E/B/R

ECONOMIC AND
BUSINESS REVIEW

CONTENTS

SPILLOVER EFFECTS THROUGH WORKER MOBILITY: EVIDENCE FROM SLOVENIAN SMEs

TINA GOLOB[1]

Abstract: The paper tests for potential productivity spillovers arising through worker mobility from foreign owned firms to domestic SMEs using Slovenian data, covering the period from 2002 to 2010. Separate analyses were done for the service and manufacturing sector. My paper contributes to a segment of literature, that is relatively scarce, since it requires the use of linked employer-employee databases, which emerged only recently. I find robust evidence in support of the hypothesis, that flows of highly educated workers from foreign owned firms to domestic SMEs boost total factor productivity growth of domestic service SMEs.

Key-words: *spillovers, worker mobility, FDI, total factor productivity, foreign firms, SMEs*
JEL: C23, D24, F21
DOI: 10.15458/85451.42

1. INTRODUCTION

Economic theory predicts that foreign owned firms have an advantage over domestic firms in terms of productivity. Several empirical studies have found evidence to support this claim (e.g. Arnold & Javorcik (2009), Damijan, Kostevc & Rojec (2012) among recent ones). This is the reason why foreign owned firms are largely seen as a potential source of knowledge and technology diffusion for the host economy. Extensive research has already been done when it comes to productivity spillovers in general. The results are mixed. A number of studies confirm their existence. Keller & Yeaple (2009) for example analysed U.S. data. They found that productivity spillovers accounted for about 14% of productivity growth in U.S. manufacturing firms in the period from 1987 to 1996. Smarzynska-Javorcik (2004) analysed Lithuanian firm-level data and confirmed the existence of positive spillovers effects taking place between firms across different industries. Girma & Wakelin (2000) further established that domestic firms benefit in terms of productivity if multinational firms operate in the same sector and region. Their study was based on UK data for manufacturing firms. They also find, that domestic firms are worse off if MNEs are located in the same sector but different region. According to them, regions that are less developed gain less from spillovers, whereas sectors with higher competition and sectors with a low technology gap between foreign owned and domestic firms gain more.

1 University of Ljubljana, Faculty of Economics, PhD Student, Ljubljana, Slovenia, e-mail: tina.golob007@gmail.com

Many studies, on the other hand, find no evidence for the existence of productivity spillovers or even detect negative spillovers. Aitken & Harrison (1999) for example used panel data on Venezuelan plants and documented the existence of negative productivity spillovers. Aslanoğlu (2000) further analysed data for Turkish manufacturing firms and found no evidence that domestic firms benefit in terms of productivity when foreign owned firms are present.

As far as the case of Slovenia is concerned, positive productivity spillovers have been documented by Damijan et al (2003) for manufacturing sector. Horizontal productivity spillover effects in Slovenian manufacturing sector are also confirmed by Zajc Kejžar (2011), however, they tend to offset only a minor part of the competition pressure which results from foreign firm entry within the industry. Zajc Kejžar and Ponikvar (2014) further confirm the important role of absorptive capacity of domestic firms for productivity gains by showing that as a result of inward FDI the least efficient incumbent firms are experiencing job destruction and the most efficient ones productivity gains, while firms from the middle part of the TFP distribution are faced with both effects. The existence of productivity spillovers has, however, not yet been tested on Slovenian data for service firms.

Productivity spillovers can occur through different mechanisms. One of them is worker mobility. In this case a person is hired by a foreign owned company and subsequently receives firm training. The employee may acquire knowledge regarding superior managerial practices, process innovations, high quality intermediate inputs etc. pertaining to the foreign owned firm (Poole, 2013). In the next step the worker, regarded as a knowledge carrier, is hired by a domestic company. This way the knowledge is transferred between companies, boosting domestic firm's productivity.

The literature in the management field agrees about the importance of expatriates for the technology transfer from the mother company to the local affiliates and their learning process. But can a MNE fully retain its technological advantages in case of worker mobility between its affiliates and local companies? Both theoretical and empirical studies examine the potential for productivity spillovers to domestic firms through the mobility of workers, who were previously employed and trained in MNE affiliates. According to Fosfuri, Motta, & Rønde's (2001) model technological spillovers arise due to the mobility of workers previously trained and employed in MNE affiliates, while pecuniary spillovers arise when the foreign affiliate pays the trained worker a higher wage to prevent him/her from moving to a local competitor. Further, technological spillovers are more likely to arise when the local firm and the MNE do not compete fiercely in the product market, when they sell in independent or vertically related markets, in the case when on-the-job training is general rather than specific and when the absorptive capability of the local firm is high. A model describing a similar setup was also derived by Glass & Saggi (2002), who additionally shed some light on government incentives to attract or discourage FDI.

The presence of spillovers through worker mobility has been empirically tested only recently with the emergence of matched employer-employee databases. Consequentially,

research on this topic is relatively scarce. However, in general they seem to confirm the role of worker mobility as a channel for spillover effects. A study by Balsvik (2011) found that in case of Norwegian manufacturing firms, during the 1990s, workers with MNE experience contributed 20% more to the productivity of their plant than workers without such experience. Since the private return to mobility is found to be smaller than the productivity effect at the plant level, labour mobility from MNEs to non-MNEs seems to represent a true knowledge externality. However, Maliranta, Mohnen, & Rouvinen (2009) found that workers transmit knowledge that can readily be copied and implemented without much additional R&D effort. Namely, only hiring workers previously in R&D to one's non-R&D but not to one's own R&D activities, boosts both productivity and profitability. Görg & Strobl (2005) further confirmed, that firms, which are run by owners who worked for multinationals and in the same industry immediately prior to opening up their own firm, are more productive than other domestic firms. Their research was done for the case of Ghana. Poole (2013) provided evidence for positive multinational wage spillovers through worker mobility in Brazil, i.e. when workers leave multinationals and are rehired at domestic establishments, continuing-workers' wages increase. Martins (2005) further examined Portuguese data and found, that employees who switched from foreign to domestic firms, have higher wages than workers in domestic firms, who have no prior experience in foreign firms. The wages of switchers also increase with the length of their past tenure at foreign firms. However, in case of Portugal, flows of workers between foreign owned and domestic firms prove to be relatively small. Finally, the author concludes, that the evidence found, at best, provides only moderate support for the role of labour mobility as a knowledge transfer channel. Hakkala & Sembenelli (2014) on the other hand show, that spillovers can only be detected in the case, when workers move from multinationals to purely domestic firms in high-tech sectors. Their analysis was conducted using Finnish data. They also report that competition reduces inter-firm worker flows. Pesola (2011) also based her findings on Finnish data and discovered that highly educated workers earn a wage premium for their previous experience at a foreign firm, which is higher than the premium for other types of experience.

The aim of my paper is to study the effects of worker flows, from foreign owned firms to domestic SMEs, on the productivity growth of domestic SMEs. I will therefore try to establish whether worker mobility indeed functions as a channel for productivity spillovers using Slovenian data. To my knowledge, this paper is in fact the first one to test for productivity spillovers through worker mobility on Slovenian data. In contrast to previously mentioned papers it analyses data for service and manufacturing sectors separately. I focus my research on domestic SMEs, since spillovers may be a relatively more important source of TFP growth for smaller firms than for larger ones. Due to the dynamic nature of the empirical model I use a system GMM estimator developed by Arellano & Bover (1995) and Blundell & Bond (1998) to conduct my analysis.

The remainder of the paper is structured as follows: Section 2 presents the data, its sources and the descriptive statistics. It is followed by a description of methodology and related issues in Section 3. Section 4 consists of empirical results, while the paper ends with Section 5, containing concluding remarks.

2. DATA AND DESCRIPTIVE STATISTICS

For the purpose of my analysis I combined three different databases covering the period from 2002 to 2010. First is the matched employer-employee database provided by the Slovenian Statistical Office. It contains data on economically active population, among other things information on a person's education, profession, identification of a current employer and their position in the firm. Second database was obtained from the Bank of Slovenia and consists of data on inward foreign direct investment. Since a 10% threshold is applied, only firms with foreign ownership exceeding 10% are included in the database. In the reminder of my paper these firms are defined as foreign owned firms. The two databases were then merged with Slovenian firms' financial data provided by AJPES (The Agency of the Republic of Slovenia for Public Legal Records and Related Services) using firm identifiers. The full merged database contains roughly 30000 firms on average per year. Firms simultaneously having negative capital and zero employees were identified as inactive and excluded. The linked data provides us with the information needed to determine firm characteristics, including total factor productivity, age, export status, employment dynamics and characteristics of its workers. Based on the full database we were also able to determine how many of the newly employed workers at a firm each year came from foreign owned firms. As already stated, my study focuses on the effects of knowledge brought by workers with previous experience at foreign owned firms on domestic SMEs' productivity growth. According to the findings of Keller & Yeaple (2009) small firms benefit more in terms of FDI spillovers than larger firms. One possible explanation for this result may be that small firms have less money available for their own R&D activities and are consequently more reliant on other sources of TFP growth. In light of the conclusion by Keller & Yeaple (2009) it seems reasonable to focus on SMEs, since the effects of spillovers may be relatively more important for them than for larger firms. My econometric analysis was therefore finally conducted based on the data for the population of domestic SMEs, covering the period from 2002 to 2010, including almost 28000 firms on average per year.

Table 1 shows some basic summary statistics for foreign owned firms and domestic SMEs. The data in the table reveal, that the number of domestic SMEs grew by 35% in the period from 2002 to 2010, namely from 23,740 to 32,002. The number of foreign owned firms on the other hand increased by merely 8% between 2002 and 2010, peaking in 2008 with 1751 foreign owned firms.

Table 1: Descriptive statistics for domestic SMEs and foreign owned firms from 2002 to 2010

Year	No. of domestic SMEs	No. of foreign owned firms	No. of workers at domestic SMEs	No. of workers at foreign owned firms	No. of switchers*	No. of switchers with h.e.**
2002	23740	1514	301978	64207	1573	685
2003	24397	1483	303717	59146	2615	842
2004	25223	1512	297381	60495	2643	1046
2005	26314	1585	300046	67304	3265	1154
2006	27352	1537	297557	63302	4130	1367
2007	28911	1638	254816	73019	4563	1746
2008	30587	1751	266434	78975	4759	1895
2009	31358	1737	257357	73142	3582	1435
2010	32002	1634	250285	72935	3858	1619

Notes: *Switchers are defined as workers who switched jobs from foreign owned firms to domestic SMEs
**h.e. stands for higher education
Source: Own calculations

On average the number of domestic SMEs was roughly 17 times the number of foreign owned firms during the period in question. The number of workers that domestic SMEs employed, on the other hand, dropped from 301,978 in 2002 to 250,285 in 2010, namely by 17%. Since the number of SMEs increased during the period, whereas the number of workers they employed decreased, it seems, that the SMEs have become smaller on average in terms of employees. The number of workers at foreign owned firms, on the other hand, increased by roughly 14% in the period, peaking at 78,975 in 2008. On average domestic SMEs employed about four times more people than foreign owned firms during 2002-2010. The latter indicates, that foreign owned firms are considerably larger on average when compared to domestic SMEs. The first necessary, but not sufficient condition for the emergence of productivity spillovers via worker mobility is of course the existence of worker flows. The data in table 1 show that the number of workers who switched jobs from foreign owned firms to domestic SMEs (switchers) in a given year, increased from 1573 in 2002 to 3858 in 2010. The number of switchers peaked in 2008, when it reached triple the number from 2002. Similar conclusions can be drawn when describing developments in the number of switchers with higher education. On average the share of switchers with higher education in the total number of switchers is 38%.

Table 2 presents the number of domestic SMEs employing at least 1 new switcher from a foreign owned firm in a given year. As can be seen from the table, the annual number of SMEs employing at least one new switcher, has more than doubled, when comparing 2002 with 2010. On average the number of SMEs employing new switchers represents roughly 7% of all domestic SMEs.

Table 2: Number of SMEs employing at least one worker, who switched from a foreign owned firm, in a given year

Year	No. of SMEs
2002	959
2003	1388
2004	1571
2005	1848
2006	2136
2007	2528
2008	2697
2009	2032
2010	2006

Source: Own calculations

Further summary statistics, presented separately for domestic SMEs and foreign owned firms, is reported in table 3.

Table 3: Descriptive statistics for foreign owned and domestic firms 2002-2010

	Domestic SMEs		Foreign owned firms	
Variable	Mean	s.d.	Mean	s.d.
Age	9.98	6.62	9.13	6.64
Export share (%)	8.43	21.86	32.34	38.69
Employment	10.26	41.45	42.30	160.22
Value added per employee (EUR)	25,611.7	162,683	40,997.6	345,742.6
Capital intensity (EUR)	123,987.1	4,520,724	390,534.2	1.43e+7
Share of highly educated employees (%)	21.38	33.49	32.54	33.87
TFP[2]	9.18	35.61	16.54	88.81

Source: Own calculations

The data indicate that on average there is not much age difference between domestic SMEs and foreign owned firms, while other indicators exhibit significant gaps. As can be seen, the average export share for domestic SMEs is 8.43%, whereas for foreign owned firms it is 32.34%. Foreign owned firms tend to be bigger, on average employing four times as many people as domestic SMEs. The latter lag behind foreign owned firms in terms of value added per employee as well as capital intensity. Capital intensity is 3.1 times higher with foreign owned firms compared to domestic SMEs, whereas value added per

2 The methodology behind TFP calculation is described in section 3.

employee is 1.6 times higher. Foreign owned firms also employ a higher share of highly educated workers. In domestic SMEs, workers with higher education on average represent 21.4% of the total workforce, compared to 32.5% in foreign owned firms. Further, another indicator crucial for my study is total factor productivity or TFP which is my chosen measure of productivity. An existence of a gap in terms of TFP, between foreign owned firms and domestic SMEs, would imply that there is potential for productivity spillovers to take place. As can readily be calculated using data in table 3, TFP is 80% higher for foreign owned firms than for domestic SMEs. Based on summary statistics at hand, we can therefore conclude, that the potential for productivity spillovers from foreign owned firms to domestic SMEs indeed exists.

I have decided to conduct my analysis separately for SMEs in the service sector and for SMEs in the manufacturing sector, since the nature of work process in the two groups of firms is very different. In order to enable comparison between service and manufacturing SMEs, table 4 presents summary statistics for both sets of firms separately. As can be seen from table 4, service SMEs tend to be slightly younger on average. For manufacturing SMEs the average export share amounts to 16.12%, whereas for service SMEs it is only 6.81%. This can of course be explained by the fact that some services cannot be exported, as well as the fact that barriers for international trade with services are greater than barriers for trade in goods. On average service firms employ 7.61 workers, whereas manufacturing firms on average employ 23.29 workers. Value added per employee seems to be slightly higher for the service sector. Surprisingly, capital intensity turns out to be greater for service firms than for manufacturing firms. This, however, may be a consequence of the way I defined capital intensity. Namely, my definition of capital includes all firm fixed assets, tangible as well as intangible. Further, in service SMEs the average share of employees with higher education is 23.3% which is roughly double the share for manufacturing SMEs. Finally, on average service firms have a slightly lower TFP.

Table 4: Descriptive statistics for domestic SMEs in service and manufacturing sector in the period from 2002 to 2010

	Service SMEs		Manufacturing SMEs	
Variable	Mean	s.d.	Mean	s.d.
Age	9.61	6.38	11.38	7.08
Export share (%)	6.81	20.00	16.12	27.87
Employment	7.61	32.89	23.29	70.32
Value added per employee (EUR)	25,756.9	171,394.8	24,419.5	72,902.0
Capital intensity (EUR)	124,143.5	3,082,028	62,217.6	543,940.1
Share of highly educated employees (%)	23.31	35.01	11.62	22.22
TFP	9.15	37.13	9.93	16.91

Source: Own calculations

3. METHODOLOGY AND EMPIRICAL ANALYSIS

3.1 Empirical model specification

In order to conduct my empirical analysis I use firm growth models. As previously indicated, my chosen dependent variable is TFP growth. As far as the specification of the models is concerned, I start by including a few factors proposed by models of firm dynamics (e.g. Ericson & Pakes, 1995; Jovanovic, 1982): firm age, firm size, capital intensity, annual dummies and industry dummies. I then further enhance them by adding some specific variables that I find important for this particular case. An empirical model specification akin to mine was for example used by Koymen & Sayek (2009), who test for productivity spillovers through forward, backward and horizontal linkages. They too use TFP growth as the dependent variable, while controlling for firm size, export status and the share of skilled workers in the firm, among other things. They base their empirical strategy on a paper by Smarzynska-Javorcik (2004), also pertaining to the spillovers literature. However, as an upgrade, my model specifications also test for TFP dynamics, since they include lags of TFP. They are specified as follows:

$$grTFP_{it} = \beta_0 + \beta_1 \ln TFP_{it-1} + \beta_2 \ln TFP_{it-2} + \beta_3 \ln TFP_{it-3} + \beta_4 ShFrHE_{it-2} + \beta_5 \ln Age_{it} + \\ + \beta_6 \ln Empl_{it-1} + \beta_7 \ln Empl^2_{it-1} + \beta_8 \ln K\,\mathrm{int}_{it-1} + \beta_9 dExporter_{it-1} + \beta_{10} ShHE_{it-1} + \\ + \beta_{11} ShNwHE_{it-2} + \sum \beta_{12,t} dyear_t + \sum \beta_{13,j} dindustry_j + u_{it} \quad (1)$$

$$grTFP_{it} = \beta_0 + \beta_1 \ln TFP_{it-1} + \beta_2 \ln TFP_{it-2} + \beta_3 \ln TFP_{it-3} + \beta_4 ShFr_{it-2} + \beta_5 \ln Age_{it} + \\ + \beta_6 \ln Empl_{it-1} + \beta_7 \ln Empl^2_{it-1} + \beta_8 \ln K\,\mathrm{int}_{it-1} + \beta_9 dExporter_{it-1} + \beta_{10} ShHE_{it-1} + \\ + \beta_{11} ShNw_{it-2} + \sum \beta_{12,t} dyear_t + \sum \beta_{13,j} dindustry_j + u_{it} \quad (2)$$

$$grTFP_{it} = \beta_0 + \beta_1 \ln TFP_{it-1} + \beta_2 \ln TFP_{it-2} + \beta_3 \ln TFP_{it-3} + \beta_4 ShFrSs_{it-2} + \beta_5 \ln Age_{it} + \\ + \beta_6 \ln Empl_{it-1} + \beta_7 \ln Empl^2_{it-1} + \beta_8 \ln K\,\mathrm{int}_{it-1} + \beta_9 dExporter_{it-1} + \beta_{10} ShHE_{it-1} + \\ + \beta_{11} ShNwSs_{it-2} + \sum \beta_{12,t} dyear_t + \sum \beta_{13,j} dindustry_j + u_{it} \quad (3)$$

$$grTFP_{it} = \beta_0 + \beta_1 \ln TFP_{it-1} + \beta_2 \ln TFP_{it-2} + \beta_3 \ln TFP_{it-3} + \beta_4 ShFrDs_{it-2} + \beta_5 \ln Age_{it} + \\ + \beta_6 \ln Empl_{it-1} + \beta_7 \ln Empl^2_{it-1} + \beta_8 \ln K\,\mathrm{int}_{it-1} + \beta_9 dExporter_{it-1} + \beta_{10} ShHE_{it-1} + \\ + \beta_{11} ShNwDs_{it-2} + \sum \beta_{12,t} dyear_t + \sum \beta_{13,j} dindustry_j + u_{it} \quad (4)$$

The first model is used to test for the effects of employing highly educated workers with immediate prior work experience in a foreign owned firm, on company TFP growth. The second model, on the other hand, is used to test for the effects of employing workers with immediate prior work experience in a foreign owned firm in general, regardless of their education, on firm TFP growth. The third model is further used to test for the effects of

employing workers with immediate prior work experience in a foreign owned firm from the same sector and the fourth model focuses on the case when the foreign owned firm is located in a different sector.

The dependent variable in all cases is therefore growth of total factor productivity. It is defined as $lnTFP_t$-$lnTFP_{t-1}$, where $lnTFP_t$ and $lnTFP_{t-1}$ are the natural logarithms of TFP at time t and t-1, respectively. When calculating TFP via production function estimation, one needs to account for simultaneity bias. As noted by Marschak and Andrews (1944) the amounts of inputs in the production function are not exogenous. Among other things, they depend on the efficiency of the firm which is a consequence of firm-level profit maximization. Simultaneity bias arises because of correlation between unobserved productivity shocks and the level of inputs chosen (De Loecker, 2007). A firm may have prior knowledge of the productivity shock unobservable to the econometrician and adapt input choices accordingly (Olley & Pakes, 1996). In order to account for this problem I decided to follow the approach developed by Levinsohn & Petrin (2003). Using Stata levpet procedure, I selected fixed assets as a proxy for capital, labour costs as a proxy for labour and energy costs as a proxy for intermediate inputs. TFP was estimated separately for manufacturing sector, service sector and agricultural sector. Revenue version of the production function was chosen as the basis of my estimation.

In the model, *Age* represents a firm's age, *Empl* is firm size, which is defined as the number of employees in a firm, whereas *Kint* represents capital intensity. The latter was defined as fixed assets per employee. *dExporter* is a dummy variable taking the value 1 if company engages in export activities and 0 if it does not, whereas *ShHE* denotes the share of employees with higher education in a firm. *dyear* and *dindustry* refer to year and industry dummies. The latter are based on Nace Rev.2 two-digit level classification. *TFP*, *Age*, *Empl* and *Kint* enter the empirical models in logarithmic values. In case of *Empl*, *Kint*, *dExporter* and *ShHE* first lags are used. Further, for TFP, the first, the second and the third lag are included into the regression.

ShFrHE is my main variable of interest in the first model, as it represents highly educated employees with immediate prior working experience at a foreign firm. It is structured as follows:

$$ShFrHE = \frac{NwFrHE}{NoEmpl}$$

where *NwFrHE* is the number of highly educated workers with immediate prior working experience at a foreign owned firm, employed by the company in the current and previous year, whereas *NoEmpl* is the number of all employees in the firm. The second lag of *ShFrHE* was used in the model. In order to check whether employing new highly educated workers (without immediate prior experience in a foreign owned firm) alone enhances TFP growth, I included a control variable, *ShNwHE*. The latter is defined as the share of highly educated workers employed by the firm in the current or

previous year in the total number of company employees. Again the second lag of the variable was used.

In the second model my main variable of interest is *ShFr*. It is defined as

$$ShFr = \frac{NwFr}{NoEmpl}$$

where *NwFr* is the number of all workers with immediate prior working experience at a foreign owned firm, regardless of their education, employed by the company in the current and previous year. As in the first model, the second lag of the core variable was used. Since the latter was changed with respect to the first model, the control variable also needed to be adjusted. The control variable constructed for the second model, *ShNw*, thus encompasses the share of all workers employed by the firm in the current and previous year in the total number of company employees.

Further, in the third model my main variable of interest is *ShFrSs*. It is defined as

$$ShFrSs = \frac{NwFrSs}{NoEmpl}$$

where *NwFrSs* is the number of all workers with immediate previous working experience at a foreign owned firm from the same sector, employed by the company in the current and previous year. Again the second lag of the core variable was used. The control variable constructed for this case is *ShNwSs*. It encompasses the share of all workers employed by the firm in the current and previous year, who previously worked in the same sector, in the total number of company employees.

Finally, the main variable of interest in the fourth model is *ShFrDs*. It is defined as

$$ShFrDs = \frac{NwFrDs}{NoEmpl}$$

where *NwFrDs* is the number of all workers with immediate previous working experience at a foreign owned firm from a different sector, employed by the company in the current and previous year. As before, the second lag of the core variable was used. The control variable included in the last model is *ShNwDs*. It encompasses the share of all workers employed by the firm in the current and previous year, who previously worked in a different sector, in the total number of company employees.

Due to the dynamic nature of my empirical model and the fact that my panel consists of a large number of firms and a small number of time periods, I use a system GMM estimator

developed by Arellano & Bover (1995) and Blundell & Bond (1998). As can be seen from the model specification equations, three lags of the dependent variable were used as instruments. Further, all regressors listed in the model specification equations, except firm age, industry dummies and annual dummies enter the model flagged as endogenous variables.

4. RESULTS

In this section I first present the base line results obtained by estimating models (1), (2), (3) and (4) using the system GMM estimator. In the next step I proceed with presenting secondary results, which serve as a robustness check.

4.1 Main results

Table 5 gives my base line results for service SMEs. In columns (1), (2), (3) and (4) I report results obtained by estimating models (1), (2), (3) and (4) respectively. The null hypothesis of Wald test is rejected for all model specifications. Sargan test of over-identifying restrictions confirms the validity of instruments used in models (1), (2), (3) as well as model (4). Further, Arellano–Bond test for serial correlation confirms the absence of a serial correlation of order 2 for all model specifications. Three lags of the dependent variable in the specification were found to be appropriate in order to yield efficient estimates.

In table 5 the coefficient on the first lag of the dependent variable is negative and statistically significant for all four specifications. In the case of model (1) it amounts to approximately -0.24, which implies that a 1 percent increase in TFP growth in the previous year leads to a 0.24 percent decrease in TFP growth in the current period. The first lag coefficients for the remaining models are very similar in size. Further, second lag coefficients are as well negative and statistically significant for all models, however smaller, amounting to roughly -0.075 for model (1), -0.084 for model (2), -0.082 for model (3) and -0.076 for model (4). The statistical insignificance of the third lag coefficients implies, that the persistence effect fades within a 3-year period.

Table 5: Spillover effects in Slovenian service SMEs, base line results

	(1)	(2)	(3)	(4)
VARIABLES	Model 1	Model 2	Model 3	Model 4
grTFP(-1)	-0.239***	-0.244***	-0.245***	-0.241***
	(0.0204)	(0.0202)	(0.0203)	(0.0204)
grTFP(-2)	-0.0745***	-0.0838***	-0.0816***	-0.0760***
	(0.0193)	(0.0195)	(0.0192)	(0.0191)
grTFP(-3),	-0.0151	-0.0172	-0.0151	-0.0138
	(0.0136)	(0.0139)	(0.0136)	(0.0135)
lnEmpl(-1)	0.144**	0.156**	0.147**	0.164**
	(0.0600)	(0.0627)	(0.0614)	(0.0636)
$lnEmpl^2$ (-1)	-0.0410***	-0.0438***	-0.0392***	-0.0433***
	(0.0143)	(0.0160)	(0.0152)	(0.0158)
lnKint(-1)	-0.0149	-0.0130	-0.0160	-0.0119
	(0.0135)	(0.0129)	(0.0144)	(0.0124)
dExporter (-1)	0.180***	0.170**	0.172**	0.188***
	(0.0675)	(0.0710)	(0.0800)	(0.0676)
ShHE(-1)	0.00142*	0.000581	0.000544	0.000445
	(0.000854)	(0.000754)	(0.000820)	(0.000755)
ShFrHE (-2)	0.423*			
	(0.218)			
ShNwHE(-2)	-0.113*			
	(0.0578)			
lnAge	0.0754	0.0122	0.0795	0.140**
	(0.0566)	(0.0448)	(0.0517)	(0.0558)
ShFr(-2)		0.397***		
		(0.106)		
ShNw(-2)		-0.0804***		
		(0.0263)		
ShFrSs(-2)			0.379**	
			(0.187)	
ShNwSs(-2)			-0.133**	
			(0.0670)	
ShFrDs(-2)				0.384***
				(0.122)
ShNwDs(-2)				-0.0558
				(0.0370)
Constant	-9.872	-0.815	-19.75	-2.074
	(27.78)	(12.97)	(37.12)	(10.69)
Observations	35,352	35,352	35,352	35,352
Number of n7	12,317	12,317	12,317	12,317
Year dummies	YES	YES	YES	YES
Industry dummies	YES	YES	YES	YES

To be continued…

…continuation

VARIABLES	(1) Model 1	(2) Model 2	(3) Model 3	(4) Model 4
(df)	(66)	(66)	(66)	(66)
Wald χ^2	1157.4***	95960.4***	8406.5***	15439.02***
(df) Sargan χ^2	(100) 110.00	(100) 105.48	(100) 105.37	(100) 104.56
(p)	(0.23)	(0.33)	(0.34)	(0.36)
AR(1) z(p)	-17.063(0.00)	-17.011(0.00)	-16.989(0.00)	-17.027(0.00)
AR(2) z(p)	-0.917(0.36)	-0.812(0.42)	-0.843(0.40)	-0.860(0.39)

Notes: z-statistics are in parentheses, ***,**,* denote significance at 1%, 5% and 10%, respectively
Source: Own calculations

All four sets of estimates imply that firm size has a non-monotonic effect on service firms' TFP growth. This means that TFP growth increases with firm size when companies are small, however, at a certain point, the correlation becomes negative and productivity growth starts decreasing with size. One part of the explanation probably stems from the fact that generally, larger firms are more productive than smaller ones. In turn, big productivity leaps are much harder to achieve for firms operating at high levels of productivity to start with, than for firms that have much space for improvement. Further, my results for the first three models show no evidence of a significant impact of age on TFP growth, whereas the estimated coefficient for age is positive and significant in case of the fourth model. Additionally, the effect of capital intensity on TFP growth is statistically insignificant in all versions of the specification. A partial explanation for this result may perhaps be found in conclusions obtained by Zajc Kejžar & Ponikvar (2014), which suggest, that capital intensity is important for TFP growth only in case of least productive firms, but not for those achieving higher levels of productivity. In line with my expectations, exporting firms seem to grow faster in terms of TFP than firms engaging in domestic sales only. Further, the share of workers with higher education, which is a proxy for skill structure of labour, has a statistically significant positive effect on TFP growth according to results for model (1), but not according to results for models (2), (3) and (4). Finally and most importantly, estimates for my main variables of interest, *ShFrHE*, *ShFr*, *ShFrSs* and *ShFrDs* confirm the existence of knowledge spillovers through worker mobility. Positive and statistically significant coefficient for variable *ShFr* obtained by estimating model (2) implies that knowledge spillovers indeed occur through mobility of workers with experience from a foreign owned firm. The negative and statistically significant coefficient for the control variable *ShNw* shows that the knowledge spillovers detected are not a result of an increase in the share of newly hired workers alone. Further, in line with my expectations given the results pertaining to model (2), estimates for model (1), that focuses on the mobility of highly educated workers with experience from foreign owned firms, also confirm the existence of productivity spillovers. The results show that the share of workers with higher education and immediate previous working experience at a foreign owned firm, newly employed by the firm within the current and previous year, positively and significantly influences firm TFP growth. In addition to that, the coefficient

for the control variable *ShNwHE* is negative and statistically significant which means that an increase in the share of newly employed workers with higher education per se cannot be considered a driver behind TFP growth. Finally, positive and statistically significant coefficients for variables *ShFrSs* and *ShFrDs* in models (3) and (4) respectively, indicate that the share of workers with immediate previous working experience at a foreign firm from either same or different sector, newly employed by the firm within the current and previous year, positively and significantly influences firm TFP growth. I can therefore conclude that, workers' experience in foreign owned firms indeed plays a role as a driver behind service SMEs TFP growth. The negative and statistically significant coefficients for ShNw, ShNwHE and ShNwSs may perhaps seem unintuitive at first glance. However, one possible explanation for this phenomenon is that firms, who employ more new workers may also have a greater turnover when it comes to their workforce. Greater fluctuation of workers could, on the other hand, have a negative effect on TFP growth.

Table 6 presents my core results for manufacturing SMEs. Again columns (1), (2), (3) and (4) report results obtained by estimating models (1), (2), (3) and (4) respectively.

Table 6: Spillover effects in Slovenian manufacturing SMEs, base line results

	(1)	(2)	(3)	(4)
VARIABLES	Model 1	Model 2	Model 3	Model 4
grTFP(-1)	-0.214***	-0.214***	-0.210***	-0.219***
	(0.0345)	(0.0350)	(0.0345)	(0.0345)
grTFP(-2)	-0.0858***	-0.0857***	-0.0833***	-0.0904***
	(0.0315)	(0.0327)	(0.0319)	(0.0323)
grTFP(-3)	-0.0162	-0.0103	-0.00877	-0.0138
	(0.0213)	(0.0216)	(0.0218)	(0.0221)
lnEmpl(-1)	0.0662	0.0478	0.0347	0.0476
	(0.0922)	(0.0843)	(0.0868)	(0.0863)
$lnEmpl^2$ (-1)	-0.0137	-0.0106	-0.00315	-0.00863
	(0.0206)	(0.0174)	(0.0192)	(0.0195)
lnKint(-1)	0.0215	0.000828	0.00528	0.00122
	(0.0247)	(0.0264)	(0.0292)	(0.0261)
dExporter (-1)	0.0109	-0.00410	0.0245	-0.00125
	(0.0682)	(0.0620)	(0.0695)	(0.0665)
ShHE(-1)	0.00106	0.000319	8.77e-05	0.000203
	(0.00147)	(0.00155)	(0.00171)	(0.00168)
ShFrHE (-2)	-0.0874			
	(0.610)			
ShNwHE (-2)	-0.207*			
	(0.115)			
lnAge	0.213**	0.162**	0.196**	0.235***
	(0.0889)	(0.0685)	(0.0815)	(0.0774)

To be continued…

…continuation

ShFr(-2)		0.254		
		(0.165)		
ShNw(-2)		-0.0232		
		(0.0392)		
ShFrSs(-2)			0.277	
			(0.422)	
ShNwSs(-2)			-0.0652	
			(0.114)	
ShFrDs(-2)				0.262
				(0.187)
ShNwDs(-2)				-0.0353
				(0.0636)
				(8.492)
Constant	-3.271	-5.198	-0.741	-1.362
	(6.950)	(6.786)	(8.839)	(2.017)
Observations	8,692	8,692	8,692	8,692
Number of n7	3,018	3,018	3,018	3,018
Year dummies	YES	YES	YES	YES
Industry dummies	YES	YES	YES	YES
(df)	(36)	(36)	(36)	(36)
Wald $\chi 2$	447.63***	736.08***	699.13***	883.94***
(df) Sargan $\chi 2$	(105) 132.09	(105)126.17	(105) 121.23	(105) 125.52
(p)	(0.04)**	(0.08)*	(0.13)	(0.08)*
AR(1) z(p)	-3.29(0.00)	-3.31(0.00)	-3.33(0.00)	-3.31(0.00)
AR(2) z(p)	-0.58(0.56)	-0.51(0.61)	-0.62(0.53)	-0.47(0.64)

Notes: z-statistics are in parentheses, ***,**,* denote significance at 1%, 5% and 10%, respectively
Source: Own calculations

As in the case of service SMEs, the Wald test rejects the joint insignificance of the independent variables for all model specifications, whereas Arellano–Bond test for serial correlation shows there is no serial correlation of order 2. Again, three lags of the dependent variable in the specification were found to be appropriate in order to yield efficient estimates. However, all specifications except (3) fail to pass the Sargan test of over-identifying restrictions, which rejects the null hypothesis that the moment conditions are legitimate. Further, the statistical insignificance of the majority of coefficients may also imply that the given model specifications are not entirely suitable for the case of manufacturing firms. However, estimation results for coefficients pertaining to lags of the dependent variable are still in line with results obtained for service firms. The coefficients for the first and second lag are negative and statistically significant for all versions of model specification, whereas the coefficient pertaining to the third lag is already statistically insignificant. As opposed to my results for service SMEs, the estimated coefficient for firm

age is significant (and positive) in all models. However, variables testing for the presence of spillovers through worker mobility *ShFrHe*, ShFr, ShFrSs and ShFrDs in models (1), (2), (3) and (4) respectively, all turn out to have statistically insignificant coefficient estimates. The results obtained by estimating empirical models (1), (2), (3) and (4) using data on manufacturing SMEs are therefore largely inconclusive.

4.2 Robustness check

In this subsection I provide a robustness check for my base line results presented in subsection 4.1. Since meaningful results were only obtained estimating models (1), (2), (3) and (4) using data on service SMEs, I will not further elaborate on the auxiliary set of results for manufacturing SMEs. However, the latter can be found in the Appendix B. In order to test the robustness of results presented in table 5, I reformulate my main variables of interest *ShFrHE*, *ShFr, ShFrSs* and *ShFrDs* by extending the time period during which new employments are included into the analysis from two years to three years. Namely, the shares now include newly employed workers in the current and two previous years. Consequentially, the control variables for each model are modified in the same way.

Table 7 gives results obtained by estimating model specifications (1), (2), (3) and (4) modified by using the reformulated core and control variables. Results for modified specifications (1), (2), (3) and (4) are presented in columns (1), (2), (3) and (4) respectively. In line with my base line results, the null hypothesis of Wald test is rejected for all model specifications. Sargan test of over-identifying restrictions again confirms the validity of moment conditions in all cases. Arellano–Bond test for serial correlation confirms the absence of a serial correlation of order 2 for all four specifications. Three lags of the dependent variable in the specification are once again found to be appropriate in order to obtain efficient estimates. Coefficient estimates for lags of the dependent variable, firm size and dummy variable identifying exporters are quite close to initial results for service SMEs. Again, capital intensity seems to have no significant effect on TFP growth, which is in line with base line results, with the exception of model (2), where the coefficient estimate for capital intensity is negative and statistically significant. The estimated coefficient for firm age is statistically significant only in specification (3), whereas with base line results it was significant only with specification (4). All four sets of results imply, that the share of employees with higher education has no statistically significant effect on firm TFP growth. This is generally in line with the base line results, with the exception of specification (1), where the coefficient for *ShHE* proved to be positive and statistically significant.

When it comes to my main variables of interest, the results show, that estimated coefficients for *ShFr*, *ShFrSs* and *ShFrDs* are statistically insignificant. This means that the results obtained failed to confirm the existence of productivity spillovers due to mobility of workers with recent experience at a foreign firm in general, at a foreign firm from the same sector or different sector. However, results obtained for model (1) once again confirm the existence of knowledge spillovers through mobility of highly educated workers from foreign owned firms to domestic SMEs. One possible explanation for this outcome is that

sophisticated knowledge brought into the firm by workers with higher education has a more persistent effect on TFP growth, whereas the effect of less sophisticated knowledge attributed to the general population of workers fades away more quickly. Further, according to results in columns (1), (2), (3) and (4), control variables have no significant effect on TFP growth.

Table 7: Spillover effects in Slovenian service SMEs, robustness check

	(1)	(2)	(3)	(4)
VARIABLES	Model 1	Model 2	Model 3	Model 4
grTFP(-1)	-0.243***	-0.246***	-0.242***	-0.244***
	(0.0205)	(0.0205)	(0.0210)	(0.0205)
grTFP(-2)	-0.0771***	-0.0768***	-0.0791***	-0.0773***
	(0.0192)	(0.0192)	(0.0195)	(0.0193)
grTFP(-3)	-0.0159	-0.0140	-0.0122	-0.0141
	(0.0136)	(0.0138)	(0.0137)	(0.0135)
lnEmpl(-1)	0.148**	0.145**	0.160**	0.162***
	(0.0602)	(0.0585)	(0.0682)	(0.0617)
$lnEmpl^2$ (-1)	-0.0423***	-0.0397***	-0.0429**	-0.0421***
	(0.0147)	(0.0135)	(0.0174)	(0.0144)
lnKint(-1)	-0.0162	-0.0212*	-0.0154	-0.0194
	(0.0148)	(0.0127)	(0.0141)	(0.0135)
dExporter (-1)	0.204***	0.181***	0.187***	0.182***
	(0.0683)	(0.0621)	(0.0684)	(0.0653)
ShHE (-1)	0.00123	0.000362	0.000372	0.000388
	(0.000847)	(0.000702)	(0.000829)	(0.000732)
ShFrHE(-2)	0.786*			
	(0.401)			
ShNwHE(-2)	-0.0851			
	(0.0575)			
lnAge	0.100	0.0476	0.146**	0.113
	(0.0628)	(0.0603)	(0.0592)	(0.0729)
ShFr(-2)		0.125		
		(0.122)		
ShNw(-2)		-0.0238		
		(0.0208)		
ShFrSs(-2)			-0.0723	
			(0.290)	
ShNwSs(-2)			0.0120	
			(0.0568)	
ShFrDs(-2)				0.159
				(0.154)

To be continued…

…continuation

ShNwDs(-2)				-0.0190
				(0.0442)
Constant	-9.410	15.29	-18.13	5.582
	(31.93)	(17.32)	(35.63)	(20.89)
Observations	35,352	35,352	35,352	35,352
Number of n7	12,317	12,317	12,317	12,317
Year dummies	YES	YES	YES	YES
Industry dummies	YES	YES	YES	YES
(df)	(66)	(66)	(66)	(66)
Wald $\chi 2$	2088.30***	2739.74***	11533.74***	1274.44***
(df) Sargan $\chi 2$	(92) 101.35	(92) 104.76	(92) 107.58	(92)103.10
(p)	(0.24)	(0.17)	(0.13)	(0.20)
AR(1) z(p)	-17.10 (0.00)	-17.07(0.00)	-17.00(0.00)	-17.07(0.00)
AR(2) z(p)	-0.96(0.34)	-0.94(0.35)	-0.84(0.40)	-0.93(0.35)

Notes: z-statistics are in parentheses, ***,**,* denote significance at 1%, 5% and 10%, respectively
Source: Own calculations

5. CONCLUDING REMARKS

The paper tests for potential productivity spillovers arising through worker mobility from foreign owned firms to domestic SMEs. Generally, research on spillover effects through worker mobility is relatively scarce due to only recent emergence of linked employer-employee databases. To my knowledge, no such study has yet been done for Slovenia. In contrast to previous research I analyse data for service and manufacturing sectors separately. I estimate the impact of knowledge brought by new workers with experience from foreign owned firms on domestic SMEs' TFP growth using Slovenian data covering the period from 2002 to 2010. Since my empirical model is dynamic in nature and my panel consists of a small number of time periods and a large set of firms, I conduct my analysis using the GMM estimator developed by Arellano & Bover (1995) and Blundell & Bond (1998). My results confirm the existence of spillover effects in the service sector. I find robust evidence in support of the hypothesis that flows of highly educated workers from foreign owned firms to domestic SMEs boost total factor productivity growth of domestic service SMEs. There is also some indication that hiring new workers with experience from foreign owned firms in general, as well as hiring new workers coming from foreign owned firms in the same or different sector, has a positive effect on service SMEs' TFP growth. However, these results are not robust when the period in which new employments are accounted for is prolonged. One possible explanation for this outcome is that sophisticated knowledge brought into the firm by workers with higher education has a more persistent effect on TFP growth, whereas the effect of less sophisticated knowledge attributed to the

general population of workers fades away more quickly. This finding is also in line with Poole (2013), who concludes that higher skilled former multinational workers are better able to transfer knowledge to domestic firms than less skilled ones. Analyses done for the manufacturing sector, on the other hand, provide no conclusive evidence.

