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INTANGIBLE ASSETS AND EXPORT GROWTH OF CROATIAN EXPORTERS: EVIDENCE FROM PANEL VAR AND VECM

ABSTRACT

This study tests the existence and direction of the relationship between investment in intangible assets and export and internationalization growth using the VAR, IRF, and VECM approaches. To gain a deeper understanding of this relationship, the following research question was posed: How does investment in intangible assets affect Croatian exporters' export and internationalization growth? How long does this effect last? Based on the microfinance data of the largest Croatian exporters, the results suggest a relationship between exports and investments in intangible assets in previous periods. Accumulated impulse responses suggest that investment in intangible assets reduces and increases export growth. This U-shaped relationship between intangible asset investment and export growth does not converge to equilibrium within the ten years studied. The VECM shows that increased intangible assets lead to increased exports in the long run. However, the speed of adjustment to long-run equilibrium is slow, only 6.42% annually. The study is significant in two ways. First, it points out the relationship between investment in intangible assets and long-term export growth. Second, it provides information for policy implementation on the choice of strategic direction companies need to take to reposition themselves, preferably in forward-looking value chains, while opening discussion of the institutional infrastructure needed for this repositioning.

KEYWORDS: *intangible asset, internationalization, export, VAR, VECM, impulse response function.*

1. INTRODUCTION

In a small open economy constrained by scarce resources, promoting the international competitiveness of firms is critical. The literature on the role of intangible assets in exporting is still inconclusive, so the positive effect of intangible assets on internationalization is context-dependent (Mansion & Bausch, 2020).

Intangible assets, intellectual capital, or knowledge do not have material forms (OECD, 2011). The role of intangible assets is represented in terms of innovation inputs (R&D expenditures, R&D personnel, software) or innovation outputs (patents, copyrights, trademarks) and, as such, are associated with sales or profits in microeconomic studies and with value-added or gross domestic product in national accounts (Demmou & Franco, 2021). Alsamawi et al. (2020) estimate that intangible assets account for

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about 27% of income in global manufacturing value chains in OECD countries, of which 6% is accounted for by measurable inputs and 21% by non-measurable inputs, while returns on investment in intangible assets increased between 2006 and 2015 in global manufacturing value chains and remained stable in global service value chains. Multinationality is essential in this context, as it allows companies to transfer their intangible assets to achieve higher returns in international markets (Kirca et al., 2011).

This study focuses on companies from the Republic of Croatia. Croatia was selected due to being a small open economy in transition from a former socialist to a capitalist market system. The country is characterized by weak institutions that have been strengthened since it joined the European Union in 2013. Most Croatian companies' exports go to European Union member states, which are developed economies (Jošić & Bašić, 2021), and thus are mainly part of European value chains. To compete in the international market (the European Union), exporters need to have specific capabilities, as their competitors have similar backgrounds and are willing to invest in their capabilities (e.g., Slovak Republic, Czech Republic, Poland, Estonia, Latvia, Lithuania, Hungary, to name a few). Therefore, this study aims to investigate and forecast the relationship between investments in intangible assets and the export and internationalization growth of the largest Croatian exporters by asking a research question: What is the effect of investment in intangible assets on the export and internationalization growth of Croatian exporters and how long does this effect last? This study used financial data of the 300 largest Croatian exporters from 2006-2015. It first examined the causalities between the variables of interest, investment in intangible assets, and export and internationalization growth. Since previous studies (Bašić, 2022) have used dynamic panel models for the same purpose, this paper employs vector autoregression (VAR), vector error correction model (VECM), and impulse response function (IRF) to gain a deeper understanding of the role of intangible asset investment in export and internationalization growth.

In the following section, the literature review, the impact of intangible assets on export and internationalization growth is explained from the perspective of the Croatian transition economy. Then, the methodology and the data used for the empirical analysis are explained, followed by the results of the empirical analysis, the discussion, and the conclusion of the paper with the main findings.

2. LITERATURE REVIEW

2.1. Intangible assets and export relationship

This paper uses a resource-based perspective (Barney, 2001; Penrose, 1959) and a dynamic capabilities perspective (Amit & Schoemaker, 1993, Teece et al., 1997) to examine export-led growth triggered by changes in intangible assets. Studies show that firms' international experience depends on their ability to use intangible resources (Camison & Villar-Lopez, 2010), as intangible assets increase labor productivity (Corrado et al., 2009).

