output that is produced). It can appear that countries that host SPEs pay a significant amount of FDI income when in fact that FDI income originates in other countries and passes thorough the economy on its way to the ultimate source of the investment. This paper presents an attempt to better integrate FDI statistics into GVCs, and TiVA by linking them to the concepts of KBC and intellectual capital through ICE and VAIC index, since intellectual capital or KBC is the part of FDI invested into wages and education of employees, that is most likely to „stick" in the country (except in case that the employees leave the country and move to the country of from which the FDI originates). This capital may represent a potential for better integration of Croatia into GVCs, and one way this capital may be used is by activating it through green economy.

4. FDI, high skilled and low skilled jobs

We start with the data for FDI in J sector communication and postal services - or electric and optic equipment - by regions in Croatia, as a proxy to the domestic value added embodied in its exports, using h_{ij} for electric and optic equipment and with the ratio of remuneration for high skilled to low skilled jobs, which are mostly in electric and optic equipment. It can be seen that in some regions more FDI is attracted and that it is correlated with ICE indeks by sectors of economy. More FDI is attracted to ICT and electric and optical industry than to machinery nec. and recycling, which also corresponds to the difference in salaries in those sectors. Therefore value added is higher in those regions and sectors and the ratio between high skilled and low skilled job remuneration is higher as well. In the study of Nina Pološki we may verify whether those

regions also have a larger proportion of tertiary employees. Therefore it can be concluded that ratio of tertiary remuneration in total remuneration is higher in those regions, which implies that they have higher stock KBC. The difference in the stock of KBC is larger not only by sectors, but also by different regions. This could in turn imply that Croatia has a fairly large stock of KBC that could be used for obtaining VAX from GVC, but only if it is able to better connect its regions and organise production on the basis of this better organisation, instead of letting high skilled workers leave the country. Second, we should check the development of green industry by regions. It is clear that some regions with higher KBC and higher FDI could have also received more support for their green industries. That may be compared with the ratio of credits issued by the banks to the GDP and receipts from EU funds for green industries, which should be correlated.

Let us go back to our model:

$$VAX_{ijt} = \beta (h_{ij} \times KBC_{jt}) + \gamma X_{ijt} + \alpha_{ij} + \alpha_{it} + \varepsilon_{ijt} \quad (1)$$

It may be shown that if FDI is correlated to ICE by sectors, and larger positive value of β indicates larger stock of KBC as the difference between knowledge intensive industries and less knowledge intensive industries is larger, than the potential of green industries within the same economy could be measured only as a ratio of green industry sector stock of KBC to the stock of KBC in the whole economy, in which case the formula of the model can be simplified and written without the economy and sector specific correction terms $\alpha_{ij} + \alpha_{it} + \varepsilon_{ijt}$

Thus the model at first becomes just $VAX_{ijt} = \beta (h_{ij} \times KBC_{jt})$ and the measure of green economy potential an the economy i and industry j is then $VAX_{igt} = \beta (h_{ig} \times KBC_{gt}) / VAX_{ijt} = \beta (h_{ij} \times KBC_{jt})$, where g signifies that only „green" industry data can be used as j terms for regression inputs. Instead of VAX and KBC (EU KLEMS) that are not available for Croatia, we may use FDI (sector, region) and ICE or statistics for wages per sector and per region. To further improve the results, we could use the second term on the right side, $\gamma X_{ijt,}$ and employ instead VAIC index for sectors in different times, to account for physical capital correction.

Thus the new simplified formulas become:

$$FDI_{ijt} = \beta (h_{ij} \times ICE_{jt}), \text{ and} \quad (2)$$

$$FDI_{ijt} = \beta (h_{ij} \times ICE_{jt}) + \gamma VAIC_{ijt} \quad (3)$$

Calculation using this formula for „green" economy and total economy wtih all sectors, using conversion for knowledge intensity variable h should give us a fairly good correlation and a fairly large and positive β, implying that Croatian economy has a fair amount of KBC to be competitive, but even more in GVCs of green economy when β just for „green" sectors is put into relation with β for total economy.

5. Job losses and job gains due to technological schocks

It has been shown that technological shocks that demand high skilled workforce create unemployment in low skilled sectors, although they stimulate employment of high skilled workforce (Agenor and Aizenman, 1997). Green industries, however, are different, in that they have the potential for employment in both sectors. It can be shown that the receipts from EU funds for green industries and FDI received by region also correspond to lower unemployment in such regions. Therefore, it may be concluded that green industries have potential for reducing unemployment, although more exact calculation of capital in green industries is necessary.

6. Conclusion

We have analysed the possibilities for development of green industries and have found that sectors with higher FDI have also higher ICE index and therefore KBC should also be larger, which can be visible in the wages of workers in different sectors of economy. This gives us a chance to integrate

FDI statistics into TiVA statistics, which have only recently been made available for Croatia by OECD Stat. Furthermore, it could be checked whether the ratio of high skilled (with higher wages and in high knowledge intensity industries) to low skilled workers is higher in regions with higher KBC expressed by ICE index and if such regions have been able to receive more support for green industries, measured by the ratio of credits issued by the banks to the GDP and EU funds for green industries by regions. It is theoretically possible that green industries, unlike ICT and other high skilled industries, reduce unemployment due to technological shock that is able to stimulate employment not only of high skilled workers, but also of workforce with lower skills. Therefore, it can be concluded that there is potential for development of high value added green industries and their inclusion in GVCs, provided that there exists adequate financial intermediation and high skilled workforce (e.g. in a particular region). One problem for this scenario may appear with the current further opening of EU borders for trade and workforce, which means that Croatian employers have to compete in wages with EU and other non-EU developed countries that may be able to offer higher wages to Croatian nationals than domestic employers, especially in the ICT sector. Comparative analysis of TiVA indexes for Croatia, 2011, and indexes for several CEE countries (Slovenia, Slovakia, Czech Republic, Hungary, Poland), show that Croatia has no significant comparative advantage in general and in green industries (electrical equipment) as well, although green industries in Croatia appear to be slightly more competitive in comparison with total economy if we take into account our simplified model with FDI and ICE indexes. In conclusion, we should expect further publication of TiVA data for Croatia by OECD, as well as EU KLEMS, in order to make further more complex and precise calculations and conclusions, which are now hardly possible with the present sets of data.

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Appendix 1

Table A1
Conversion matrix of FDI industries (ISIC 4) to TiVA industries

Industry (TiVA)	Economic Activity (FDI)	Notes	Industry	Economic Activity (FDI)	Notes
C01T05	595		C34T35	3595	
C10T14	1495		C36T37	----	C36T37 missing completely
C15T16	1605		C40T41	4195	
C17T19	1805		C45	4500	
C20T22	2205		C50T55	5295 + 5500	
C23T26	2595		C60T64	6495	
C27T28	2805		C65T67	6895	
C29	2900		C70T74	7395	
C30T33	3295 + 3300		C75T95	9995	