The findings of this paper bear important policy implications. For starters, they may represent an additional incentive for greater effort in terms of FDI promotion policy. Perhaps making the labour market in Slovenia more flexible would also be a path worth considering in light of these results. The current legislation in Slovenia offers strong protection to the employees with permanent work contract. Hence, it is hard for firms to lay off workers. As a consequence they consider every new employment very carefully. From the job seekers' perspective that makes it harder to get a new job. If the job market was more flexible, more people would consider leaving the safety of their current job and move to another employer, potentially enabling knowledge spillovers.

The work done opens a lot of new interesting questions for further research. For example, although the results of this paper indirectly confirm the existence of absorbtive capacity for the Slovenian SMEs, it would be interesting to test for it directly. Further, it would be possible to test whether the spillovers coming from the same sector effect the intensity of competition and market structure in this sector. The impact of spillovers on market concentration in the presence of endogeneous sunk costs was for example studied by Senyuta & Žigić (2016), using a theoretical model. On the other hand, the existence of spillovers may induce protective measures by the source firms (intellectual property protection, higher wages, special contracts etc.) The behaviour of firms in the presence of spillovers was for example analysed by Gersbach & Schmutzler (2003), Zabojnik (2002) as well as Senyuta & Žigić (2016) using theoretical framework. It would, however, be interesting to explore these issues empirically, as an extension of research done in this paper. Finally, it would also be intriguing to repeat the study described in this paper for the data pertaining to the financial crisis period.

REFERENCES

Aitken, B. J., & Harrison, A. E. (1999). Do Domestic Firms Benefit from Direct Foreign Investment ? Evidence from Venezuela. *The American Economic Review*, *89*(3), 605–618.

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, *68*(1), 29–51.

Arnold, J. M., & Javorcik, B. S. (2009). Gifted kids or pushy parents? Foreign direct investment and plant productivity in Indonesia. *Journal of International Economics*, *79*(1), 42–53.

Aslanoğlu, E. (2000). Spillover Effects of Foreign Direct Investments on Turkish Manufacturing Industry. *Journal of International Development*, *12*(8), 1111–1130.

Balsvik, R. (2011). Is Labor Mobility a Channel for Spillovers from Multinationals? Evidence from Norwegian Manufacturing. *Review of Economics and Statistics*, *93*(1), 285–297.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, *87*(1), 115–143.

Damijan, J., Knell, M. S., Majcen, B., & Rojec, M. (2003). *Technology Transfer Through FDI in Top-10 Transition Countries: How Important are Direct Effects, Horizontal and Vertical Spillovers?* (William Davidson Institute Working Papers Series).

Damijan, J., Kostevc, Č., & Rojec, M. (2012). *Growing lemons and cherries ? Pre- and post-acquisition performance of foreign-acquired firms in new EU member states* (LICOS Discussion Papers No. 31812). Leuven.

De Loecker, J. (2007). *Product Differentiation, Multi-product Firms and Estimating the Impact of Trade Liberalization on Productivity* (No. 13155). Cambridge, MA.

Ericson, R., & Pakes, A. (1995). Markov-Perfect Industry Dynamics: A Framework for Empirical Work. *The Review of Economic Studies*, *62*(1), 53–82.

Fosfuri, A., Motta, M., & Rønde, T. (2001). Foreign direct investment and spillovers through workers ' mobility. *Journal of International Economics*, *53*(1), 205–222.

Gersbach, H., & Schmutzler, A. (2003). Endogenous spillovers and incentives to innovate. *Economic Theory*, *21*(1), 59–79.

Girma, S., & Wakelin, K. (2000). Are There Regional Spillovers from FDI in the UK ? In D. Greenaway, R. Upward, & K. Wakelin (Eds.), *Trade, Investment, Migration and Labour Market Adjustment* (pp. 172–186). Palgrave Macmillan UK.

Glass, A. J., & Saggi, K. (2002). Multinational Firms and Technology Transfer. *The Scandinavian Journal of Economics*, *104*(4), 495–513.

Görg, H., & Strobl, E. (2005). Spillovers from Foreign Firms through Worker Mobility : An Empirical Investigation *. *The Scandinavian Journal of Economics*, *107*(4), 693–709.

Hakkala, K. N., & Sembenelli, A. (2014). *Multinationals , Competition and Productivity Spillovers through Worker Mobility* (VATT Working Papers No. 54). Helsinki.

Jovanovic, B. (1982). Selection and the Evolution of Industry. *Econometrica*, *50*(3), 649–670.

Keller, W., & Yeaple, S. R. (2009). Multinational Enterprises, International Trade, and Productivity Growth: Firms Level Evidence from the United States. *The Review of Economics and Statistics*, *91*(4), 821–831.

Koymen, S., & Sayek, S. (2009). *The role of human capital in productivity spillovers from FDI: An empirical analysis on Turkish manufacturing firms* (2009 Meeting Papers No. 919). *2009 Meeting Papers*. Retrieved from https://economicdynamics.org/meetpapers/2009/paper_919.pdf

Levinsohn, J., & Petrin, A. (2003). Estimating Production Functions Using Inputs to Control for Unobservables. *Review of Economic Studies*, *70*(2), 317–341.

Maliranta, M., Mohnen, P., & Rouvinen, P. (2009). Is inter-firm labor mobility a channel of knowledge spillovers? Evidence from a linked employer-employee panel. *Industrial and Corporate Change*, *18*(6), 1161–1191.

Marschak, J., & Andrews, W. H. (1944). Random Simultaneous Equations and the Theory of Production. *Econometrica*, *12*(3/4), 143–205.

Martins, P. S. (2005). Inter-Firm Employee Mobility , Displacement , and Foreign Direct Investment Spillovers. *Mimeo*.

Olley, S., & Pakes, A. (1996). The Dynamics of Productivity in the Telecommunications Equipment Industry. *Econometrica*, *64*(6), 1263–1297.

Pesola, H. (2011). Labour mobility and returns to experience in foreign firms. *Scandinavian Journal of Economics*, *113*(3), 637–664.

Poole, J. P. (2013). Knowledge Transfers from Multinational to Domestic Firms: Evidence from Worker Mobility. *Review of Economics and Statistics*, *95*(2), 393–406.

Senyuta, O., & Žigić, K. (2016). Managing spillovers : An endogenous sunk cost approach. *Information Economics and Policy*, *35*, 45–64.

Smarzynska-Javorcik, B. (2004). Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers through Backward Linkages. *The American Economic Review*, *94*(3), 605–627.

Zabojnik, J. (2002). A theory of trade secrets in firms. *International Economic Review*, *43*(3), 831–855.

Zajc Kejžar, K. (2011). The role of foreign direct investment in the host-country firm selection process : firm-level evidence from Slovenian manufacturing. *Review of World Economics*, *147*(1), 169–193.

Zajc Kejžar, K., & Ponikvar, N. (2014). Job Destruction and Productivity Gains in Heterogeneous Incumbent Firms : Comparing the Effects of Imports and Inward Foreign Direct Investment. *Emerging Markets Finance and Trade*, *50*(6), 154–173.

TESTING THE HYPOTHESIS OF THE ADEQUACY OF THE DISTANCE-TO-DEFAULT AS AN INDICATOR OF CHANGES IN BANKS' RISK EXPOSURES

BOŽO JAŠOVIČ[1]

Received: June 6, 2016
Accepted: December 1, 2016

ABSTRACT: *A distance to default indicates the distance measured in standard deviations of the market value of assets from the default point. The hypothesis that distance to default is indicative of changes in the levels of risk of the banking system since it precedes accounting data that indicate similar changes was tested on the basis of selected financial ratios. We have applied a modification developed by Toda and Yamamoto of the standard Granger causality test to see whether there is causality between distance to default and the selected financial ratios. Contrary to expectations, we could only prove Granger causality from lagged values of distance to default (6–12 months) to a leverage ratio, whereas we were not able to obtain similar relationship with other ratios.*

Keywords: *financial stability, market discipline, distance to default, default risk, augmented Granger causality*
JEL Classification: G21, G28
DOI: 10.15458/85451.43

Introduction

In this paper, we aim to determine whether the *distance-to-default (dd)* indicator based on market data reflects better the changes in banks' risk profile in comparison with standard financial ratios calculated solely by using accounting information. We have chosen the Black-Scholes option pricing theory adapted to calculate the implied value of assets and their volatility as the theoretical basis for assessing the selected indicator. In the case of the Slovenian banks, the distance-to-default indicator could not be used as an "off-the-shelf" tool for a number of reasons. According to traditional B-S model distance-to-default indicator is calculated by using series of individual bank market share prices. We have followed this approach and derived the aggregate indicator as a weighted average of individual indicators. In the observed period only shares of three banks were traded on a stock exchange (NKBM, Abanka Vipa and Probanka) and in addition, in an earlier part of this period only shares of Probanka were listed. Due to this and low liquidity of Slovenian capital market we consider the sample as not representative and therefore present the calculation for an illustrative purposes only. Therefore, the traditional approach has been adjusted to take into account the specific features of the local environment and has been

1 Gorenjska banka d.d, Kranj, Slovenia, e-mail: bjasovic@siol.net

calculated by making use of indirect market data. Indirect market data (e.g. daily changes in interest rates, selected stock-exchange indices, specialised indices or individual prices of company shares, which may be representative for certain sectors of the economy) complement static accounting information and bring in market dynamics (volatility), which has a considerable influence on the value of bank portfolios and, in turn, also on their financial results. We have empirically tested on an aggregate level the fundamental hypothesis that the estimates of numerous market participants, which are reflected in prevailing market prices, may indicate in advance (precede) changes in a bank's risk profile in comparison with static financial ratios made available at intervals and referring to the past periods.

The results of empirical testing are not fully in line with the expectations based on the proposed hypothesis given the fact that the results obtained confirm it only up to a point. With the Toda-Yamamoto version of the Granger causality test, however, we have been able to prove that the adjusted distance-to-default measure indicates (precedes) 6 to 12 months in advance changes in the leverage ratio (capital to total assets ratio). A few other empirical studies also underline the significance of the leverage ratio, since it better reflects a bank's insolvency risk in comparison with other indicators. One of the explanations for the absence of Granger causality between the distance-to-default and other financial indicators is derived from the finding that the regulatory framework leaves quite some room for discretion at measurement of bank assets at fair value or at amortised cost at a considerable time lag.

The sections in the paper are arranged as follows: we start by presenting the empirical studies carried out to date that examined the application of the distance-to-default concept. Then we present the theoretical basis for the valuation of a company's equity by using the option pricing model. We proceed by describing the proposed changes to the calculation of the indicator by using indirect market data; we then present in the next section the empirical testing to demonstrate that changes in the computed distance-to-default indicator precede changes in the standard ratios (indicators) of bank performance. In the last section we wrap up by drawing some conclusions.

1. OVERVIEW OF EMPIRICAL STUDIES USING THE MODEL FOR THE VALUATION OF EQUITY AND LIABILITIES

Empirical studies of the distance-to-default have gained popularity both in the research sphere and in practical sense. The key guiding principle for the use of that approach is that the *dd* combines market data of numerous independent market participants in a single indicator. In addition, the fact that the indicator is used so often is attributable to the recognition that market participants' estimates, unlike periodical, static reports for supervisors, are prospective, i.e. turned into the future and are continuously available.

Gropp et al. (2002, 2004) empirically demonstrated that *dd*, calculated on the basis of the movements in market pricing of bank shares, indicates deterioration in the bank's

credit rating with the lead time of 6 to 18 months. They proved by means of partial derivatives with regard to the value of assets, debt (financial leverage) and assets volatility completeness and unbiasedness of *dd* indicator (Gropp et. al., 2002, p. 10).

The distance to default as a bank risk indicator has been also used by Takami and Tabak (2007). They find the distance-to-default indicator to be significantly sensitive to the interest rate: the higher the interest rate, the lower the value of the distance to default and the higher the default risk. Having analysed the indicator on a sample of banks whose shares were listed on a stock exchange, they demonstrated that the indicator reflected fairly well the relative risk of each bank (the deviation of *dd* for individual banks from reference value).

Gray and Walsh (2008) have shown different possible uses of distance-to-distress measure calculated by using the Black-Scholes-Merton model: from the indicator that reflects risk exposure of individual institutions, to aggregate–sector-based indicator and its correlation with macroeconomic variables. Despite their affirmative position regarding the use of the aforementioned approach to analyse risk exposure of individual banks and the banking sector, they point out the limitations for the use of option pricing model, which arise from the lack of market-based information. In an aggregated sectoral analysis, imbalances pile up for a longer period and market participants begin to incorporate them consistently in their price estimates. The authors of the paper have merely indicated in their research study that there is a significant correlation between distance-to-default indicator and traditional risk measures with different time leads or lags.

Chan-Lau and Sy (2006) favour the indicators derived from market-based risk measures over balance-sheet indicators, which reflect changes in riskiness of the observed institutions with considerable time lags. The two authors have empirically calculated and compared the distance-to-default indicator for individual banks and concluded that it has proved useful for predicting bank rating downgrades. However, the indicator should be treated with a dose of scepticism, since the indicator disregards the probability that a bank will be subject to remedial regulatory actions. What they had in mind was maintaining a capital adequacy threshold set for banks and monitored by supervisors. Chan-Lau and Sy adjusted the *dd* indicator by raising the insolvency threshold using the quotient λ^2, which reflects the expected bank's capital adequacy ratio and named it distance-to-capital. It is worth noting that the two authors tested the empirical calculation of the indicator on individual banks; however, in the conclusions they point out that the *dd* approach could apply to analyse the entire banking sector, i.e. stability of the financial system.

The analysts from the ECB also analysed the banking system fragility by using the *dd* indicator. They emphasised that it is a measure based on market prices of shares that generates information regarding market asset value and asset volatility. By using a pre-defined point of insolvency the indicator shows how vulnerable the banking sector is

2 The authors increased liabilities in equation (1) by factor $\lambda = 1/(1\text{-PCAR})$. PCAR in the quotient stands for expected capital adequacy (Chan-Lau & Sy, 2006, p. 10).

(how many standard deviations away from the point of insolvency). Given the rising popularity market discipline has for supervisory purposes, the ECB analysts warn that the aforementioned approach should not be taken "at face value"–as a substitute for the conventional analysis based on balance-sheet data (ECB, 2005, p. 91).

Vassalou and Xing (2004) investigated the probability of default of companies. The authors examined a vast number of companies (more than 4,000 in the last part of the observed period) between 1971 and 1999. They calculated the indicator of a company's default probabilities where default occurs when value of the indicator *dd* in a cumulative probability function of normal distribution (*N(-dd)*) is negative. Based on such comprehensive empirical research, they concluded that insolvency risk (default) is closely linked to the size of a company and the ratio between the book to market value of a company. The empirical research confirms that the probability of default in the observed corporate sector decreases monotonically as the company size increases and as the ratio of book to market value of equity decreases. The authors argue that asset volatility implicitly calculated from the daily fluctuations in market share prices is the key information for the estimates of default probabilities (Vassalou & Xing, 2004, p. 833).

Chan-Lau, Jobert and Kong (2004) have empirically tested the use of the distance-to-default indicator for banks that operate in emerging markets and have arrived at a conclusion that the *dd* measure could be used as a forecasting tool for distress looming on the banking system. They concluded that the early warning indicator predicts difficulties in banking systems with up to 9-month lead time (Chan-Lau et al., 2004, p. 13). Furthermore, the research study highlights that the risk-free rate of return is not a proper parameter in a risky world. In addition, it also points at the unsuitability of constant debt assumption which should be revisited. Despite the previously mentioned weaknesses, their conclusion is that the *dd* indicator could be useful tool in supervising banks. The research also uses the probit and logit regression models to assess the ability to predict the occurrence of a negative credit event (default or rating downgrade) and the conclusion drawn is that the *dd* can be useful for forecasting bank distress/vulnerability.

Gapen, Gray, Lim and Xiao (2004) have examined in their research study the corporate sector vulnerability by applying the option pricing model. Their key conclusion is that the approach combines balance-sheet data with market-based data where asset volatility is the key determinant of default probability. By taking into account asset volatility in the model, we are able to account for the fact that companies with a similar financing structure of (debt to equity ratio) have different values of indicator *dd*, i.e. probability of default. Asset volatility is largely related to the economic activity (industry) (Crosbie & Bohn, 2003, p. 9), i.e. its technological characteristics, while a company's financial leverage only increases its underlying asset volatility, which is then reflected on higher equity volatility. The research study underlines non-linear links in the Black-Scholes model, which enables a more reliable estimate of basic function driven by changes in underlying parameters.

Gapen et al. (2004) have warned that the model has its shortcomings since it uses normal distribution probability when calculating the distance-to-default indicator. Also Crosbie

and Bohn (2003, p. 18) underline that using normal distribution for the calculation of *dd* is a bad choice. All authors underscore that in order to obtain more reliable estimates for the indicators, empirical distribution should be used.

In an analogy with the use of the model to value assets and liabilities of individual companies or banks based on market data, a similar approach could be followed at the sector-based level. Persson and Blavarg (2003) have shored up the thesis that the credit portfolio risk in banks largely reflects the corporate sector risk to which they are exposed by comparing time series of default probabilities for seven economic sectors (industries). Their conclusion is that increased credit risk in individual banks estimated with *dd* could be a consequence of increased risk in the corporate sector (Persson & Blavarg, 2003, p. 24). To explain the reasons that influence the indicator movement in banks, we should analyse the indicator for the corporate sector that account for the bulk of a bank's credit portfolio and has direct impact on its riskiness. Moreover, as regards the corporates, the two authors draw attention to the fact that only the shares issued by larger companies are traded on a stock exchange. They assess that expectations of market participants regarding the financial instruments issued by larger companies should also reflect up to a point the expectations of a sector (industry) as a whole and eventually influence the development of smaller, non-listed companies in a particular industry.

Willem van den End and Tabbae (2005) have focused their research on the sector-based approach. They assume that a sector-based analysis has an advantage over a traditional analysis based on macroeconomic aggregates, since with the latter, some risks might be hidden. Furthermore, at the sector-based level, it becomes possible to identify foreign exchange and balance-sheet structural imbalances, as well as the shortage of capital. The most significant advantages of the sector-based approach include interdependence and the possibility of a spill-over effect (contagion) between sectors. The authors distinguish in the research study two indicators, i.e. measures of risk: probability-of-default measure and loss measure. The latter presents, in accordance with the option pricing model, the value of put option, i.e. loss incurred by the excess of liabilities over the value of assets. The value of a put option for the banking sector is the assessment of the necessary capital that sector needs in order to absorb losses, i.e. the value of an implied government-backed guarantee to ensure macrofinancial stability. The authors have calculated both measures of risk for five sectors: banking, pension, insurance, corporate sector, and household sector. Given the fact that market asset value and asset volatility could not be calculated for all sectors by using direct market data, they have used alternative approaches: company-specific balance-sheet data provided that they are marked-to-market, discounted future cash flows or implied market values derived from option market prices (Willem van den End & Tabbae 2005, p. 9). We highlight the described approach since it indicates how to overcome the lack of direct market data (prices) when applying the Black-Scholes model.

Based on the above overview, we could summarise our observations in the following conclusions:

- Numerous studies point out the usefulness of information content inherent in market-based data, their forward-looking nature, the large number of participants

that generate market data and, consequently, make them objective and available on on-going basis (see for instance Flannery, 2001; Flannery 1998).
- The authors explicitly stress that accounting data cannot be completely replaced by market information, it should be rather viewed as complementary source to accounting data.
- The authors are aware of the limitations or deficiencies resulting from the direct application of the structural model introduced by Black-Scholes hence they try to correct it with methodological adaptations, i.e. by testing the plausibility of the assumptions on which the model is founded.
- The studies recommend complementary use of the discussed approach both for the analysis of risk sensitivity of individual credit institutions and at the aggregate level for the analysis of macrofinancial stability.
- Some studies explicitly conclude that asset variability (volatility) determined on the basis of market data is indeed the key component that contributes to the explanatory power of the *dd* indicator (see, for instance, Gapen et al., 2004; Vassalou & Xing, 2004; Crosbie & Bohn, 2003).

2. THEORETICAL BASIS FOR APPLYING THE OPTION PRICING MODEL IN THE VALUATION OF COMPANY EQUITY AND LIABILITIES

The methodology for the calculation of the distance-to-default is derived from the Black-Scholes-Merton option pricing model (Black & Scholes, 1973) that can also be used to determine a firm's equity value and corporate liabilities (see also Merton, 1974). The assumption for the use of the model for equity valuation is that owners of companies have an option (call option)–the right to purchase all assets of the company by paying off all its liabilities. Having paid off all outstanding liabilities, only the equity holders have claim to the company's assets, and the price for exercising such an option (exercise price) is equal to the value of total liabilities.

Shareholders' equity has positive value only in the case that the value of the company's assets exceeds the value of its liabilities. Should that not be the case, owners would never exercise their call option to buy assets, since they would have to pay for the assets more than their value. If that is the case, the company's creditors could exercise the option they have (put option) and sell their claims on the company in exchange for taking over all its assets in order to minimise their loss.

Let us assume that a bank (or a company) is insolvent and unable to honour its obligations, meaning that the value of its assets is lower that the value of its liabilities. Under these circumstances, creditworthiness of banks (or any other company) can be measured with the difference between the value of its assets and the value of its liabilities (the distance to the default point). The smaller the difference is, the greater the probability of insolvency and vice versa. The *distance-to-default* (*dd*) as shown by the equation below measures how many standard deviations a bank is away from insolvency, i.e. the default point (Gapen et al., 2004, p. 34; Crosbie & Bohn, 2003, p. 18; Gropp et al., 2002, page 10):

$$dd = \frac{ln\frac{S_a^T}{O^t} + \left(\mu - \frac{\sigma_a^2}{2}\right)}{\sigma_a\sqrt{T}} \qquad (1)$$

where:

S_a = asset value,
O = amount of liabilities,
μ, σ_a = expected rate of return on assets and the volatility of returns,
T = time to maturity.

According to some authors (e.g. Chan-Lau et al., 2004, p. 5; Gropp et al., 2004, p. 55), the distance-to-default is a complete and unbiased indicator of bank fragility, i.e. changes in its risk profile. The foundation for such a conclusion is the finding that the indicator captures the most significant determinants of insolvency risk: expectations regarding earnings i.e. return on assets, financial leverage (indebtedness) and risk associated with the volatility of assets. The expectations regarding rising returns decrease insolvency risk and, therefore, increase the value of the indicator *dd*. The value of the indicator *dd* also increases, if financial leverage (bank indebtedness) decreases and if asset volatility declines. Inverse processes have an impact on lowering the value of the indicator and consequently lead a bank (company) closer to the point of insolvency (Gropp et al., 2002, p. 10).

For the calculation of the indicator *dd,* the data on the market value of a bank's assets and asset volatility are necessary. Since such data are not directly available, a direct calculation by using equation (1) is less appropriate for practical reasons. It is why most research studies have used the indirect approach to calculate implied asset value and their volatility by using the model developed by Black and Scholes (Black & Scholes, 1973). For the calculation it is necessary to have as input a series of market share prices and their volatility (standard deviation), market capitalisation, the size of debt and risk-free rate of return.[3]

By following the Black-Scholes model (B-S model), we are in a position to estimate the value of capital as the value of the call option of the company where the exercise price is equal to the nominal value of its debt, by applying the following formula (Hull, 2005, p. 295):[4]

$$K = S_a N(d_1) - Oe^{-rT}N(d_2) \qquad (2)$$

where:

$N(d..)$ = cumulative density function of the standard normal distribution,

3 See for instance in Bukatarević, Jašovič, Košak and Šuler, 2008.

4 The derivation of the Black-Scholes-Merton model was carried out under the assumption that fluctuations in share prices follow the general Wiener process (stochastic share price movement process). (For more details see Hull (2005, p. 291– 295).

$$d_1 = \frac{ln\left(\frac{S_a}{O}\right) + \left(r + \frac{\sigma_a^2}{2}\right)T}{\sigma_a\sqrt{T}} \quad (3)$$

$$d_2 = d_1 - \sigma_a\sqrt{T} \quad (4)$$

r = risk-free rate.

A relationship between share price volatility and asset volatility is given with the following equality:

$$\sigma_k = \frac{S_a}{K}\sigma_a N(d_1) \quad (5)$$

where:

K = capital,
σ_k = volatility of share prices or returns.

Given that market prices for listed bank shares traded on regulated markets are continuously available, and given that standard deviation of returns can be computed on the basis of those prices, it is possible to solve with the iterative method the system of simultaneous equations (3) and (5) so that we obtain the implied assets value S_a and their standard deviation σ_a. We then use both variables for the calculation of the indicator *dd* following the equation (1).

3. METHODOLOGICAL ADJUSTMENT USING INDIRECT MARKET DATA TO CALCULATE THE DISTANCE-TO-DEFAULT INDICATOR

Since bank shares traded on a regulated securities market are "in short supply" and also due to poor liquidity of the equity market in Slovenia in general, we have undertaken the calculation of the distance-to-default indicator with the use of "indirect" market data. Market expectations in the corporate sector are best reflected by share prices of companies listed on a stock exchange. As a rule, these are shares issued by larger companies whose pricing mostly reflects market sentiment in a particular sector as a whole (as, for instance, Persson & Blavarg, 2003, p. 24). Market expectations of investors who invested in shares of such companies have implied effects on the bank portfolio risk dynamics. That impact is direct and given that bank balance sheets tend to be non-transparent (investors are not informed of all bank's investments), the described approach is more appropriate than the approach using market prices of bank shares used to calculate the implied value of assets and their volatility (by applying B-S model), which in such light actually is »indirect«. Moreover, we must not forget to emphasise that using indirect market data is more relevant for the sector-based distance-to-default indicator (for the entire banking sector) since it indicates changes in risk exposure

at the sectoral level. For a single bank risk analysis it is more appropriate to calculate *dd* indicator in line with traditional methodology (based on market share prices of a concrete bank) where we also capture specific expectations of market participants, which relate to that particular bank only.

Willem van den End and Tabbae (2005, p. 9) have also pointed out that in the absence of market prices of financial instruments, other sources of market data can be used in order to apply the Black-Scholes model. It is the latter approach seen as a key guide to the adjustments on which this paper elaborates below.

We use the alternative, indirect approach to calculate the time series for the distance-to-default indicator. By tapping different sources of market data we introduced market variability in the model. We assume that a bank portfolio is composed of the following segments:

1. w_1 – cash and cash equivalents;
2. w_2 – loans to banking and non-banking sector (retail and corporate, other than items 4, 5 and 6) largely influenced by movement in variable EURIBOR;
3. w_3 – debt securities portfolio;
4. w_4 – loans to companies from the manufacturing sector;
5. w_5 – loans to companies from trading sector;
6. w_6 – loans to companies from 'other services' sector;
7. w_7 – equity securities, capital investments and derivatives;
8. w_8 – other (fixed assets, accounting categories).

In the equation (6), the shares of above portfolio segments are used as risk weights (w_{it}) for the calculation of σ_{at} of bank assets (investments) at the end of every month during the observed period beginning January 1996 and ending June 2009. We present for an illustrative purposes time series of risk weights per each segment at year ends and at the end of observed period.

Table 1: Time series of shares of bank portfolio segments (in %)[5]

Date	w_1	w_2	w_3	w_4	w_5	w_6	w_7	w_8
31.12.1996	3,45%	1,96%	27,87%	35,81%	10,52%	5,07%	9,61%	5,70%
31.12.1997	3,72%	2,08%	34,26%	28,83%	9,34%	5,17%	10,89%	5,72%
31.12.1998	3,68%	3,30%	29,83%	30,27%	9,94%	6,23%	11,60%	5,14%
31.12.1999	3,38%	3,69%	25,56%	31,34%	10,15%	7,73%	13,22%	4,94%
31.12.2000	3,16%	3,61%	23,94%	32,33%	9,98%	8,03%	13,68%	5,27%
31.12.2001	5,32%	28,57%	27,09%	10,07%	7,87%	13,10%	3,34%	4,65%
31.12.2002	3,15%	26,67%	32,32%	9,85%	7,70%	12,05%	3,20%	5,07%
31.12.2003	2,80%	25,85%	32,59%	11,24%	7,88%	12,05%	3,05%	4,54%
31.12.2004	2,48%	29,83%	27,47%	12,04%	8,60%	12,53%	3,01%	4,02%
31.12.2005	2,05%	32,35%	26,15%	11,82%	8,69%	12,09%	3,66%	3,18%
31.12.2006	3,12%	36,57%	20,73%	11,53%	7,72%	13,51%	3,85%	2,97%
31.12.2007	1,43%	40,49%	15,50%	11,42%	8,13%	16,43%	4,19%	2,43%
31.12.2008	2,61%	41,95%	13,13%	11,75%	8,39%	16,77%	3,47%	1,93%
30.6.2009	2,35%	42,46%	13,83%	11,11%	7,84%	16,32%	3,88%	3,09%

Source: Bank of Slovenia

For each of the described eight segments, we have assigned a source of "indirect" market data, which has most significant impact on the value of movements in that segment (in the same order as description of the segments above):

1. w_1 – movement in one-month LIBOR in EUR until the end of 1999, then the interbank interest rate EONIA for overnight deposits;
2. w_2 – movement in in six-month LIBOR in EUR until the end of 1999, then the interbank interest rates EURIBOR for 6-month period;
3. w_3 – movement in average return on bond indices composed of 5 European sovereign bond indices (GDBR5 Index, GECU10YR Index, GECU2YR Index, GECU30YR Index and GECU5YR Index), 4 U.S. sovereign bond indices (USGG10YR Index, USGG2YR Index, USGG30YR Index and USGG5YR Index) and BIO, Slovenian bond index;
4. w_4 – movement in average return on shares of the companies Gorenje, Krka, Pivovarna Laško and Žito (representatives of manufacturing sector);
5. w_5 – movement in average return on shares of the companies Mercator, Merkur and Petrol (representatives of trading sector);
6. w_6 – movement in average return on shares of the companies Helios, Intereuropa, Luka Koper, Sava and Terme Čatež (representatives of "other services" sector);
7. w_7 – movement in average return on equity indices composed of 9 European indices (AEX Index, ATX Index, BEL 20 Index, CAC Index, DAX Index, ISEQ Index, MIBTEL Index, UKX Index and SMI Index), 3 U.S. indices (CCMP Index, INDU Index and SPX Index) and SBI, Slovenian stock exchange index;
8. w_8 – movement in consumer price index.

5 Data series are available in Bank of Slovenia statistical publications. The segments on an aggregate level were grouped together with the help of Financial Stability Department. Data series are available from author upon a request.

We have calculated from the above market sources on a daily frequency for the moving one-year window the returns, variances and standard deviations at the annual level for the entire observed period from the beginning of 1997 until June 2009. Variances of returns of all variables were included in the calculation of variance-covariance matrix from equation (6):

$$\sigma_{at} = \sqrt{\sum_{i=1}^{n} w_{it}^2 \, var_{it} + \sum_{i=1}^{n} \sum_{j=1}^{n} w_{it} w_{jt} cov_{ijt}} \qquad (6)$$

where:
$w_{..t,}$ = shares of individual segments *(i = j = 1–8)* in the banking system portfolio at the end of the month *t*,
var_{it} = variance of selected returns,,
cov_{it} = covariance of returns.

The above calculated time series volatility σ_{at} on a daily basis was translated to a monthly series as the daily data average at the annual level in an individual month and then used for the calculation of the distance-to-default indicator at the aggregate level with monthly frequency. We have used the book values for assets, equity and liabilities at an aggregate level for the banking sector at the end of each month in the calculation of *dd* indicator.

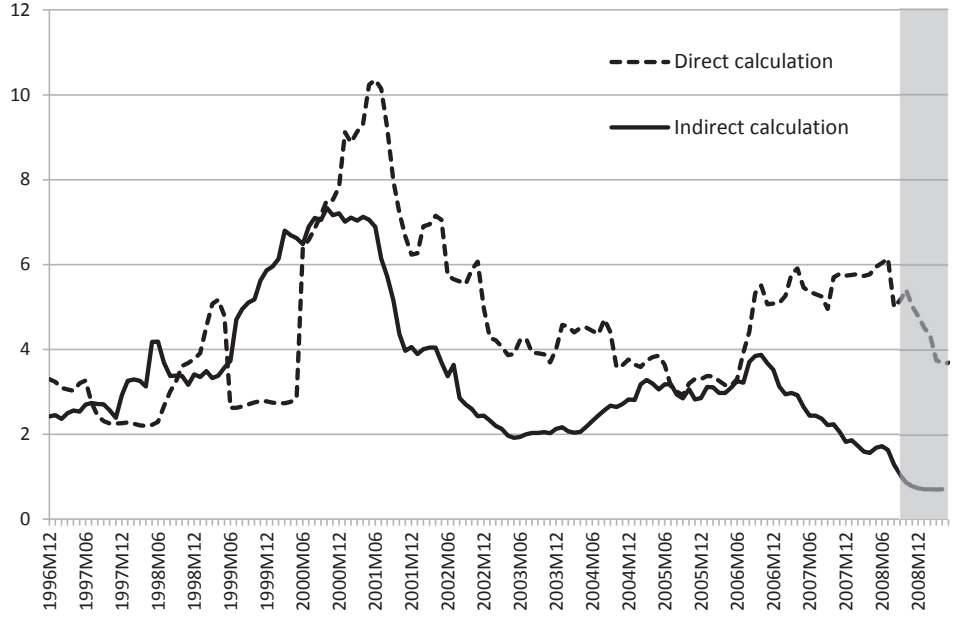
The essential point of using market data is that they reflect investors' expectations and uncertainty (volatility) in relation to the future price fluctuations. Asset volatility is the key parameter when calculating the indicator *dd* and without volatility (σ_a), the Black-Scholes model is useless, since in such a case we are dealing with a specific, deterministic situation typical of traditional, static analyses. In our modification to the methodology, we have ensured that by providing a large set of statistically processed market data, the volatility (uncertainty) has been introduced in the calculation, which impacts to a highest possible degree the fluctuation of the value of a selected bank's portfolio segments. Similar conclusions have been presented also in some of the aforementioned studies, which explicitly state that asset variability (volatility), determined on the basis of market data, is indeed the key component that contributes to the indicator's explanatory power (see, for instance, Gapen et al., 2004; Vassalou & Xing, 2004; Crosbie & Bohn, 2003).

Figure 1 shows a comparative movement of both calculated series of the distance-to-default indicator *dd*. Under the first approach–based on movement of bank share prices[6]–we have calculated implied asset value and asset volatility (by using the traditional B-S model) and then used the output in the calculation of the indicator *dd* for an individual bank; the aggregate indicator has been calculated based on risk-weighted average of individual indicators. In the second, adjusted approach, for the calculation of the indicator *dd* we

6 To calculate the time series of indicator dd, we have used the movement in the price of shares in Probanka, NKBM and Abanka Vipa. In the greater part of the period observed only the shares of Probanka were listed on a stock exchange. Due to this the sample is not representative and we present it only for an illustrative purpose.

have used the assets book value and calculated the asset volatility on the basis of a large set of the market data that have the highest impact on certain bank asset segments.

Figure 1: Movement in distance-to-default indicator computed directly from prices of bank shares and indirectly from market data based on adjusted methodology during the period 1997–June 2009 (number of standard deviations)



Legend: The shaded area shows the period in which the quarterly GDP growth was negative.
Source: Author's calculations.

The indicator calculated directly from the bank share prices moves consistently at the higher level than the indirectly computed indicator; hence, it reflects banks' lower risk profile. Based on the anecdotic evidence, we could argue that market optimism was reflected in high valuation of bank shares (we have to caution that for the greater part of the observed period, we dealt with one issuer only). The favourable market capitalisation of the banks was mirrored in a high implied asset value and, as a consequence, in the value of the *dd* indicator. Even in the first half of 2008 when the global financial crisis was already evident, the indicator was still moving at a relatively high level and it only started to decline in the second half of 2008. We may conclude that the series calculated on the basis of the bank share prices exhibits, contrary to expectations, a relatively delayed reaction to the crisis situation. One of plausible explanations for it is that bank shareholders, despite the turbulences on financial markets, valued the bank shares relatively high knowing that the Slovenian banks did not have toxic assets in their portfolios. Only later on, when the financial crisis spread to the real sector, the value of the indicator started to fall because of investors' negative perception.

The movement in the indirectly calculated indicator corresponds more to the expectations. If we focus on the pre-crisis period, the value of the indicator was increasing from mid-2004 onward all the time until the second half of 2006, and then the trend reversed and its value kept on decreasing. In mid-2009, the indicator value hit the rock-bottom. The indicator calculated in the indirect manner and by use of several different market data series reflects the perception of market instability in the eyes of different investor groups. The downward trend of the indicator's value started as early as in second half of 2006 when the sub-prime mortgage crisis started to unfold in the United States and with the full-blown crisis in 2007 and 2008 (the demise of the investment bank Lehman Brothers), that tendency only continued. Against that background, a movement in the indicator computed on the basis of "indirect" market information changes much more according to expectations and in line with anecdotal evidence on the evolution of the financial crisis. Market participants were recognising crisis impulses and valued their investments accordingly as reflected in the fluctuations of market categories we have used for the calculation of *dd* indicator.

4. EMPIRICAL TESTING OF ASSUMPTIONS OF THE ADEQUACY OF DISTANCE-TO-DEFAULT AS A PREDICTOR OF BANK RISK EXPOSURE

Our starting point is the basic assumption that market data (prices, indices, returns) are a valuable additional source of information for an analysis of financial stability. What is the grounding for making such an assumption? Market data have the following properties:

- they are a reflection of numerous market participants–less informed small investors, professional market analysts, institutional investors, credit rating agencies, investment advisors and others–and reflect their prevailing judgement;
- they are prospective, forward-looking, since they reflect prevailing expectations;
- they are continuously available without lengthy time lags, if not even in real time.

In comparison with official, accounting data and reports submitted by financial institutions to their supervisors, market-based data have several advantages. Official reports are published with a delay; they refer to the past and tend to disclose a limited scope of data. If we add the tendency sometimes displayed by reporting institution that makes the reporting entity look better than it actually is, then the usefulness of information obtained on the basis of market data is even more valuable. We are not arguing that official information should not be treated as reliable or that it might not be required. On the contrary, in the absence of official, accounting information, any serious analysis of the financial condition of an individual institution or the system made solely on the basis of market data would be all but credible. That said, we want to demonstrate that a traditional, static analysis based merely on official accounting data should be complemented by market information drawn from numerous market transactions (see for instance Curry et al., 2003; Krainer & Lopez, 2003; Krainer & Lopez, 2002; Gunther et al., 2001; Berger et al., 2000).