Intangible assets are "*the current and capital expenditure for (in)tangible products that became available in the period under review and that remain in use for more than one year*" (Vosselman, 1998, p. 5). Intangible assets refer to: a) computerized information (software and databases), innovative property (R&D, copyrights, designs, trademarks), and economic competencies (brand equity, human capital, networks, know-how, advertising, and marketing) (OECD, 2011). In this context, information asymmetries or inappropriate valuation and appropriation methods complicate the measurement and valuation of investments in intangible assets (Cummins, 2009; Demmou et al., 2019). In some developed economies, investment in intangible assets exceeds investment in tangible assets such as machinery and equipment, which increases the price-to-book ratio of firms (OECD, 2011) and enables the growth of national output in developed economies (Miyagawa, 2011). Intangible assets account for 18% of multi-factor productivity in the United States. In the United Kingdom, investment in intangible assets is associated with a higher export share. Miyagawa et al.'s (2015) study on the impact of intangible assets on firm value in the Japanese economy shows that firms with more considerable intangible assets have a higher value.

Moreover, the complementarity of investments in tangible and intangible assets leads to the best results (Roth, 2019). When examining the European Union economy, the lower productivity of European Union member states compared to the United Kingdom or the United States is attributed to lower investment in intangible assets (OECD, 2011). Indeed, investment in intangible assets promotes the knowledge economy's growth, increasing labor productivity and, thus, multi-factor productivity (van Ark et al., 2008).

Therefore, investments in intangible assets require different infrastructure and policies to fully impact the national economies' firms (Haskel & Westlake, 2018). For example, smaller and younger firms often do not have the (financial) capacity to invest in intangible assets, so investments in intangible assets

are predominantly made in large firms (Demmou & Franco, 2021). This paper, therefore, seeks to answer the research question: What is the effect of investments in intangible assets on the export and internationalization growth of Croatian exporters, and how long does this effect last? The impact of investments in intangible assets by the largest Croatian exporters is examined, along with their contribution to the growth of export revenues of their companies.

Of previous similar studies, a study of Irish firms has shown that productivity in terms of intangible investment is relatively inelastic and depends on industries and groups (Di Ubaldo & Siedschlag, 2021). Similarly, using a large sample of Italian manufacturing firms, D'Angelo et al. (2013) find that firms' export performance determinants vary with the geographic scope of internationalization, but innovation (intangible assets) does not match this finding. Intangible assets associated with innovation positively affect exports, regardless of the geographic scope of exports. Based on a sample of Portuguese firms, Monteiro et al. (2019) conclude that financial, informational, and relational resources associated with intangible assets indirectly affect export performance through dynamic capabilities. Moreover, using vector autoregression (VAR), Coad and Rao (2009) found that profit growth is not associated with consequent R&D investment. Still, sales and employment growth are, with a negative growth shock in sales and employment, no more likely to cause firms to reduce R&D levels than a positive shock in sales and employment causes firms to increase R&D.

2.2. Croatian position concerning intangible assets and export growth

Croatia is a small open economy that has been in transition from a socialist, centrally planned economy to a capitalist economy since the early 1990s. Družić (2007) notes that Croatia's periods of growth are immediately followed by periods of stagnation and general regression, with unsatisfactory long-term growth performance. Moreover, Croatia's export industry is characterized by more than 50% of firms operating in the manufacturing sector (Orbis, 2016). Basarac and Vučković (2011) find that the export competitiveness of 14 subsectors of the Croatian manufacturing sector in the period 2005-2011 is mainly determined by the electronics industry and wood exports. Croatian exports are mainly in traditional labor- and resource-intensive sectors with low technology intensity. Based on the global value chain index in 1995-2011, Kersan-Škabić (2017) finds that Croatia has not experienced significant changes in its position in the value chain. Backward integration is dominant, with

imports larger than intermediate goods exports.

Regarding value-added, Croatian final products are dominated by German, Italian, and Slovenian value-added and domestic value-added. Moreover, Croatia's stagnant export market share in the EU is due to its lack of competitiveness (Ćudina et al., 2012). To increase the competitiveness of final or intermediate products, innovation is essential. Investment in intangible resources and their endowments per employee is crucial. Therefore, this study aims to analyze the impact of intangible assets on Croatian exports and export intensity.

3. DATA AND METHODS

Data for this study come from the 2016 Orbis database, covering ten years between 2006 and 2015, to better understand the causal relationship between the impact of intangible asset investment and export and internationalization growth. The microfirm financial data were obtained from the test database, and the data were selected based on the criterion of the largest exporters in the Republic of Croatia. The descriptive statistics of the selected variables are presented in Table 1. To minimize size differences, all variables - intangible assets, exports, and export intensity - are presented as the natural logarithm of their thousand-euro values.

TABLE 1. Descriptive statistics

	Intangible assets	Export	Export intensity
Mean	3.3395	5.8714	-1.4801
Median	4.0477	6.9366	-0.3546
Maximum	7.8550	8.5126	1.7625
Minimum	0.0000	0.000000	-19.6902
Std. Dev.	2.2846	2.4466	3.4818
Skewness	-0.3944	-1.7024	-3.6779
Kurtosis	1.7998	4.4053	15.9701
Jarque-Bera	246.6494	1622.366	26587.26
Probability	0.0000	0.0000	0.0000
Sum	9584.220	16850.97	-4247.759
Sum Sq. Dev.	14974.47	17173.63	34781.12
Observations	2870	2870	2870

Source: Orbis (2016) database. Author's calculation.
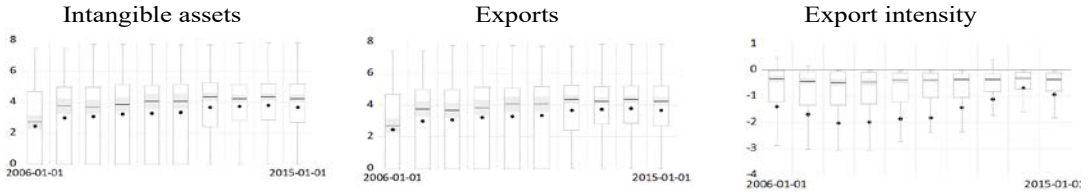
FIGURE 1. Boxplots

Note: Dots represent period means.

Source: Orbis (2016) database. Author's calculation.

ΔX_t
$\hat{\varepsilon}_t$

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Intangible assets are derived from companies' balance sheets and include the value of R&D expenditures, goodwill, and proprietary intellectual property rights such as patents, trademarks, and copyrights. Differencing intangible assets in the form (log yt - log yt-1), where y is a differenced variable, allows us to define the annual change in this variable, i.e., investment in intangible assets or growth in exports or export intensity. Box plots of intangible assets, export revenues, and export intensities are shown in Figure 1 to illustrate the data better.

Figure 1 shows a slow but steady increase in intangible assets and exports in both the periodic means and the median values, with values tending to concentrate more around the median in later periods. The periodic mean values of export intensity show a decline between 2006 and 2008, when the recovery process begins. The median values of export intensity show less fluctuation. Therefore, we will examine the cointegration between intangible assets and export intensity using the cointegration tests described in the Results section.

We first used vector autoregression analysis (VAR) and then impulse response function (IRF) to illustrate the effects and enable their prediction and then proceeded with the vector error correction model (VECM). The research interest of this paper is the causal relationship between the effects of intangible asset investment and export and internationalization growth. The model VAR examines the impact of previous years of intangible asset investment and export or internationalization growth on this year's export growth or internationalization growth. VAR equation is represented by the following formula (Sims, 1980):

$$Z_t = A_0 + A_1 Z_{t-1} + e_t \qquad (1),$$

where Z_t is a vector of variables, A_o is a matrix of intercepts, A_1 is a matrix of coefficients and e_t is a vector of error terms.

The following formula represents the VECM equation:

$$\Delta Y_t = \lambda \Delta X_t + \pi \hat{\varepsilon}_t + a_t \qquad (2),$$

where $\lambda \Delta X_t$ shows short-term dynamics and $\pi \hat{e}_t$ depicts long-term dynamics, and an error correction term $\hat{e}_t$ reduces the difference between Y_{t-1}. Error correction term is estimated value:

$$\hat{\varepsilon}_{t-1} = Y_{t-1} - (\widehat{\beta_0} + \widehat{\beta_1} X_{t-1}) \qquad (3),$$

where π indicates a speed of adjustment to the equilibrium state. If $\pi>0$, then Y_t decreases as a result of deviation from the equilibrium state. If , then increases because of deviation from the equilibrium state. The adjustment process to or from the equilibrium state results from the cointegration of the two variables, which disables that error terms increase in the long run.