In our case, we have calculated the indicator *dd* from the market data sets by applying two methodologically different approaches. Now we want to determine whether the fluctuations in the indicator by taking into account properties of market data communicates some

information, even before it is disclosed in official reports. More specifically, we would like to establish whether a change in the *dd* indicator indicates in advance (precedes) a probable movement in certain variables (parameters) - before they appear also in accounting data after some time has passed. To this end we have selected such variables (parameters) of bank performance that to certain extent also indicate the changes in degree of riskiness in the banking system:

- C_DOB_SKM - profit before tax in the 12-month moving window;
- C_PLL_SKM - costs for net impairments and provisions in the 12-month moving window;
- K_DVP_SKM - share of debt securities in total assets;
- K_KAP_SKM - share of equity in total assets;
- P_KU_SKM - capital adequacy ratio in percentage;
- P_NPL_SKM - percentage of claims classified as D and E (approximation for non-performing assets) in classified assets;
- P_OSLAB_SKM - percentage of impairments and provisions in gross assets;
- P_ROA_SKM - return on assets in the 12-month moving window in percentage;
- S_TA_SKM - total assets.

The selection of the variables from static accounting records proves the necessity to use both types of information, since in the absence of historical data, it would also be difficult to verify the reliability of market data, i.e. indicators, calculated on their basis. Moreover, static indicators reflect changes in institutions' risk profiles and the question we can ask is how long a lag is between the realisation of risk to its identification and disclosure in reports.

If we go back to the above variables, each of them reflects in its own right the changed performance influenced by changed risk. Pre-tax profit starts to decline with the narrowing net interest margin and/or banks have to book increased impairments for credit risk due to deteriorating portfolio quality and vice versa. Credit risk costs (net impairments) grow, if the quality of credit portfolio deteriorates and, by contrast, banks form impairments at a slower pace and even decide to release accumulated impairments, if portfolio quality starts to improve in favourable economic conditions. The need for additional impairments arises, however, during the period of economic contraction and bank de-leveraging that follows the period of unsustainable credit growth. The share of debt securities in total assets is a specific indicator that directly reflects a change in the level of secondary liquidity reserves in banks: a fall in that share is a signal for sound economic conditions and vice versa–its rise indicates stressed financial conditions in which risk aversion rises and the aspiration to maintain stable liquidity is high.

The leverage ratio (capital to total assets) and the capital adequacy ratio may seem rather similar at first glance, but they differ both in their approach to on- and off-balance sheet items inclusion in terms of risk and the approach to the calculation of capital. The concept

of credit risk weights attributed to asset classes in accordance with Basel recommendations is often subject to a critical scrutiny for allegedly failing to reflect risk appropriately (see for instance Haldane, 2012). The conceptual differences in the calculation of both indicators, is precisely the reason for including both indicators in our analysis.

The share of assets classified as D and E categories can be used as an approximation for non-performing loans (bad assets). Otherwise, the number of days past due (more than 90 days) is commonly used as a criterion for non-performing loans but given the fact that it was not consistently used in the past, we have chosen as its substitute the share of banks' claims classified as D and E, which as a rule by their substance are non-performing, i.e. bad assets. It was our assumption that when the economic conditions deteriorate, the portion of non-performing exposures on banks' balance sheets surges. At this point we should add that banks are usually rather late and start to apply a conservative assessment approach to their claims and form loan loss impairments with a delay. This practice is also attributable to the provisions of International Financial Reporting Standards that did not allow forming *ex ante* impairments for expected losses, which means that unless there was objective evidence of a customer's financial difficulties meaning that such a customer would not be able to make the full repayment of the debt, no provisioning was allowed.

The return on assets is a combined ratio which may reflect deterioration in bank business/operations: reduced profitability that impacts the numerator, and unsustainable bank assets growth, that impacts the denominator of that parameter. It is expected that the value of that indicator will start to decline when the economic conditions get tighter: profits that are in the numerator start to plunge, while total assets in the denominator after high unsustainable growth do not decrease at the same dynamics, but only after a breakout of a crisis when a deleveraging process starts. The latter parameter, total assets, was included in the denominator of the previous indicator: however, we also examine it independently as it exhibits a different correlation with other variables than return on assets. We assume that during the period before economic conditions tighten, banks' total assets swelled driven by fast credit activities in a boom cycle. A surge in total assets growth is followed by a period of crisis and depressed economic conditions. As it is to be expected, total assets start to decline only in the post-crisis period with a contraction of credit activity, the diminished reliance on wholesale financing and when banks begin to adjust their business models to the changed situation (divestiture of non-core assets).

Table 2: Descriptive statistics for selected variables for the period February 1997–June 2009[7]

	C_DOB_SKM	C_PLL_SKM	K_DVP_SKM	K_KAP_SKM	P_KU_SKM	P_NPL_SKM	P_OSLAB_SKM	P_ROA_SKM	S_TA_SKM
	EUR 000	EUR 000	ratio	ratio	percentage	percentage	perentage	percentage	EUR millions
Median	185.173,0	137.614,0	0,2295	0,0858	11,66%	3,71%	3,35%	0,98%	19.283,0
Average	213.682,4	132.682,4	0,2147	0,0935	13,08%	3,39%	3,22%	0,95%	22.420,4
Minimum	59.375,0	29.881,0	0,1058	0,0763	10,46%	1,56%	2,26%	0,35%	7.183,0
Maksimum	538.368,0	420.663,0	0,3051	0,1200	20,07%	4,88%	3,78%	1,35%	49.682,3
Standard deviation	136.373,5	64.111,0	0,0654	0,0135	2,82%	0,95%	0,40%	0,20%	12.600,6
Number of observations	149	149	86	149	149	149	149	149	149

Source: Bank of Slovenia and author's calculations.

Table 3: Correlation coefficients between the selected variables for the period February 1997–June 2009

	C_DOB_SKM	C_PLL_SKM	K_DVP_SKM	K_KAP_SKM	P_KU_SKM	P_NPL_SKM	P_OSLAB_SKM	P_ROA_SKM	S_TA_SKM
C_DOB_SKM	1,000	0,262	-0,790	-0,682	-0,624	-0,879	-0,791	0,479	0,868
C_PLL_SKM		1,000	-0,228	-0,625	-0,607	-0,543	-0,250	-0,536	0,627
K_DVP_SKM			1,000	0,217	0,418	0,960	0,965	-0,131	-0,969
K_KAP_SKM				1,000	0,925	0,757	0,377	0,038	-0,771
P_KU_SKM					1,000	0,740	0,329	0,060	-0,697
P_NPL_SKM						1,000	0,846	-0,133	-0,955
P_OSLAB_SKM							1,000	-0,220	-0,830
P_ROA_SKM								1,000	0,039
S_TA_SKM									1,000

Source: Bank of Slovenia and author's calculations.

We have gathered monthly series for the period from February 1997 to June 2009 and Tables 2 and 3 show some descriptive statistics and correlation coefficients for all the described variables of the bank operations. We find the observed period to be relevant for our research since it is sufficiently long and encompasses at least two peaks (cycles) in the fluctuation of the indicator *dd*. Furthermore, it is adequate from the view point of the evolution of the latest financial and economic crisis: the first signs emerged with the sub-prime mortgage lending crisis in July 2007 in the United States to be followed by a full-blown distrust in the financial markets and the collapse of the interbank market in autumn 2008 when the investment bank Lehman Brothers failed (for more details of the unfolding of the financial crisis see De Larosiere et al., 2009, p. 11). Economic recession unfolded in the aftermath of those events and in 2009 all EU Member States with the exception of Poland had negative economic growth. In terms of the economic cycle, the second part of the period under review was the most dynamic one: a strong cyclical upswing coupled with unsustainable credit growth which ultimately tilted to a contraction period marked by credit crunch. The observed period ends in mid-2009 when Slovenia was already in the third quarter in a row of negative quarterly GDP growth (the shaded area in Figure 1). From that time on, the strained situation in the financial markets and its consequences began to manifest in standard financial ratios for bank performance (banks posted losses

7 Data series of selected variables are available from author upon a request.

from operations, there was pressure to increase impairments for credit risk, credit activity contracted, etc.). Testing distance-to-default indicator under such circumstances would hardly be productive. The question we should ask is whether the information extracted from a large market data set, preceded the described dynamics of the economic cycle, even before it appeared in banks' accounting data and business reports or standard bank performance ratios. Therefore, we continue by testing the hypothesis that the distance-to-default indicator, points to stressed conditions and increasing risk associated with a bank's operations even before it is reflected in the standard, static indicators of bank financial performance.

We have carried out our empirical test by applying the Granger causality test. The assumption underlying the test is that the future cannot predict the past, but it is the other way round. If changes in a particular variable predict changes in the other variable, then we are talking about Granger causality (Gujarati, 1995, p. 620; Asteriou & Hall, 2007, p. 281). Granger has developed a relatively simple test that defines causality by saying that the variable y_t Granger-causes x_t, if x_t can be predicted more accurately by using past values of the y_t variable rather than not using such past values, while all other terms remain unchanged. Therefore, we are not to interpret causality in statistics as we would have done in everyday use, since it relates to a cause and effect relationship. By using the Granger causality test, we are able to prove that changes in one variable predict changes in the other variable.

The direct Granger causality test can be carried out only with the stationary time series. It is a commonplace in the time series that describe economic phenomena to be non-stationary, since their mean value and/or variance change over time given the fact that they comprise trends or breakpoints. To that end, we have carried out the ADF test (ADF, Augmented Dickey-Fuller Test, see in Asteriou & Hall, 2007, p. 297) of stationarity for all-time series of bank performance indicators and both time series of the distance-to-default. The results of the ADF unit root test are presented in Table 4.

Table 4: Results of the Augmented Dickey-Fuller Unit Root Test

	t - test	Probability		t - test	Probability
Variable	*t*	*p*	Variable	*t*	*p*
Δ_1 C_DOB_SKM	-10,4136	0,00***	Δ_1 P_OSLAB_SKM	-15,2170	0,00***
Δ_1 C_PLL_SKM	-11,4574	0,00***	Δ_1 P_ROA_SKM	-11,3207	0,00***
Δ_1 K_DVP_SKM	-8,3084	0,00***	Δ_1 S_TA_SKM	-1,8189	0,37010
Δ_1 K_KAP_SKM	-15,1904	0,00***	Δ_2 S_TA_SKM	-9,2725	0,00***
Δ_1 P_KU_SKM	-11,0158	0,00***	Δ_1 DTOD_PON_1L	-9,5310	0,00***
Δ_1 P_NPL_SKM	-12,3422	0,00***	Δ_1 DTOD_VAR_COV_1	-8,9714	0,00***

Legend:
- Δ_1 or Δ_2 designate the first or the second difference of the baseline time series;
- *** designates the rejection of null hypothesis at the 1% level of significance.

Source: Author's calculations.

By testing for stationarity, we have determined that all tested time series (both distance-to-default indicator time series and all bank performance variables time series) are non-stationary in levels of data (it was not possible to reject the null hypothesis). We have tested the first difference time series and rejected the null hypothesis at low level of significance and confirmed stationarity of the series of differences save for the variable total assets (S_TA_SKM) where we have been able to determine the stationarity only at the level of second differences.

The finding that all baseline time series in value levels are non-stationary has significant consequences when conducting the Granger casualty test. In such a case, it is not possible to use the Granger test directly, but the augmented Granger causality test should be performed (see for instance Toda & Yamamoto, 1995; Giles, 2011; Binh, 2010). Toda and Yamamoto have shown that the VAR model can be evaluated by applying a time series at the value levels and then tested for introduced restrictions in the model regardless of the different levels of integration or cointegration of time series (Toda & Yamamoto, 1995, p. 225). They have developed an alternative causality test where the VAR model has to be evaluated with the number of lags $n + d$, or $m + d$, where d presents the additional number of lags, which equals the highest level of integration of the used variables. When testing for linear restrictions, we do not take into account the coefficients of the additional d lags, since they are introduced in the model in order to ensure the validity of the standard asymptotic theory. Therefore, additional lags appear in the model specification as exogenous variable (Giles, 2011, p. 5). The expanded Granger causality test requires the assessment of the VAR model specified with the following equations:

$$y_t = a_1 + \sum_{i=1}^{n+\boldsymbol{d}} \beta_i x_{t-1} + \sum_{j=1}^{m+\boldsymbol{d}} \gamma_j y_{t-j} + \varepsilon_{yt} \quad (7)$$

$$x_t = a_2 + \sum_{i=1}^{n+\boldsymbol{d}} \theta_i x_{t-1} + \sum_{j=1}^{m+\boldsymbol{d}} \delta_j y_{t-j} + \varepsilon_{xt} \quad (8)$$

We have carried out the augmented Granger causality test between the distance-to-default indicator series and the selected banking performance ratios[8]. For each test we have chosen different monthly lagged variables, since the test is sensitive to the selected lag-length. It should be highlighted that the literature suggests using rather a higher number of lags than just a few, since thus the problem of autocorrelation is eliminated. We set in the test the null hypothesis that the coefficients of lag variable as a group are not different from zero. We test the assumption by applying the X^2 (*Chi Square*) test and if the calculated value exceeds the critical value for the selected level of significance, then we can reject the fundamental assumption (null hypothesis) and conclude that the changes in the lagged variable (in our case: distance-to-default) precede (Granger cause) changes in the dependent variable (selected banking performance ratio). An overview of the test results is presented in Table 5.

8 We have performed the Granger causality test also with a series *dd* calculated on the basis of bank share prices. Since the sample is not representative, we do not present the calculation.

Table 5: The results of the Granger test–values X^2 and corresponding probabilities (p) (dd, calculated by using adapted methodology, February 1997–June 2009, monthly series)

		Number of monthly lags				
Variable		**2**	**4**	**6**	**8**	**12**
C_DOB_SKM	X^2	1,5150	2,0021	2,9495	3,1576	7,4933
	p	0,4688	0,7354	0,8152	0,9241	0,8234
C_PLL_SKM	X^2	1,7982	3,2649	5,5101	5,6259	4,7317
	p	0,4069	0,5145	0,4802	0,6891	0,9663
K_DVP_SKM	X^2	1,3347	10,3139	10,9263	3,7109	10,6023
	p	0,5131	**0,0355****	**0,0907***	0,8822	0,5633
K_KAP_SKM	X^2	4,7983	6,6886	14,8312	15,6122	20,6755
	p	**0,0908***	0,1533	**0,0216****	**0,0483****	**0,0553***
P_KU_SKM	X^2	0,5162	4,1889	5,1531	7,5471	11,8765
	p	0,7725	0,3810	0,5243	0,4789	0,4556
P_NPL_SKM	X^2	1,3958	3,0893	3,2725	4,6516	8,4581
	p	0,4976	0,5430	0,7739	0,7941	0,7484
P_OSLAB_SKM	X^2	0,9807	2,3316	6,8204	7,7198	14,1308
	p	0,6124	0,6750	0,3378	0,4613	0,2924
P_ROA_SKM	X^2	6,1574	5,2266	6,8483	7,1213	11,5871
	p	**0,0460****	0,2648	0,3351	0,5236	0,4794
S_TA_SKM	X^2	1,5763	2,2342	4,9274	5,1222	8,3780
	p	0,4547	0,6928	0,5532	0,7444	0,7549

Legend:
*** designates the rejection of null hypothesis at the 1% level of significance;
** designates the rejection of null hypothesis at the 5% level of significance;
* designates the rejection of null hypothesis at the 10% level of significance.
Source: Author's calculations.

The results in Table 5 show the value of X^2 statistics and the corresponding probabilities, i.e. significance levels for the rejection of the null hypothesis on the non-existence of Granger causality. The results contradict the expectations that changes in the *dd* indicator precede changes in most indicators (ratios) of bank performance. The variables for which the null hypothesis may be rejected with a higher degree of probability (5% or 10% level of significance), are the share of debt securities and the share of capital in total assets. For these two variables we may assert that the indicator *dd* precedes their changes with the lead time of 4 months up to one year; the result for the share of debt securities in total assets should be interpreted with a caution given the fact that at a higher number of lags, it is not possible to prove the existence of Granger causality. A similar argument holds true also for the return on total assets ratio, where the null hypothesis is rejected only at the lowest number of lags.

Evidence for existence of Granger causality for the capital in total assets ratio (leverage ratio) does not come as a surprise. The market sentiment is also reflected in a number of market prices we have used for the calculation of the variability of bank assets. Some of the selected market parameters even have direct impact on movement in value of bank assets and, as a consequence, influence also the selected banking performance ratios. In this regard, we draw attention to the adjusted methodology we have used for the calculation of the indicator *dd*. The values of assets are entered in the calculation at their book value since the domestic equity market does not provide pricing information on bank shares for the calculation of the implied asset value. We have calculated the volatility that reflects market sentiment, i.e. prospective view of market participants on the developments in financial markets by using a large data set of market prices (indices) and use of variance-covariance matrix and thus included the synthesised market data in the calculation of *dd*. With a certain time lag and in a limited scope, market changes are also reflected on the book value of bank assets that influence the modified *dd* value. In this process, the equity is a residual claim, which at a high financial leverage typical for credit institutions, becomes highly sensitive to the fluctuations in asset value, which are the consequences of the changed market situation. Consequently, the existence of Granger causality between *dd* and the leverage ratio does not come as a surprise, even though it was not possible to prove Granger causal relation between *dd* and total assets. Nevertheless, what does come as a surprise is the existence of causality also at shorter time lag, where the null hypothesis is rejected at a relatively low level of significance (10%). With longer time lags (6–12 months), the results are more reliable (at a 5% level of significance).

Adrian and Shin (2010) warned of the changes in leverage where leverage is the inverse value of the share of capital in total assets. They claim that the net value of financial institutions (shareholders' equity value), given high leverage, is particularly sensitive to changes in market pricing, i.e. asset valuation. Based on empirical evidence, they report that movement in leverage is procyclical, since it swells during boom cycles and plunges during busts (Adrian & Shin, 2010, p. 1). In an analogy with the capital in total assets (leverage ratio), it would mean that leverage ratio falls during booms and then starts to increase again during downturns. In the case that financial institutions would refrain from additional borrowing on the market during booms, they would have excess capital which the authors call »surplus capacity« in an analogy with non-financial companies (ibid, p. 29). Financial institutions (banks) borrow additional funds (and reduce the capital in total assets or leverage) and, consequently, »deploy« surplus capital. Should there be no additional borrowing, the leverage would drop, i.e. the equity in total assets (leverage ratio) would rise. In the conditions of an economic upswing, there are expectations regarding rising asset values and a fear that capital would end up idle; hence when looking for additional placements, credit standards decline and losses start to pile up. However, these losses will not surface until recession hits. The authors have concluded that such behaviour played a role in the development of sub-prime mortgage market in the United States where the financial crisis erupted (ibid, p. 30).

However, there are also other elements that drive changes in bank financial leverage. Baumann and Nier (2003) have explored the impact of market discipline, risk-related

elements and other impact on the share of capital in total assets (the leverage ratio we have used in our analysis). They found that the banks, which are subject to stronger market discipline, have on average higher shares of capital in total assets (Baumann & Nier, 2003, p. 137). That finding means that it is not possible to understand the mechanism of rising leverage in boom cycles in a mechanical sense, but we have to take into account other aspects as well. The authors represented market discipline in their model by means of different variables (government support, disclosure index, listing on a regulated securities market, deposit guarantee scheme, etc.).

The question that arises at this point is: why Granger causality between distance to default and capital adequacy ratio has not been demonstrated given the fact that in its substance it is similar to the leverage ratio. The key substantive reason is linked to the differences in the calculations of both indicators. The calculation of capital adequacy is based on risk-weighted assets where bank's assets are given a weighting that should reflect exposure to risk associated with a particular investment. The allocation of investments based on risk exposure can be, up to a point, also the result of judgement or national regulatory discretions. On the other hand, regulatory capital determined on the basis of special rules and regulations represents a broader concept than the book value of equity. With the new Basel standards, the regulatory framework for the calculation of risk-weighted assets and regulatory capital should have converged; nonetheless, there are still considerable differences in computations from one country to another and also among banks. In addition, the Basel standards give free hands to banks to choose different methodological approaches to the calculation of capital adequacy (standardised or advanced approach); hence there are differences in designating risk-weighted assets among banks that operate in the same country. These differences and, on top of that, the doubts as whether the given risk weights correctly reflect risk faced by banks, are the reason for making the concept for the capital adequacy calculation a popular target for criticism. And there are more reasons for concern: ever-increasingly complex rules for the calculation of risk-weighted assets and regulatory capital that are often changed. So it should not come as a surprise that criticism also comes from the ranks of regulators proposing more straightforward and clear regulation. They even produced empirical evidence that "...a straightforward metric of solvency, such as a leverage ratio, might do better at predicting failure than one, like a risk-weighted capital ratio, that banks could more easily game" (Haldane, 2012, p. 11).

5. CONCLUDING REMARKS

Based on the presented empirical testing by using the augmented Granger causality test, we may conclude the following:

- The adapted methodology for the calculation of the distance-to-default indicator *dd* is a proper tool to identify changes in exposure to risk of the entire banking system, since it uses as an input a large set of market data , which impact equally all banks; hence we talk about *dd* as a possible indicator of financial stability.
- The changes in the distance-to-default indicator whose value also depends on market sentiment and synthesised market data should, in accordance with our expectations,

precede changes in those variables of the banking performance, which are most sensitive to the changed market conditions.
- In the case of our study, we can only confirm the existence of Granger causality from *dd* to the capital in total assets or leverage ratio.
- Furthermore, as reported in some other empirical studies, the capital in total assets ratio is a significant objective of market discipline and it better mirrors risk of bank insolvency than, for instance, capital adequacy ratio (see Haldane, 2012; Adrian & Shin, 2010 or Nier & Baumann, 2003).
- The existence of Granger causality was also confirmed for the debt securities in total assets ratio; nevertheless, caution is advised for the interpretation of the result due to specific conditions related to the functioning of foreign exchange market in Slovenia before euro adoption.
- In the case where bank performance variables are calculated on the basis of specific regulations and methodologies or are the result of management discretion, the existence of Granger causality between the indicator *dd* and the selected variable was not proved.
- The ultimate objective of further research would be to determine more precise (functional) links between *dd* and performance variables where Granger causality was identified, or compare the values of *dd* with particular critical values of performance variables given the fact that they are used to identify risk to financial stability.

Empirical research done so far still falls short of coming up with a methodologically finished analytical tool for a financial stability analysis, but merely corroborates the need for further research effort with the aim to work out an indicator that could be deployed for the identification of risk when the financial stability of the banking system is analysed. The described methodology adjustment would be more appropriate for a sectoral, systematic analysis of financial stability in the circumstances when no longer-term series of market prices of bank shares are available. The official supervision of financial institutions shall be complemented by market discipline or surveillance (see Flannery, 1998; Tarullo, 2008). Market surveillance means that informative content of market messages (prices) will influence decision-making processes in banks and companies and, at the same time, these messages must be grasped also by bank supervisors in the analyses of banks' risk exposures.

REFERENCES

Adrian, T., & Shin, H. S. (2008). Liquidity and Leverage. *Staff Report no. 328.* New York: Federal Reserve Bank of New York.

Asteriou, D. & Hall, G. S. (2007). *Applied Econometrics. A Modern Approach using EViews and Microfit*. Revised Edition. New York: Palgrave Macmillan.

Baumann, U. & Nier, E. (2003). Market discipline and financial stability: some empirical evidence. *Financial Stability Review*, June 2003, 134–141. London: Bank of England.

Berger, A., Davies, S. & Flannery, M. (2000). Comparing Market and Supervisory Assessments of Bank Performance: Who Knows What When? *Journal of Money, Credit, and Banking*, *vol. 32* (3), 641–667.

Binh, P. T. (2010). Toda–Yamamoto Version of Granger Causality. (Augmented Granger Causality).*Time Series Analysis.* http://www.slideshare.net/QuangHoang1/7-toda-yamamotogranger-causality (accessed October 20, 2013).

Black, F. & Scholes, M. (1973). The Pricing of Options and Corporate Liabilities. *Journal of Political Economy*, *81*(3), 637–654.

Bukatarević, V., Jašovič, B., Košak, T. & Šuler, T. (2008). The Use of Market Information in the Analysis of the Financial Stability of Banks. *Financial Stabilty Review–Expert Papers on Financial Stability, May 2008,* 1–12. https://www.bsi.si/iskalniki/reports.asp?MapaId=1698 (accessed April 17, 2010).
Chan-Lau, J. & Sy, A. (2006) Distance-to-Default in Banking: A Bridge Too Far? *IMF Working Paper*, WP/06/215. Washington, D.C.: Intenational Monetary Fund.

Chan-Lau, J., Jobert, A. & Kong, J. (2004). An Option-Based Approach to Bank Vulnerabilities in Emerging Markets. *IMF Working Paper*, WP/04/33. Washington, D.C.: Intenational Monetary Fund.

Crosbie, P. & Bohn, J. (2003). Modeling Deafult Risk. *White Papers*, 18. december 2003. Moody's KMV Research. http://www.moodysanalytics.com/~/media/Insight/Quantitative-Research/Default-and-Recovery/03-18-12-Modeling-Default-Risk.ashx (accessed October 8, 2008).

Curry, T., Elmer, P. & Fissel, G. (2003). Using Market Information to Help Identify Distressed Institutions. A Regulatory Perspective. *FDIC Banking Review*, *Vol. 15*(3), Washington, D.C.: Federal Deposit Insurance Corporation.

De Larosiere, J., Balcerowicz, L., Issing, O., Masera, R., Mc Carthy, C., Nyberg, L., Perez, J. & Ruding, O. (2009). *Report of the High Level Group on Financial Supervision in the EU*. Brussels: European Commission.

European Central Bank. (2005). *Financial Stability Review*, June 2005. Frankfurt: European Central Bank.

Flannery, M. (2001). The Faces of »Market Discipline«. *Journal of Financial Services Research*, *20*(2/3), 107–119.

Flannery, M. (1998). Using Market Information in Prudential Bank Supervision: A Review of the U.S. Empirical Evidence. *Journal of Money, Credit and Banking, 30*(3), 273–305.

Gapen, T. M., Dale, F. G., Lim, C. H., & Xiao, Y. (2004). The Contingent Claims Approach to Corporate Vulnerability Analysis: Estimating Default Risk and Economy-Wide Risk Transfer. *IMF Working Paper*, WP/04/121. Washington, D.C.: Intenational Monetary Fund.

Giles, D. (2011). Testing for Granger Causality. *Econometrics Beat: Dave Gile's Blog*. http://davegiles.blogspot.ca/2011/04/testing-for-granger-causality.html (accessed November 14, 2013).

Gray, D. & Walsh, P. J. (2008). Factor Model for Stress-testing with a Contingent Claims Model of the Chilean Banking System. *IMF Working Paper*, WP/08/89. Washington, D.C.: Intenational Monetary Fund.

Gropp, R., Vesala, J. & Vulpes, G. (2004). Market Indicators, Bank Fragility, and Indirect Market Discipline. *FRBNY Economic Policy Review*, September 2004, 53–62. New York: Federal Reserve Bank of New York.

Gropp, R., Vesala, J. & Vulpes, G. (2002). Equity and Bond Market Signals as Leading Indicators of Bank Fragility. *Working Paper Series* No. 150. Frankfurt: European Central Bank.

Gujarati, N. D. (1995). *Basic Econometrics*. Third Edition. New York: McGraw Hill.

Gunther, J., Levonian, M. & Moore, R. (2001). Can the Stock Market Tell Bank Supervisors Anything They Don't Already Know? *Economic and Financial Review,* Second Quarter 2001, 2- 9. Dallas: Federal Reserve Bank of Dallas.

Haldane, A. G. (2012). The dog and the frisbee. In *Jacksone Hole Economic Policy Symposium. The Changing Policy Landscape* (pp. 109–159). Kansas City: Federal Reserve Bank of Kansas City.

Hull, J. (2005). *Options, Futures, and Other Derivatives*. Sixth Edition. New Jersey: Prentice Hall.

Krainer, J. & Lopez, J. (2003a). How Might Financial Market Information Be Used for Supervisory Purposes*? FRBSF Economic Review*, 29–45. San Francisco: Federal Reserve Bank of San Francisco.

Krainer, J. & Lopez, J. (2002). Incorporating Equity Market Information into Supervisory Monitoring Models. *Federal Reserve Bank of San Francisco*. http://www.frbsf.org/publications/economics/papers/2001/wp01-14bk.pdf (accessed June 10, 2008).

Merton, C. R. (1974). On the Pricing of Corporate Debt: The Risk Structure of Interest Rates. *The Journal of Finance, 29*(4), 449–470.

Persson, M. & Blavarg, M. (2003). The use of market indicators in financial stability analysis. *Economic review,* 2/2003. Stockholm: Sveriges Riksbank.

Tarullo, D. (2008). *Banking on Basel. The Future of International Financial Regulation.* Washington D. C.: Peterson Institute for International Economics.

Todda, Y. H., & Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated processes. *Journal of Econometrics, 66*(1/2), 225–250.

Vassalou, M. & Xing, Y. (2004). Default Risk and Equity Returns. *The Journal of Finance, 59*(2), 831–868.

Willem van den End, J. & Tabbae, M. (2005). Measuring financial stability: applying the MfRisk model to the Netherlands. *DNB Working Paper*, No. 30/March 2005. Amsterdam: Dutch National Bank.

CORPORATE FINANCIAL REPORTING IN SLOVENIA: HISTORICAL DEVELOPMENT, CONTEMPORARY CHALLENGES AND POLICY IMPLICATIONS

MAJA ZAMAN GROFF[1]
METKA DUHOVNIK[2]

Received: July 28, 2016
Accepted: December 2, 2016

ABSTRACT: *Slovenia historically belongs to the continental legal system but has built its corporate financial reporting framework on the principles of measurement and recognition primarily derived from the Anglo-American system. The aim of the article is to present the development of the accounting practice in the transition period in Slovenia and to critically assess the current corporate financial reporting framework in Slovenia. Contingency approach, recognising that best solutions are dependent upon broader setting and that solutions that are effective in one country can be inappropriate in others, is used in the assessment of the current corporate financial reporting framework. The article highlights the challenges related to corporate financial reporting in the context of the Slovenian under developed capital market and deficiencies stemming from the discrepancies between legal and financial reporting frameworks. Although the new Slovenian Accounting Standards 2016 are expected to resolve some of the exposed problematic areas and increase transparency of financial reporting, additional regulatory changes in the field of accounting that are needed to further contribute to corporate financial reporting quality in Slovenia are pointed out.*

Keywords: *accounting history; corporate financial reporting; accounting profession; policy implications; Slovenia*
JEL Classification: M41, M42, M48
DOI: 10.15458/85451.44

1. INTRODUCTION

Slovenia declared independence from Yugoslavia in June 1991. This represents the most notable milestone regarding the characteristics of its business environment, provoking fast and thorough changes in regulation, institutional setting and ownership of organizations. Transformation of the former (relatively market-oriented) socialist economy into an open market economy was characterized by the efforts of Slovenian companies to mitigate the declining revenues caused by the loss of the Yugoslav market by entering on a larger scale the highly competitive Western markets (Boduszyński, 2010).

1 University of Ljubljana, Faculty of Economics, Ljubljana, Slovenina, e-mail: maja.zaman@ef.uni-lj.si

2 Metka Duhovnik passed away after a difficult illness in May 2017. In Slovenia and internationally, she significantly contributed to development of auditing profession. She was also a dedicated researcher. We are thankful for the privilege of having worked with her over many years.

Although the Slovenian economy successfully completed the transition to a market economy, the rise of unemployment was remarkable and companies often had to sell at or below marginal cost (Zapp, 1996) to gain business in highly competitive market economies. Social ownership of organizations, overstaffing and low productivity, all remnants of the previous socialist regime, resulted in lack of competitiveness and called for explicit regulatory changes. Slovenia opted for a decentralized mass privatization, a strategy which led to lower levels of foreign direct investments as compared to other countries in the region (Invest Slovenia, 2016).

Unlike privatization, regulation related to taxation and company law was developed centrally, drawing on established models from market economies (Garrod & Turk, 1995). Regulatory requirements post-independence have been predominantly based on continental European practice, a logical choice considering tight historical ties with Austria and the increasing importance of Germany for the Slovenian economy.

In spite of the many differences between socialist and developed Western economies, even before independence the Slovenian accounting profession as part of the Yugoslav profession was relatively advanced and independent. The leading professional organization, The Association of Accountants, Treasurers and Auditors (previously known as the Slovenian Society of Bookkeepers), was founded in 1957. As early as 1965, along with the Association of Economists it had initiated regular annual symposia "*with the intention of disseminating modern Western accounting concepts and approaches to Slovene practitioners*" (Garrod & Turk, 1995, p. 754). What is more, two years before Slovenian independence the Yugoslav Law on Accountancy (1989) had indicated movement towards harmonization with the EC Fourth Council Directive 78/660/EEC and called for the preparation of a set of domestic accounting standards in line with international norms. Notwithstanding the general orientation towards internationally viable accounting solutions some peculiarities of the former regime inevitably influenced corporate financial reporting. These were related to social ownership of companies (the concept of socially-owned capital differed from the established term in private firms), high independence of individual companies (consolidation procedures were not established), high incidence of workforce benefits, often at the cost of efficiency (high levels of non-business assets such as vacation properties offered to workers) etc. Moreover, the characteristics of the hyperinflationary environment just before Slovenian independence resulted in mandatory revaluation procedures, which were a very practical solution, but the resulting high levels of revaluation reserves were often regarded as peculiarities of the former regime. Considering the IAS 29 (*Financial Reporting in Hyperinflationary Economies*) issued in July 1989 that required the financial statements of an entity with a hyperinflationary functional currency to be restated for the changes in the general pricing power, this solution was, at the time, actually a modern accounting solution.

The years immediately following independence saw extensive legislation as well as sustained economic reforms in Slovenia. Moreover, the Slovenian Accounting Standards Committee, nominated by the newly established Slovenian Institute of Auditors, prepared the first Slovenian Accounting Standards (thirty core standards and an additional two

standards for banks and insurance companies, respectively) that were issued in April 1993. In line with the pre-independence developments in the accounting profession, the Slovenian Accounting Standards Committee managed to incorporate both developed domestic theory as well as international expertise – from the UK and US in particular – in the new standards, an important aim of which was to prevent state intervention in the accounting profession (Turk, 2012). The requirement to use accounting standards was incorporated into the newly adopted Companies Act (1993) and the need for a separate Law on Accountancy, previously representing core regulation in the field, no longer existed.

In short, global and local business environments have been changing rapidly during the 25 years of Slovenian independence. The changes are reflected in amended legislation, regulation and professional standards but historical traits also continue to impact the Slovenian corporate financial reporting practices.

The aim of the article is to present the development of the accounting practice in the transition period in Slovenia and to critically assess the current corporate financial reporting framework in Slovenia. We pinpoint some contemporary challenges identified in the field of corporate financial reporting in Slovenia and question to what extent the historical development of the Slovenian corporate financial reporting framework has led to an effective and efficient system. In the context of the contingency theory, recognising that best solutions are dependent upon broader settings, we support the idea that the particular characteristics of Slovenia and the wish to 'conform' with externally imposed regulations has led to a sub-optimal system that neither fits the local environment in Slovenia, nor achieves the objective of the Slovenian audit profession to be outward-looking and progressive. As a consequence, we discuss whether the already accepted changes in accordance with the European Accounting Directive 2013/34/EU are bringing any improvements in the field of corporate financial reporting.

The paper is structured as follows. To provide the framework of current corporate financial reporting in Slovenia, we first present the development of the accounting profession in Slovenia, the process of the gradual harmonization of the Slovenian Accounting Standards (SAS) with International Financial Reporting Standards (IFRS) and the application of the IFRS in Slovenia. Next, we identify some notable contemporary corporate financial reporting deficiencies in Slovenia and discuss their consequences for presentation of financial statements. The final discussion highlights the problematic regulatory areas in the field and suggests some viable regulatory changes that are still needed in the current context.

2. DEVELOPMENT OF THE ACCOUNTING PROFESSION AND ACCOUNTING STANDARDS IN SLOVENIA

The accounting profession in Slovenia was originally organized by the Slovenian Society of Bookkeepers, established in Ljubljana in December 1957. In its early years the Society

comprised 3,000 members (Society of Accountants, Treasurers and Auditors: History, 2016), mainly bookkeepers and preparers of financial reports. The core accounting activities at the time of its founding were recording business transactions, and preparing yearly income statements and end-of-year balance sheets. Although professional societies were organized separately in each of the Yugoslav republics (Garrod & Turk, 1995), close co-operation and co-organization of professional events was intended to develop new knowledge and spread best practice throughout the profession. In addition to the Slovenian Society of Bookkeepers, the Slovenian Society of Economists played an important role in introducing modern Western accounting concepts to the developing Slovenian accounting profession. In 1965 it initiated the yearly symposia on contemporary methods in accounting, outlining new developments (both domestic and international) in accounting. These symposia, which were renowned for high quality contributions and wide practitioner participation, were also organized by professional societies in other Yugoslav republics. However, the role played by the Society of Economists as a co-organizer of symposia in Slovenia demonstrates the general Slovenian preference for considering economic implications along with the technical aspects and a receptiveness to contemporary developments from Western economies (Garrod & Turk, 1995).

The high level of independence and commitment to professional development were further reflected by the adoption of an independent Code of Accounting Principles in 1974, presenting the theoretical concepts of Slovenian accounting. The aim of the Code was to provide professional guidance and to set up a foundation for future development of more specific accounting rules in the form of accounting standards. In 1988, at the annual conference of the Yugoslav Association of Accountants and Treasurers, professor Turk underlined the need to upgrade the code. He advocated the formulation of national accounting standards with more specific accounting rules to guide and standardize accounting practices beyond accounting principles, incorporating the methods of recording and processing accounting data, preparation of financial statements and maintenance of accounting data and financial information (Turk, 2012). The profession followed the indicated direction in the wake of Slovenian independence in 1991 when the question regarding the future accounting framework called for an immediate response. One option was to follow the previous model where accounting practice was comprehensively prescribed by regulation and legislation in the field. The Slovenian accounting profession, following the direction set at the annual conference of the Yugoslav Association of Accountants and Treasurers in 1988, opted for the second option, the development and implementation of national accounting standards. This choice enabled the profession to incorporate the emergent domestic theory along with the established international accounting concepts into the new Slovenian Accounting Standards (SAS).

The first set of SAS 1993 included some characteristics of both the continental and the Anglo-American model. Although the basis of standard setting was closer to the Anglo-American model, emphasizing primarily shareholders' interests, the prudence principle embedded in the SAS 1993 reflected the continental approach, where shareholders are seen as a constituency of stakeholders among others, therefore emphasizing also the aspect of creditors, suppliers, customers, employees, government and the public. A total of

32 standards were issued in April 1993 and adopted in 1994. The standards were based on the drafts of the Yugoslav standards (Jerman & Novak, 2014) that were finalized in 1992 but never adopted due to, inter alia, very high levels of inflation (Turk, 2012). In addition to higher quality of accounting information, the expectation was that the preparation of national accounting standards would further reduce state involvement in the accounting profession (Garrod & Turk, 1995). While financial statements for 1993 were presented in line with existing Yugoslav regulation that remained effective at the time, the SAS were adopted on January 1, 1994 along with the new Slovenian Companies Act (at that time known as the Law on Commercial Companies) of 1993 which was highly influenced by the German and Austrian corporate law model. The new framework of corporate financial reporting, based on national accounting standards, significantly transformed the traditional (socialist) perception of the role of accounting and financial information. The major changes introduced by the SAS 1993 included the following (Turk, 2012, p. 181):

- accounting information was now required to present a fair view (presentation of accounting information was previously dominated by lawfulness),
- new solutions were directed to business needs and were no longer as tightly related to tax legislation,
- a broader stakeholder approach was adopted by stricter control over management, including financial statements auditing,
- the requirement to disclose all relevant information regarding financial position and net income reduced the incidence of hidden reserves,
- to ensure that accounting information gave a relevant and accurate presentation of transactions, the accounting principle of substance over form was implemented,
- the SAS were prepared by the accounting profession and replaced numerous acts and regulations that were previously highly influenced by political interests,
- in addition to the business aspect, reflected in the balance sheet and the income statement, the SAS also emphasized the financial aspect by introducing the statement of changes in financial position,
- accounting solutions were no longer focused only on processing historical data; book-keeping, the previous focus of accounting function, was supplemented by solutions in the field of budgeting and financial analysis.