4. RESULTS

After descriptive statistics and graphs depicting trends and no stationarity at levels have been shown, unit root tests are calculated for all variables. The unit root tests confirm the existence of unit roots at level, but when differenced once variables become stationary. The ADF-Fisher χ2 test and the ADF-Choi-Z-statistic were used to confirm the cointegration of the variables with the order of integration of I (1).

4.1. Panel VAR estimation

Lag lengths were estimated using VAR lag order selection criteria. 2 lags are optimal and correspond to Schwarz and Hannan-Quinn's information criterion for the relationship between intangible assets and exports, and three lags for the relationship between intangible assets and export intensity, i.e., internationalization. The lag length for the relationship between intangible assets and export intensity was determined using the AIC criterion, which is based on the economic rationale that a more extended period

TABLE 2. Panel VAR estimation: Intangible assets

	LM Autocorrelation test at lag 8	Granger causality	White test	Johansen cointegration test	Wald test
IA - > EX	4.4051	4.3932*	394.2950***	1	8.7863*
IA - > EI	3.7746	3.2409	488.7845***	1	0.7062

Note: *** p < 0.001, ** p < 0.01, * p < 0.05, †p < 0.1. Short-run and long-run causalities depict the results of Wald F-statistic. Johansen cointegration test equations with no trend and no intercept in VAR.

Source: Orbis (2016) database. Author's calculations.

is required for the impact of intangible assets on profits, or export intensity, to become apparent. Given ten years, we believe that three lags are still sufficient for the remainder of our analysis. Unit roots satisfied the stability condition.

The Johansen panel cointegration test, assuming no deterministic trend, yielded a cointegrating equation at the 0.05 significance level for the relationship between intangible assets and exports and a cointegrating equation between intangible assets and export intensity (Table 2). The Lagrange multiplier autocorrelation test results at the 8th lag show no significant autocorrelation. The White test for heteroskedasticity shows heteroskedasticity in the data. VAR, however, is prone to heteroskedasticity problems (Table 2).

Table 2 shows that intangible assets are associated with export growth at a 5% significance level, while they are not associated with export intensity at a significant level. Nevertheless, we exemplify the equation of VAR models with substituted coefficients:

$$EX = 0.6548*EX_{t-1} + 0.1077*EX_{t-2} + 0.0428*IA_{t-1} - 0.0039*IA_{t-2} + 1.4609 \qquad (4)$$

$$EI = 0.4832*EI_{t-1} + 0.1150*EI_{t-2} + 0.0637*EI_{t-3} - 0.0107*IA_{t-1} - 0.0293*IA_{t-2} + 0.0708*IA_{t-3} - 0.4291 \quad (5)$$

4.2. Impulse response function

Impulse response functions for the Granger significant effects were also analyzed. Angrist and Pischke (2008, 2010) point out that the research environment in economics can be pretty limited for making statements about the causality of impact. Therefore, their proposed terms are used in the study to make statements about the association between variables as a function of previous periods. Figure 2 shows the response of one standard deviation shock using Chole-

sky degrees of freedom adjusted factors of intangible assets on exports (Figure 2a) and intangible assets on export intensity (Figure 2b).
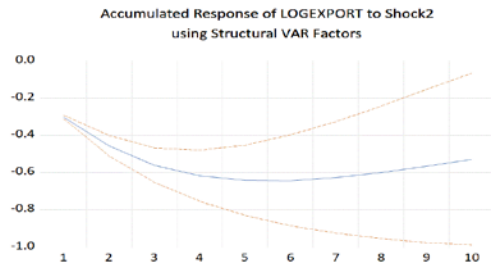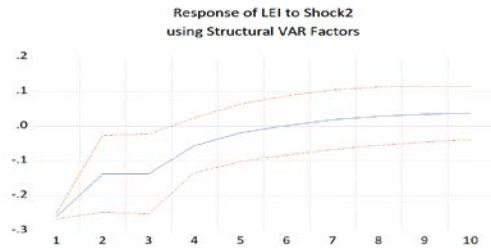

FIGURE 2A. IRF IA - > EX

FIGURE 2B. IRF IA->EI

Note: Impulse response function of one standard deviation shock in labor (LP) or total factor productivity (TFP) on export or export intensity (internationalization) using Cholesky (d.f. adjusted) factors.

Source: Author.

TABLE 3. Panel VECM estimation: Intangible assets

	LM Autocorrelation test at lag 8	Granger causality	White test	Johansen cointegration test	Short run causality (Wald test)	Long-run causality (Wald)	Long-run coefficient
ΔIA - >Δ EX	1.3812	0.6097	325.9613***	1	0.6097	48.7738***	-0.0642***
ΔIA - >Δ EI	6.5548	3.2588	500.1226***	1	3.2588	369.3268***	-0.3477***

Note: *** p < 0.001, ** p < 0.01, * p < 0.05, †p < 0.1. Short-run and long-run causalities depict the results of Wald F-statistic. Johansen cointegration test indicates equations with no trend and no intercept in VECM.

Source: Orbis (2016) database. Author's calculations.

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One standard deviation shock in intangible assets is associated with a change in exports. This change is positive and significant. However, the variance decomposition shows strong endogeneity of exports and only a weak effect of the intangible asset shock on the export change. As mentioned earlier, changes in intangible assets are not associated with changes in export intensity. We can conclude that the impulse response function shows positive long-run effects, which the variance decomposition confirms. The variance decomposition of export intensity shows strong endogeneity properties of export intensity and only a weak effect of exogenous intangible assets on export intensity.

4.3. Panel VECM estimation

VECM model substituted coefficients are as follows:

$$\Delta EX = -0.0642*(EX_{t-1} - 1.73494*IA_{t-1}) - 0.1755*\Delta EX_{t-1} - 0.0559*\Delta EX_{t-2} + 0.0128*\Delta IA_{t-1} - 0.0143*\Delta IA_{t-2} \quad (6),$$

$$\Delta EI = -0.347693174766*(EI_{t-1} + 0.1572*IA_{t-1} - 0.1835*\Delta EI_{t-1} - 0.0778*\Delta EI_{t-2} - 0.0140*\Delta EI_{t-3} + 0.0261*\Delta IA_{t-1} - 0.0558*\Delta IA_{t-2} + 0.0502*\Delta IA_{t-3} \quad (7).$$

The Lagrange multiplier we used to test for autocorrelation up to lag 8 was insignificant; therefore, we can reject the hypothesis of autocorrelation being present. The White tests show evidence of heteroskedasticity, but the VECM is robust to the problem of heteroskedasticity. Therefore, we proceed with the analysis. The Wald test showed no short-term relationship, only a long-term one. One standard deviation shock in IA is not associated with a change in exports. The long-run coefficient is negative, which means that the entire system returns to equilibrium at a rate of 6.42% per year when the effect of the change in intangible assets on export growth occurs.

Similarly, the effect of one standard deviation shock in intangible assets is not associated with a change in export intensity. However, the long-run coefficient is negative, meaning that the whole system returns to equilibrium at 34.77% per year when intangible assets affect export intensity.

5. DISCUSSION AND CONCLUSION

The objective of this study was to gain a deeper understanding of the causal relationship between the impact of investment in intangible assets on export and internationalization growth by answering the research question: *"What is the impact of intangible asset investments on export and internationalization growth of Croatian exporters and how long does this effect last?"* This is done by analyzing the impact of intangible assets on Croatian exports and export intensity. The periods of growth in Croatia, followed by periods of stagnation (Družić, 2007), can be attributed to the lack of competitiveness resulting from the stagnant lagging position in global value chains (Ćudina et al., 2012; Kersan-Škabić, 2017). Intangible assets include investments in research and development, patents, copyrights, trademarks, and goodwill, i.e., innovation. Innovative products and services tend to move up the value chain and include a larger share of intangible assets, at least in the short-term periods. Therefore, constant investment in intangible assets and the constant search for product and service innovation are prerequisites for global competitiveness. The result of a slow return to equilibrium is a remarkable outcome because it shows how long it takes for investments in intangible assets to have an effect.

Since this study showed that an increase in exports is followed by investment in intangible assets, it is not consistent with the study of Coad and Rao

(2009) since the latter shows that investment in intangible assets comes before the increase in export growth and internationalization. Although the effect might be negative in the first period, intangible asset investment tends to increase export growth slowly in the long run. On the other hand, intangible assets are unrelated to internationalization, i.e., the export intensity of Croatian exports. Even when investment in intangible assets increases, export intensity returns to equilibrium quickly. Both results are consistent with the expectations of a small open economy integrated into European value chains, especially into backward streams of European value chains.