Following the initial SAS adoption in Slovenia the business environment continued to change rapidly and involved processes of privatization, internationalization and the beginning of the EU accession process. An increasingly competitive global environment, the requirement to start the harmonization process and the desire of the accounting profession to keep pace with the international accounting developments and best practices called for the revision of the 1993 SAS. The new standards were issued in 2001 and first used in 2002, following the adoption of the new Companies Act of 2002, which was based on the *acquis communautaire* and the German legal tradition (World Bank, 2004). It required all companies to apply SAS in their consolidated and legal entity financial statements but it did not require public interest entities to prepare financial statements in conformity with the IFRS. The amended SAS 2001 retained the established structure and their scope was broader than the IFRS in the sense that they outlined accounting

procedures regarding budgeting, financial analysis and other aspects of accounting function in addition to external corporate reporting (Turk, 2012). The major shift introduced by the SAS 2001 was related to the valuation of assets and liabilities emphasizing their true and fair presentation. To implement the valuation- related accounting practices already incorporated in the IFRS, the fair value principle as a typical Anglo-American accounting concept was introduced to measure individual balance sheet items. Although the changes in SAS 2001 were considered to be a massive step towards harmonization with IFRS (Jerman & Novak, 2014), the World Bank (2004) pointed out some fundamental differences remaining between the SAS 2001 and IFRS: capitalization of foreign exchange losses, broader definition of extraordinary items, capitalization of start-up costs, treasury stock recorded as investment and long-term receivables recorded as current assets.

In the following years, the preparation for Slovenia's accession to the European Union on May 1, 2004 was dominated by the processes of harmonization of the national legislation with the EU legal framework. In the field of accounting, the most important EU legislation that had to be adopted included the Fourth Council Directive 78/660/EEC on the annual accounts of certain types of companies, the Seventh Council Directive 83/349/EEC on consolidated accounts and Regulation (EC) 1606/2002 on the application of international accounting standards. According to Article 4 of Regulation 1606/2002 all companies governed by the law of any member state were required to prepare their consolidated accounts in conformity with the international accounting standards if their securities were traded on a regulated market of any member state, for each financial year starting on or after January 1, 2005. To adopt the aforementioned EU legislation into the Slovenian legal framework, Article 54 of the amended Companies Act of 2006 required that the new SAS must incorporate the content of Directive 78/660/EEC and Directive 83/349/EEC (the EU accounting directives) and their concept must not conflict with the International Financial Reporting Standards. Moreover, the Companies Act introduced the requirement for all companies whose securities were traded on any EU regulated market to prepare their consolidated financial statements in conformity with the IFRS. The use of the IFRS was optional for all other companies if so decided by the company's annual general meeting, for a minimum period of five years. In line with the Regulation 1606/2002 on the application of international accounting standards the IFRS also became mandatory for preparation of financial statements of banks and insurance companies whose securities were traded on any EU regulated market. This provision was shortly followed by the requirements of the Bank of Slovenia and the Slovenian Insurance Supervision Agency, calling for mandatory use of the IFRS also for the annual (individual) financial statements of banks (starting in year 2006) and insurance companies (from year 2007).

To achieve the required high level of harmonization with the IFRS the new SAS 2006 were adopted. The most notable amendments introduced by the SAS 2006 related to the field of property, plant and equipment as well as intangible assets[3], investment property[4],

3 For measurement after recognition a company could use either cost or revaluation model.

4 Separate accounting treatment of investment property was introduced and the option was given to use the fair value model for measurement after recognition.

financial assets[5] and loans and receivables[6], along with some additional changes in the financial statements (Novak, 2008). Despite the high level of harmonization of SAS 2006 with the IFRS the national standards retained the original structure.

In its relatively short history Slovenia's progress in the development of high quality accounting standards and their harmonization with the IFRS has been evident. As international financial reporting practice has developed, there have been additional pressures and challenges to delivering relevant, internationally aligned, accounting regulation. This has raised tensions between the corporate legal framework of German origin and the financial reporting framework of Anglo-American origin. It has also given rise to implementation problems caused by technical deficiencies of prepares of financial statements, and their limited experience of new concepts.

3. CHALLENGES RELATED TO THE SLOVENIAN CORPORATE FINANCIAL REPORTING FRAMEWORK

Since Slovenian independence the corporate financial reporting framework of Slovenian companies has been determined by the Companies Act. According to this act companies are obliged to prepare financial statements either on the basis of the SAS (that are highly harmonized with the IFRS) or by direct use of the IFRS as adopted by the EU. In the following paragraphs we will try to support or reject the suitability of legally offering all companies the possibility to use IFRS.

The World Bank Centre for Financial Reporting Reform (2011) outlined that the mandatory use of the IFRS in the EU is intended for the preparation of consolidated accounts of publicly traded companies whose securities are traded on a regulated market in the European Union. The term 'regulated market', which is important in the regulatory context, is defined in Article 4 of Directive 2004/39/EC on markets in financial instruments as the authorized multilateral system operated and/or managed by a market operator, which brings together or facilitates the bringing together of multiple third-party buying and selling interests in financial instruments and functions regularly.

Under the subsidiary principle Regulation 1606/2002 authorized the member states to allow or require other companies and groups to prepare separate or consolidated accounts in accordance with the IFRS. The latest publicly available data (Overview of the use of options provided in the IAS Regulation, 2013) reveal that very few EU countries (Bulgaria, Cyprus, Estonia, Ireland, Luxemburg, Malta, Slovenia and the UK) permit the use of IFRS to all companies regardless their size and activity.

Many influential European countries with developed market economies (France, Germany, Spain and Sweden) were much more resistant to the general IFRS adoption. This can be

5 The four categories of financial assets had to be introduced in line with the IFRS.

6 Amendments were related to different accounting treatments for measurement after recognition.

explained by the fact that the IFRS are intended to serve the particular financial reporting needs of large companies with public accountability. However, in the Basis for Conclusions related to the International Financial Reporting Standard for Small and Medium sized Entities (IFRS for SMEs) even the International Accounting Standards Board (IASB) recognized that the circumstances of SMEs can be different from those of large publicly accountable companies. The differences include different users of financial statements and their information needs, the way the financial statements are used, the accounting knowledge and experiences that is available to the entity and the financial ability to cover the cost of rather extensive requirements of the IFRS (International Accounting Standards Board, 2009). On the basis of this we can conclude that the option to offer all companies the possibility of using IFRS might not have been as judicious as expected by the legislative bodies.

In Slovenia the development of the SAS can be described as a gradual approach to the IFRS. It started with the prudence principle (SAS 1993), continued with moderate fair valuation (SAS 2001) through to almost complete adjustment to IFRS (SAS 2006). The problem related to the adjustment of SAS to the IFRS is that technically the SAS became 'small IFRS' in the sense that they are not as detailed, and do not include similar explanatory materials intended to enhance understanding and proper use of accounting concepts. Nevertheless, the requirements for recognition, valuation and measurement of financial statement items are as demanding as those of the IFRS. Because in companies using SAS the requirements and explanatory materials of the IFRS cannot be used directly, and considering the relatively less developed market environment, some questions regarding the appropriate accounting treatment cannot be adequately answered by the SAS nor by the IFRS. As stated in the SAS 2006 the companies that are obliged to comply with the SAS shall directly apply only the provisions of the IFRS to which the SAS directly refer. Other provisions of the IFRS cannot directly be construed as provisions of the SAS. Pending their integration into the SAS, or the adoption of a relevant interpretation from the Slovenian Institute of Auditors, such IFRS can only be construed as information about professional practice. At this point it has to be stressed that the direct use of individual IFRS requirements might be problematic if the user is not acquainted with the context of the IFRS as a whole. The individual requirement, taken out of context might be misunderstood and misused.

The concept of materiality in SAS 2006 is a viable example of insufficient guidance and explanatory materials for preparers of financial statements. Companies using SAS often do not understand the concept of materiality at the financial statement level. Although the SAS define that information is material if its omission or misrepresentation could influence the economic decisions of users taken on the basis of financial statements, such a definition does not provide the appropriate understanding to the SAS users. Consequently, materiality-related internal rules, prepared by companies using SAS, are often unreasonable; for example their internal rules may state that equipment is considered material if it represents more than 10% of total plant and equipment. Such determination of materiality for each individual financial statement item prevents the management's accurate estimation of materiality at the financial statement level. Lack of materiality-

related guidance is also reflected in additional efforts to calculate deferred taxes, deferred compensations for redundancy and similar. While these inevitably increase the workload and related cost, they might be completely immaterial by substance and size and therefore omitted.

The highly concentrated substance of SAS requirements also causes legal lacunae[7] in different areas of SAS and thus difficulties for preparers as well as financial statements auditors. Since IFRS pronouncements are not part of SAS, the innovative solutions presented in the SAS compliant financial statements cannot be effectively challenged by auditors without appropriate legal basis. In the absence of an active market the consequence is an array of different measurements and valuations of the same phenomena in financial statements of different companies, causing decreased information value of such information for financial statements users (especially creditors). From the annual reports published by the Slovenian Institute of Auditors[8] and the Agency for Public Oversight of Auditing[9] it is evident that inappropriate input data and inappropriate use of valuation methods are among the most frequent violations of International Standards on Auditing used in Slovenia.

The external quality control of the Slovenian auditing firms in the last few years has demonstrated that the most frequent problems are related to fair valuation of individual financial statement items especially property, plant and equipment, intangibles, investment property, financial investments and derivatives (Annual report of the Slovenian Institute of Auditors, 2014; Annual report of the Slovenian Agency for Public Oversight of Auditing, 2014). For this reason we illustrate the legal lacunae in SAS for the case of fair valuation.

Fair value of various balance sheet items in SAS (2006) is defined as follows:

- Fair value is the amount for which the asset could be exchanged, or a liability settled, or a granted equity instrument exchanged between knowledgeable and willing parties in an arm's length transaction (general definition in the Introduction to SAS).
- The fair value of land and buildings and also of plant and equipment is usually determined on the basis of marked-based evidence by appraisal normally undertaken by certified appraisers in accordance with the International Valuation Standards (SAS 1.27).
- Intangible assets may be revalued to fair value if there is an active market for the assets (SAS 2.30)
- Fair value is evidenced if it can be reliably measured. Fair value is reliably measurable if there is:
  a) a quoted market price in an active securities market; or
  b) a valuation technique which incorporates data inputs taken from the active market. (SAS 3.21 referring to financial investments.)

7 For the purposes of this paper the term legal lacunae is defined as imprecisely defined legal requirements.

8 http://si-revizija.si/oinstitutu/porocila-o-delu

9 http://www.anr.si/Porocanje_Agencije

- The fair value of an investment property is measured on the basis of market value at the balance sheet date, usually determined by certified appraisers in accordance with the International Valuation Standards (SAS 6.13).

The presented provisions of SAS reveal that the ability to determine fair value depends on the existence of an active market granting either the price or the input data for the valuation model. At the same time, the SAS do not specify what kind of valuation model is acceptable. In the case of direct interpretation of the provision it is sufficient that an active market exists. It is left to the certified appraiser to decide which model is appropriate in the given circumstances according to the International Valuation Standards (IVS, 2013). The section of the IVS that specifies the valuation rules for accounting purposes refers to various requirements of IFRS, especially IFRS 13 (Commission Regulation (EU) No 1255/2012), and not to national accounting standards. This means that the IVS can properly be used if the financial reporting framework is IFRS, or at least very similar to IFRS in the sense of extensive fair valuation requirements ranking the quality of fair valuation according to the reliability of the available input data as follows:

- Level 1 inputs are quoted prices (unadjusted) in active markets for identical assets or liabilities that the entity can access at the measurement date.
- Level 2 inputs are inputs other than quoted prices included within Level 1 that are observable for the asset or liability, either directly or indirectly.
- Level 3 inputs are unobservable inputs for the asset or liability.

Comparing IFRS (Regulation (EC) No 1606/2002) and SAS (2006) it is quickly apparent that the requirements and guidance related to fair valuation and measurement are much more detailed in IFRS than in SAS. In an environment with a considerably less developed financial market this gives rise to different and usually creative approaches of valuing assets for accounting purposes. The World Economic Forum has recently presented the Competitiveness Report 2015-16. The ranking of the financial market development places Slovenia as low as 128th out of 140 countries (World Economic Forum, 2016), which implies that the mentioned fair value related issues are highly relevant. Considering that the valuation model used gives better results the closer the period and environment in which it was developed, the model used, for example the Capital Asset Pricing Model, can often be rendered inappropriate (Pustoslemšek, Slapničar & Valentinčič, 2016) and/or assumptions connected with its use unrealistic (Duhovnik, 2007).

As contemporary financial reporting frameworks such as IFRS rise from an environment with relatively high market efficiency, small economies like Slovenia are faced with a certain paradox. "Since their capital markets are less efficient than the developed capital markets with a long historical tradition, the need to establish fair value by using a valuation technique is more frequent. But the domestic market does not offer adequate market inputs for valuation models. The use of data from developed capital markets requires better skills of appraisers valuing the business, although the level of general knowledge in a small economy is different from a country with a long-term market tradition" (Duhovnik, 2007, p.77). The problem can also be observed from the other perspective by asking whether

the need to establish fair value by using a valuation technique under IFRS really exists even though there are no appropriate market data available (compare with Nobes, 2015). Although the answer to this question is clear according to the IFRS, in the national environment it is often left to the discretion of preparers of the financial statements and their advisers due to the lack of relevant provisions in national standards.

In the circumstances described statutory auditors that audit financial statements containing categories measured at fair value are in a rather unenviable position. Although they may consider that the estimated value is far from being fair, no legal basis is available to support their opinion. Carrying out professional judgment in the young Slovenian audit profession is therefore much more challenging as compared to the mature profession in well-developed market economies. This can give rise to higher audit risk that can consequently result in a lower degree of confidence on the part of intended users of the audited financial statements.

4. CHALLENGES RELATED TO DISCREPANCIES BETWEEN LEGAL AND FINANCIAL REPORTING FRAMEWORKS

At the national level, a financial reporting system should enable the country to trace the allocation of resources and optimally apportion goods and services. The method of allocation (economic system) is strongly influenced by the legislation (legal system), determined by the people in power (political system). Collectively, the three systems affect the external financial reporting requirements. Historically, legal systems can be divided into *civil law* based on Roman law, and *common law* (also known as *case law*) referring to precedents or rules established in previous legal cases.

As explained by The Economist (What is the difference between common and civil law, 2013) the difference between common and civil legal traditions lies in their main source. Although common law systems make extensive use of statutes, judicial cases are regarded as the most important source of law. This approach gives judges and courts an active role in developing rules. To ensure consistency, the courts abide by precedents set by higher courts, deciding cases on the same issues. In civil-law systems, by contrast, codes and statutes are designed to cover all eventualities, and judges and courts have a more limited role of applying the law to the case in hand. Past judgments play a secondary role in the sense of loose guides. In court cases, the judges in civil law systems tend towards being investigators, while their peers in common law systems act as arbiters between parties that present their arguments. Civil law systems are more widespread than common law systems: the CIA World Factbook reports the numbers at 150 and 80 countries, respectively (What is the difference between common and civil law, 2013). Common law systems prevail in the UK and the former British colonies and countries that have been influenced by the Anglo-American tradition, such as Australia, India, Canada and the United States.

The main effect of the two legal systems on general principles of their respective financial reporting and selected recognition and valuation rules are illustrated in Table 1.

Table 1. The effect of the main environmental factors on financial reporting

Financial reporting	
Anglo-American	**Continental**
General principles of financial reporting[1]	
- fairness	- legal basis
- disclosure	- confidentiality
- independence of tax rules	- strong connection to tax rules
- professional behaviour over legal form	- legal form over professional behaviour
- professional standards of financial reporting	- legal rules (law, pronouncements etc.)
Selected recognition and valuation rules[2]	
- relatively large number of accounting options allowed, encouraged professional reasoning	- limited number of accounting options allowed
- principle of prudence implementation – not explicitly required	- principle of prudence implementation –explicitly required
- fair value use very important	- historical cost and fair value

Source: [1] Hayn, 1997, p. 43.
[2] Deaconu & Buiga, 2011, p. 140.

With the adoption of Regulation 1606/2002 on the application of international accounting standards and gradual endorsement of individual IFRSs inside the EU, the principles of measurement and recognition deriving from the Anglo-American background became part of the European legislation. They supplemented the continental environment originated prudence principles in the Fourth and the Seventh Directives to enable the use of the fair value principle in certain circumstances.

Although recent decades reflect a constant tendency towards international harmonization of financial reporting these trends still indicate that different legal environments and other historical, developmental, environmental and political factors should be taken into account when deciding on the optimal corporate reporting requirements in a given national setting (compare with Lourenço et al., 2015). Slovenia historically belongs to the continental legal system and is still under the very strong influence of German and Austrian legislation. The majority of provisions in the Companies Act have German or Austrian origin. On the other hand Slovenian accounting requirements are based on common law Anglo-American principles. The way in which historical, developmental and environmental factors have been taken into account when incorporating such legal requirements was left to decision making structures with limited market economy experience.

During the privatization process, starting in 1993, a total of approximately 1,500 Slovenian companies with social capital were privatized. 140 of these were selling shares to the public and were subsequently listed on the Ljubljana Stock Exchange, established at the

end of 1989 (Duhovnik, 2007). Due to a strong tradition of self-management and soft financial conditions for management and employee buyouts, the privatization process led to a high percentage of insider ownership. Such ownership did not necessarily imply that each privatized company had a group of active private owners, able and willing to take the strategic choices needed to adapt to the changed environment and ensure continuous growth and efficiency. Consequently, a process of concentrating ownership in the hands of active owners was inevitable. The companies with concentrated ownership predominantly withdrew from the stock exchange; by the end of 2007 the number of listed companies had decreased to around 100.

In spite of the convincing motivation to transfer continental corporate legislation from developed economies with a strong market tradition into the Slovenian environment, its implementation was incomplete, especially as regards implementation and enforcement of penal provisions. Evidenced by the rather poor level of corporate ethics in the Slovenian private sector - 82nd place among 140 countries (World Economic Forum, 2015-2016) - the lack of relevant penal provisions and/or their enforcement resulted in a situation where core business priorities were recurrently replaced by managements' activities in ownership concentration. This practice was reflected in increased indebtedness of Slovenian companies after the start of the privatization process until the start of the financial crisis in Slovenia in 2009. Table 2 reveals a sharp drop of capital/total assets ratio of Slovenian commercial companies from 1992 (64.2%) to 2008 (34.8%), brought to an end in 2009 when due to the start of the financial crisis the banking sector started to refrain from assigning or extending loans to poorly performing, non performing and/or heavily indebted companies. In conditions of efficient management and strong corporate governance increasing indebtedness should result in enhanced corporate performance. However, comparing the level of indebtedness with the net income/sales ratio of Slovenian commercial companies it appears that the growing indebtedness of the Slovenian economy before the financial crisis had no positive impact on sales needed for further sustained growth.

Table 2. Rates of indebtedness and returns on sales of Slovenian commercial companies for years 1992, 1996 and 2007 – 2014

Year	1992	1996	2007	2008	2009	2010	2011	2012	2013	2014
Capital/Total assets (%)	64.2	54.6	37.0	34.8	35.1	37.8	38.1	38.8	40.0	41.9
Net income/Sales (%)	n/a	n/a	4.4	1.9	0.8	-0.3	0.6	0.4	0.2	1.1

Source: AJPES (1993, 2012, 2015a, 2016)

As accounting policies and practices (especially different approaches used for fair valuation and diverse criteria for impairment of assets) enabled many companies to choose extremely optimistic options for presentation of their financial position, the levels of indebtedness continued to rise in spite of the lack of economic arguments. Considering the aforementioned lack of any legal basis to reject the auditee's selection of fair valuation

it is not surprising that quite a few companies[10] that are in the process of bankruptcy had received no going concern modification of audit opinion in the years before bankruptcy (Pikelj & Slapničar, 2014). It is highly plausible that such practice would not have been observed in an environment with high levels of business ethics, efficiency of corporate governance and effectiveness of the judicial system. The Competitiveness Rankings of the World Economic Forum offers some corroborating evidence for the aforementioned observations. The Slovenian ranking (among 140 countries) is weak in the fields of strength of auditing and reporting standards (87th place), efficacy of corporate boards (110th place), protection of minority shareholders' interests (121st place), judicial independence (85th place) and efficiency of legal framework in settling disputes (115th place) (World Economic Forum 2015-2016).

5. DISCUSSION AND POLICY IMPLICATIONS

The Auditing Council of the Slovenian Institute of Auditors, as the leading professional institution in accounting and auditing profession, took an active role in the public discussion related to the implementation of Accounting Directive 2013/34/EU into the Slovenian Companies Act. Its principal aim was to enhance the implementation of requirements that would improve the true and fair view of the financial statements of Slovenian companies, considering its less efficient capital market environment. Most notably, in a letter to the Ministry of the Economic Development and Technology in 2013, it proposed to narrow the option of fair valuation as it was reasonable to expect that such provision would have a positive effect on the risk of financial statements being materially misstated (Slovenian Institute of Auditors – Auditing Council, 2013). More specifically, the proposal supported the following solutions:

- Only listed companies, obliged to prepare consolidated accounts, banks and insurance companies, should be obliged to use IFRS.
- The option to use IFRS should be given to other listed companies and companies incorporated in groups with parent companies using IFRS.
- All other companies should use national accounting standards (SAS) that should be prepared in line with the Accounting Directive 2013/34/EU incorporating the prudence principle. The items recognised in financial statements should therefore be measured in accordance with the principle of purchase price or production cost to ensure reliability of financial statement information. Financial instruments quoted on the active market, which should be measured at fair (market) value, represent an exemption to the aforementioned rule. It was argued that the proposed solution would prevent usage of valuation models that, in the majority of cases, do not fit the circumstances and consequently do not result in true and fair presentation. Regarding new SAS the proposal included some simplifications, including simplifications related to deferred taxes, which were often subject to different professional interpretations and did not improve the information value of financial statements.

10 Some viable examples include Avto Celje d.d. - v stečaju, Merkur d.d. – v stečaju, Peko d.d. – v stečaju (retreived from AJPES database).

As regards statutory auditing, the Auditing Council proposed the implementation of size thresholds as stated in the Accounting Directive 2013/34/EU. In addition, to improve the quality of financial statements prepared for smaller companies by service organizations (as these are often not qualified to properly understand and use the financial reporting framework) it called for a requirement that the small (not micro) companies using service organizations for preparation of financial statements should submit a compilation report.

To incorporate the Accounting Directive 2013/34/EU, particularly the changes related to the balance law, into Slovenian national legislation the Companies Act was amended in 2015. The changes in accounting represented the major part of the amendments. As before, the amended Companies Act still governs only fundamental balance law questions by determining fundamental rules regarding the drawing up of the annual report and financial accounts, while leaving the details to the SAS (Kocbek, 2015). Although the most notable changes in the Accounting Directive are related to the valuation of financial statements items with an emphasis on historical cost valuation while measurement at revalued amount or at fair value is treated as an allowed alternative (Kocbek, 2015), this is not clearly reflected in the implemented amendments of the Companies Act. Equally, the IFRS limitation proposed by the Auditing Council was not accepted; the option for all the companies to prepare financial statements in line with the IFRS was retained. The proposed compilation report was not endorsed.

On the other hand, some innovations regarding corporate reporting were incorporated in the Companies Act. With the aim of better protecting minority shareholders' interests the presentation of an extended report on transactions with related companies is now required. Although the idea was taken from German law it is evident that in Germany this report is an obligation of public liability companies only (HFA 3/1991) while the Slovenian Companies Act also requires the report from audited limited liability companies. For a limited liability company with a single owner-manager the additional reporting causes an additional administrative burden without appropriate positive effects.

On the basis of the amended Companies Act the accounting profession has issued the new SAS 2016, applicable for financial statements for periods starting on January 1, 2016 or later. Although the proposal of the Auditing Council to avoid the use of valuation models in the process of fair valuation was not accepted, the new SAS, prescribing much more detailed (market oriented) rules for determining fair value, can be regarded as a step towards enhanced true and fair presentation. In addition to increasing the transparency of financial reporting the more detailed and market-oriented rules have at least partly resolved the discussed legal lacunae in the case of fair valuation. Additional benefits of the new SAS include simplification applicable to small and especially micro companies regarding the layout of annual accounts and the treatment of some other items, such as deferred taxes and compensations for pensions.

Notwithstanding the changes in the accounting field the professional judgment of auditors will still be challenged during the process of auditing. Whether the audit reform will bring the desired effects regarding audit quality remains to be seen. In any case, the auditors will

be faced with two different regimes – Regulation (EU) 537/2014, governing the statutory audits of public interest entities, and the national Auditing Act, harmonized with Directive 2014/56/EU, covering general aspects of the mandatory audit. Due to the small size of the Slovenian audit market with approximately 100 public interest entities (including listed companies, banks and insurance companies), 1,637 separate accounts and 477 consolidated accounts in 2014 (AJPES, 2015b) subject to mandatory audit, Slovenia has little scope to avoid the administrative burden related to the audit regulation. To make the implementation as efficient as possible it has to be very careful when choosing between the options put forward by the regulation.

However, to promote high audit quality as the main aim of the recent EU audit reform, emphasis should be placed on auditor independence. Decisions between different options in the field of provision of non-audit services and auditor rotation should be judged against their influence on auditor independence. Therefore, audit firms should be restrained from provision of any tax and valuation services for their audit clients unless such services have no material effects on the financial statements and the principle of independence is fully respected in line with the Directive 2014/56/EU. To avoid deviations from conditions for auditing parent companies abroad, it would be advisable to select the option of tendering to prolong audit tenure to more than ten years. This solution would prevent deterioration of competitiveness within the business environment and simultaneously enable governance structures (especially audit committees) to make informative decisions whether audit quality and independence of incumbent statutory auditor warrant the prolongation of audit engagement. Corruption and unethical behaviour would be minimized by the granting of full disclosure of data gathered in the audit process that indicates violation of law and regulation to the supervisors of public interest entities (Article 12). To avoid price competition deteriorating audit quality it would also be advised for the initial audit engagement to last more than one year (Article 17). Although some of the recommendations are already incorporated within the proposals for the amended Auditing Act, the final solutions are still unsure, but there is no doubt that all the provisions intended to increase audit quality will have a positive effect on true and fair financial reporting.

All in all it seems that currently Slovenian legislation is much more complex than appropriate in the given circumstances. The complexity can be misused by groups, politically and technically strong enough to follow their own interests through the array of generally accepted solutions. Therefore, the endeavours of policy makers when incorporating the European audit reform into Slovenian national legislation should not disregard the fact that simplicity makes things less risky. And when the legal system is unable to detect, correct and punish deviations on a timely basis, this is even more important.

6. CONCLUSION

Throughout its history, the Slovenian accounting profession has been receptive to contemporary developments of the accounting practices of developed economies. In this paper we have outlined the progress in development of high quality accounting standards

in Slovenia which can be described as a process of gradual approach to IFRS: starting with the prudence principle (SAS 1993) and continuing with moderate fair valuation (SAS 2001) the process has resulted in almost complete adjustment to the IFRS (SAS 2006).

Considering close historical ties with Austria, Slovenia historically belongs to the continental civil-law legal system. Although the prudence principle embedded in the first set of national accounting standards reflected this continental approach, the fair value principle as a typical accounting concept of Anglo-American common-law origin was introduced at the turn of the century. The effect of this shift in the Slovenian financial reporting framework was threefold. First, implementing the EU legal framework into the national legislation, it was part of the harmonization process and enabled Slovenia's accession to the EU. Second, in the context of a relatively underdeveloped capital market the new financial reporting framework posed some viable challenges to preparers, users and auditors of financial statements. These were predominantly related to legal lacunae in the field of fair valuation of individual financial statement items especially property, plant and equipment, intangibles, investment property, financial investments and derivatives. The resulting array of different options for measurement and valuation of individual balance sheet items decreased the information value of audited financial statements. And third, in the Slovenian civil law setting, the implementation of a viable Anglo- American accounting concept posed some challenges related to discrepancies between legal and financial reporting frameworks, especially as regards increasing indebtedness of Slovenian companies and implementation and enforcement of penal provisions.

Recently, Slovenia has incorporated the European Accounting Directive 2013/34/EU into its national legislation. Although some of the proposals that were aimed at resolving the discussed corporate financial reporting deficiencies (such as limitation of companies allowed to use IFRS) were not adopted, the new SAS 2016 prescribe more detailed rules for fair valuation, a measure intended to address the legal lacunae in the case of fair valuation and result in increased transparency of financial reporting. Moreover, simplifications applicable to small and micro firms (such as annual accounts layout, treatment of deferred taxes, compensations for pensions and annual leave) represent additional benefits of the new SAS. But since the SAS 2016 are applicable since January 1, 2016 or later more time is needed to establish whether or not the implemented changes are bringing the necessary improvements in the field of corporate financial reporting in Slovenia.

With the amended Companies Act 2015 and the new SAS 2016 a step forward has been made in adapting corporate financial reporting to the Slovenian legal and economic environment. However, given that the Slovenian legal framework has a continental origin it would be advisable to keep the Anglo-American accounting freedom under control by means similar to those used in Austria and Germany, particularly effective enforcement of sanctions for noncompliance. Moreover, on the basis of presented arguments we argue that the use of valuation models in Slovenia often does not fit the circumstances and consequently does not result in true and fair presentation. Although the most notable changes in the Accounting Directive are related to the valuation of financial statements items with an emphasis on historical cost valuation while measurement at revalued amount

or at fair value is treated as an allowed alternative (Kocbek, 2015), this is not clearly reflected in the implemented amendments of the Companies Act. Consequently, with the exception the financial instruments quoted on the active market (which should be measured at market value), we propose to narrow the option of fair valuation as it is reasonable to expect that such provision would decrease the risk of financial statements being materially misstated. The items recognised in financial statements should therefore be measured in accordance with the principle of purchase price or production cost to properly incorporate prudence principle and ensure reliability of financial statement information. Our analysis also revealed that very few EU countries permit the use of IFRS to all companies regardless their size and activity. Many EU countries with developed market economies are more resistant to general IFRS adoption, as use of IFRS is primarily intended for preparation of consolidated accounts of publicly traded companies. Since the circumstances of SMEs differ from publicly accountable companies in terms of financial statements users, their information needs and accounting knowledge, to list just a few, we believe that in Slovenia the use of IFSR should be restricted to public interest entities, companies incorporated in groups with parent companies using IFRS and for consolidation purposes.

Although some remarkable improvements have been made in the financial reporting framework on the basis of the European accounting reform there is still room for improvements seeking the balance between the ideal theoretical framework and requirements granting optimal results in a small economy. Considering that in Slovenia the majority (around 97%) of companies are small and micro companies (taking into account the thresholds from the Directive 2013/34/EU) and that the ranking of the financial market development is among the lowest (World Economic Forum, 2016) our analysis of the current corporate financial reporting framework exposed some of the problems that still need to be resolved in the given context.

REFERENCES

AJPES (Agency of the Republic of Slovenia for Public Legal Records and Related Services). (1993). Statistical data from the Balance Sheets and Income Statements of the commercial companies for year 1992.

AJPES. (2012). Informacija o poslovanju gospodarskih družb v Republiki Sloveniji v letu 2011 [Information on operation of commercial companies in the Republic of Slovenia in the year 2011].

AJPES. (2015a). Informacija o poslovanju gospodarskih družb v Republiki Sloveniji v letu 2014 [Information on operation of commercial companies in the Republic of Slovenia in the year 2014].

AJPES. (2015b). Published annual reports for the year 2014. http://www.ajpes.si/Letna_porocila/Druzbe_in_zadruge/Javna_objava/Koledar_JOLP?md_id_menu=99 (accessed February 1, 2016).

AJPES. (2016). Statistical data from the Balance Sheets and Income Statements of the commercial companies for year 1996.

Annual report of the Slovenian Agency for Public Oversight of Auditing. (2014). http://www.anr.si/f/docs/Porocanje_Agencije/LP_2014_6_3_2015_revidirano_koncno.pdf (accessed January 6, 2016).

Annual report of the Slovenian Institute of Auditors. (2014). http://www.si-revizija.si/sites/default/files/o_siru/porocilo-o-delu-2014.pdf (accessed March 10, 2016)

Boduszyński, M. P. (2010). *Regime Change in the Yugoslav Successor States: Divergent Paths toward a New Europe.* Baltimore: The Johns Hopkins University Press.

Commission Regulation (EU) No 1255/2012 of 11 December 2012 amending Regulation (EC) No 1126/2008 adopting certain international accounting standards in accordance with Regulation (EC) No 1606/2002 of the European Parliament and of the Council as regards International Accounting Standard 12, International Financial Reporting Standards 1 and 13, and Interpretation 20 of the International Financial Reporting Interpretations Committee, *OJ* 2012 L 360/78.

Deaconu, A. & Buiga, A. (2011). Accounting and the environmental factors – An empirical investigation in post-communist Romania. *Accounting and Management Information Systems*, *2*(10), 135-168.

Duhovnik, M. (2007). The problems of fair value in small emerging market economies (The case of Slovenia). *East-West Journal of Economics and Business*, *10*(2), 61– 81.

Garrod, N., & Turk, I. (1995). The development of accounting regulation in Slovenia. *The European Accounting Review*, *4*(4), 749-764.

Hayn, S. (1997). *Internationale Rechnungslegung*. Stuttgart: Schäffer-Poeschel Verlag.

International Accounting Standards Board. (2009). *International Financial Reporting Standard for Small and Medium-sized Entities (IFRS for SMEs): Basis for Conclusions*. London: IASC Foundation Publications Department.

International Valuation Standards 2013. (2013). London: International Valuation Standards Council.

Invest Slovenia. Republic of Slovenia, Ministry of Economic Development and Technology. (2016). http://www.investslovenia.org/business-environment/fdi-in-slovenia/inward-investment-flows-stock/ (accessed January 3, 2016).

Jerman, M., & Novak, A. (2014). IFRS application in Slovenia. *Accounting and Management Information Systems, 13*(2), 351–372.

Kocbek, M. (2015). Spremenjeno bilančno – računovodsko pravo po noveli ZGD-1I [The changed balance – accounting law under the novel of the Companies Act – ZGD-1I]. *Podjetje in delo [Company and Labour]*, *41*(3/4), 500 – 516.

Lourenço, I. C., Sarquis, R., Branco, M. C., & Pais, C. (2015). Extending the Classification of European Countries by their IFRS Practices: A Research Note. *Accounting in Europe, 12*(2), 223–232.

Nobes, C. (2015). IFRS Ten Years on: Has the IASB Imposed Extensive Use of Fair Value? Has the EU Learnt to Love IFRS? And Does the Use of Fair Value make IFRS Illegal in the EU? *Accounting in Europe*, *12*(2), 153–170.

Novak, A. (2008). Harmonization of Slovenian Accounting Standards with International Financial Reporting Standards. In: Kandzija, V., Kumar, A. (Eds.). *50 years of European Union = L'Union Européenne a 50 ans: research monograph*. Rijeka: University of Rijeka, Faculty of Economics, 511-520.

Overview of the use of options provided in the IAS Regulation (1606/2002) in the EU (Dec 2013). http://ec.europa.eu/internal_market/accounting/docs/legal_framework/20140718-ias-use-of-options_en.pdf (accessed Fabruary 26, 2016).

Pikelj, U. & Slapničar, S. (2014). Ali revizorji opozarjajo na finančne težave podjetij? *Bančni vestnik*, (7/8), 10–15.

Pustoslemšek, T., Slapničar, S. & Valentinčič, A. (2016). Uporabnost modela določanja donosnosti lastniškega kapitala za slovenski kapitalski trg. *Economic and Business Review, 18*(Pos. št.), 73–88.

Regulation (EC) No 1606/2002 of the European Parliament and of the Council of 19 July 2002 on the application of international accounting standards, *OJ* 2002 L 243/1.

Slovenian Institute of Auditors - Auditing Council. (2013). Javni poziv strokovni, zainteresirani in drugim javnostim. Spremembe Zakona o gospodarskih družbah. [Public appeal to the professional, interested and other public. Changes of the Companies Act]. http://www.si-revizija.si/sites/default/files/aktualno/spr-zgd-predlog-rs.pdf (accessed February 22, 2016).

Society of Accountants, Treasurers and Auditors: History. http://www.zvezarfr.si/zveza/zgodovina-zveze (accessed April 14, 2016).

Turk, I. (2012). *Razvoj dojemanja ekonomskih in finančnih kategorij poslovanja v Sloveniji*. Ljubljana: Zveza ekonomistov Slovenije.

What is the difference between common and civil law? (2013). *The Economist.* http://www.economist.com/blogs/economist-explains/2013/07/economist-explains-10 (accessed March 20, 2016).

World Bank. (2004) "Accounting and Auditing, Slovenia", *Report on the Observance of Standards and Codes* (ROSC), World Bank Group. http://documents.worldbank.org/curated/en/2004/10/14393198/republic-slovenia-report-observance-standards-codes-rosc-accounting-auditing (accessed March 10, 2016).

World Bank Centre for Financial Reporting Reform. (2011). *Corporate Sector Accounting and Auditing in the Acquis Communautaire: A Building Block to the Internal Market,* 2nd Edition. Vienna: The World Bank Centre for Financial Reporting Reform.

World Economic Forum. (2015-2016). Competitiveness Rankings. http://reports.weforum.org/global-competitiveness-report-2015-2016/competitiveness-rankings/#indicatorId=GCI.B.08 (accessed January 20, 2016).

Zapp, K. (1996). Compromise in Slovenia produces a unique privatization process. *Problems of Post-Communism, 43*(3), 60–70.

VALUE INVESTING WITHIN THE UNIVERSE OF S&P500 EQUITIES

GAŠPER SMOLIČ[1]
ALEŠ BERK SKOK[2]

Received: September 9, 2016
Accepted: May 8, 2017

ABSTRACT: *By employing financial data screening we show that profitable value investment strategy can be built within the S&P 500 stock universe. We use simple ranking of stocks based on four screens that we identify as good joint candidates to influence stock returns – book-to-market ratio, return on equity, market capitalization and risk of bankruptcy. As expected, our four-variable portfolio consistently beats the market, which points to the conclusion that – using the standard risk models - investors inefficiently price stocks in the world's most developed capital market. We compare performance of our investment strategy with market performance, and also adjust for risk used in both current conventional asset pricing models – CAPM and Fama & French three-factor model. When comparing performance of our four-variable portfolio strategy to separate single-variable strategies, we find that other strategies record even higher returns. However, returns of such strategies exhibit lower significance levels, and are more volatile than the four-variable investment strategy.*

Keywords: *asset pricing, value investing, investment strategy*
JEL Classification: G12, G11
DOI: 10.15458/85451.41

INTRODUCTION AND MOTIVATION

Already in the middle of the eighties Rosenberg et al. (1985) reported superior value strategy performance on the largest 1,400 stock in the Compustat database between January 1973 and September 1984 and argued that the world's most developed capital market is inefficiently priced. Authors have created a monthly hedge portfolio based upon data available at the prior month's close. The hedge portfolio was created in a way to have equal long and short positions, with high book-to-market stocks being on the long side and low book-to-market stocks being on the short side. During the 12-year period of their study this portfolio had an average monthly return of 0.36 percent. The portfolio was positive 38 out of the 54 studied months.

After the breakthrough article of Fama & French (1992), return between portfolio of value companies (proxied by highest book-to-market ratio) and the one of portfolio of growth

1 University of Ljubljana, Faculty of Economics, PhD Candidate, Ljubljana, Slovenina, e-mail: gasper.smolic@gmail.com

2 University of Ljubljana, Faculty of Economics, PhD Candidate, Ljubljana, Slovenina, e-mail: ales.berk@ef.uni-lj.si@ef.uni-lj.si

companies (proxied by the lowest book-to-market ratio) started even to be considered by the proponents of the market efficiency hypothesis as a risk factor. Value stocks were thus considered by many scholars to be inherently riskier. Fama & French (1992) examined the data in the period July 1963 - December 1990. They created one hundred equally weighted portfolios and showed that the difference in the average monthly returns for the highest book-to-market decile and the lowest book-to-market decile is 0.99 percent. They documented that book-to-market effect exists even when controlling for size as well as vice versa. In each size class, the average returns generally increase as the book-to-market increases and the effect is stronger for the smaller stocks. The high minus low book-to-market portfolio difference is over one percent for smaller size classes, 0.25 percent for the largest size class.