Several implications emerge from these results. First, the results confirm that Croatian exports lack competitiveness and that small changes in intangible assets are insufficient to make the big leap into the necessary catch-up process. Second, there are implications for both management and policy. Namely, managers should be aware of technological differences and thus the need to overcome them, but they can also rely on existing technologies to improve their performance. However, radical innovation is needed for a leap in the catch-up process. Currently, the Croatian economy lags behind its European competitors.

Several policy recommendations emerge from this study. European Cohesion Policy is the European Union's most important measure for promoting balanced growth in European regions. Therefore, it should be vital to promote investment in intangible assets (Roth & Popescu, 2012), especially for small and young enterprises. Policies to promote growth should vary from region to region, as each region has its specificities (Srhoj et al., 2020). In this sense, export promotion, public grants for exporters, especially technology-oriented grants (Srhoj and Walde, 2020), public export guarantee schemes, subsidized export loans (especially for young and small firms), and randomized foreign market access programs are beneficial for exporters on the demand side of the spectrum.

On the other hand, investment in intangible infrastructure requires different institutions, rules, and norms to optimize the environment for investment in intangible assets (Haskel & Westlake, 2018). Changing the composition of financing through tax treatment, favorable competition policies, and a sound legal environment is necessary to encourage investment in intangible assets, as are clear guidelines for financial reporting, bank lending, equity financing, and direct government support (Demmou et al., 2019; Demmou & Franco, 2021). The problem with these policies is their focus on the short-term commercialization of innovations (Srhoj and Walde, 2020), which mostly lead to incremental innovations and, thus, a short-term increase in exports. In the longer term, the institutional infrastructure must create an environment for basic research that generates radical innovations and increases economic output. This requires the strategy and direction of the institutional economic setup.

This study has several limitations. First, the data used relate to a specific period when test access to the Orbis database was granted. The study would benefit from a more extensive data set. It would also be interesting to compare the data with other countries in Central and Eastern Europe that have undergone a similar transition process, some more successfully than others.

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NEMATERIJALNA IMOVINA I RAST IZVOZA HRVATSKIH IZVOZNIH PODUZEĆA: DOKAZI IZ PANEL VAR I VECM ANALIZE

SAŽETAK

Ova studija testira postojanje i smjer veze između investiranja u nematerijalnu imovinu i rasta izvoza i internacionalizacije, korištenjem VAR, IRF i VECM pristupa. Kako bi se dublje razumjela ova veza, postavljeno je istraživačko pitanje: Kakav je utjecaj investiranja u nematerijalnu imovinu na rast izvoza i internacionalizaciju hrvatskih izvoznika i koliko dugo traje taj utjecaj? Rezultati, temeljeni na mikro-financijskim podacima najvećih hrvatskih izvoznika, ukazuju na vezu između izvoza i ulaganja u nematerijalnu imovinu u prethodnim razdobljima. Akumulirani impulsni odgovor pokazuje da ulaganje u nematerijalnu imovinu prvo smanjuje, a zatim povećava rast izvoza. Veza između ulaganja u nematerijalnu imovinu i rasta izvoza ima oblik slova U i ne konvergira prema ravnoteži unutar analiziranog desetogodišnjeg razdoblja. VECM pokazuje da povećanje nematerijalne imovine dovodi do povećanja izvoza u dugom roku. Međutim, brzina prilagodbe dugoročnoj ravnoteži je spora i iznosi samo 6,42% godišnje. Postoje dva znanstvena doprinosa ove studije. Ona ukazuje na vezu između investiranja u nematerijalnu imovinu i dugoročnog rasta izvoza. Nadalje, studija pruža informacije za provedbu politika o izboru strateškog smjera, kojeg poduzeća trebaju izabrati, da bi se ponovno pozicionirale, po mogućnosti u perspektivnim lancima vrijednosti, otvarajući pritom raspravu o institucionalnoj infrastrukturi, potrebnoj za ponovno pozicioniranje.

KLJUČNE RIJEČI: *neopipljiva imovina, internacionalizacija, izvoz, VAR, VECM, funkcija impulsnog odgovora*