Lakonishok et al. (1994) conducted an interesting study of value and growth stocks in 1994. They evaluated the performance of several value strategies based on several measures, i.e. book-to-market, cash-flow-to-price, earnings-to-price, and growth of sales as well as multi-dimensional measures of value. In their paper growth of sales is used as a measure of value which unlike most measures of value is not a function of the price. They used five years of accounting data, formed equally weighted portfolios and reported the buy and hold returns for five years. The first decile of portfolio based on growth of sales returned 19.5 percent per annum over the five year holding period compared to 12.7 percent of the tenth decile. That gave them an annual difference of 6.8 percentage points. The cash flow to price presented the biggest difference in return between first and last decile of about 11 percentage points per annum. Authors argue that in contrary to Fama & French (1992) value is not a risk factor itself (i.e. they argue value strategies are not fundamentally riskier) as superior returns are a result of suboptimal behaviour of market participants. This view was also shared by some other authors. Namely, at the beginning of the nineties Klarman (1991) believed that the reason for their low price is that they are unheralded or just ignored. According to the author, some securities are very much out of favour in depressed financial markets and can thus be purchased at significant discount relative to other, more in-favour stocks. As with any value investment, the greater the undervaluation, the greater the margin of safety to investors. If we buy at considerable discounts from underlying value, we provide margin of safety for imprecision, bad luck, or analytical error, while avoiding sizable losses. Also Rafael La Porta, Josef Lakonishok, Andrei Schleifer, and Robert Vishny (La Porta et al. 1997) examined the hypothesis that the superior return to the so-called value stocks is the result of expectation errors made by investors. They studied stock price reactions around earnings announcements for value and growth stocks listed on the NYSE, AMEX and NASDAQ over the period of 5 years after portfolio formation. The examined period ranges from 1971 to 1993. The announcement suggested that a significant portion of the return difference between value and growth stocks is attributable to earnings surprises that were systematically more positive for value stocks. Authors note that evidence suggests that behavioural factors play an important role.

This has also been proven outside the United States. Chan et al. (1991) demonstrated the performance of high book-to-market stocks in the Japanese market. Their paper examines returns on Japanese stocks based on four variables: earnings yield, size, book-to-market ratio, and cash flow yield. They have based their research on the data ranging from 1971

to 1988 and their sample includes manufacturing and non-manufacturing companies from Tokyo Stock Exchange as well as delisted stocks. Their findings show a significant relation between the fundamental factors and expected returns. Among four considered factors, the book-to-market ratio was one with the most significant positive impact on expected return. They have found out that firms with large positive book-to-market ratios earn a premium of 1.10% over firms with low, positive book-to-market ratios. Among the examined variables, the book-to-market ratio consistently has the largest coefficient and the highest t-statistic.

More recent study performed by Chui et al. (2013) examines the market using CRSP and DataStream international database. The data range is from February 1980 to June 2003, and includes 40 capital markets. Among other things the authors have evaluated the returns of high and low book-to-market portfolios. Portfolios were sorted into three groups from bottom 30 percentages to top 30 percentages. The average monthly book-to-market effect for the low, medium and high group, were the following: 0.53%, 0.43% and 0.09%. The difference in the book-to-market effect between the low and the high groups is 0.43% per month with a t-statistic of 1.87. They further argue that value premium is significantly higher in countries where investors have higher degree of risk aversion. There is thus substantial evidence that value stocks proxied by low book-to-market ratio outperform and we are interested in designing a simple strategy that is capable of beating the market.

Lakonishok et al. (1994) reported that strategies built with two value measures outperform those using only one variable. They have formed nine groups of stocks and sorted them independently into bottom 30 percent, middle 40 percent and top 30 percent for two measures of value. The high cash flow-to-price and low growth of sales portfolio earned 22.1 percent per annum for five years following the formation period compared to 20.1 percent of the high cash flow to price and 19.5 percent of the low growth of sales decile. The improvements above one-dimensional strategy are similar for other portfolios. They have also restricted the analysis to only large capitalization stocks and found similar return differences between the value and growth stocks, suggesting that value strategies are useful for large stocks as well as small stocks.

One of the most intuitive measures that should perhaps be used in combination with book-to-market is return on equity (ROE). Some authors explicitly show the importance of taking the ROE in consideration when purchasing high book-to-market securities. Based on Value Line database, Wilcox (1984) reported strong relation between price-to-book ratio and the return on equity. Damodaran (2002) also argues that book-to-price ratio is strongly influenced by ROE and shows a connection through stock valuation. Namely, price of the stock P is equal to expected dividends per share divided by the equity return spread (i.e., required rate of return and the company's growth rate):

$$P=\frac{DPS*(1+g)}{k-g} \qquad (1)$$

If we substitute the DPS with earning per share EPS times the pay-out ratio, and further if we know that ROE equals earnings per share EPS divided by book value of equity BV, one can write the value of equity as follows:

$$P = \frac{BV*ROE*(1+g)*Payout\ ratio}{k-g} \qquad (2)$$

Rewriting equation (2) leads us to the following equation explaining the price-to-book ratio (i.e. the inverse of the book-to-price ratio):

$$\frac{P}{B} = \frac{ROE*(1+g)*Payout\ ratio}{k-g} \qquad (3)$$

We can see that the main factors influencing price-to-book ratio are: *first*, return on equity *ROE*, *second*, pay-out ratio, *third*, growth rate, and *fourth*, required rate of return (i.e. risk). Second, third and fourth factor together determine price earnings ratio (*P/E*)[3], and that is why it is no surprise that Sutton (2004) defines price-to-book ratio as a multiple of *ROE* and *P/E* ratio:

$$\frac{P}{B} = \frac{Earnings\ per\ share}{Book\ value\ per\ share\ (end\ period)} X \frac{Current\ market\ price\ per\ share}{Earnings\ per\ share} \qquad (5)$$

A lower return on equity affects the price-to-book ratio directly as well as indirectly through lowering the expected growth and pay-out. Damodaran (2002) argues that the price-to-book ratio of a firm is supposed to be determined by the differential between the return on equity and its cost of equity, and further that if the return on equity exceeds the cost of equity the stock price has a tendency to exceed the book value of equity.

ROE is thus a very good measure to use in justifying price of the stock. However, investors should distinguish between good firms and good investments. Unsophisticated investors may equate a good company with good investment irrespective of the price and put too much emphasis on company's performance (La Porta et al., 1997). Stock of a well performing firm (in terms of ROE), which is selling at extremely high price-to-book multiples, is poised to underperform. Unsophisticated investors may even perceive such stock to be less risky, even though the opposite in the case (La Porta et al., 1997). High ROE in itself does not imply that the stock is a good investment. Bodie et al. (2011) argue that firms with low ROEs can be even better investments if their prices are low enough. The same line of argument is used by Damodaran (2002) in his famous corporate valuation book stating that investors should carefully screen mismatches between of price

3 Again, substitute the DPS with earning per share EPS times the payout ratio in equation (1), and devide both sides by EPS to get a P/E ratio.

book ratios and returns on equity. If we assume that firms within a sector have similar costs of equity and growth opportunities, then ROE is the only variable to play the role in determining undervalued and overvalued stocks. The higher the ROE, the higher the justifiable price to book ratio. Investors should therefore prefer stocks with higher ROE for the same level of price-to-book ratio. Examples of recent empirical research combining price-to-book ratio and ROE are Wilcox & Philips (2005) and Hou et al. (2015). This argumentation is the reason we decided to include ROE together with book-to-price ratio in our tests, and that we expect that strategy using a combination of both measures will improve profitability of our investment strategy.

Building our investment strategy further, we look for further candidates to be included into our investment strategy. In their pioneering work, Fama & French (1992) reported that value premium decreases with company size. The performance difference between high minus low book-to-market portfolio is four-times bigger for smallest companies compared to largest ones. In the paper they argue that size should also be considered as a risk premium, in addition to market risk from the CAPM model and value premium described above. Small companies as such are the preferred strategy for some authors. Banz (1981) examined the empirical relation between the return and the total market value of NYSE common stocks. All common stocks quoted on the NYSE for at least five years between 1926 and 1975 were included in the sample. He found out that the smaller firms have had higher risk-adjusted returns on average than large firms. He went further and determined that the size effect is not linear. The main effect occurs for very small firms while there is little difference in return between average sized and large firms. The author based the empirical tests on a generalized asset pricing model which allows the expected return of a common stock to be a function of risk β and an additional factor, the market value of the equity. In the beginning of the eighties, Basu (1983) also reported size effect. He had examined the sample of companies traded on the NYSE between December 1962 and March 1980. He examined whether the high return associated with stocks that have high earning yields is related to the high return attributed to stocks with small market capitalizations. Conclusion was that small NYSE firms had substantially higher returns than large NYSE firms. Recently, Fama & French (2012) examined international stock returns and accounting data in the period November 1989 to March 2011, obtained from Bloomberg DataStream and Worldscope. Authors confirm presence of the standard size effect. Namely, small extreme value portfolios have higher average returns than the big extreme value portfolios. Based on the stated evidence above, we are including size as an important measure to screen outperforming stocks.

Based on the evidence that multiple-variable screens can improve the strategy, we build our strategy on all three above described drivers of stock performance; *first*, value indicator - proxied by high book-to-market, *second*, return on equity - as a justifier of level of stock pricing, and *third*, size of the company.

All this being argued, one should also bear in mind literature addressing issue of potential underperformance of some stocks with high book-to-ratio values. Namely, Piotroski (2000) establishes that within his database only 44 percent of high book-to-price companies earned positive returns two years after the portfolio formation. He concluded

that universe of high book-to-market stocks also includes companies that exhibit low pricing for a reason. Within this universe, one might find stocks with falling profitability, increasing leverage or/and falling operational efficiency. He argues in his famous paper that researchers should screen out companies that are simply not performing well. This is the reason we have resorted to a financial distress measure being very famous in financial literature – Altman (1968) Z-Score. Altman (1968) uses five financial ratios (working capital, retained earnings, earnings before interest and taxes, sales, and market value of liabilities, every item compared to total assets) to rank companies in terms of bankruptcy risk. High Z-Score means low risk of bankruptcy, and low Z-Score just the opposite – high risk of bankruptcy. The accuracy of the model, reported by many authors (Lie, 2012; Altman, 2000; Gutzeit, 2011;) is high and ranges between 80 and 95 percent, even for non-US companies (Lugovskaya, 2010; Wang, 2010). Based on the evidence of Altman's model success and argumentation of Piotroski regarding the fact that some companies have high book-to-market ratio for a reason (as they are financially distress or approaching such state) we also use Altman Z-Score within our main model.

In this paper we contribute by providing evidence of market inefficiency in the world's most developed capital market, using standard risk measures. Our strategy based on careful selection of variables documented in the literature to contribute to excess stock performance, beats the market. Apart from comparing strategy results with general market index, we also adjust for the two most conventional asset pricing models risk factors, i.e. CAPM and Fama & French three-factor model. Even after controlling for risk, our strategy yields positive excess returns.

In the next chapter we provide description of the data we use and the method, and in the chapter that follows presents results from our tests. The last chapter concludes and lays down orientation for future work.

DATA AND METHOD

We use S&P 500 universe of stocks for our analysis. S&P Dow Jones U.S. indices are designed to reflect the U.S. equity market. The S&P 500 focuses on the largest-capitalization stocks in the market, however since it includes a significant portion of the total value of the market, it is also widely considered to represent the market. The index includes 500 leading companies and captures approximately 80% of available market capitalization (S&P Dow Jones Indices, 2014). We have obtained data for the period 2000 - 2013 from the Bloomberg terminal. We used individual stock price data, dividend data and total return index data with weekly frequency. We have built strategies with holding period of one year, always for periods May-to-May.

The book-to-market ratio is calculated as an accounting book value of equity provided by each company at year end divided by the company stocks' current closing market price. Market capitalization is calculated as closing market price of common equity at the date of portfolio rebalancing multiplied by the number of common stocks issued. Altman's

Z-Score is calculated only for industrial corporations; financial corporations were ignored and deleted from the database. The return on equity is calculated as a five-year average return on equity, considered to be normalized so that annual cyclical swings could not influence the analysis.

Investment strategy design:
We always arbitrarily select 20 companies to construct our strategies. Companies are selected based on the four metrics, namely the five-year average reported return on equity (ROE), book-to-market ratio (BtM), Altman's Z-score (AZS) and market capitalization (MCap). Every stock receives ranking score in each separate metric (i.e. stock with the highest ROE reading gets score 1, the second highest score 2, etc.; also stock with the highest book-to-market reading gets score 1, the second highest score 2, etc.). Each metric is equally weighted meaning that 20 stocks with the lowest joint score qualify to form the portfolio. Each of the 20 companies represents an equal stake (1/20). The portfolio is rebalanced every year in May.

In addition to the main investment strategy - we label this strategy as 4VP standing for Four Variables Portfolio - we also created partial strategy only including BtM & ROE joint screening – i.e. every year 20 companies were selected based on the BtM ratio and average five-year ROE screens. The 20 companies with the lowest sum of rankings were included in portfolio each year.

We also check what is performance of the four building blocks of our strategy. We measure performance of:

- BtM portfolio – i.e. in every year 20 companies that were included in S&P 500 with the highest rank according to the BtM metric were included in the portfolio;
- ROE portfolio – i.e. in every year 20 companies that were included in S&P 500 with the highest five-year average ROE metric were included in the portfolio;
- MCap portfolio – i.e. every year 20 of the smallest companies by market capitalization measure that were part of the S&P 500 index were included in the portfolio.
- AZS portfolio – i.e. in every year 20 companies that were included in S&P 500 with the highest rank of Altman's Z-Score (i.e. the most distant from bankruptcy) were included in the portfolio.

Return calculation:
We measured returns as total returns, taking account also of received dividends on all included stocks within the strategy. We thus added dividends D_t received during the past year to the each company's stock price at the end of the year P_{t+1}, and divided the sum by the price of a stock at the portfolio construction date P_t. We assumed no dividend reinvesting up to the end of formation year. Dividends are thus assumed to be held as cash until the date of portfolio rebalancing. While rebalancing these dividends would be used as receipts to buy new stock, based on the same screening criteria.

Individual stock returns were then weighted with their relative size in the portfolio. Since the portfolio consisted of 20 corporations and each was assigned equal weight, the returns

were multiplied with 1/20 and summed up. The result of this calculation is the portfolio yearly return. After calculating these, the cumulative return and compound annual rate of return were calculated for all portfolios in order to facilitate comparison across different strategies.

We have used three standard risk-adjustment techniques for comparing our strategies returns' in the literature. Each individual portfolio performance was then compared against the used benchmark return. *First*, we used market return. We calculated total S&P 500 return (i.e. return including dividend, using the same formula as presented above) over the same period as we calculated returns for our strategies.

Second, we have used CAPM model of Sharpe (1964), Lintner (1965) and Mossin (1966) to take account of systematic risk of our portfolio selected stocks. Betas were calculated as raw betas for a two-year period and calculated against the S&P 500 index. They are stated as a volatility measure of the percentage price change of the security given a one percent change in the representative market index. The beta values were determined by comparing the price movements of the security and the representative market index for the weekly data over past two years. The risk free rates were estimated using the one year U.S. Treasury bill yield to maturity on the date of portfolio rebalancing. We thus use risk free rate over the same period as our strategy. Market returns were calculated as S&P500 return over the observed period and treated in the same way as portfolio returns in other calculations.

Third, we have used additional two Fama & French (1992) factors to additionally test for value and size factors of our return. We have retrieved Fama & French annual benchmark factors from Kenneth R. French Data Library. Data was used in performing a regression analysis of excess returns against the small market capitalization companies' excess returns, large book-to-market corporations' excess returns and market over the risk free rate excess returns. According to the website, the Fama & French factors are constructed using the 6 value weighted portfolios. Small minus big is the average return on three small portfolios minus the average return on three big portfolios.

RESULTS

As outlined in the Table AI.1, Panel A, portfolio based on four variables has grown with a compounded annual growth rate of 9.01% over the observed period, resulting in a cumulative return of 206.86%. The standard deviation of observed returns amounted to 0.265, with a Sharpe ratio of 0.248. As shown in the Panel C, when compared to a market returns, as a first benchmark, selected portfolio has generated excess returns in eight out of 13 observed periods, beating S&P500 index in terms of compound annual return (hereafter: CAR) by 6.5 percentage points. The difference was proven to be significant at a five percent level. If we further observe the Table AI.2, Panel D, taking into account CAPM risk, our portfolio has generated an alpha in terms of CAR of 6.63 percentage points, significant at five percent level. Further, comparing portfolio returns to Fama &

French adjusted performance (see Panel C of Table AI.3), selected portfolio has again produced alpha in terms of CAR of 2.23 percentage points, significant at ten percent level. As indicated in the Panel B of Table AI.2, portfolio betas have ranged between 0.75 in 2001 and 1.26 in both 2003 and 2010. Maximum portfolio drawdowns, shown in a Table AII.1, have amounted to -51%, a 12.8 percentage points more compared to a maximum index return drawdown.

Observing the Table AI.1, Panel A, BtM&ROE portfolio has grown with a compounded annual growth rate of 9.34% over the observed period, resulting in cumulative return of 219.28%. The standard deviation of observed returns amounted to 0.251, with a Sharpe ratio of 0.276. As shown in the Panel C, when compared to a market returns, as a first benchmark, selected portfolio has generated excess returns in nine out of 13 observed periods, beating S&P500 in terms of CAR by 6.83 percentage points. The difference has proven to be significant at ten percent level. If we further observe the Table AI.2, Panel D, taking into account CAPM captured risk, our portfolio has generated an alpha in CAR of 5.87 percentage points. Further, comparing portfolio returns to Fama & French adjusted performance (see Panel C of Table AI.3), selected portfolio has again produced alpha in terms of CAR amounting to 3.98 percentage points. As indicated in the Panel B of Table AI.2, portfolio betas have ranged between 0.66 in 2001 and 1.45 in 2008. Maximum portfolio drawdowns, shown in a Table AII.1, have amounted to -69.8%, a 31.6 percentage points more compared to a maximum index return drawdown.

Table AI.1, Panel A, shows that BtM portfolio has grown with a compounded annual growth rate of 11.21% over the observed period, resulting in cumulative return of 297.85%. The standard deviation of observed returns amounted to 0.308, with a Sharpe ratio of 0.285. As shown in the Panel C, when compared to a market returns, as a first benchmark, selected portfolio has generated excess returns in ten out of 13 observed periods, beating S&P500 in terms of CAR by 8.7 percentage points. The difference has proven to be significant at ten percent level. If we further observe the Table AI.2, Panel D, taking into account CAPM captured risk, our portfolio has generated alpha in terms of CAR of 8.02 percentage points, significant at ten percent level. Further, comparing portfolio returns to Fama & French adjusted performance (see Panel C of Table AI.3), selected portfolio has again produced alpha in terms of CAR amounting to 4.97 percentage points. As indicated in the Panel B of Table AI.2, portfolio betas have ranged between 0.58 in 2001 and 1.61 in 2003. Maximum portfolio drawdowns, shown in a Table AII.1, have amounted to -31.1%, a 7.1 percentage points less compared to a maximum index return drawdown.

Observing the ROE portfolio, Table AI.1, Panel A, shows that the portfolio has grown with CAR of 7.96% over the observed period, resulting in cumulative return of 170.65%. The standard deviation of observed returns amounted to 0.203, with a Sharpe ratio of 0.273. As shown in the Panel C, when compared to a market returns, as a first benchmark, selected portfolio has generated excess returns in eight out of 13 observed periods, beating S&P500 in terms of CAR by 5.45 percentage points. If we further observe the Table AI.2, Panel D, taking into account CAPM captured risk, our portfolio has generated an alpha in terms of CAR of 4.79 percentage points. Further, comparing portfolio returns to Fama & French

adjusted performance (see Panel C of Table AI.3), selected portfolio has again produced alpha in terms of CAR amounting to 4.11 percentage points. As indicated in the Panel B of Table AI.2, portfolio betas have ranged between 0.66 in 2002 and 1.06 in 2008. Maximum portfolio drawdowns, shown in a Table AII.1, have amounted to -20%, a 18.2 percentage points less compared to a maximum index return drawdown.

As seen in the Table AI.1, Panel A, portfolio based on size has grown with a compounded annual growth rate of 14.46% over the observed period, resulting in cumulative return of 497.05%. The standard deviation of observed returns amounted to 0.399, with a Sharpe ratio of 0.302. As shown in a Panel C, when compared to a market returns, as a first benchmark, selected portfolio has generated excess returns in eight out of 13 observed periods, beating S&P500 in terms of CAR by 11.95 percentage points. The difference has proven to be significant at a ten percent level. If we further observe the Table AI.2, Panel D, taking into account CAPM captured risk, our portfolio has generated an alpha in terms of CAR of 10.23 percentage points, significant at a ten percent level. Further, comparing portfolio returns to Fama & French adjusted performance (see Panel C of Table AI.3), selected portfolio has again produced alpha in terms of CAR amounting to 9.09 percentage points. As indicated in the Panel B of Table AI.2, portfolio betas have ranged between 0.60 in 2001 and 1.45 in 2003. Maximum portfolio drawdowns, shown in a Table AII.1, have amounted to -32.8%, a 5.4 percentage points less compared to a maximum index return drawdown.

Observing Altman portfolio, looking at the Table AI.1, Panel A, portfolio has grown with a compounded annual growth rate of -5.81% over the observed period, resulting in cumulative return of -54.10%. The standard deviation of observed returns amounted to 0.235, with a Sharpe ratio of -0.35. As shown in a Panel C, when compared to a market returns, as a first benchmark, selected portfolio has generated excess returns in four out of 13 observed periods, beating S&P500 in terms of CAR returns by -8.32 percentage points. If we further observe the Table AI.2, Panel D, taking into account CAPM captured risk, our portfolio has generated an alpha in terms of CAR of -4.82 percentage points. Further, comparing portfolio returns to Fama & French adjusted performance (see Panel C of Table AI.3), selected portfolio has again produced alpha in terms of CAR amounting to -9.23 percentage points. As indicated in the Panel B of Table AI.2, portfolio betas have ranged between 1.04 in 2009 and 2.08 in 2002. Maximum portfolio drawdowns, shown in a Table AII.1, have amounted to -40.9%, a 2.7 percentage points more compared to a maximum index return drawdown.

Comparing portfolio drawdowns one can observe that ROE portfolio, proven not to be superior to other investigated strategies, has turned out to be a leading portfolio in this aspect as seen from the table AII.1. On the other hand, BtM&ROE portfolio, proven to be a strong in other aspects, has lagged behind on this criteria, having the largest observed drawdown of near 70 percent, more than 30 percent higher compared to the benchmark index.

CONCLUSION

Since the middle of the eighties value stocks proxied by high book-to-market stock have been found to be outperforming the market, which led authors to question validity of efficient market hypothesis. In the beginning of the nineties Fama & French (1992) even postulated return difference between high and low book-to-market stock as a risk premium, for which CAPM model should be improved. Authors started to justify book-to-market ratio by return on equity and argued that better-performing business should be worth relatively more that worse-performing counterparts. Further, quest for better performance also offered insight into performance of strategies built around multiple screens. This is why, we developed a strategy that is based on book-to-market screen, return on equity and also size. The latter was also found to have superior impact on stock performance. As some high book-to-market stocks are priced relatively low for the fact they exhibit (near) financial distress, we include also Altman Z-Score reading in order to filter out companies that have higher probability of becoming bankrupt.

Our results are in line with our expectations. Our four-variable investment strategy was superior to all the tested partial strategies in terms of significance. While interestingly, individual factors such as size, value and ROE have again proven to be important determinants of excess returns (i.e. some have shown even higher returns compared to the four-variable investment strategy), they exhibited much higher volatility and lower significance levels. With 9.01% compound annual return our four-variable strategy significantly (at level below 5%) outperformed market by 6.5 percentage points, which is more than 2.5-time the compound annual market return. The strategy has also beaten both conventional risk models, i.e. CAPM by 6.63 percentage points (at significance level below 5%) and Fama-French three-factor model by 2.23 percentage points at significance level below 10%), delivering returns significantly above the calculated benchmarks.

This paper represents an important building block for further exploration of possibilities of how to improve value investment strategy design. We are interested at extending the data to longer period and into the international markets, and perhaps also forming long-short investment strategies in order to also show the difference in returns towards stocks with worst rankings by the chosen metrics. It would also make a lot of sense to simulate daily returns from different portfolio construction dates, and test for optimal holding period. Also improved ranking system of stock attributes based on regression analysis has great potential to improve the strategy even further.

REFERENCES

1. Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *The Journal of Finance*, *23*(4), 589–609.

2. Altman, E. I. (2000). Predicting Financial Distress of Companies: Revisiting the Z-Score and ZETA models.

3. Banz, R. W. (1980). The relationship between return and market value of common stocks. *Journal of Financial Economics*, *9*(1), 3–18.

4. Basu, S. (1983). The Relationship Between Earnings Yield, Market Value and Return for NYSE Common Stocks. *Journal of Financial Economics*, *12*(1), 129–156.

5. Bodie, A. K. (2011). Investments. New York: McGraw-Hill Companies, Inc.

6. Chan, L.K.C., Hamao, Y. & Lakonishok, J. (1991). Fundamentals and Stock Returns in Japan. *Journal of Finance*, *46*(5), 1739–1764.

7. Chui, A.C.W., Titman, S., Wei, K.C.J. & Xie, F. (2012). Explaining the Value Premia Around the World: Risk or Mispricing? EFA 2012 conference paper.

8. Damodaran, A. (2002). *Investment Valuation.* New York: John Wiley & Sons.

9. Fama, E. F. & French K. R. (1992). The Cross Section of Expected Stock Returns. *Journal of Finance*, *47*(2), 427–465.

10. Fama, E. F. & French K. R. (2012). Size, Value, and Momentum in International Stock Returns. *Journal of Finacial Economics*, *105*(3), 457–472.

11. Gutzeit, G. a. (2011). Z-Score performance Amid Great Recession. *American Bankruptcy Institute Journal*, *30*, 44, 45, 80.

12. Hou, K., Xue, C., & Zhang, L. (2015). Digesting Anomalies: An Investment Approach, *The Review of Financial Studies, 18*(3), 650–705.

13. Klarman, S. A. (1991). *Margin of Safety, Risk Averse Value Investing Strategies for the Thoughtful Investor.* New York: HarperBusiness.

14. Lakonishok J., Shleifer J. & Vishny R. W. (1994). Contrarian Investment, Extrapolation, and Risk. *Journal of Finance*, *49*(5), 1541–1571.

15. Li, J. (2012). Prediction of Corporate Bankruptcy from 2008 Through 2011. *Journal of Accounting and Finance, 12*(1), 31–41.

16. Lintner, John (1965). *The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets*, Review of Economics and Statistics, *47*(1), 13–37.

17. Lugovskaya, L. (2010). Predicting Default of Russian SMEs on The Basis of Financial and Non-Financial Variables. *Journal of Financial Services Marketing*, *14*, 301–313.

18. Mossin, Jan. (1966). *Equilibrium in a Capital Asset Market*, Econometrica, *34*(4), 768–783.

19. Piotroski, J. D. (2000). Value Investing: The Use of Historical Financial Statement Information to Separate Winners. *Journal of Accounting Reseach*, *38*, 1–41.

20. Rosenberg, B., Reid K. & Lanstein R. (1985). Persuasive Evidence of Market Inefficiency. *Journal of Portfolio Management*, *11*(3), 9–16

21. S&P Dow Jones Indices. (2014). *Index Methodology.*

22. Sharpe, William F. (1964). *Capital asset prices: A theory of market equilibrium under conditions of risk*, Journal of Finance, *19*(3), 425–442.

23. Sutton, T. (2004). *Corporate Financial Accounting and Reporting.* Glasgow: Prentice Hall.

24. Wang, Y. a. (2010). Business Failure prediction for Publicly Listed Companies in China. *Journal of Business and Management*, *16*(1), 75–88.

25. Wilcox, J. W. (1984). The P/B-ROE Valuation Model. *Financial Analysts Journal*, 58-66.

26. Wilcox, J. W., & Philips, T. K. (2005). The P/B-ROE Valuation Model Revisited. *Journal of Portfolio Management*, vol. 31, no. 4, 56-66.

Appendix I: Performance

Table AI.1: Raw strategy returns and performance measures compared to benchmark market portfolio (in %, except STD and SR/IR)

In Panel A raw strategy annual returns are presented, their cumulative 2001-2013 returns (CR), compound annual return (CAR), annual standard deviations, and Sharpe ratios (SR). In Panel B annual average risk free rates and annual S&P500 index returns are presented. Panel C reports annual strategy excess returns above S&P500 returns, i.e. alphas of every investment strategy. Instead of SR, information ratio (IR) is reported in the last column.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	CR	CAR	STD	SR/IR
Panel A: Strategy performance																	
4VP	24.28	11.48	-3.72	36.24	3.21	22.22	4.12	-18.17	-40.13	47.38	16.91	-3.41	57.67	206.86	9.01	0.265	0.248
BtM&ROE	12.89	13.69	-16.55	35.22	12.99	20.94	-0.06	12.74	-40.86	53.62	20.22	-8.39	43.12	219.28	9.34	0.251	0.276
BtM	14.32	6.02	-31.06	70.67	4.61	26.23	19.32	0.74	-28.83	65.16	22.19	-10.75	37.11	297.85	11.21	0.308	0.285
ROE	13.71	-2.28	-16.71	28.49	-2.61	2.63	18.93	-2.56	-17.91	40.08	9.15	4.64	49.59	170.65	7.96	0.203	0.273
MCAP	8.96	10.08	-31.07	72.64	-2.91	70.30	22.83	-10.07	-25.25	89.06	6.63	-8.52	61.15	497.05	14.46	0.399	0.302
AZS	-40.84	-20.98	-15.25	26.55	-10.53	6.33	0.72	-9.89	-30.26	47.30	15.53	-0.69	-10.02	-54.10	-5.81	0.235	-0.350
Panel B: Market performance																	
Risk free rate	6.24	3.91	2.33	1.21	1.60	3.34	4.97	4.89	1.94	0.49	0.43	0.22	0.19	36.53	2.42	0.020	0.000
S&P500	-12.74	-13.03	-14.12	24.07	5.85	14.41	16.02	-3.28	-36.07	39.91	15.50	5.53	15.16	37.97	2.51	0.199	0.005
Panel C: Alphas above market																	
4VP	37.02	24.51	10.40	12.17	-2.64	7.81	-11.90	-14.89	-4.06	7.47	1.41	-8.95	42.52	168.89	6.50**	0.179	0.228
BtM&ROE	25.63	26.72	-2.43	11.14	7.13	6.52	-16.08	16.02	-4.79	13.71	4.72	-13.93	27.96	181.31	6.83*	0.145	0.305
BtM	27.06	19.05	-16.94	46.60	-1.25	11.82	3.30	4.03	7.24	25.25	6.69	-16.29	21.96	259.88	8.7*	0.176	0.356
ROE	26.45	10.75	-2.59	4.42	-8.46	-11.79	2.91	0.72	18.16	0.17	-6.35	-0.89	34.43	132.68	5.45	0.137	0.221
MCAP	21.70	23.10	-16.95	48.57	-8.76	55.88	6.81	-6.79	10.82	49.15	-8.86	-14.06	45.99	459.08	11.95*	0.267	0.356
AZS	-28.10	-7.95	-1.13	2.48	-16.39	-8.08	-15.31	-6.61	5.81	7.39	0.03	-6.23	-25.18	-92.07	-8.32	0.111	-0.969

Notes: BtM – book-to-market strategy, MCAP – market cap strategy, ROE – return on equity strategy, BtM&ROE – combined book-to-market and return on equity strategy, AZS – Altma Z-score strategy, 4VP – four variables portfolio strategy; In Panel C, one-sided t-tests are calculated for alphas above the market, measured as CARs – compound annual returns. Significance levels are stated as follows: *** at 1% level; ** at 5% level; * at 10% level.

Table AI.2: Raw strategy returns and CAPM-adjusted performance measures (in %, except betas, STD and SR/IR)

In Panel A raw strategy annual returns are presented, their cumulative 2001-2013 returns (CR), compound annual return (CAR), annual standard deviations, and Sharpe ratios (SR). In Panel B strategy CAPM model betas are presented. Panel C reports annual returns of each strategy when corrected for market (CAPM) risk. Panel D reports annual strategy excess returns above CAPM risk-adjusted returns. In column CAR significance of excess returns is reported. Instead of SR, information ratio (IR) is reported in the last column.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	CR	CAR	STD	SR
Panel A: Strategy performance																	
4VP	24.28	11.48	-3.72	36.24	3.21	22.22	4.12	-18.17	-40.13	47.38	16.91	-3.41	57.67	206.86	9.01	0.265	0.248
BtM&ROE	12.89	13.69	-16.55	35.22	12.99	20.94	-0.06	12.74	-40.86	53.62	20.22	-8.39	43.12	219.28	9.34	0.251	0.276
BtM	14.32	6.02	-31.06	70.67	4.61	26.23	19.32	0.74	-28.83	65.16	22.19	-10.75	37.11	297.85	11.21	0.308	0.285
ROE	13.71	-2.28	-16.71	28.49	-2.61	2.63	18.93	-2.56	-17.91	40.08	9.15	4.64	49.59	170.65	7.96	0.203	0.273
MCAP	8.96	10.08	-31.07	72.64	-2.91	70.30	22.83	-10.07	-25.25	89.06	6.63	-8.52	61.15	497.05	14.46	0.399	0.302
AZS	-40.84	-20.98	-15.25	26.55	-10.53	6.33	0.72	-9.89	-30.26	47.30	15.53	-0.69	-10.02	-54.10	-5.81	0.235	-0.350
Panel B: Betas																	
4VP	0.75	1.20	1.26	1.07	1.07	1.16	1.24	1.25	1.13	1.26	0.90	1.03	1.09				
BtM&ROE	0.66	0.83	1.01	1.02	0.78	1.22	1.38	1.45	1.20	1.41	0.99	1.12	1.25				
BtM	0.58	0.93	1.61	1.28	0.99	1.29	0.98	1.16	1.13	1.27	1.02	1.03	1.42				
ROE	0.68	0.66	0.61	0.77	0.81	0.81	1.01	1.06	0.87	0.86	0.67	0.82	0.81				
MCAP	0.60	0.97	1.45	1.18	1.52	1.39	1.19	1.15	1.12	1.33	1.43	1.25	1.33				
AZS	1.56	2.08	1.59	1.21	1.46	1.38	1.25	1.36	1.04	0.91	0.91	1.12	1.05				
Panel C: CAPM-adj. perform.																	
4VP	-8.02	-16.34	-18.46	25.59	6.13	16.20	18.72	-5.33	-40.98	50.05	14.06	5.70	16.46	35.80	2.38	0.231	-0.002
BtM&ROE	-6.37	-10.10	-14.32	24.58	4.93	16.86	20.24	-6.92	-43.86	56.26	15.42	6.15	18.97	57.67	3.56	0.240	0.047
BtM	-4.81	-11.90	-24.09	30.45	5.81	17.64	15.85	-4.57	-41.17	50.54	15.79	5.69	21.42	50.40	3.19	0.239	0.032
ROE	-6.67	-7.35	-7.71	18.92	5.05	12.27	16.14	-3.81	-31.26	34.45	10.51	4.55	12.30	49.95	3.17	0.162	0.046
MCAP	-5.15	-12.52	-21.49	28.21	8.06	18.72	18.13	-4.49	-40.82	53.05	21.91	6.86	20.09	71.31	4.23	0.241	0.075
AZS	-23.43	-31.30	-23.85	28.89	7.82	18.68	18.74	-6.26	-37.68	36.43	14.17	6.18	15.84	0.87	0.06	0.240	-0.098
Panel D: Alphas above CAPM																	
4VP	32.30	27.82	14.74	10.65	-2.92	6.02	-14.60	-12.84	0.85	-2.67	2.85	-9.11	41.22	171.06	6.63**	0.175	0.378
BtM&ROE	19.26	23.79	-2.23	10.63	8.06	4.08	-20.30	19.66	3.00	-2.64	4.80	-14.54	24.15	161.61	5.78	0.139	0.417
BtM	19.13	17.92	-6.97	40.23	-1.20	8.59	3.47	5.32	12.34	14.62	6.40	-16.45	15.70	247.45	8.02*	0.139	0.579
ROE	20.39	5.07	-9.00	9.57	-7.66	-9.65	2.79	1.25	13.34	5.63	-1.36	0.09	37.29	120.70	4.79	0.130	0.369
MCAP	14.11	22.60	-9.59	44.43	-10.97	51.57	4.71	-5.58	15.56	36.01	-15.27	-15.38	41.06	425.74	10.23*	0.241	0.424
AZS	-17.41	10.32	8.60	-2.33	-18.36	-12.34	-18.03	-3.64	7.42	10.86	1.35	-6.87	-25.86	-54.97	-4.82	0.125	-0.470

Notes: BtM – book-to-market strategy, MCAP – market cap strategy, ROE – return on equity strategy, BtM&ROE – combined book-to-market and return on

equity strategy, AZS – Altman Z-score strategy, 4VP – four variables portfolio strategy; In Panel D, one-sided t-tests are calculated for alphas above the CAPM, measured as CARs – compound annual returns. Significance levels are stated as follows: *** at 1% level; ** at 5% level; * at 10% level.

Table AI.3: Raw strategy returns and Fama & French-adjusted performance measures (in %, except STD and SR/IR)

In Panel A raw strategy annual returns are presented, their cumulative 2001-2013 returns (CR), compound annual return (CAR), annual standard deviations, and Sharpe ratios (SR). In Panel B reports annual returns of each strategy when corrected for risk according to Fama & French three-factor model. Panel C reports annual strategy excess returns above Fama & French risk-adjusted returns. In column CAR significance of excess returns is reported. Instead of SR, information ratio (IR) is reported in the last column.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	CR	CAR	STD	SR/IR
Panel A: Strategy performance																	
4VP	24.28	11.48	-3.72	36.24	3.21	22.22	4.12	-18.17	-40.13	47.38	16.91	-3.41	57.67	206.86	9.01	0.265	0.248
BtM&ROE	12.89	13.69	-16.55	35.22	12.99	20.94	-0.06	12.74	-40.86	53.62	20.22	-8.39	43.12	219.28	9.34	0.251	0.276
BtM	14.32	6.02	-31.06	70.67	4.61	26.23	19.32	0.74	-28.83	65.16	22.19	-10.75	37.11	297.85	11.21	0.308	0.285
ROE	13.71	-2.28	-16.71	28.49	-2.61	2.63	18.93	-2.56	-17.91	40.08	9.15	4.64	49.59	170.65	7.96	0.203	0.273
MCAP	8.96	10.08	-31.07	72.64	-2.91	70.30	22.83	-10.07	-25.25	89.06	6.63	-8.52	61.15	497.05	14.46	0.399	0.302
AZS	-40.84	-20.98	-15.25	26.55	-10.53	6.33	0.72	-9.89	-30.26	47.30	15.53	-0.69	-10.02	-54.10	-5.81	0.235	-0.350
Panel B: FF-adj. performance																	
4VP	19.22	8.19	-15.02	30.46	22.51	11.62	26.94	-15.40	-40.96	43.14	14.04	-5.40	22.60	134.71	6.78	0.230	0.190
BtM&ROE	2.68	1.11	-18.55	36.16	18.68	8.92	21.89	-5.53	-40.75	39.93	18.52	-2.63	20.22	97.13	5.36	0.220	0.133
BtM	-2.51	6.88	-21.93	51.21	22.85	8.75	24.40	-7.54	-48.62	51.43	26.06	-4.05	23.48	119.64	6.24	0.279	0.137
ROE	7.56	-5.97	-15.81	20.84	14.46	9.22	19.50	-3.16	-33.63	28.37	10.95	-0.99	17.26	63.37	3.85	0.170	0.084
MCAP	5.37	3.10	-25.97	50.19	26.96	11.80	30.21	-12.73	-58.26	57.71	25.28	-4.77	29.04	97.46	5.37	0.315	0.094
AZS	-23.43	-1.97	-17.49	42.97	9.89	2.61	9.93	10.70	-29.26	29.17	23.92	1.07	11.28	54.74	3.42	0.205	0.049
Panel C: Alphas above FF																	
4VP	5.06	3.29	11.30	5.78	-19.30	10.61	-22.82	-2.77	0.83	4.24	2.87	1.98	35.08	72.15	2.23%*	0.141	0.159
BtM&ROE	10.20	12.59	2.01	-0.94	-5.69	12.02	-21.95	18.27	-0.11	13.69	1.70	-5.76	22.90	122.15	3.98	0.120	0.330
BtM	16.84	-0.86	-9.13	19.46	-18.24	17.48	-5.08	8.28	19.79	13.73	-3.88	-6.70	13.64	178.21	4.97	0.128	0.387
ROE	6.15	3.69	-0.90	7.65	-17.07	-6.59	-0.56	0.60	15.71	11.71	-1.80	5.63	32.34	107.28	4.11	0.118	0.349
MCAP	3.58	6.97	-5.11	22.45	-29.87	58.49	-7.37	2.65	33.01	31.36	-18.65	-3.76	32.11	399.59	9.09	0.245	0.371
AZS	-17.41	-19.01	2.24	-16.41	-20.42	3.72	-9.22	-20.59	-1.00	18.13	-8.39	-1.77	-21.31	-108.84	-9.23	0.122	-0.758

Notes: BtM – book-to-market strategy, MCAP – market cap strategy, ROE – return on equity strategy, BtM&ROE – combined book-to-market and return on equity strategy, AZS – Altman Z-score strategy, 4VP – four variables portfolio strategy; In Panel C, one-sided t-tests are calculated for alphas above the Fama-French three factor model returns, measured as CARs – compound annual returns. Significance levels are stated as follows: *** at 1% level ; ** at 5% level; * at 10% level.

Appendix II: Drawdown

Table AII.1: Maximal strategy drawdowns (DD) measured as percentage between the peak and the subsequent trough

	Max DD	Difference to S&P500 DD
4VP	-51	-12.8
BtM&ROE	-69.8	-31.6
BtM	-31.1	7.1
ROE	-20	18.2
MCAP	-32.8	5.4
AZS	-40.9	-2.7

Notes: BtM – book-to-market strategy, MCAP – market cap strategy, ROE – return on equity strategy, BtM&ROE – combined book-to-market and return on equity strategy, AZS – Altman Z-score strategy, 4VP – four variables portfolio strategy.

THE EFFECTS OF OUTSOURCING AND OUTWARD FDI ON SKILL STRUCTURE IN SLOVENIA: EVIDENCE ON MATCHED FIRM-EMPLOYEE DATA

MOJCA LINDIČ[1]

Accepted: June 12, 2017
Received: October 10, 2016

ABSTRACT: *This paper studies the effect of outsourcing and outward FDI on firms' skill structure. Its main contributions consist of studying changes in the skill structure that can be associated with outsourcing and outward FDI to high- and low-income countries, and including a new dimension when defining skills, which also controls for occupational classification of workers. The analysis employs a matched employer-employee dataset for Slovenian manufacturing and service firms between 1997 and 2010. The results indicate that outward FDI to high- and low-income countries has a positive impact on the skill share in manufacturing firms. The results also show that in the case of some occupational groups firms prefer to employ more educated individuals.*

Keywords: *skill structure, FDI, outsourcing, skill differentiation, manufacturing and service firms.*
JEL classification: F14, F16
DOI: 10.15458/85451.40

1. INTRODUCTION

Globalisation has changed the world dramatically in the most recent decades, with trade liberalisation and technology improvements leading to lower trade barriers and to the drop of transportation and communication costs (IMF, 2013). In line with these changes, transnational companies change and adjust the structure and organisation of their value added activities, where outward foreign direct investment (FDI) and outsourcing are among their main methods of strategic positioning. Forecasts on increasing internationalisation specify that firms will carry out even more of their activities outside of their enterprises in the future; for instance by increasing FDI flows, or by increasing foreign affiliate activity (UNCTAD, 2013). Studies argue that outward FDI and outsourcing activities are likely to depend upon several determinants in the future (see for example Baldwin, 2013). First, increasing developments in coordination and communication technology would make the supply chains more complex in terms of the number of stages and countries involved. On the other hand, improvements in information technology would combine different stages of production and thus lead to less complex supply chains. Widening or narrowing the

1 This paper was prepared when Mojca Lindič was employed at the University of Ljubljana, Faculty of Economics, Ljubljana, Slovenia, e-mail: mojca.lindic@ef.uni-lj.si

wage gap between developed and developing countries is also expected to have a significant impact. Following the "new trade theory", the growth of developing countries would increase the overall trade, while increasing wages and income convergence of emerging markets would cause the flying geese pattern. Finally, an important factor will also be transportation costs, especially oil prices. Increasing oil prices would influence the geography of supply chains, which would consequently become more regional (Baldwin, 2013).

Although empirical studies confirm a significant impact of outward FDI and outsourcing on the skill structure of firms in developed countries, they do not control for both factors in a single model. On average, studies conclude that through increased import competition from low-wage countries, which transfers labour demand towards more skilled workers (Feenstra & Hanson, 1996), outward FDI and outsourcing have a positive impact on the employment of skilled labour (see for example Mion & Zhu, 2013, Hijzen, Görg, & Hine, 2005, Strauss-Kahn, 2003, Egger & Egger, 2003, and Feenstra & Hanson, 1996). Positive impact on the skill structure of firms in developed countries is a consequence of relocating the unskilled labour-intensive production to countries abundant with unskilled labour, whereas high-technology stages of productions continue to be produced in developed countries (Hijzen, Görg, & Hine, 2005). In addition, analysing Slovenian data, Drenkovska and Redek (2015) find that internationalization offers firms access to more developed and competitive markets, which in turn has a positive impact on Slovenian exporters.

The paper is motivated to analyse the following goals. The first aim is to measure the effect of outward FDI and outsourcing on the skill structure of firms. To the best of my knowledge, previous empirical models controlled for only one of the measures at a time and on average confirmed a positive impact of outward FDI or outsourcing on the skilled labour in developed countries. Not controlling for both factors in one model might lead to the missing variable bias. In addition, it is important to account for both factors since their combined effect is expected to increase in the future (see for example UNCTAD, 2013 and Baldwin, 2013). In addition, a new dimension is added for defining skills, which controls also for the occupational classification of workers. It is important to take this into account since workers gain their skills not only by formal education but also through various forms of vocational trainings and during their work career. The final aim is to control for the income level of outward FDI and outsourcing destinations, since previous studies indicate shifts of unskilled-intensive parts of production to countries abundant with relatively less-skilled labour. As a result, one would expect outsourcing from high-income countries and outward FDI to low-income countries to have a positive impact on the relative employment of skilled workers in the home country. The reasoning behind is that outsourcing from high-income countries enables firms to have access to technologically more advanced intermediate inputs, which in turn demand the employment of highly skilled workers. On the other hand, outward FDI to low-income countries might shift some of the more manually-intensive parts of production abroad and keep the high value added departments in the home country (as for example research, sales, marketing, finance, etc.).

The analysis employs a matched firm-employee panel dataset for Slovenian firms in the period from 1997 to 2010. Outsourcing is defined as the ratio between firm's value of

intermediate imports and its value of total material costs, while a dummy variable controls for a presence of outward FDI in a firm. Results of the basic model indicate to a positive impact of outward FDI on the relative employment of tertiary educated workers in manufacturing firms, and to a positive impact of outsourcing on the relative employment of skilled workers in service firms. The results confirm it is important to account for differential effect of the two measures in one model, as their impact on the skill structure of firms differs. In addition, outward FDI to low- and high-income countries shows a positive impact on the relative employment of skilled labour in manufacturing firms. In service firms, results are not statistically significant. Finally, results show that the impact of educational level differs between occupational groups, indicating that firms give different emphasis on educational level when employing different occupational groups.

The remainder of the paper is organised as follows. In the next section, a brief summary of the relevant literature is given. Section three introduces the methodology used, whereas section four describes the data and presents descriptive statistics. The empirical analysis and discussion of results are included in section five. The last section summarises and provides conclusions.

2. LITERATURE REVIEW

First are discussed theoretical models which explore the effects of outsourcing and outward FDI on the labour demand. Since there is not a unique definition of outsourcing and outward FDI/offshoring in the literature, the terms will be used interchangeably throughout the literature review, following the terminology used by the authors of the studies.

Grossman and Rossi-Hansberg (2008) study the impacts of the falling offshoring costs on factor prices in the home country by differentiating between trade in goods, which is the conventional meaning of trade, and trade in tasks, which relates to adding a value to goods in different locations. In the model, offshoring influences the firms' performance positively by allowing them to hire some factors abroad at a lower price. On the other hand, offshoring also brings costs as the monitoring and management of workers is hindered due to long distances. The model also shows that trade in tasks gives rise to shared gains for all domestic factors, including skilled workers (Grossman & Rossi-Hansberg, 2008).

In another theoretical paper, Egger and Egger (2003) focus on a small country case, treated as home country, which has a possibility to outsource a low-skilled part of its production to low-wage foreign countries. In a competitive labour market framework, outsourcing increases relative wages of high-skilled labour, while it does not affect relative employment. However, in a unionised framework, outsourcing increases both, relative wages and the relative employment of high-skilled labour in the home country.

Compared to rather scarce theoretical analyses on the effects of outsourcing and offshoring on the labour market, empirical studies are more abundant. Feenstra and Hanson (1996, 1999) analyse the impact of outsourcing in the United States. The results

of their earlier paper point to an increase in the relative demand for skilled labour due to increased outsourcing (Feenstra & Hanson, 1996). In their later paper, Feenstra and Hanson (1999) conclude that outsourcing impacts the relative wages of non-production workers positively (Feenstra & Hanson, 1999).

Amiti and Wei (2005a, 2005b) explore the effects of service outsourcing and offshoring in the UK and US, respectively. For the UK market, the authors find that job growth and outsourcing are not negatively correlated at the sectoral level (Amiti & Wei, 2005a), whereas for the US market, the effect of offshoring on employment differs according to the disaggregation of industries. When industries are finely disaggregated, the results point to a negative effect. On the other hand, when industries are defined on a broader level, the negative effect disappears. This leads to a conclusion that, although offshoring might affect employment negatively within industries, dismissed workers renew their employment in other growing industries (Amiti & Wei, 2005b).

Hijzen, Görg, and Hine (2005) also examine the effects of outsourcing on the UK labour market. The results indicate that outsourcing affects the demand for unskilled labour negatively and together with technological change leads to changes in the skill structure of manufacturing industries (Hijzen, Görg, & Hine, 2005). Parallel conclusions on the negative effect of increased outsourcing on the relative employment of unskilled workers were made by Strauss-Kahn (2003) for French manufacturing industries. In addition, Egger and Egger (2003) indicate that outsourcing increases the relative employment of high-skilled labour in Austria as a consequence of trade liberalisation in the Central and Eastern Europe.

While Michel and Rycx (2009) find no major influence of materials or business services offshoring on the employment in Belgian firms, they highlight the importance of distinguishing between manufacturing and service industries. Traditionally, only manufacturing industries were related to offshoring, since their products are easily tradable. However, improvements in information and communication technologies had a significantly positive impact on offshoring in service industries (Michel & Rycx, 2009). This was confirmed also by De Backer and Yamano (2012), who compare the increase of offshoring in different countries. Although offshoring increased in the observed period from 1995 to 2005 in both, manufacturing and service industries, the increase was on average bigger in the latter. Importing intermediates from abroad is however on average still more important in manufacturing industries (De Backer & Yamano, 2012). Similar conclusions were made by Horgos (2006) using German data, inferring that outsourcing is concentrated in high-skilled manufacturing industries, while the highest increase in outsourcing is visible in service industries (Horgos, 2006).

A noteworthy restraint of empirical studies, presented in previous paragraphs, is in the type of data used. The studies used data, disaggregated only at the industry level and therefore could not control for firm-specific and individual-specific characteristics that may have an impact on the skill structure of firms. Moreover, identifying the labour demand curve is more challenging when using industry-level data (Hijzen & Swaim, 2010).

Konings and Murphy (2006) evaluate the substitution of workers between parents and their affiliates in European multinational enterprises. Contrary to the common belief, their results indicate employment relocations between parent firms and their affiliates, both based in the North EU, but they find no significant employment flows between the parent and affiliates, based in the South EU, and Central and Eastern Europe (Konings & Murphy, 2006).

In another study using firm-level data, Biscourp and Kramarz (2007) differentiate between two types of imports – imports of finished goods and imports of intermediate goods, which they define as offshoring. They find a strong and negative correlation between imports and job destruction, where this impact is especially strong for imports of finished goods, imports from low-wage countries, and for larger firms (Biscourp & Kramarz, 2007).

Focusing on trade liberalisation in China after its accession to the World Trade Organisation, Bloom, Draca, and Van Reenen (2011) find that the impact on labour demand varied across firms. Specifically, although the increased Chinese competition did not affect labour demand in high-tech firms, it decreased in low-tech firms (Bloom, Draca, & Van Reenen, 2011). Mion and Zhu (2013) analysed the effects of increased Chinese imports on Belgian manufacturing firms and the Belgian labour market, by differentiating between imports of final and intermediate goods. Authors find that the increased Chinese competition hurt firms in low-tech industries, while on the whole, the increased competition was followed by reduces in firm employment growth, and upgrades in skill structure (Mion & Zhu, 2013).

Furthermore, Lo Turco and Maggioni (2012) studied the effects of offshoring on the labour demand in Italian manufacturing firms by controlling also for the origin of countries. The authors emphasise it is important to differentiate between high- and low-income countries, since different origins of outsourcing can point to a different performance level of firms. Their results show that importing intermediates from high-income countries does not affect employment, while the effects on the employment are negative when importing intermediates from low-income countries.

To sum up, the findings of presented studies show that liberalising trade with developing countries brings opportunities for cost reductions and technology improvements in the developed countries, while on the other hand it also presents threats to labour markets. However, the majority of studies conclude this threat is not large and is usually concentrated on the low-skilled employees. Also important is the emphasis made in several papers (see for example De Backer & Yamano, 2012, Michel & Rycx, 2009, Horgos, 2006) on the significance of differentiating between manufacturing and service industries, as well as the importance of using firm-level data (Hijzen & Swaim, 2010).

This paper contributes to the abovementioned studies in several ways. First, to the extent of my knowledge, previous analyses defined skills only by looking at workers' educational attainment or by differentiating between production and non-production workers. However, since skills can be acquired through employment and experience, and not only

through formal education, it is important to take into account alternative dimensions when defining skills. This study defines skills also by the occupational classification of workers and makes separate analyses for occupational groups that define skills. Second, while the bulk of analyses were concentrated on the effects of only outward FDI or only outsourcing, it is important to study differential effect of the two by controlling for both factors in one model, and to avoid the missing variable bias problem. More precisely, previous empirical models, which accounted for only one of the factors in their model, showed that outward FDI and outsourcing both have a positive impact on the labour demand. Finally, I also control for the income level of source markets of both, outsourcing and outward FDI, in order to control for the potential differences of partner's performance. While Lo Turco and Maggioni (2012) also differentiated between outsourcing from high- and low-income countries, they did not account for outward FDI, skilled workers or service firms in their analysis.

3. METHODOLOGY

As aforementioned, since definitions of outsourcing and offshoring/outward FDI vary significantly across different studies, this section first presents the definitions of outsourcing and outward FDI, used in this analysis. The framework and specification of the basic and extended models are presented next.

Feenstra and Hanson (1996) define outsourcing as the import of intermediate inputs by domestic firms, whereas in their more recent paper (Feenstra & Hanson, 1999), they introduce two measures of outsourcing. First is the ratio between imported intermediate inputs, relative to the total expenditure of non-energy intermediates in each industry, and the second is defined as inputs that are purchased from the same two-digit Standard Industrial Classification (SIC) industry as the good being produced (Feenstra & Hanson, 1999). Many of the papers follow these definitions and methodology. Similar definition for outsourcing is also used in the reports of IMF (2013) and UNCTAD (2013), which define outsourcing as purchasing intermediates from another firm, rather than producing them within the firm. Taking into account these definitions, in this analysis, outsourcing is defined as the ratio between the value of non-energy intermediate imports and the value of total material costs of a firm i in year t:

$$Outsourcing_{it} = \frac{Intermediate\ imports_{it}}{Total\ material\ costs_{it}} \qquad (1)$$

where intermediate imports are defined according to the assigned Broad Economic Categories (BEC) codes. Under BEC classification, goods can be classified in three categories; capital, intermediate, and consumption goods.

Besides estimating the effects of outsourcing, this analysis also takes into account the effects of outward FDI. For the latter, I again follow the definition of IMF (2013) and UNCTAD (2013) which define offshoring either as a process of relocating a part of or

all the activities to another firm, located overseas, or as foreign direct investments. To estimate the effect of outward FDI, I take into account the dataset from the Bank of Slovenia, which comprises information on the FDI flows for every Slovenian firm. This dataset also gathers information on the volume of the FDI and the destination country of the investment. Since the information on the volume and the type of FDI is available only for 2007 onwards, whereas the information on the presence of firm's FDI flows, if the share of equity of the Slovenian firm in a foreign enterprise is at least 10%, is available for the entire observation period, this variable was formed as a dummy variable.

Definitions of the outsourcing and outward FDI therefore take into account only foreign flows. The weaknesses of the abovementioned definitions are mainly the consequence of data limitations. More precisely, since firms can buy intermediate goods also from domestic firms, it would be important to include this information to the analysis, should it be available. To control for this, this study used a proxy in the form of domestic cost level, calculated as the difference between the total level of material costs and imported intermediates. In addition, since not all FDI flows affect firms' skill share, definition of outward FDI should also include information on the type and volume of the FDI flows in order to make a more comprehensive measure on its effect on the skill share. Unfortunately, this data is available only for the recent years. It is also important to mention that the outward FDI dummy can also reflect relocating its assembly to a foreign subsidiary or obtain inputs from the subsidiary. The former would increase the skill share in a Slovenian firm, especially if the outward FDI is present in a country with cheaper labour. To control for this, it is important to take into account also the destination country of the outward FDI. On the other hand, importing inputs from the subsidiary might interlink with firms' outsourcing. Therefore, in future studies, it would be interesting to analyse the share of inputs from countries, where firms have outward FDI, and compare this with the share of inputs from countries, where firms do not have outward FDI.

3.1 Framework and specification of the basic model

The empirical model mainly follows the theoretical framework, introduced by Hummels et al. (2014). The production function of a firm *i* in year *t* is defined as:

$$Y_{it} = A_{it} f(K_{it}, H_{it}, C_{it}) \qquad (2)$$

where the dependent variable, Y_{it}, is the output, A_{it} is productivity, K_{it} is capital, H_{it} is skilled labour, and C_{it} is a composite input, consisting of domestic and foreign inputs. The latter relate to outsourcing and/or outward FDI activities, and the former relate to unskilled labour and domestic inputs. As presented in the literature review, outward FDI and outsourcing activities have distinct impacts on skilled and unskilled labour, where the impact on the skilled labour is on average positive, while the impact on the unskilled labour is on average negative (see for example Hummels et al., 2014, Mion & Zhu, 2013, Hijzen, Görg, & Hine, 2005, Strauss-Kahn, 2003, Egger & Egger, 2003, Feenstra & Hanson, 1996).

Since both factors affect the labour demand of firms, the model of Hummels et al. (2014) is extended by including also domestic inputs and outward FDI into the model. Due to the abovementioned data limitations of outward FDI and outsourcing's definitions, it was not possible to find an appropriate measure for both factors that would consider all flows and is therefore not entirely consistent with the presented model. It would be interesting to take this into account in the future studies, when data limitations are resolved.

To implement the theoretical model in the data, the equation (2) is rearranged and P_{it} introduced as a reduced-form of the demand for firm *i*'s products. Furthermore, international activities of firms are separated into outward FDI (FDI_{it}) and outsourcing (Out_{it}), and domestic inputs into unskilled labour (L_{it}) and domestic costs (DC_{it}). Furthermore, following Hummels et al. (2014), the logarithm of the average wage level (W_{it-s}), and the logarithm of the value of exports (X_{it-s}) in firm *i* and year *t* are added to the model. The latter is introduced in order to capture time varying shocks to demand for firms' output. A detailed derivation of the model is enclosed in the Appendix.

After rearranging, the empirical model becomes:

$$Skill\_share_{it} = \beta_0 + \beta_1 Out_{it} + \beta_2 FDI_{it} + \beta_3 X_{it} + \beta_4 A_{it} + \beta_5 K_{it} + \\ + \beta_6 W_{it} + \beta_7 DC_{it} + Time_t + Ind_t + \varepsilon_{it}, \quad (3)$$

where the dependent variable $Skill\_share_{it}$ is the logarithm of the ratio between skilled employees and the total number of employees in firm *i* and year *t*. Similarly to Hummels et al. (2014), skilled workers in the first part of the analysis are defined as tertiary educated workers, i.e. if they attain some form of college degree, which is normally at least 14 years of school attainment in Slovenia. As already explained, outsourcing (Out_{it}) is defined as the share of intermediate imports in the total material costs, and outward FDI (FDI_{it}) as the dummy variable, controlling for the outward FDI. Other explanatory variables are the following: X_{it} is a logarithm of the value of exports, A_{it} is a measure of productivity, K_{it} is a logarithm of capital per employee, W_{it} is a logarithm of the average annual wage level, and DC_{it} is a logarithm of the domestic cost level in firm *i* and year *t*. Domestic cost level (DC_{it}) is calculated as the difference between the total level of material costs and imported intermediates. To increase the sensitivity of results, two different measures of productivity (A_{it}) are used; value added per employee and total factor productivity. The total factor productivity is calculated using the proposed method of Levinsohn and Petrin (2003). Levinsohn and Petrin (2003) extend the model of Olley and Pakes (1996) by substituting investments with intermediate inputs when estimating the production function. The authors argue one of the main benefits of this procedure is data driven as the procedure can be used also for firms with zero investments, while another advantage is the result of intermediate inputs being more responsive to the total productivity term than investments (see for example Levinsohn & Petrin, 2003, Petrin, Poi & Levinsohn, 2004). Both measures – the Levinsohn-Petrin measured total factor productivity and the value added – have been for example used in Damijan, Konings, and Polanec (2014). Finally, variable $Time_t$ controls for year specific effects and Ind_t denotes industry dummy variables (2-digit NACE rev. 1 industries).

Following Hummels et al. (2014), outsourcing, exports, and levels of domestic costs are not scaled by firm size in order to enhance the explanatory value of the model. More precisely, changes in firm size might be a consequence of the changes in these variables. Instead, the model has been estimated with and without firm size as one of the explanatory variables.

It would be convenient to include also other control variables that have an important effect on the skill structure of firms, as for example information on the R&D expenditures and the number of patents. However, since this data is not available or is incomplete, there exists a missing variable bias, which would be important to be taken into account in the future studies.

Finally, the models are estimated with methods for panel data analysis; the pooled ordinary least squares, fixed effects, and random effects. The three basic panel methods were used in order to test the sensitivity of the results, while the methods were applied following the procedures suggested by Cameron and Trivedi (2009). Following Hummels et al. (2014), standard errors were clustered at firm levels. Due to cluster-robust standard errors and an unbalanced panel dataset, a robust version of the Hausman test was needed in order to compare the models (Cameron & Trivedi, 2009). In accordance, the method proposed by Schaffer and Stillman (2010) was applied, while the Sargan-Hansen test is reported in the tables with regression results.

3.2 Extensions of the model

The formation of the extended model is based on the model, presented in the previous subsection. First, the model is extended by differentiating between outsourcing from high- and low-income countries, and outward FDI to high- and low-income countries. Countries are classified as high- or low-income according to the definitions, made by the World Bank, where the low-income, lower-middle-income and upper-middle-income economies for a particular year are assigned as low-income countries, and high-income economies as high-income countries (WB, 2015).

The extended model, controlling for outsourcing from low- and high-income countries, and outward FDI to low- and high-income countries is the following:

$$\begin{aligned} Skill\_share_{it} = {} & \beta_0 + \beta_1 Out_{it} + \beta_2 Out\_high_{it} + \beta_3 FDI_{it} + \beta_4 FDI\_high_{it} + \\ & + \beta_5 High_{it} + \beta_6 X_{it} + \beta_7 A_{it} + \beta_8 K_{it} + \beta_9 W_{it} + \beta_{10} DC_{it} + \\ & + Time_t + Ind_t + \varepsilon_{it}, \end{aligned} \tag{4}$$

where Out_high_{it} is outsourcing from high-income countries, FDI_high_{it} is an interaction term between outward FDI and a dummy variable, controlling for high-income countries, and $High_{it}$ denotes a dummy variable, controlling for high-income countries. Since firms could import only a fraction of their inputs from high-income countries, the variable Out_high_{it} was restricted so that the definition covers only firms that import more than a half of their intermediate inputs, in terms of value, from high-income countries. The rest of the

model in the expression (4) follows the basic model (3). As aforementioned, the presented literature suggests that outsourcing from high-income countries and outward FDI to low-income countries would increase firms' skill share. The coefficients $ß_1$ and $ß_2$ reflect the impact on firms' skill structure if firms outsource the majority of their intermediate inputs from high-income countries, while the impact of outward FDI to low-income countries on firms' skill structure is reflected in the coefficient $ß_3$.

Subsequently, the extensions of the model also include occupational level when defining skills, in order to take into account also the nature of the tasks and duties of workers' jobs. Four different skill levels could be applied to ten major groups of occupations, which are classified by the International Labour Organization (ILO). The setting of the present paper takes into account a version of the International Standard Classification of Occupations (ISCO), the ISCO-88 classification. The top two skill levels, 3 and 4, with the skill level 4 being the highest, relate to tertiary education and correspond to three major groups: "Managers" (skill levels 3 and 4), "Professionals" (skill level 4) and "Technicians" (skill level 3) (ILO, 2012, Elias & Birch, 1994). These three major groups of occupations define skilled workers in the extended model. "Managers" include legislators, senior officials and managers, whose main tasks consist of determining, formulating and supervising the implementation of government policies, laws and public regulations, or planning, directing and coordinating the policies and activities of enterprises, organisations, or departments. "Professionals" work in the fields of physical, life or social sciences, or humanities and are responsible for increasing the existing stock of knowledge, finding solutions to the problems by applying scientific and artistic concepts and theories, and transferring their knowledge onto others. Finally, "Technicians" include technicians and associate professionals who have technical knowledge and experience in the fields of physical, life or social sciences, or humanities. Their main tasks include carrying out technical work and teaching at particular educational levels, related to the abovementioned fields (ILO, 2014).

4. DATA AND DESCRIPTIVE STATISTICS

By combining different databases, a rich firm-level and employee-level panel dataset for Slovenian firms was obtained, covering the period from 1997 to 2010. The dataset comprises information on the balance sheet data and income statements of Slovenian firms, their export and import activities (i.e. value of exports and imports, type of exported and imported goods, and destination of exports and imports), characteristics of employees (i.e. gender, age, gross wage, educational level, and occupational level), and information on the foreign direct investments of Slovenian firms. The latter gathers information on the FDI flows for a particular Slovenian firm. The dataset links the following databases: personal income-tax data, transaction-level data on exports and imports of goods, Statistical Registry of Employees, firm-level accounting data, and FDI, and was provided by the Statistical office of the Republic of Slovenia (SORS), the Tax Authorities of Slovenia (TARS), the Bank of Slovenia, and the Agency of the Republic of Slovenia for Public Legal Records and Related Services (AJPES).

As a small and open economy, Slovenia presents an interesting country for empirical analysis. During the observation period, Slovenia was exposed to increasing international competition due to EU accession and multilateral liberalisation (Zajc Kejžar & Ponikvar, 2014), while at the end of the observation period, Slovenia experienced the economic downturn.

After observing vast differences between manufacturing and service firms (Table 1), and taking into account the aforementioned emphasis on the importance of separating the analysis for manufacturing and service firms (see for example De Backer & Yamano, 2012, Michel & Rycx, 2009, Horgos, 2006), the empirical analysis was carried out independently for the two types of firms. Manufacturing firms on average employ a higher total number of employees and tertiary educated employees, compared to service firms. Furthermore, especially in the more recent years, manufacturing firms on average employ slightly older employees than service firms, where age can be considered as a proxy for the experience of employees (Zoghi, 2010). When comparing the average annual gross wages for the recent years, manufacturing firms on average pay their employees lower wages than service firms. However, when comparing the average wages of tertiary educated employees, manufacturing firms pay higher average wages than service firms. Manufacturing firms on average also have lower skill shares than service firms. The latter differences in the average gross wages and the skill shares could be the outcome of a different occupational and educational structure of employees in manufacturing and service firms, which will be presented in one of the upcoming paragraphs. For brevity, in the following tables, the descriptive statistics for the first half of the treated period is presented with a four-year gap, while the descriptive statistics for the recent years is complete.

Table 1. Characteristics of Slovenian manufacturing and service firms

Total							
Year	**1998**	**2002**	**2006**	**2007**	**2008**	**2009**	**2010**
Employment	18.1	17.3	15.5	15.2	14.2	13.0	12.2
Employment of tertiary educated	2.1	2.3	2.4	2.5	2.4	2.4	2.4
Skill share	21.7	23.2	25.0	25.4	25.9	27.0	28.1
Age	36.3	38.2	39.3	39.5	39.8	40.2	40.5
Gross wage	5,139	8,002	10,625	11,311	11,850	11,941	12,260
Gross wage of tertiary educated	8,696	12,804	16,132	16,993	17,993	17,752	17,703
Number of firms	25,216	27,064	30,908	32,799	35,833	36,814	37,882
Manufacturing firms							
Year	**1998**	**2002**	**2006**	**2007**	**2008**	**2009**	**2010**
Employment	41.4	38.9	35.0	34.4	31.8	27.8	26.6
Employment of tertiary educated	3.9	4.2	4.5	4.6	4.4	4.3	4.3
Skill share	14.5	14.6	15.9	16.1	16.3	17.2	18.0
Age	36.2	37.9	39.7	39.9	40.4	40.8	41.2
Gross wage	5,048	7,658	10,320	11,066	11,664	11,547	11,962
Gross wage of tertiary educated	9,785	14,154	17,397	18,267	19,232	18,868	18,808
Number of firms	5,411	5,750	6,140	6,318	6,696	6,746	6,798
Service firms							
Year	**1998**	**2002**	**2006**	**2007**	**2008**	**2009**	**2010**
Employment	9.7	9.9	9.6	9.6	9.3	8.9	8.5
Employment of tertiary educated	1.4	1.7	1.9	2.0	2.0	2.0	2.0
Skill share	25.1	27.4	30.1	30.9	31.7	32.9	34.1
Age	36.3	38.3	39.4	39.6	40.0	40.3	40.6
Gross wage	5,229	8,257	11,036	11,779	12,426	12,511	12,791
Gross wage of tertiary educated	8,260	12,363	15,723	16,557	17,565	17,379	17,351
Number of firms	18,037	19,047	21,527	22,729	24,773	25,647	26,495

Note: Explanations of the variables are as follows: *Employment*: mean number of employees; *Employment of tertiary educated*: mean number of tertiary educated employees; *Skill share*: the average of the share of the tertiary educated; *Age*: mean age of employees; *Gross wage*: mean annual gross wage in €; *Gross wage of tertiary educated*: mean annual gross wage of tertiary educated employees in €; *Number of firms*: number of observations.
Source: SORS, author's calculations

In addition, I also make a comparison between outward FDI and outsourcing firms (Table 2). Both types of firms are bigger in size, compared to an average firm in Table 1. This confirms previous findings of Wagner (2011), whose study indicates a self-selection of firms into outward FDI and finds that these firms are larger, more productive and more human capital intensive. The average age of employees in outward FDI and outsourcing firms is also slightly higher than in the average firm. Finally, the average gross wages and gross wages of tertiary educated employees are above the average, where the highest average is in the FDI firms. Checking the overlap between outward FDI and outsourcing by transforming the outsourcing variable into a dummy variable and performing the cross-tabulation between the two dummy variables shows that less than 10% of outsourcing firms also make use of the outward FDI, and vice versa. The table is enclosed in the Appendix.

A separate analysis was done also for firms that make use of outward FDI to high-income countries and outsource the majority of their intermediate inputs from high-income countries. The descriptive statistics for these firms show that they on average pay higher wages than the average FDI and outsourcing firms. Furthermore, while firms that make use of outward FDI to high-income countries are on average bigger than the average FDI firm, firms that outsource from high-income countries are on average smaller than the average outsourcing firm. The table is enclosed in the Appendix. Different characteristics of FDI and outsourcing firms, and the finding that the overlap between both types of firms is less than 10% confirm the importance of taking into account both factors, outsourcing and outward FDI, in one model.

Table 2. Characteristics of Slovenian firms which use outward FDI and outsource

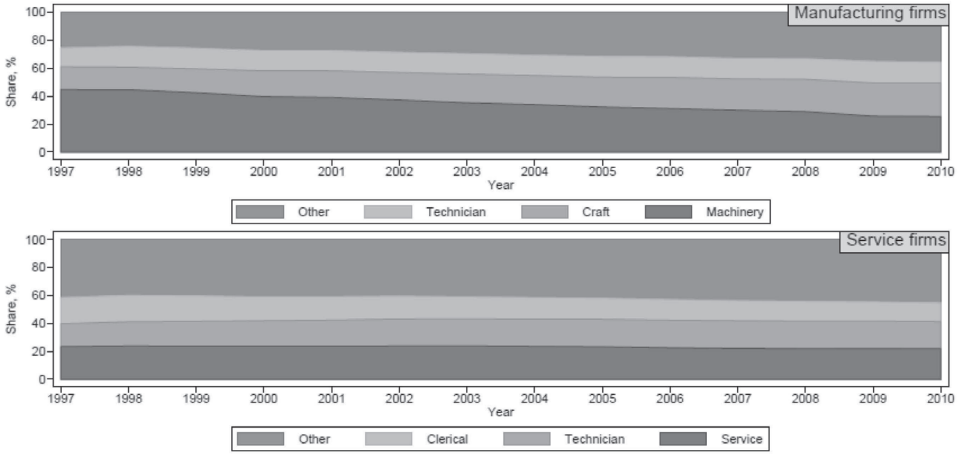
FDI firms							
Year	**1998**	**2002**	**2006**	**2007**	**2008**	**2009**	**2010**
Employment	301.9	207.3	194.3	185.6	175.0	163.6	161.3
Employment of tertiary educated	35.1	27.9	32.1	32.1	31.9	32.6	34.0
Skill share	22.5	25.7	31.8	32.9	34.5	35.4	37.6
Age	38.9	39.1	40.1	40.1	40.4	41.0	41.5
Gross wage	8,384	11,988	16,934	18,187	19,325	19,453	20,081
Gross wage of tertiary educated	15,215	19,729	24,759	26,282	27,707	27,380	27,487
Number of firms	474	831	895	943	994	957	894
Outsourcing firms							
Year	**1998**	**2002**	**2006**	**2007**	**2008**	**2009**	**2010**
Employment	56.9	56.2	64.7	57.0	55.4	48.7	48.4
Employment of tertiary educated	5.9	6.5	8.7	8.2	8.2	8.1	8.4
Skill share	23.0	22.2	24.4	25.0	25.1	26.4	27.4
Age	36.6	38.4	39.2	39.5	39.9	40.4	40.6
Gross wage	5,930	9,277	13,391	14,474	15,587	15,622	16,333
Gross wage of tertiary educated	9,867	14,863	19,995	20,758	22,416	22,092	22,370
Number of firms	2,524	2,820	2,430	2,619	2,695	2,473	2,486

Note: Explanations of the variables are as follows: *Outsourcing firms*: firms that import intermediate products; *FDI firms*: firms that engage in outward FDI; *Employment*: mean number of employees; *Employment of tertiary educated*: mean number of tertiary educated employees; *Skill share*: the average of the share of the tertiary educated; *Age*: mean age of employees; *Gross wage*: mean annual gross wage in €; *Gross wage of tertiary educated*: mean annual gross wage of tertiary educated employees in €; *Number of firms*: number of observations.
Source: SORS, author's calculations

Next, the occupational structure of manufacturing and service firms is compared by using ISCO-88 classification (Figure 1). In manufacturing firms, the share of Machinery workers has been decreasing through the period, but it is still the highest among all occupational groups. On the other hand, the share of Craft workers has been increasing through the period, but remained second. The third largest share in manufacturing firms belongs to Technicians, while the fourth and fifth largest shares appertain to Elementary occupations and Clerks, respectively. In service firms, on the other hand, Service workers occupy the largest share and the share remains steady throughout the observed period. The second largest share in service firms belongs to Technicians, while the third to Clerks. Among other occupational groups, Elementary occupations represent the fourth largest share and Machinery workers the fifth. Since the shares of Agricultural and Army workers represent

only a minor part of the total shares in both, manufacturing and service firms, they were excluded from further empirical analysis (description of all major occupational groups is included in the Appendix).

Figure 1. Occupational structure of manufacturing and service firms in Slovenia



Source: SORS, author's calculations

Table 3 presents the descriptive statistics of the three major groups of occupations that define skilled workers in the extended model; i.e. Managers, Professionals, and Technicians. The table combines results for both, manufacturing and service firms. Professionals represent the highest share of tertiary educated among all groups, followed by Managers and Technicians. Looking at the total average in the observed period, 88.7 % of Professionals, 55.1 % of Managers, and 27.4 % of Technicians were tertiary educated. This allocation of shares is consistent with the ISCO-88 classes of skill levels, presented in the methodological part. Taking into account the average age of employees, Managers are on average the oldest among all occupational groups, Professionals were on average a bit older than the average worker in the first years of the observational period, while in the recent years, they are a bit younger than the average. In contrast, Technicians are the youngest of the three groups and compared to the total population of employees. Managers earn the highest gross wages among all occupational groups, followed by Professionals. Technicians also have above average wages, in parallel to the total average numbers. However, since Professionals and Managers present more than a half of all tertiary educated workers and earn the highest wages, tertiary educated Technicians earn below the average gross wages, when taking into account only tertiary educated workers.

Table 3. Characteristics of employees in skilled occupations

Managers							
Year	**1998**	**2002**	**2006**	**2007**	**2008**	**2009**	**2010**
Share in the total employment	5.6	5.5	6.1	6.1	6.3	6.8	7.0
Share in the tertiary educated	25.2	23.4	22.6	21.8	21.7	21.8	21.1
Age	41.5	43.0	43.7	43.7	43.6	43.9	43.9
Gross wage	8,972	14,125	18,436	19,530	20,398	20,231	20,301
Gross wage of tertiary educated	12,859	18,988	24,080	25,517	26,755	26,237	26,092
Professionals							
Year	**1998**	**2002**	**2006**	**2007**	**2008**	**2009**	**2010**
Share in the total employment	3.9	4.5	5.7	6.0	6.2	7.0	7.8
Share in the tertiary educated	31.2	31.6	33.9	34.1	34.2	34.6	34.8
Age	38.4	38.5	38.6	38.7	39.0	39.2	39.4
Gross wage	9,756	14,707	17,803	18,642	19,792	19,750	19,503
Gross wage of tertiary educated	10,277	15,411	18,455	19,462	20,732	20,750	20,622
Technicians							
Year	**1998**	**2002**	**2006**	**2007**	**2008**	**2009**	**2010**
Share in the total employment	15.6	16.2	16.8	16.7	16.5	16.9	16.9
Share in the tertiary educated	32.2	31.7	30.9	30.7	30.1	29.3	29.1
Age	35.7	37.5	38.6	38.7	39.1	39.5	39.9
Gross wage	6,113	9,389	12,166	12,980	13,891	13,970	14,246
Gross wage of tertiary educated	8,377	12,484	15,190	16,077	17,127	16,993	17,006

Note. Explanations of the variables are as follows: *Share in the total employment*: share of a particular occupational group in the total employment (in %); *Share in the tertiary educated*: share of a particular occupational group in the total number of tertiary educated employees (in %); *Age*: mean age of a particular occupational group; *Gross wage*: mean annual gross wage of a particular occupational group in €; *Gross wage of tertiary educated*: mean annual gross wage of tertiary educated in a particular occupational group in €.
Source: SORS, author's calculations

The descriptive statistics of other occupational groups (included in the Appendix) reveal that other groups present only a minor share in the group of tertiary educated workers. The highest share in the total employment is on average presented by Machinery workers, followed by Craft workers, Elementary workers, Service workers, and Clerical workers, while the highest earners among these groups are on average Clerical workers, followed by Machinery workers, Craft workers, Service workers and Elementary workers. This distribution of occupations is also the reason for higher average wages and higher average skill shares in service firms.

5. EMPIRICAL ANALYSIS

What is here called a basic model measures the effect of outsourcing and outward FDI on the skill structure of firms. Later, the first extension of the model differentiates between outsourcing from high- and low-income countries, and outward FDI to high- and low-income countries, while in the second extension an alternative definition of skilled employees is introduced, taking into account information on the occupational level of employees.

5.1 Basic model

The basic model analyses the effect of outsourcing and outward FDI on the skill structure in Slovenian firms. As introduced in the methodology part, the models were estimated with the pooled ordinary least squares, and with fixed effects and random effects models. In the basic model, tertiary educated workers are defined as skilled.

Table 4. The effect of outsourcing and outward FDI on the skill share in Slovenian manufacturing and service firms (observation period: 1997-2010)

	Manufacturing firms			*Service firms*		
	Pooled OLS	**FE**	**RE**	**Pooled OLS**	**FE**	**RE**
FDI	0.147***	0.063**	0.092***	0.315***	0.002	0.071**
	[4.19]	[2.28]	[3.53]	[7.88]	[0.08]	[2.31]
Outsourcing	-32.55***	1.111	-0.64	34.500**	11.820*	17.180***
	[-4.51]	[0.20]	[-0.13]	[2.15]	[1.93]	[2.72]
log(capital per emp)	0.014	0.013	0.016*	-0.008	0.000	0.001
	[1.23]	[1.39]	[1.92]	[-1.08]	[0.080]	[0.21]
log(tfp)	0.027*	-0.020*	-0.021*	0.046***	-0.067***	-0.043***
	[1.89]	[-1.67]	[-1.95]	[4.74]	[-8.34]	[-6.10]
log(export value)	-0.002	0.000	0.000	-0.016***	-0.002	-0.006***
	[-0.89]	[0.08]	[0.19]	[-4.85]	[-0.68]	[-2.69]
log(gross wage)	0.619***	0.244***	0.295***	0.643***	0.155***	0.260***
	[15.6]	[8.86]	[10.8]	[27.0]	[10.5]	[17.1]
log(domestic costs)	0.172***	0.051***	0.101***	0.126***	0.088***	0.099***
	[13.6]	[3.49]	[9.40]	[14.6]	[8.48]	[13.6]
Constant	-6.172***	-0.675	-2.446***	-6.060***	-0.600*	-2.036***
	[-11.7]	[-1.17]	[-4.49]	[-20.4]	[-1.77]	[-8.11]
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,751	41,751	41,751	87,613	87,613	87,613
R-squared (within)		0.068	0.064		0.035	0.027
R-squared (between)		0.097	0.167		0.059	0.209
R-squared (overall)	0.182	0.158	0.201	0.192	0.175	0.219
Sargan-Hansen statistics		503.727***			1,359.569***	

Note. Econometric methods: Pooled OLS: pooled ordinary least squares; FE: fixed effects; RE: random effects. The dependent variable is defined as the logarithm of the ratio between skilled employees and the total number of employees, where tertiary educated workers are defined as skilled. The explanation of variables: *FDI*: dummy variable, controlling for the outward FDI*; Outsourcing*: share of intermediate imports in the total material costs; *log(capital per emp)*: logarithm of the capital per employee in a firm; *log(tfp)*: logarithm of the total factor productivity per employee in a firm; *log(export value)*: logarithm of the value of exports; *log(gross wage)*: logarithm of the average annual gross wage level; *log(domestic costs)*: logarithm of the domestic cost level. *** p<0.01, ** p<0.05, * p<0.1, robust t-statistics in brackets, the analysis used cluster-robust standard errors.
Source: SORS, author's calculations

Taking into account only the results of the most preferred model, according to the Sargan-Hansen test, i.e. the fixed effects, outward FDI shows a positive impact on the share of skilled workers in manufacturing firms, while outsourcing shows a positive impact on firms' skill share in service firms (Table 4).

To control the robustness of the results, the models were estimated by adding firm size as one of the control variables. In addition, value added was substituted for the total factor productivity. Robustness checks confirm results from the basic model for manufacturing firms, while the correlation between outsourcing and firms' skill share is no longer statistically significant when controlling also for firms' size. The robustness checks are included in the Appendix.

5.2 Extensions of the model

In order to obtain new information, two extensions of the basic model have been made. The first extension differentiates between outsourcing from high- and low-income countries and outward FDI to high- and low-income countries. The second extension includes information on the occupational level of workers when defining skills.

5.2.1 Differentiation between high- and low-income countries

Differentiating between outsourcing from high- and low-income countries and outward FDI to high- and low-income countries makes possible to estimate whether a particular type of source country of outward FDI and outsourcing has a more significant impact on the skill structure of domestic firms.

Results indicate that the effect of outsourcing and outward FDI on the share of high skilled employees is different for different source countries, especially when including also the alternative definition of skills, which will be presented in the subsequent subsection. Again, according to the Sargan-Hansen statistics, the most preferred results are obtained with the fixed effects method, so the following conclusions concentrate on the results of this method. For manufacturing firms, FDI to low-income countries shows a statistically significant positive impact on the share of skilled employees. The insignificant coefficient of the variable *FDI_high* implies that FDI to high-income countries does not have a stronger impact on the relative employment of skilled employees than FDI to low-income countries. In order to test if the sum between the coefficient *FDI*, which measures the impact of outward FDI to low-income countries on firms' skill share, and interaction term, i.e. *FDI_high*, is statistically significantly different from zero, the Wald test was applied (the p-value of the F-test was 0.056). On the other hand, the impacts of outsourcing and outward FDI on firms' skill structure are statistically insignificant in service firms.

Table 5. The effect of outsourcing and outward FDI on the skill share in Slovenian manufacturing and service firms, differentiating between high- and low-income countries (observation period: 1997-2010)

	Manufacturing firms			*Service firms*		
	Pooled OLS	**FE**	**RE**	**Pooled OLS**	**FE**	**RE**
FDI	0.196***	0.059**	0.088***	0.313***	0.006	0.072**
	[5.01]	[2.01]	[3.18]	[7.04]	[0.17]	[2.27]
FDI_high	-0.176***	0.023	0.019	0.012	-0.025	-0.012
	[-3.46]	[0.57]	[0.50]	[0.17]	[-0.43]	[-0.20]
Outsourcing	-19.510	33.190	27.720	59.230**	18.110	26.880**
	[-0.49]	[0.80]	[0.78]	[2.00]	[1.53]	[2.14]
Outsourcing_ high	-16.330	-37.140	-33.370	-42.910	-9.236	-15.86
	[-0.40]	[-0.89]	[-0.93]	[-1.19]	[-0.81]	[-1.28]
High	0.029	0.032*	0.032*	0.014	0.005	0.018
	[0.85]	[1.82]	[1.95]	[0.38]	[0.25]	[0.98]
log(capital per emp)	0.014	0.013	0.016*	-0.008	0.000	0.001
	[1.24]	[1.39]	[1.93]	[-1.09]	[0.08]	[0.19]
log(tfp)	0.026*	-0.020*	-0.020*	0.046***	-0.067***	-0.043***
	[1.83]	[-1.67]	[-1.95]	[4.72]	[-8.34]	[-6.10]
log(export value)	-0.002	0.000	0.000	-0.016***	-0.001	-0.006***
	[-0.91]	[0.083]	[0.20]	[-4.83]	[-0.68]	[-2.67]
log(gross wage)	0.618***	0.244***	0.295***	0.643***	0.155***	0.260***
	[15.6]	[8.85]	[10.8]	[27.1]	[10.5]	[17.1]
log(domestic costs)	0.172***	0.050***	0.100***	0.126***	0.088***	0.099***
	[13.4]	[3.43]	[9.26]	[14.6]	[8.48]	[13.6]
Constant	-6.176***	-0.657	-2.425***	-6.054***	-0.600*	-2.034***
	[-11.6]	[-1.14]	[-4.45]	[-20.3]	[-1.77]	[-8.10]

Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,751	41,751	41,751	87,613	87,613	87,613
R-squared (within)		0.068	0.064		0.035	0.027
R-squared (between)		0.097	0.166		0.059	0.209
R-squared (overall)	0.183	0.099	0.158	0.192	0.061	0.175
Sargan-Hansen statistics		517.471***			1,371.458***	

Note. Econometric methods: Pooled OLS: pooled ordinary least squares; FE: fixed effects; RE: random effects. The dependent variable is defined as the logarithm of the ratio between skilled employees and the total number of employees, where tertiary educated workers are defined as skilled. The explanation of variables: *FDI*: dummy variable, controlling for the outward FDI*; FDI_high*: dummy variable, controlling for the outward FDI to high-income countries*; Outsourcing*: share of intermediate imports in the total material costs; *Outsourcing_high*: share of intermediate imports from high-income countries in the total material costs if a firm imports the majority of its intermediate products from high-income countries; *High*: dummy variable, controlling for high-income countries; *log(capital per emp)*: logarithm of the capital per employee in a firm; *log(tfp)*: logarithm of the total factor productivity per employee in a firm; *log(export value)*: logarithm of the value of exports; *log(gross wage)*: logarithm of the average annual gross wage level; *log(domestic costs)*: logarithm of the domestic cost level. *** p<0.01, ** p<0.05, * p<0.1, robust t-statistics in brackets, the analysis used cluster-robust standard errors.
Source: SORS, author's calculations

5.2.2 Alternative definition of skills

In the final extension of the model, the information on the occupational level of workers is added to the definition of skills, which was to this point defined by reaching a tertiary level of education. As in the previous section, a differentiation between high- and low-income countries has been made. The most preferred method, according to the Sargan-Hansen test, is again the fixed effects, so the following conclusions relate to the results of this method.

When defining skilled employees only by their occupational level; i.e. when they are classified as Managers, Professionals, or Technicians, the results are not statistically significant anymore for manufacturing firms (Table 6). Similarly as when defining skills only by the educational level, the results for service firms are not statistically significant.

Next, to further exploit the advantages of taking into account information on occupational level, the effect of outward FDI and outsourcing on firms' skill share is estimated using disaggregated data for each of the three major skilled occupational groups. The following table presents only the results of the most preferred method according to the Sargan-Hansen test (i.e. the fixed effects), while the results of all methods are included in the Appendix.

When defining skills only by the occupational level and disaggregating the data by the three major skilled occupational groups (Table 7), results for manufacturing firms show a statistically significant impact of outsourcing only for the relative employment of Technicians. The results point to a positive impact of outsourcing from low-income countries on the relative employment of Technicians, while the statistically significant and negative coefficient of the variable, controlling for outsourcing from high-income countries, implies that outsourcing from high-income countries has a weaker but still positive impact on the relative employment of Technicians. In order to test if the sum between the coefficient *Outsourcing*, which measures the impact of outsourcing from low-income countries on the relative employment of Technicians, and interaction term, i.e. *Outsourcing_high*, is statistically significantly different from zero, the Wald test was applied (the p-value of the F-test was 0.035). In service firms, outward FDI to low-income countries shows a statistically significant positive impact on the relative employment of Professionals. The insignificant coefficient of the variable *FDI_high* implies that FDI to high-income countries does not have a stronger impact on the relative employment of Professionals than FDI to low-income countries. The Wald test indicates outward FDI has a positive impact on the relative employment of Professionals in service firms (the p-value of the F-test between the variables *FDI* and *FDI_high* was 0.000). In addition, similarly as for manufacturing firms, the results for service firms show a positive impact of outsourcing from low- and high-income countries on the relative employment of Technicians (the p-value of the F-test between the two variables was 0.001).

Table 6. The effect of outsourcing and outward FDI on the skill share in Slovenian manufacturing and service firms, using occupational classification for defining skills (observation period: 1997-2010)

	Manufacturing firms			*Service firms*		
	Pooled OLS	**FE**	**RE**	**Pooled OLS**	**FE**	**RE**
FDI	0.153***	0.022	0.037*	0.132***	0.014	0.033
	[5.04]	[1.08]	[1.85]	[4.19]	[0.59]	[1.44]
FDI_high	-0.001	0.004	0.006	0.086	-0.064	-0.052
	[-0.03]	[0.17]	[0.25]	[1.32]	[-1.05]	[-0.85]
Outsourcing	18.390	9.327	11.240	37.49***	6.797	13.40***
	[0.69]	[0.45]	[0.66]	[2.86]	[1.51]	[2.85]
Outsourcing_high	-64.63**	-10.290	-15.370	-27.73*	-2.318	-6.16
	[-2.24]	[-0.49]	[-0.89]	[-1.75]	[-0.43]	[-1.08]
High	0.150***	0.000	0.020	0.153***	0.029*	0.058***
	[4.52]	[0.005]	[1.07]	[6.65]	[1.93]	[4.21]
log(capital per emp)	0.004	0.019***	0.018***	-0.012**	0.002	-0.002
	[0.45]	[2.59]	[2.74]	[-2.18]	[0.47]	[-0.55]
log(tfp)	0.138***	0.030***	0.043***	0.146***	0.017***	0.046***
	[11.6]	[2.75]	[4.40]	[19.4]	[2.63]	[8.00]
log(export value)	-0.008***	-0.003*	-0.004***	-0.010***	0.000	-0.004**
	[-4.22]	[-1.80]	[-3.04]	[-3.69]	[0.079]	[-2.15]
log(gross wage)	0.454***	0.229***	0.260***	0.353***	0.157***	0.203***
	[13.1]	[8.68]	[9.90]	[21.4]	[11.0]	[14.8]
log(domestic costs)	0.041***	-0.024*	-0.006	0.000	0.012	0.007
	[3.69]	[-1.88]	[-0.61]	[0.028]	[1.43]	[1.09]
Constant	-2.250***	1.500***	-0.606*	-0.857***	1.620***	0.746***
	[-5.84]	[3.82]	[-1.79]	[-4.14]	[6.93]	[3.30]

Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,751	41,751	41,751	87,613	87,613	87,613
R-squared (within)		0.026	0.024		0.012	0.009
R-squared (between)		0.084	0.145		0.131	0.212
R-squared (overall)	0.176	0.091	0.150	0.195	0.110	0.185
Sargan-Hansen statistics		608.733***			1,003.023***	

Note. Econometric methods: Pooled OLS: pooled ordinary least squares; FE: fixed effects; RE: random effects. The dependent variable is defined as the logarithm of the ratio between skilled employees and the total number of employees, where Managers, Professionals, and Technicians in ISCO-88 classification are defined as skilled. The explanation of variables: *FDI*: dummy variable, controlling for the outward FDI; *FDI_high*: dummy variable, controlling for the outward FDI to high-income countries; *Outsourcing*: share of intermediate imports in the total material costs; *Outsourcing_high*: share of intermediate imports from high-income countries in the total material costs if a firm imports the majority of its intermediate products from high-income countries; *High*: dummy variable, controlling for high-income countries; *log(capital per emp)*: logarithm of the capital per employee in a firm; *log(tfp)*: logarithm of the total factor productivity per employee in a firm; *log(export value)*: logarithm of the value of exports; *log(gross wage)*: logarithm of the average annual gross wage level; *log(domestic costs)*: logarithm of the domestic cost level. *** p<0.01, ** p<0.05, * p<0.1, robust t-statistics in brackets, the analysis used cluster-robust standard errors.
Source: SORS, author's calculations

Table 7. The effect of outsourcing and outward FDI on the skill share in Slovenian manufacturing and service firms, for the major skilled occupational groups (observation period: 1997-2010)

	Manufacturing firms			*Service firms*		
	Managers	**Professionals**	**Technicians**	**Managers**	**Professionals**	**Technicians**
FDI	-0.013	0.049	-0.014	-0.022	0.161***	-0.032
	[-0.47]	[1.26]	[-0.53]	[-0.54]	[4.06]	[-0.90]
FDI_high	0.031	0.068	-0.041	0.042	0.007	-0.067
	[0.72]	[1.33]	[-1.32]	[0.58]	[0.10]	[-1.09]
Outsourcing	-8.522	9.717	79.35**	3.162	-3.324	37.180**
	[-0.47]	[0.18]	[2.40]	[0.36]	[-0.68]	[2.29]
Outsourcing_high	3.103	-12.38	-67.09**	-10.32	-1.262	4.780
	[0.17]	[-0.23]	[-2.02]	[-1.28]	[-0.22]	[0.27]
High	0.022	0.014	0.031	0.006	0.028**	0.065***
	[1.02]	[0.74]	[1.21]	[0.32]	[1.99]	[3.00]
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,751	41,751	41,751	87,613	87,613	87,613
R-squared (within)	0.029	0.053	0.024	0.016	0.028	0.035
R-squared (between)	0.030	0.186	0.126	0.030	0.084	0.084
R-squared (overall)	0.040	0.176	0.103	0.026	0.093	0.091
Sargan-Hansen statistics	268.051***	504.516***	487.702***	250.856***	796.516***	584.975***

Note. Econometric method: FE: fixed effects. The dependent variable is defined as the logarithm of the ratio between skilled employees and the total number of employees, where Managers, Professionals, and Technicians in ISCO-88 classification are defined as skilled. The explanation of variables: *FDI*: dummy variable, controlling for the outward FDI; *FDI_high*: dummy variable, controlling for the outward FDI to high-income countries; *Outsourcing*: share of intermediate imports in the total material costs; *Outsourcing_high*: share of intermediate imports from high-income countries in the total material costs if a firm imports the majority of its intermediate products from high-income countries; *High*: dummy variable, controlling for high-income countries. Control variables used: logarithm of the capital per employee in a firm, logarithm of the total factor productivity per employee in a firm, logarithm of the value of exports, logarithm of the average annual gross wage level, logarithm of the domestic cost level. *** p<0.01, ** p<0.05, * p<0.1, robust t-statistics in brackets, the analysis used cluster-robust standard errors.
Source: SORS, author's calculations

Finally, both dimensions for defining skills are combined, defining workers as skilled if they meet both criteria; i.e. if they attain tertiary education and are classified as Managers, Professionals, or Technicians. Equally as when defining skills by only occupational level, the results from the Table 8 for the most preferred method, i.e. the fixed effects, are not statistically significant. When dividing the analysis into the three major occupational groups (Table 9), the results for manufacturing and service firms show that outsourcing from low- and high-income countries has a positive impact on the relative employment of tertiary educated Technicians, where outsourcing from high-income countries has a positive but weaker impact than outsourcing from low-income countries. For manufacturing firms, the p-value of the F-test between the two variables was 0.069, whereas for service firms, it was 0.014. In addition, outward FDI to low- and high-income countries has a positive impact on the relative employment of tertiary educated Technicians in manufacturing firms (the p-value of the F-test between the two variables was 0.026) and also on the relative employment of tertiary educated Professionals in service firms (the p-value of the F-test between the two variables was 0.000).

These results suggest that the effect of educational level is not common, but it instead differs between different occupational groups, indicating that firms give different weight on educational attainment when employing individuals with different occupations. In manufacturing firms, outward FDI to high- and low-income countries does not have a positive impact on the relative employment of Technicians but only on the relative employment of tertiary educated Technicians. This result indicates that FDI firms would rather employ more educated Technicians. The finding is especially interesting as, taking into account descriptive statistics, less than a third of Technicians in the sample are tertiary educated, which means that a higher educational level gives them an opportunity to differentiate from the peers. Furthermore, following the hypothesis made in the introduction, one would expect that outsourcing from high-income countries would increase firms' skill share due to importing more technologically advanced inputs. However, results show that outsourcing from low-income countries has a positive impact on the relative employment of Technicians in both, manufacturing and service firms, and that the impact of outsourcing from low-income countries is on average stronger than the impact of outsourcing from high-income countries. The latter result is not entirely consistent with aforementioned hypothesis. But, this finding might also indicate that outsourcing from high-income countries might not be a sufficient proxy for importing technologically more advanced inputs, which would be important to take into account in the future analyses.

Table 8: The effect of outsourcing and outward FDI on the skill share in Slovenian manufacturing and service firms, using educational level and occupational classification for defining skills (observation period: 1997-2010)

	Manufacturing firms			*Service firms*		
	Pooled OLS	**FE**	**RE**	**Pooled OLS**	**FE**	**RE**
FDI	0.220***	0.036	0.071**	0.364***	0.026	0.092***
	[5.39]	[1.21]	[2.53]	[7.72]	[0.77]	[2.82]
FDI_high	-0.135**	0.025	0.027	0.073	-0.042	-0.018
	[-2.56]	[0.68]	[0.75]	[1.02]	[-0.71]	[-0.31]
Outsourcing	-26.840	17.480	14.800	71.24**	18.57	27.54**
	[-0.65]	[0.44]	[0.43]	[2.23]	[1.47]	[2.10]
Outsourcing_ high	-7.378	-17.230	-16.000	-52.92	-11.68	-16.79
	[-0.18]	[-0.45]	[-0.47]	[-1.42]	[-0.95]	[-1.30]
High	0.186***	0.041**	0.060***	0.184***	0.057***	0.095***
	[4.73]	[1.96]	[2.95]	[5.69]	[3.14]	[5.71]
log(capital per emp)	0.002	0.011	0.013	-0.008	0.003	0.003
	[0.14]	[1.26]	[1.62]	[-1.03]	[0.51]	[0.55]
log(tfp)	0.029**	-0.007	-0.010	0.068***	-0.049***	-0.024***
	[2.08]	[-0.59]	[-0.93]	[6.87]	[-6.41]	[-3.47]
log(export value)	0.001	0.001	0.002	-0.005	0.000	-0.002
	[0.45]	[0.62]	[1.03]	[-1.42]	[0.16]	[-0.89]
log(gross wage)	0.640***	0.246***	0.297***	0.674***	0.168***	0.273***
	[16.4]	[9.41]	[11.3]	[27.3]	[11.3]	[17.6]
log(domestic costs)	0.168***	0.044***	0.096***	0.110***	0.076***	0.085***
	[13.0]	[3.15]	[9.16]	[12.3]	[7.39]	[11.5]
Constant	-6.439***	-0.648	-3.164***	-6.425***	-0.801**	-2.355***
	[-12.1]	[-1.32]	[-9.98]	[-21.6]	[-2.45]	[-9.38]

Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,751	41,751	41,751	87,613	87,613	87,613
R-squared (within)		0.061	0.057		0.031	0.024
R-squared (between)		0.111	0.180		0.085	0.234
R-squared (overall)	0.196	0.111	0.173	0.212	0.078	0.195
Sargan-Hansen statistics		542.808***			1,611.500***	

Note. Econometric methods: Pooled OLS: pooled ordinary least squares; FE: fixed effects; RE: random effects. The dependent variable is defined as the logarithm of the ratio between skilled employees and the total number of employees, where tertiary educated Managers, Professionals, and Technicians in ISCO-88 classification are defined as skilled. The explanation of variables: *FDI*: dummy variable, controlling for the outward FDI; *FDI_high*: dummy variable, controlling for the outward FDI to high-income countries; *Outsourcing*: share of intermediate imports in the total material costs; *Outsourcing_high*: share of intermediate imports from high-income countries in the total material costs if a firm imports the majority of its intermediate products from high-income countries; *High*: dummy variable, controlling for high-income countries; *log(capital per emp)*: logarithm of the capital per employee in a firm; *log(tfp)*: logarithm of the total factor productivity per employee in a firm; *log(export value)*: logarithm of the value of exports; *log(gross wage)*: logarithm of the average annual gross wage level; *log(domestic costs)*: logarithm of the domestic cost level. *** p<0.01, ** p<0.05, * p<0.1, robust t-statistics in brackets, the analysis used cluster-robust standard errors.
Source: SORS, author's calculations

Table 9. The effect of outsourcing and outward FDI on the skill share in Slovenian manufacturing and service firms, for the major skilled occupational groups (observation period: 1997-2010, only tertiary educated)

	Manufacturing firms			*Service firms*		
	Managers	**Professionals**	**Technicians**	**Managers**	**Professionals**	**Technicians**
FDI	0.015	0.036	0.089***	-0.026	0.145***	0.070
	[0.50]	[0.99]	[2.70]	[-0.66]	[3.69]	[1.62]
FDI_high	-0.004	0.075	-0.036	0.021	0.046	-0.091
	[-0.086]	[1.51]	[-0.81]	[0.33]	[0.72]	[-1.16]
Outsourcing	6.473	25.900	57.590**	2.340	-1.409	41.350**
	[0.44]	[0.57]	[2.14]	[0.28]	[-0.31]	[2.43]
Outsourcing_high	-6.381	-29.770	-52.080*	1.138	-5.204	-26.810*
	[-0.43]	[-0.67]	[-1.95]	[0.13]	[-0.95]	[-1.71]
High	0.024	0.017	0.045**	0.017	0.031**	0.048***
	[1.35]	[1.03]	[2.37]	[1.08]	[2.35]	[2.80]
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,751	41,751	41,751	87,613	87,613	87,613
R-squared (within)	0.021	0.055	0.058	0.011	0.030	0.037
R-squared (between)	0.013	0.181	0.139	0.060	0.082	0.064
R-squared (overall)	0.012	0.175	0.133	0.047	0.091	0.076
Sargan-Hansen statistics	693.487***	586.418***	380.796***	569.012***	791.558***	563.509***

Note. Econometric method: FE: fixed effects. The dependent variable is defined as the logarithm of the ratio between skilled employees and the total number of employees, where tertiary educated Managers, Professionals, and Technicians in ISCO-88 classification are defined as skilled. The explanation of variables: *FDI*: dummy variable, controlling for the outward FDI; *FDI_high*: dummy variable, controlling for the outward FDI to high-income countries; *Outsourcing*: share of intermediate imports in the total material costs; *Outsourcing_high*: share of intermediate imports from high-income countries in the total material costs if a firm imports the majority of its intermediate products from high-income countries; *High*: dummy variable, controlling for high-income countries. Control variables used: logarithm of the capital per employee in a firm, logarithm of the total factor productivity per employee in a firm, logarithm of the value of exports, logarithm of the average annual gross wage level, logarithm of the domestic cost level. *** p<0.01, ** p<0.05, * p<0.1, robust t-statistics in brackets, the analysis used cluster-robust standard errors.
Source: SORS, author's calculations

6. CONCLUSION

This paper studies the impact of outward FDI and outsourcing on the relative employment of skilled employees in Slovenian manufacturing and service firms. Using a matched firm-employee level dataset for the period from 1997 to 2010, the study contributes to the previous studies in several ways. First, it incorporates both measures of strategic positioning of firms into one model with the purpose of measuring differential effect of outward FDI and outsourcing on the skill structure of firms. In addition, study differentiates between outsourcing from high- and low-income countries, and outward FDI to high- and low-income countries. Finally, different dimensions when defining skills are taken into account in order to increase the explanatory value of the model. The basic model uses a conventional definition of skills, defining workers as skilled when they attain tertiary education. However, since workers develop additional knowledge and expertise after entering employment, taking into account solely the level of formal education when defining skills ignores the knowledge acquired during the course of employment. Consequently, three major occupational groups define workers as skilled in the model extensions; Managers, Professionals, and Technicians.

The main findings of the analysis are the following. First, outward FDI has a positive impact on firms' skill share in manufacturing firms, while outsourcing has a positive impact on firms' skill share in service firms. Second, when controlling also for the income level of destination countries, the impact of outsourcing in service firms is no longer positive. On the other hand, in manufacturing firms, outward FDI to low- and high-income countries have a positive impact on firms' skill share. These results confirm the hypothesis about the expected positive effect of outward FDI to low-income countries, while the hypothesis for the expected positive effect of outsourcing from high-income countries is not confirmed.

Finally, using workers' occupational level for defining skills increases the explanatory power of the model. Results for manufacturing firms show that outward FDI to high- and low-income countries have a positive impact on the relative employment of tertiary educated Technicians, while the result for Technicians in general is not significant. This result indicates that firms differentiate between more and less educated individuals within the same occupational group. In addition, this holds only in the case of Technicians, the group with the lowest share of tertiary educated among the three skilled occupation groups, indicating that a Technician can best differentiate from his or her peers by obtaining a higher level of education. Furthermore, the results also show that outsourcing from low-income countries has a stronger impact on the relative employment of tertiary educated Technicians than outsourcing from high-income countries in both, manufacturing and service firms. This result might be the consequence of a different skill structure of outsourcing firms, which was already indicated in descriptive statistics. Namely, the share of tertiary educated workers in outsourcing firms is lower than in FDI firms, which might be a sign that outsourcing firms have different preferences for employing workers with different occupational attainment compared to FDI firms. In the future analyses, it would therefore be interesting to control also for reverse causality between the dependent and control variables. In addition, this result in general confirms the hypothesis, which

assumed that outsourcing from high-income countries increases firms' skill share. The reasoning behind the hypothesis was that outsourcing from high-income countries is a proxy for importing more technologically advanced inputs. In order to fully analyse this hypothesis, it would be important in the future studies to instead of controlling only for the income level of source countries to control also for the type of imported inputs; i.e. high-technology versus low-technology inputs. The results in this paper might indicate that controlling solely for the income level of source countries in the case of outsourcing might not be a sufficient proxy for the technology level of inputs.

Results also bring policy implications as they confirm how important it is for the governments to provide competitive educational system that would equip individuals with skills and knowledge, which would they later use while working. Finally, paper's results might also encourage individuals to invest in acquiring additional skills and increase their educational level in order to increase their employability.

With the aim of deepening the results of the empirical model, it would be useful to include additional measures for the outward FDI, especially since outward FDI proved to have an important impact on the skill structure of firms. These measures would for instance include the performance indicators of foreign partners that are in control of domestic firms, their employment structure, their value added, their value of the foreign investment, etc. Some of the information is already included in the dataset, but only for the recent years. Therefore, by extending the observation period, the new information might bring additional contributions to the results. In addition, although this study uses additional dimension when defining skills, it would be interesting to control also for other variables (e.g. the period of employment), and personal characteristics of workers (e.g. gender, length of pursuing the studies, social status of the family, etc.) in order to fully control for the informal education of workers. Finally, since previous empirical studies confirmed the importance of analysing not only the impact of outward FDI and/or outsourcing on skills, but rather its impact on offshorable and non-offshorable occupations, it would be interesting to broaden the empirical analysis also to other occupational groups.

In the future studies, it would also be interesting to test the self-selection of firms into outward FDI and outsourcing, as many studies confirmed the self-selection of more productive firms into trading activities (see for example Damijan and Kostevc, 2015; Wagner, 2011; and Melitz 2003). By estimating data on German manufacturing firms, Wagner (2011) confirms there is a self-selection of firms into offshoring. The analysis concludes these firms are larger, more productive and more human capital intensive. Studying the Spanish manufacturing firms, Damijan and Kostevc (2015) confirm that more productive firms self-select into importing. By importing, firms get an access to new, cheaper and/or better-quality products, which decrease firms' variable costs and enable greater investing in innovations. Furthermore, studying the Belgian firm-level data, Amiti, Itskhoki and Konings (2014) confirm that more productive firms import a larger share of their inputs from abroad, which additionally increases their productivity. Although the current paper controls for several firm-characteristic variables, it is limited in controlling fully also for the self-selection of firms into outward FDI and outsourcing.

Therefore, it would be interesting to analyse also the reverse causality between firms' skill structure, and outward FDI and outsourcing.

Finally, it would also be important to take into account in the future studies the recent changes in the economic environment and especially the impacts of various structural reforms. However, since Slovenia passed a labour market reform only in 2013, it would be necessary to extend the observation period in order to fully capture its effects. Using Italian survey data, Presbitero, Richiardi, and Amighini (2012) empirically analyse whether the increased usage of more flexible types of employment can be a substitute to offshoring, and whether it also additionally increases delocalization. The results show that a higher share of temporary workers reduces the likelihood of offshoring in the future. However, the results no longer hold after controlling also for reverse causality and spurious correlation.

REFERENCES

Amiti, M., Itskhoki, O., & Konings, J. (2014). Importers, Exporters, and Exchange Rate Disconnect. *American Economic Review*, *104*(7), 1942–1978.

Amiti, M. & Wei., S.-J. (2005a). Fear of service outsourcing: is it justified? *Economic Policy*, *20*(42), 307–347.

Amiti, M. & Wei., S.-J. (2005b). Service Offshoring, Productivity, and Employment: Evidence from the United State. *IMF Working Paper*, Paper No. WP/05/238.

Biscourp, P. & Kramarz, F. (2007). Employment, skill structure and international trade: Firm-level evidence for France. *Journal of International Economics*, *72*(1), 22–51.

Baldwin, R. (2013). *Global supply chains: why they emerged, why they matter, and where they are going*. In Elms, D. K., & Low, P. (Eds.), *Global value chains in a changing world* (11–61). Fung Global Institute (FGI), Nanyang Technological University (NTU), and World Trade Organization (WTO).

Bloom, N., Draca, M. & Van Reenen, J. (2011). Trade Induced Technical Change? The Impact of Chinese Imports on Innovation, IT and Productivity. *NBER Working Paper Series*, Paper No. 16717.

Cameron, A. C. & Trivedi, P. K. (2009). *Microeconometrics Using Stata*. College Station, Texas: StataCorp LP.

Damijan, J., & Kostevc, Č. (2015). Learning from trade through innovation: Causal link between imports, exports and innovation in Spanish microdata. *Oxford Bulletin of Economics and Statistics*, *77*(3), 408–436.

Damijan, J., Konings, J. & Polanec, S. (2014). Import Churning and Export Performance of Multi-product Firms. *The World Economy*, *37*(11), 1483–1506.

De Backer, K. & Yamano, N. (2012). International comparative evidence on global value chains. *OECD Science, Technology and Industry Working Paper*, Paper No. 2012/3.

Drenkovska, M. & Redek, T. (2015). Intangible capital, innovation and export-led growth: Empirical comparative study of Slovenia and the Western Balkans. Economic and Business Review, *17*(1), 25–67.

Egger, H. & Egger, P. (2003). Outsourcing and skill-specific employment in a small economy: Austria after the fall of the Iron Curtain. *Oxford Economic Papers*, *55*(4), 625–643.

Elias, P. & Birch, M. (1994). Establishment of Community-Wide Occupational Statistics. ISCO 88 (COM), A Guide for Users. *Institute for Employment Research, University of Warwick*.

Feenstra, R. C. & Hanson, G. H. (1999). The Impact of Outsourcing and High-Technology Capital on Wages: Estimates for the United States. *The Journal of Economics*, *114*(3), 907–940.

Feenstra, R. C., & Hanson, G. H. (1996). Globalization, Outsourcing, and Wage Inequality. *The American Economic Review*, *86*(2), 240–245.

Grossman, G. M. & Rossi-Hansberg, E. (2008). Trading Tasks: A Simple Theory of Offshoring. *American Economic Review*, *98*(5), 1978–1997.

Hijzen, A. & Swaim, P. (2010). Offshoring, labour market institutions and the elasticity of labour demand. *European Economic Review*, *54*(8), 1016–1034.

Hijzen, A., Görg, H. & Hine, R. C. (2005). International outsourcing and the skill structure of labour demand in the United Kingdom. *The Economic Journal*, *115*(506), 860–878.

Horgos, D. (2006). International Outsourcing – Some Measurement Problems: An Empirical Analysis of Outsourcing Activities in Germany. *IAW-Report*, *34*(1), 77–102.

Hummels, D., Jørgensen, R., Munch, J. & Xiang, C. (2014). The Wage Effects of Offshoring: Evidence from Danish Matched Worker-Firm Data. *American Economic Review*, *104*(6), 1597–1629.

ILO (2014). International Standard Classification of Occupations. http://www.ilo.org/public/english/bureau/stat/isco/isco88/publ4.htm (accessed August 21, 2014).

ILO (2012). International Standard Classification of Occupations. Structure, groups definitions and correspondence tables. http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_172572.pdf (accessed January 8, 2015).

IMF (2013). Trade interconnectedness: the world with global value chains. http://www.imf.org/external/np/pp/eng/2013/082613.pdf (accessed August 19, 2014).

Konings, J. & Murphy, A. P. (2006). Do Multinational Enterprise Relocate Employment to Low-Wage Regions? Evidence from European Multinationals. *Review of World Economics*, *142*(2), 267–286.

Levinsohn, J. & Petrin, A. (2003). Estimating Production Functions Using Inputs to Control for Unobservables. *The Review of Economic Studies*, *70*(2), 317–341.

Lo Turco, A. & Maggioni, D. (2012). Offshoring to High and Low Income Countries and the Labor Demand. Evidence from Italian Firms. *Review of International Economics*, *20*(3), 636–653.

Melitz, M. J. (2003). The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity. *Econometrica*, *71*(6), 1695–1725.

Michel, B. & Rycx, F. (2009). Does Offshoring of Materials and Business Services Affect Employment? Evidence from a Small Open Economy. *IZA Discussion Paper Series*, Paper No. 4164.

Mion, G. & Zhu, L. (2013). Import competition from and offshoring to China: A curse or blessing for firms? *Journal of International Economics*, *89*(1), 202–215.

Olley, G. S. & Pakes, A. (1996). The Dynamics of Productivity in the Telecommunications Equipment Industry. *Econometrica*, *64*(6), 1263–1297.

Petrin, A., Poi, B. P. & Levinsohn, P. (2004). Production function estimation in Stata using inputs to control for unobservables. *The Stata Journal*, *4*(2), 113–123.

Presbitero, A. F., Richiardi, M. G. & Amighini, A. (2012). Is labor flexibility a substitute to offshoring? Evidence from Italian manufacturing. *MoFiR working paper*, Paper No. 72.

Schaffer, M. E. & Stillman, S. (2010). xtoverid: Stata module to calculate tests of overidentifying restrictions after xtreg, xtivreg, xtivreg2 and xthtaylor. http://ideas.repec.org/c/boc/bocode/s456779.html

Strauss-Kahn, V. (2003). The role of globalization in the within-industry shift away from unskilled workers in France. *NBER Working Paper Series*, Paper No. 9176.

UNCTAD (2013). World investment report. http://unctad.org/en/PublicationsLibrary/wir2013_en.pdf (accessed August 19, 2014).

Wagner, J. (2011). Offshoring and firms performance: self-selection, effects on performance, or both? *Review of World Economics*, *147*(2), 217–247.

WB (2015). World Bank Country and Lending Groups. http://data.worldbank.org/about/country-and-lending-groups (accessed February 9, 2015).

Zajc Kejžar, K. & Ponikvar, N. (2014). The effect of industry maturity, turnover and competition on firm survival: evidence from Slovenian firms, *Post-Communist Economies*, *26*(1), 122–136.

Zoghi, C. (2010). *Measuring Labor Composition: A Comparison of Alternate Methodologies*. In Abraham, K. G., Spletzer, J. R., & Harper, M. (Eds.), *Labor in the New Economy* (457–485). University of Chicago Press.

Acknowledgements: Author would like to thank prof. dr. Jože Damijan, Jozef Konings, PhD, prof. dr. Črt Kostevc, and prof. dr. Katja Zajc Kejžar for their comments on an earlier version of the manuscript. I am also very grateful to two anonymous reviewers for their insights. The views expressed in the paper are solely the responsibility of the author. The usual caveat applies.

APPENDICES

Appendix A: Derivation of the model

First, consider the following production function for firm i in year t:

$$Y_{it} = A_{it} K_{it}^{\alpha} H_{it}^{\beta} C_{it}^{1-\alpha-\beta} \quad \text{(A1)}$$

As already mentioned, the dependent variable, Y_{it}, is output, A_{it} is productivity, K_{it} is capital, H_{it} is skilled labour, and C_{it} is composite input, consisting of domestic and foreign inputs ($C_{it} = D_{it} + F_{it}$), where the latter relate to outsourcing and/or outward FDI activities, whereas the former relate to domestic costs and unskilled labour.

As in Hummels et al. (2014), I introduce P_{it} as a reduced-form of the demand for firm i's products and determine the demand for skilled labour of firm i in year t, by taking derivatives of the equation (A1):

$$P_{it} (\partial Y_{it} / \partial H_{it}) = P_{it} A_{it} K_{it}^{\alpha} \beta H_{it}^{\beta-1} C_{it}^{1-\alpha-\beta} \quad \text{(A2)}$$

First, foreign inputs of firms, F_{it}, are separated into outsourcing (Out_{it}) and outward FDI (FDI_{it}) activities ($F_{it} = Out_{it} + FDI_{it}$), while the domestic inputs of firms, D_{it}, are separated into unskilled labour (L_{it}) and domestic costs (DC_{it}); ($D_{it} = L_{it} + DC_{it}$). Next, I take logarithms of the equation (A2) and get the following:

$$\ln P_{it} + \ln A_{it} + \alpha \ln K_{it} + \beta(\beta-1) \ln H_{it} + (1-\alpha-\beta) \ln(Out_{it} + FDI_{it} + L_{it} + DC_{it}) = 0 \quad \text{(A3)}$$

To implement equation (A3) in the data, the equation is first rearranged so that the variable of interest is the skilled labour:

$$-\beta(\beta-1) \ln H_{it} = \ln P_{it} + \ln A_{it} + \alpha \ln K_{it} + (1-\alpha-\beta) \ln(Out_{it} + FDI_{it} + L_{it} + DC_{it}) \quad \text{(A4)}$$

The variables are divided by the total number of employees in a firm. However, as already explained, following Hummels et al. (2014), I do not scale outsourcing, exports and levels of domestic costs by firm size in order to enhance the explanatory value of the model. Furthermore, as in Hummels et al. (2014), the logarithm of the value of exports (X_{it}) is introduced to capture time varying shocks to the demand of firms' output (P_{it}), and the logarithm of the average wage level in firm i and year t (W_{it}).

Finally, the observed model is the following:

$$\begin{aligned} Skill\_share_{it} = {} & \beta_0 + \beta_1 Out_{it} + \beta_2 FDI_{it} + \beta_3 X_{it} + \beta_4 A_{it} + \beta_5 K_{it} + \\ & + \beta_6 W_{it} + \beta_7 DC_{it} + Time_t + Ind_t + \varepsilon_{it} \end{aligned} \quad \text{(A5)}$$

Appendix B: Description of ISCO-88 major occupational groups

ISCO-88 classification arranges occupations in ten major groups. The first major group, "Managers", includes legislators, senior officials and managers, whose main tasks consist of determining, formulating and supervising the implementation of government policies, laws and public regulations, or planning, directing and coordinating the policies and activities of enterprises, organisations or departments. The next major group are "Professionals" who work in the fields of physical, life or social sciences, or humanities. They are responsible for increasing the existing stock of knowledge, finding solutions to the problems by applying scientific and artistic concepts and theories, and transferring their knowledge onto others. Another major group, "Technicians", includes technicians and associate professionals who have technical knowledge and experience in the fields of physical, life or social sciences, or humanities. Their main tasks include carrying out technical work and teaching at particular educational levels, related with the abovementioned fields. Furthermore, the group "Clerks" includes occupations which possess the knowledge and skills of organising, storing, computing and retrieving information. Their main tasks are performing secretarial duties, operating different office machines, recording and computing numerical data, and performing various customer-oriented clerical duties. The group "Service workers" covers service, shop, and market sales workers whose main tasks consist of providing personal and protective services, and selling goods in shops or at markets. In addition, the group "Agricultural workers" consists of skilled agricultural and fishery workers, who produce farm, forestry and fishery products, and sell them to purchasers, marketing organisations or at markets. Next, the group "Craft workers" includes craft and other related trade workers, whose main tasks include extracting raw materials, constructing buildings and other structures, and making various products and handicraft goods. Moreover, the group "Machine operators" includes plant and machine operators and assemblers who operate and monitor large scale, and often highly automated, industrial machinery and equipment. "Elementary occupations" combine occupations the main tasks of which in general include simple and routine tasks by using the hand-held tools and in some cases considerable physical effort. Finally, the group "Armed forces" includes individuals, who are serving in the armed forces on a voluntary or compulsory basis and are restricted to accept civilian employment (ILO, 2014).

Appendix C: Complementary tables

Table C1. Cross-tabulation between outward FDI and outsourcing dummy variables

			FDI		Total (Outsource)
			No	Yes	
Outsource	No	Row percentage	98.0%	2.0%	100.0%
		Column percentage	91.8%	68.7%	91.2%
	Yes	Row percentage	90.8%	9.2%	100.0%
		Column percentage	8.2%	31.3%	8.8%
Total (FDI)		Row percentage	97.4%	2.6%	100.0%
		Column percentage	100.0%	100.0%	100.0%

Note. Outsource is a dummy variable, controlling for firms that import intermediate products from abroad; *FDI* is a dummy variable, controlling for firms that engage in the outward FDI. Pearson's chi-squared test: 7,000 (Pr = 0.000).
Source: SORS, author's calculations

Table C2. Characteristics of Slovenian firms which use outward FDI to and outsource from high-income countries

Firms, using outward FDI to high-income countries							
Year	**1998**	**2002**	**2006**	**2007**	**2008**	**2009**	**2010**
Employment	509.4	421.3	407.8	309.1	214.2	200.4	199.3
Employment of tertiary educated	56.3	55.0	63.5	59.1	39.6	40.1	42.1
Skill share	23.83	25.49	31.46	32.6	34.69	35.85	37.5
Age	39.5	39.5	40.1	40.1	40.6	41.2	41.7
Gross wage	8,930	12,782	17,741	20,128	19,547	19,894	20,481
Gross wage of tertiary educated	15,835	21,712	26,789	29,254	27,963	27,881	28,004
Number of firms	143	172	198	197	207	194	195
Firms, outsourcing from high-income countries							
Year	**1998**	**2002**	**2006**	**2007**	**2008**	**2009**	**2010**
Employment	27.8	27.2	34.2	35.3	33.6	30.3	29.6
Employment of tertiary educated	2.4	3.0	4.2	4.6	4.5	4.8	4.8
Skill share	22.8	22.4	25.1	25.8	25.6	26.9	27.9
Age	35.9	38.1	39.0	39.4	39.9	40.4	40.5
Gross wage	5,787	9,256	13,987	14,884	15,897	16,167	16,936
Gross wage of tertiary educated	9,106	14,139	20,092	20,677	22,361	22,156	22,437
Number of firms	1,495	1,782	1,345	1,649	1,942	1,839	1,797

Note. The explanations of variables are as follows: *Outsourcing firms*: firms that import intermediate products; *FDI firms*: firms that engage in the outward FDI; *Employment*: mean number of employees; *Employment of tertiary educated*: mean number of tertiary educated employees; *Skill share*: the average of the share of the tertiary educated; *Age*: mean age of employees; *Gross wage*: mean annual gross wage in €; *Gross wage of tertiary educated*: mean annual gross wage of tertiary educated employees in €; *Number of firms*: number of observations.
Source: SORS, author's calculations

Table C3. Characteristics of employees in unskilled occupations

Clerical workers							
Year	**1998**	**2002**	**2006**	**2007**	**2008**	**2009**	**2010**
Share in the total employment	12.0	10.5	9.7	9.5	9.3	9.5	9.4
Share in the tertiary educated	4.5	4.7	5.9	6.3	6.4	6.6	6.8
Age	35.0	37.1	38.7	38.8	39.3	39.7	39.9
Gross wage	5,203	8,126	10,451	11,064	11,622	11,730	12,044
Gross wage of tertiary educated	7,357	11,217	12,981	13,593	14,419	14,482	14,626
Service workers							
Year	**1998**	**2002**	**2006**	**2007**	**2008**	**2009**	**2010**
Share in the total employment	11.1	11.3	11.2	11.4	11.5	12.1	12.3
Share in the tertiary educated	1.3	1.6	2.3	2.8	3.0	3.3	3.6
Age	33.0	35.0	36.4	36.7	37.2	37.6	38.0
Gross wage	4,225	6,369	8,286	8,862	9,365	9,458	9,859
Gross wage of tertiary educated	6,698	9,654	11,006	11,411	12,295	12,286	12,766
Craft workers							
Year	**1998**	**2002**	**2006**	**2007**	**2008**	**2009**	**2010**
Share in the total employment	15.8	16.8	17.8	18.0	18.2	17.9	17.4
Share in the tertiary educated	0.4	0.7	1.3	1.4	1.5	1.6	1.7
Age	35.0	36.6	38.2	38.3	38.6	39.1	39.6
Gross wage	4,553	6,827	9,054	9,615	10,218	10,244	10,631
Gross wage of tertiary educated	6,689	10,606	13,804	14,393	15,984	15,680	15,744
Machinery workers							
Year	**1998**	**2002**	**2006**	**2007**	**2008**	**2009**	**2010**
Share in the total employment	27.8	23.1	19.0	18.2	17.5	15.8	15.5
Share in the tertiary educated	4.9	5.9	2.5	2.3	2.4	2.1	2.0
Age	35.3	37.4	39.4	39.7	40.1	40.6	41.2
Gross wage	4,582	7,120	9,468	10,154	10,601	10,529	11,241
Gross wage of tertiary educated	6,210	8,512	12,522	13,744	14,427	14,645	16,352
Elementary workers							
Year	**1998**	**2002**	**2006**	**2007**	**2008**	**2009**	**2010**
Share in the total employment	7.2	11.2	13.1	13.5	13.8	13.4	13.1
Share in the tertiary educated	0.1	0.2	0.5	0.5	0.6	0.6	0.7
Age	35.8	36.5	37.9	38.1	38.5	39.2	40.0
Gross wage	3,664	5,400	7,031	7,483	7,700	7,815	8,385
Gross wage of tertiary educated	4,942	6,463	8,340	8,702	9,619	9,334	9,571

Note. The explanations of variables are as follows: *Share in the total employment*: share of a particular occupational group in the total employment (in %); *Share in the tertiary educated*: share of a particular occupational group in the total number of tertiary educated employees (in %); *Age*: mean age of a particular occupational group; *Gross wage*: mean gross annual wage of a particular occupational group in €; *Gross wage of tertiary educated*: mean gross annual wage of tertiary educated employees in €.
Source: SORS, author's calculations

Table C4. The effect of outsourcing and outward FDI on the skill share in Slovenian manufacturing and service firms, robustness checks: include firm size as explanatory variable (observation period: 1997-2010)

	Manufacturing firms			*Service firms*		
	Pooled OLS	**FE**	**RE**	**Pooled OLS**	**FE**	**RE**
FDI	0.158***	0.063**	0.090***	0.285***	-0.019	0.042
	[4.52]	[2.26]	[3.43]	[7.08]	[-0.57]	[1.38]
Outsourcing	-29.46***	0.114	-2.032	32.280**	6.616	12.270**
	[-4.13]	[0.020]	[-0.41]	[1.99]	[1.20]	[2.11]
log(capital per emp)	0.009	0.016	0.019**	-0.005	0.012**	0.0104**
	[0.81]	[1.64]	[2.26]	[-0.68]	[2.07]	[2.05]
log(tfp)	-0.031	-0.005	-0.001	0.126***	0.003	0.033***
	[-1.39]	[-0.43]	[-0.098]	[8.90]	[0.40]	[4.11]
log(export value)	-0.001	0.000	0.000	-0.017***	-0.001	-0.006***
	[-0.59]	[0.08]	[0.08]	[-5.19]	[-0.55]	[-2.75]
log(gross wage)	0.638***	0.240***	0.290***	0.608***	0.132***	0.234***
	[15.7]	[8.63]	[10.5]	[25.3]	[9.02]	[15.6]
log(domestic costs)	0.204***	0.039**	0.0849***	0.080***	0.026**	0.034***
	[11.2]	[2.30]	[5.90]	[6.38]	[2.37]	[3.88]
log(employment)	-0.081***	0.032	0.039*	0.130***	0.197***	0.188***
	[-2.72]	[1.16]	[1.77]	[6.36]	[9.45]	[11.8]
Constant	-6.354***	-0.606	-2.363***	-5.638***	-0.105	-1.482***
	[-11.9]	[-1.04]	[-4.19]	[-18.0]	[-0.31]	[-5.78]
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,751	41,751	41,751	87,613	87,613	87,613
R-squared (within)		0.068	0.064		0.039	0.031
R-squared (between)		0.098	0.165		0.060	0.205
R-squared (overall)	0.099	0.156	0.200	0.056	0.168	0.216
Sargan-Hansen statistics		503.784***			1,384.700***	

Note. Econometric methods: Pooled OLS: pooled ordinary least squares; FE: fixed effects; RE: random effects. The dependent variable is defined as the logarithm of the ratio between skilled employees and the total number of employees, where tertiary educated workers are defined as skilled. The explanation of variables: *FDI*: dummy variable, controlling for the outward FDI*; Outsourcing*: share of intermediate imports in the total material costs; *log(capital per emp)*: logarithm of the capital per employee in a firm; *log(tfp)*: logarithm of the total factor productivity per employee in a firm; *log(export value)*: logarithm of the value of exports; *log(gross wage)*: logarithm of the average annual gross wage level; *log(domestic costs)*: logarithm of the domestic cost level; *log(employment)*: logarithm of the number of employees. *** p<0.01, ** p<0.05, * p<0.1, robust t-statistics in brackets, the analysis used cluster-robust standard errors.
Source: SORS, author's calculations

Table C5. The effect of outsourcing and outward FDI on the skill share in Slovenian manufacturing and service firms; robustness checks: exchange total factor productivity for value added (observation period: 1997-2010)

	Manufacturing firms			*Service firms*		
	Pooled OLS	**FE**	**RE**	**Pooled OLS**	**FE**	**RE**
FDI	0.136***	0.063**	0.094***	0.302***	0.012	0.082***
	[3.87]	[2.30]	[3.62]	[7.54]	[0.37]	[2.68]
Outsourcing	-34.140***	1.577	0.012	32.730**	12.580**	17.290***
	[-4.65]	[0.29]	[0.0024]	[2.03]	[1.98]	[2.69]
log(capital per emp)	0.015	0.013	0.016*	-0.022***	0.003	0.001
	[1.30]	[1.40]	[1.90]	[-2.84]	[0.52]	[0.14]
log(value added per emp)	0.013	-0.014	-0.012	0.112***	-0.039***	-0.006
	[0.60]	[-1.08]	[-0.97]	[8.27]	[-4.50]	[-0.77]
log(export value)	-0.003	0.000	0.001	-0.017***	-0.002	-0.006***
	[-1.18]	[0.098]	[0.32]	[-4.99]	[-0.77]	[-2.74]
log(gross wage)	0.629***	0.243***	0.294***	0.613***	0.153***	0.255***
	[15.5]	[8.83]	[10.7]	[25.7]	[10.4]	[16.8]
log(domestic costs)	0.157***	0.057***	0.108***	0.100***	0.098***	0.105***
	[15.4]	[3.80]	[10.4]	[12.4]	[9.21]	[13.9]
Constant	-5.924***	-0.780	-2.608***	-5.909***	-0.937***	-2.348***
	[-11.4]	[-1.37]	[-4.87]	[-20.7]	[-2.74]	[-9.52]
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,795	41,795	41,795	87,621	87,621	87,621
R-squared (within)		0.068	0.064		0.033	0.025
R-squared (between)		0.097	0.167		0.067	0.213
R-squared (overall)	0.183	0.100	0.160	0.193	0.068	0.179
Sargan-Hansen statistics		1,694.361***			1,464.491***	

Note. Econometric methods: Pooled OLS: pooled ordinary least squares; FE: fixed effects; RE: random effects. The dependent variable is defined as the logarithm of the ratio between skilled employees and the total number of employees, where tertiary educated workers are defined as skilled. The explanation of variables: *FDI*: dummy variable, controlling for the outward FDI; *Outsourcing*: share of intermediate imports in the total material costs; *log(capital per emp)*: logarithm of the capital per employee in a firm; *log(value added per emp)*: logarithm of the value added per employee in a firm; *log(export value)*: logarithm of the value of exports; *log(gross wage)*: logarithm of the average annual gross wage level; *log(domestic costs)*: logarithm of the domestic cost level. *** p<0.01, ** p<0.05, * p<0.1, robust t-statistics in brackets, the analysis used cluster-robust standard errors.
Source: SORS, author's calculations

Table C6. The effect of outsourcing and outward FDI on the skill share in Slovenian manufacturing and service firms, robustness checks: include firm size as explanatory variable; robustness checks: exchange total factor productivity for value added (observation period: 1997-2010)

	Manufacturing firms			*Service firms*		
	Pooled OLS	**FE**	**RE**	**Pooled OLS**	**FE**	**RE**
FDI	0.159***	0.063**	0.090***	0.280***	-0.019	0.043
	[4.52]	[2.26]	[3.44]	[6.96]	[-0.57]	[1.38]
Outsourcing	-29.63*0**	-0.007	-2.150	32.310**	6.641	12.300**
	[-4.15]	[-0.0012]	[-0.43]	[2.00]	[1.21]	[2.11]
log(capital per emp)	0.013	0.016*	0.019**	-0.022***	0.012**	0.006
	[1.09]	[1.72]	[2.26]	[-2.90]	[2.01]	[1.19]
log(value added per emp)	-0.020	-0.003	0.001	0.127***	0.003	0.0319***
	[-0.91]	[-0.26]	[0.10]	[8.92]	[0.30]	[4.00]
log(export value)	-0.001	0.000	0.000	-0.017***	-0.001	-0.006***
	[-0.57]	[0.083]	[0.11]	[-5.16]	[-0.55]	[-2.74]
log(gross wage)	0.634***	0.240***	0.290***	0.607***	0.132***	0.234***
	[15.6]	[8.62]	[10.5]	[25.3]	[9.03]	[15.6]
log(domestic costs)	0.201***	0.038**	0.083***	0.078***	0.026**	0.035***
	[11.1]	[2.22]	[5.81]	[6.44]	[2.39]	[3.93]
log(employment)	-0.055***	0.037	0.041**	0.037**	0.195***	0.164***
	[-2.80]	[1.56]	[2.23]	[2.50]	[10.5]	[12.0]
Constant	-6.364***	-0.594	-2.351***	-5.632***	-0.104	-1.485***
	[-12.0]	[-1.02]	[-4.17]	[-18.1]	[-0.31]	[-5.79]
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,795	41,795	41,795	87,621	87,621	87,621
R-squared (within)		0.069	0.065		0.039	0.031
R-squared (between)		0.099	0.165		0.060	0.205
R-squared (overall)	0.184	0.100	0.157	0.193	0.056	0.168
Sargan-Hansen statistics		1,693.178***			1,571.077***	

Note. Econometric methods: Pooled OLS: pooled ordinary least squares; FE: fixed effects; RE: random effects. The dependent variable is defined as the logarithm of the ratio between skilled employees and the total number of employees, where tertiary educated workers are defined as skilled. The explanation of variables: *FDI*: dummy variable, controlling for the outward FDI*; Outsourcing*: share of intermediate imports in the total material costs; *log(capital per emp)*: logarithm of the capital per employee in a firm; *log(value added per emp)*: logarithm of the value added per employee; *log(export value)*: logarithm of the value of exports; *log(gross wage)*: logarithm of the average annual gross wage level; *log(domestic costs)*: logarithm of the domestic cost level; *log(employment)*: logarithm of the number of employees. *** p<0.01, ** p<0.05, * p<0.1, robust t-statistics in brackets, the analysis used cluster-robust standard errors.
Source: SORS, author's calculations

Table C7. The effect of outsourcing and outward FDI on the skill share in Slovenian manufacturing and service firms for the occupational group "Managers" (observation period: 1997-2010)

	Manufacturing firms			*Service firms*		
	Pooled OLS	**FE**	**RE**	**Pooled OLS**	**FE**	**RE**
FDI	0.153***	-0.013	-0.007	0.075	-0.022	-0.0244
	[4.04]	[-0.47]	[-0.26]	[1.37]	[-0.54]	[-0.64]
FDI_high	0.077	0.031	0.033	0.094	0.042	0.045
	[1.56]	[0.72]	[0.81]	[0.88]	[0.58]	[0.65]
Outsourcing	39.38	-8.522	-4.528	5.631	3.162	3.072
	[1.18]	[-0.47]	[-0.27]	[0.20]	[0.36]	[0.33]
Outsourcing_high	-66.26*	3.103	-4.694	-22.73	-10.32	-9.253
	[-1.87]	[0.17]	[-0.27]	[-0.67]	[-1.28]	[-1.06]
High	0.0898**	0.022	0.031	0.083**	0.006	0.016
	[2.20]	[1.02]	[1.48]	[2.57]	[0.32]	[0.91]
log(capital per emp)	0.024**	0.023**	0.020**	-0.029***	0.010*	0.001
	[2.16]	[2.53]	[2.55]	[-3.78]	[1.78]	[0.14]
log(tfp)	0.148***	0.040***	0.057***	0.136***	0.029***	0.048***
	[10.1]	[3.16]	[5.02]	[13.3]	[3.58]	[6.70]
log(export value)	-0.001	0.001	-0.001	-0.011***	-0.005*	-0.007***
	[-0.46]	[0.34]	[-0.30]	[-2.95]	[-1.89]	[-3.02]
log(gross wage)	0.400***	0.257***	0.272***	0.300***	0.233***	0.248***
	[10.2]	[8.72]	[9.52]	[14.3]	[13.4]	[15.4]
log(domestic costs)	-0.088***	-0.050***	-0.065***	-0.074***	-0.013	-0.035***
	[-6.65]	[-3.48]	[-5.73]	[-8.28]	[-1.25]	[-4.50]
Constant	-0.868*	-0.074	-1.152**	0.251	0.111	0.127
	[-1.79]	[-0.18]	[-2.05]	[0.78]	[0.39]	[0.51]
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,751	41,751	41,751	87,613	87,613	87,613
R-squared (within)		0.029	0.027		0.016	0.014
R-squared (between)		0.030	0.055		0.030	0.049
R-squared (overall)	0.087	0.040	0.067	0.053	0.026	0.046
Sargan-Hansen statistics		268.051***			250.856***	

Note. Econometric methods: Pooled OLS: pooled ordinary least squares; FE: fixed effects; RE: random effects. The dependent variable is defined as the logarithm of the ratio between skilled employees and the total number of employees, where Managers in ISCO-88 classification are defined as skilled. The explanation of variables: *FDI*: dummy variable, controlling for the outward FDI*; FDI_high*: dummy variable, controlling for the outward FDI to high-income countries*; Outsourcing*: share of intermediate imports in the total material costs; *Outsourcing_high*: share of intermediate imports from high-income countries in the total material costs if a firm imports the majority of its intermediate products from high-income countries; *High*: dummy variable, controlling for high-income countries; *log(capital per emp)*: logarithm of the capital per employee in a firm; *log(tfp)*: logarithm of the total factor productivity per employee in a firm; *log(export value)*: logarithm of the value of exports; *log(gross wage)*: logarithm of the average annual gross wage level; *log(domestic costs)*: logarithm of the domestic cost level. *** p<0.01, ** p<0.05, * p<0.1, robust t-statistics in brackets, the analysis used cluster-robust standard errors.
Source: SORS, author's calculations

Table C8. The effect of outsourcing and outward FDI on the skill share in Slovenian manufacturing and service firms for the occupational group "Professionals" (observation period: 1997-2010)

	Manufacturing firms			*Service firms*		
	Pooled OLS	**FE**	**RE**	**Pooled OLS**	**FE**	**RE**
FDI	0.267***	0.049	0.101***	0.373***	0.161***	0.223***
	[5.85]	[1.26]	[2.86]	[6.72]	[4.06]	[5.97]
FDI_high	0.040	0.068	0.0886*	0.166*	0.007	0.046
	[0.59]	[1.33]	[1.82]	[1.67]	[0.10]	[0.70]
Outsourcing	-20.98	9.717	11.01	-17.82*	-3.324	-5.842
	[-0.64]	[0.18]	[0.25]	[-1.81]	[-0.68]	[-1.22]
Outsourcing_high	6.365	-12.38	-13.12	-17.76	-1.262	-2.706
	[0.19]	[-0.23]	[-0.30]	[-1.42]	[-0.22]	[-0.47]
High	0.009	0.014	0.016	0.056***	0.028**	0.047***
	[0.32]	[0.74]	[0.94]	[2.84]	[1.99]	[3.81]
log(capital per emp)	-0.017**	0.004	0.002	0.004	-0.007*	-0.001
	[-2.26]	[0.50]	[0.37]	[0.91]	[-1.91]	[-0.40]
log(tfp)	-0.070***	-0.041***	-0.055***	-0.084***	-0.068***	-0.067***
	[-7.35]	[-4.33]	[-7.17]	[-11.6]	[-11.6]	[-13.6]
log(export value)	0.004**	0.002	0.004**	0.007***	0.005**	0.005***
	[2.01]	[1.03]	[2.46]	[2.73]	[2.07]	[2.96]
log(gross wage)	0.361***	0.096***	0.141***	0.366***	0.048***	0.121***
	[13.6]	[5.51]	[8.56]	[22.8]	[4.89]	[13.1]
log(domestic costs)	0.147***	0.078***	0.121***	0.079***	0.080***	0.083***
	[16.5]	[6.47]	[15.4]	[12.7]	[9.77]	[15.5]
Constant	-4.273***	-0.849**	-2.673***	-3.497***	-1.100***	-1.741***
	[-9.36]	[-2.12]	[-11.8]	[-17.7]	[-3.98]	[-12.8]
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,751	41,751	41,751	87,613	87,613	87,613
R-squared (within)		0.053	0.049		0.028	0.022
R-squared (between)		0.186	0.244		0.084	0.222
R-squared (overall)	0.242	0.176	0.227	0.214	0.093	0.203
Sargan-Hansen statistics		504.516***			796.516***	

Note. Econometric methods: Pooled OLS: pooled ordinary least squares; FE: fixed effects; RE: random effects. The dependent variable is defined as the logarithm of the ratio between skilled employees and the total number of employees, where Professionals in ISCO-88 classification are defined as skilled. The explanation of variables: *FDI*: dummy variable, controlling for the outward FDI; *FDI_high*: dummy variable, controlling for the outward FDI to high-income countries; *Outsourcing*: share of intermediate imports in the total material costs; *Outsourcing_high*: share of intermediate imports from high-income countries in the total material costs if a firm imports the majority of its intermediate products from high-income countries; *High*: dummy variable, controlling for high-income countries; *log(capital per emp)*: logarithm of the capital per employee in a firm; *log(tfp)*: logarithm of the total factor productivity per employee in a firm; *log(export value)*: logarithm of the value of exports; *log(gross wage)*: logarithm of the average annual gross wage level; *log(domestic costs)*: logarithm of the domestic cost level. *** p<0.01, ** p<0.05, * p<0.1, robust t-statistics in brackets, the analysis used cluster-robust standard errors.
Source: SORS, author's calculations

Table C9. The effect of outsourcing and outward FDI on the skill share in Slovenian manufacturing and service firms for the occupational group "Technicians" (observation period: 1997-2010)

	Manufacturing firms			*Service firms*		
	Pooled OLS	**FE**	**RE**	**Pooled OLS**	**FE**	**RE**
FDI	-0.027	-0.014	-0.002	0.024	-0.032	0.009
	[-0.68]	[-0.53]	[-0.091]	[0.46]	[-0.90]	[0.27]
FDI_high	-0.304***	-0.041	-0.069**	-0.210**	-0.067	-0.060
	[-5.47]	[-1.32]	[-2.28]	[-2.17]	[-1.09]	[-1.07]
Outsourcing	-43.280	79.35**	57.860	59.580***	37.180**	46.050***
	[-0.90]	[2.40]	[1.60]	[2.77]	[2.29]	[2.90]
Outsourcing_high	-0.257	-67.09**	-49.910	2.928	4.780	1.549
	[-0.01]	[-2.02]	[-1.37]	[0.11]	[0.27]	[0.087]
High	0.192***	0.031	0.055**	0.206***	0.065***	0.103***
	[4.77]	[1.21]	[2.25]	[6.61]	[3.00]	[5.29]
log(capital per emp)	-0.002	0.007	0.010	0.006	-0.024***	-0.017***
	[-0.14]	[0.68]	[1.12]	[0.81]	[-3.56]	[-2.99]
log(tfp)	-0.038***	-0.083***	-0.082***	-0.102***	-0.132***	-0.124***
	[-2.74]	[-6.26]	[-7.19]	[-10.1]	[-14.1]	[-15.8]
log(export value)	-0.007***	-0.002	-0.003	-0.002	0.003	-0.002
	[-2.93]	[-0.89]	[-1.62]	[-0.62]	[0.97]	[-0.69]
log(gross wage)	0.325***	0.070***	0.114***	0.255***	-0.010	0.052***
	[10.1]	[2.66]	[4.65]	[13.1]	[-0.61]	[3.77]
log(domestic costs)	0.215***	0.105***	0.158***	0.241***	0.188***	0.222***
	[17.2]	[6.34]	[13.6]	[28.7]	[15.7]	[28.2]
Constant	-5.234***	-0.608	-1.883***	-5.096***	-0.839**	-2.143***
	[-9.39]	[-0.97]	[-3.86]	[-19.4]	[-2.42]	[-10.5]
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,751	41,751	41,751	87,613	87,613	87,613
R-squared (within)		0.024	0.022		0.035	0.030
R-squared (between)		0.126	0.185		0.084	0.166
R-squared (overall)	0.176	0.103	0.154	0.170	0.091	0.158
Sargan-Hansen statistics		487.702***			584.975***	

Note. Econometric methods: Pooled OLS: pooled ordinary least squares; FE: fixed effects; RE: random effects. The dependent variable is defined as the logarithm of the ratio between skilled employees and the total number of employees, where Technicians in ISCO-88 classification are defined as skilled. The explanation of variables: *FDI*: dummy variable, controlling for the outward FDI*; FDI_high*: dummy variable, controlling for the outward FDI to high-income countries*; Outsourcing*: share of intermediate imports in the total material costs; *Outsourcing_high*: share of intermediate imports from high-income countries in the total material costs if a firm imports the majority of its intermediate products from high-income countries; *High*: dummy variable, controlling for high-income countries; *log(capital per emp)*: logarithm of the capital per employee in a firm; *log(tfp)*: logarithm of the total factor productivity per employee in a firm; *log(export value)*: logarithm of the value of exports; *log(gross wage)*: logarithm of the average annual gross wage level; *log(domestic costs)*: logarithm of the domestic cost level. *** p<0.01, ** p<0.05, * p<0.1, robust t-statistics in brackets, the analysis used cluster-robust standard errors.
Source: SORS, author's calculations

Table C10. The effect of outsourcing and outward FDI on the skill share in Slovenian manufacturing and service firms for the occupational group "Managers" (observation period: 1997-2010, only tertiary educated)

	Manufacturing firms			*Service firms*		
	Pooled OLS	**FE**	**RE**	**Pooled OLS**	**FE**	**RE**
FDI	0.172***	0.015	0.038	0.296***	-0.026	0.012
	[4.19]	[0.50]	[1.38]	[5.36]	[-0.66]	[0.31]
FDI_high	-0.058	-0.004	0.001	0.028	0.021	0.031
	[-1.02]	[-0.086]	[0.013]	[0.27]	[0.33]	[0.51]
Outsourcing	-1.731	6.473	6.051	39.070	2.340	7.559
	[-0.054]	[0.44]	[0.44]	[1.48]	[0.28]	[0.87]
Outsourcing_high	-16.01	-6.381	-6.625	-30.540	1.138	-1.760
	[-0.49]	[-0.43]	[-0.47]	[-0.90]	[0.13]	[-0.19]
High	0.117***	0.024	0.032*	0.098***	0.017	0.037**
	[3.40]	[1.35]	[1.90]	[3.25]	[1.08]	[2.53]
log(capital per emp)	0.005	0.015**	0.015**	-0.019**	0.001	-0.002
	[0.47]	[2.00]	[2.15]	[-2.57]	[0.19]	[-0.41]
log(tfp)	0.037***	0.025**	0.022**	0.090***	-0.006	0.011*
	[2.75]	[2.14]	[2.17]	[9.63]	[-0.88]	[1.82]
log(export value)	0.004	0.003	0.004*	-0.008**	-0.003	-0.005***
	[1.63]	[1.51]	[1.89]	[-2.37]	[-1.56]	[-2.62]
log(gross wage)	0.432***	0.164***	0.193***	0.440***	0.154***	0.206***
	[13.0]	[7.63]	[9.15]	[21.4]	[11.9]	[16.1]
log(domestic costs)	0.037***	-0.016	0.011	0.031***	0.025***	0.024***
	[3.16]	[-1.30]	[1.14]	[3.69]	[2.80]	[3.64]
Constant	-3.544***	-0.203	-1.520***	-3.761***	-0.790***	-1.367***
	[-7.24]	[-0.52]	[-5.24]	[-12.1]	[-2.89]	[-6.15]
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,751	41,751	41,751	87,613	87,613	87,613
R-squared (within)		0.021	0.018		0.011	0.009
R-squared (between)		0.013	0.062		0.060	0.111
R-squared (overall)	0.075	0.012	0.055	0.098	0.047	0.089
Sargan-Hansen statistics		693.487***			569.012***	

Note. Econometric methods: Pooled OLS: pooled ordinary least squares; FE: fixed effects; RE: random effects. The dependent variable is defined as the logarithm of the ratio between skilled employees and the total number of employees, where tertiary educated Managers in ISCO-88 classification are defined as skilled. The explanation of variables: *FDI*: dummy variable, controlling for the outward FDI*; FDI_high*: dummy variable, controlling for the outward FDI to high-income countries*; Outsourcing*: share of intermediate imports in the total material costs; *Outsourcing_high*: share of intermediate imports from high-income countries in the total material costs if a firm imports the majority of its intermediate products from high-income countries; *High*: dummy variable, controlling for high-income countries; *log(capital per emp)*: logarithm of the capital per employee in a firm; *log(tfp)*: logarithm of the total factor productivity per employee in a firm; *log(export value)*: logarithm of the value of exports; *log(gross wage)*: logarithm of the average annual gross wage level; *log(domestic costs)*: logarithm of the domestic cost level. *** p<0.01, ** p<0.05, * p<0.1, robust t-statistics in brackets, the analysis used cluster-robust standard errors.

Source: SORS, author's calculations

Table C11. The effect of outsourcing and outward FDI on the skill share in Slovenian manufacturing and service firms for the occupational group "Professionals" (observation period: 1997-2010, only tertiary educated)

	Manufacturing firms			*Service firms*		
	Pooled OLS	**FE**	**RE**	**Pooled OLS**	**FE**	**RE**
FDI	0.288***	0.036	0.093***	0.368***	0.145***	0.204***
	[6.37]	[0.99]	[2.80]	[6.65]	[3.69]	[5.53]
FDI_high	0.053	0.075	0.101**	0.174*	0.046	0.075
	[0.78]	[1.51]	[2.13]	[1.74]	[0.72]	[1.21]
Outsourcing	-21.370	25.900	22.980	-13.730	-1.409	-3.239
	[-0.69]	[0.57]	[0.60]	[-1.47]	[-0.31]	[-0.76]
Outsourcing_high	7.226	-29.770	-25.640	-20.260*	-5.204	-6.498
	[0.23]	[-0.67]	[-0.68]	[-1.69]	[-0.95]	[-1.17]
High	0.020	0.017	0.020	0.060***	0.031**	0.048***
	[0.78]	[1.03]	[1.30]	[3.17]	[2.35]	[4.12]
log(capital per emp)	-0.017**	0.006	0.005	0.001	-0.008**	-0.002
	[-2.27]	[0.86]	[0.84]	[0.27]	[-2.11]	[-0.70]
log(tfp)	-0.063***	-0.034***	-0.048***	-0.080***	-0.062***	-0.061***
	[-7.05]	[-3.77]	[-6.63]	[-11.7]	[-11.2]	[-13.1]
log(export value)	0.005**	0.001	0.004**	0.006***	0.005**	0.005***
	[2.43]	[0.81]	[2.54]	[2.71]	[2.12]	[3.06]
log(gross wage)	0.343***	0.090***	0.134***	0.366***	0.051***	0.122***
	[13.5]	[5.57]	[8.72]	[23.1]	[5.58]	[13.9]
log(domestic costs)	0.139***	0.069***	0.112***	0.073***	0.073***	0.076***
	[16.2]	[6.43]	[15.8]	[12.0]	[9.32]	[14.7]
Constant	-4.049***	-0.741**	-2.598***	-3.391***	-1.063***	-1.727***
	[-9.06]	[-2.01]	[-12.4]	[-17.7]	[-3.92]	[-13.3]
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,751	41,751	41,751	87,613	87,613	87,613
R-squared (within)		0.055	0.050		0.030	0.023
R-squared (between)		0.181	0.248		0.082	0.218
R-squared (overall)	0.251	0.175	0.234	0.213	0.091	0.201
Sargan-Hansen statistics		586.418***			791.558***	

Note. Econometric methods: Pooled OLS: pooled ordinary least squares; FE: fixed effects; RE: random effects. The dependent variable is defined as the logarithm of the ratio between skilled employees and the total number of employees, where tertiary educated Professionals in ISCO-88 classification are defined as skilled. The explanation of variables: *FDI*: dummy variable, controlling for the outward FDI*; FDI_high*: dummy variable, controlling for the outward FDI to high-income countries*; Outsourcing*: share of intermediate imports in the total material costs; *Outsourcing_high*: share of intermediate imports from high-income countries in the total material costs if a firm imports the majority of its intermediate products from high-income countries; *High*: dummy variable, controlling for high-income countries; *log(capital per emp)*: logarithm of the capital per employee in a firm; *log(tfp)*: logarithm of the total factor productivity per employee in a firm; *log(export value)*: logarithm of the value of exports; *log(gross wage)*: logarithm of the average annual gross wage level; *log(domestic costs)*: logarithm of the domestic cost level. *** p<0.01, ** p<0.05, * p<0.1, robust t-statistics in brackets, the analysis used cluster-robust standard errors.

Source: SORS, author's calculations

Table C12. The effect of outsourcing and outward FDI on the skill share in Slovenian manufacturing and service firms for the occupational group "Technicians" (observation period: 1997-2010, only tertiary educated)

	Manufacturing firms			*Service firms*		
	Pooled OLS	**FE**	**RE**	**Pooled OLS**	**FE**	**RE**
FDI	0.214***	0.089***	0.130***	0.340***	0.070	0.156***
	[4.83]	[2.70]	[4.33]	[6.70]	[1.62]	[4.13]
FDI_high	-0.210***	-0.036	-0.048	0.000	-0.091	-0.030
	[-3.62]	[-0.81]	[-1.16]	[-0.00]	[-1.16]	[-0.43]
Outsourcing	19.890	57.590**	50.200*	51.680**	41.350**	45.940***
	[0.63]	[2.14]	[1.94]	[1.98]	[2.43]	[2.77]
Outsourcing_high	-38.790	-52.080*	-47.520*	-24.660	-26.810*	-27.120*
	[-1.22]	[-1.95]	[-1.85]	[-0.88]	[-1.71]	[-1.73]
High	0.123***	0.045**	0.063***	0.092***	0.048***	0.073***
	[4.46]	[2.37]	[3.59]	[3.65]	[2.80]	[4.85]
log(capital per emp)	0.003	-0.014	-0.004	0.002	-0.004	-0.001
	[0.36]	[-1.51]	[-0.52]	[0.39]	[-0.76]	[-0.24]
log(tfp)	-0.019*	-0.046***	-0.048***	-0.063***	-0.081***	-0.077***
	[-1.72]	[-4.48]	[-5.77]	[-7.83]	[-10.9]	[-13.1]
log(export value)	-0.001	-0.002	-0.001	0.003	0.001	0.001
	[-0.33]	[-0.97]	[-0.60]	[0.91]	[0.49]	[0.27]
log(gross wage)	0.300***	0.109***	0.147***	0.341***	0.035***	0.122***
	[11.3]	[5.62]	[8.40]	[18.7]	[2.90]	[11.1]
log(domestic costs)	0.177***	0.0745***	0.126***	0.170***	0.118***	0.146***
	[18.5]	[5.69]	[15.1]	[23.5]	[12.0]	[24.7]
Constant	-5.280***	-1.487***	-2.795***	-5.222***	-1.348***	-2.627***
	[-13.8]	[-3.16]	[-11.4]	[-22.5]	[-4.79]	[-16.9]
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,751	41,751	41,751	87,613	87,613	87,613
R-squared (within)		0.058	0.055		0.037	0.032
R-squared (between)		0.139	0.199		0.064	0.144
R-squared (overall)	0.194	0.133	0.181	0.152	0.076	0.142
Sargan-Hansen statistics		380.796***			563.509***	

Note. Econometric methods: Pooled OLS: pooled ordinary least squares; FE: fixed effects; RE: random effects. The dependent variable is defined as the logarithm of the ratio between skilled employees and the total number of employees, where tertiary educated Technicians in ISCO-88 classification are defined as skilled. The explanation of variables: *FDI*: dummy variable, controlling for the outward FDI*; FDI_high*: dummy variable, controlling for the outward FDI to high-income countries*; Outsourcing*: share of intermediate imports in the total material costs; *Outsourcing_high*: share of intermediate imports from high-income countries in the total material costs if a firm imports the majority of its intermediate products from high-income countries; *High*: dummy variable, controlling for high-income countries; *log(capital per emp)*: logarithm of the capital per employee in a firm; *log(tfp)*: logarithm of the total factor productivity per employee in a firm; *log(export value)*: logarithm of the value of exports; *log(gross wage)*: logarithm of the average annual gross wage level; *log(domestic costs)*: logarithm of the domestic cost level. *** p<0.01, ** p<0.05, * p<0.1, robust t-statistics in brackets, the analysis used cluster-robust standard errors.

Source: SORS, author's calculations

E/B/R

POVZETKI V SLOVENSKEM JEZIKU

SPILLOVER EFFECTS THROUGH WORKER MOBILITY: EVIDENCE FROM SLOVENIAN SMEs

UČINKI PRELIVANJA S POMOČJO MOBILNOSTI DELOVNE SILE: PRIMER SLOVENSKIH MSP

TINA GOLOB

POVZETEK: *Raziskava preverja obstoj potencialnih učinkov prelivanja produktivnosti, ki nastanejo s pomočjo mobilnosti delovne sile med podjetji v tuji lasti in domačimi malimi in srednje velikimi podjetji (MSP). Izračuni so narejeni na podlagi podatkov za Slovenijo v obdobju od 2002 do 2010, posebej za proizvodni ter storitveni sektor. Moj članek prispeva k segmentu literature, ki je dokaj omejen, saj zahteva uporabo baz podatkov, ki povezujejo zaposlene in delodajalce. Tovrstne baze so se namreč pojavile šele pred kratkim. Raziskava daje robustne dokaze v podporo hipotezi, da tokovi visoko izobraženih delavcev od podjetij v tuji lasti k domačim MSP, povečujejo rast skupne faktorske produktivnosti domačih MSP v storitvenem sektorju.*

Ključne besede: učinek prelivanja, mobilnost delovne sile, neposredne tuje investicije, faktorska produktivnost, tuja podjetja, MSP

TESTING THE HYPOTHESIS OF THE ADEQUACY OF THE DISTANCE-TO-DEFAULT AS AN INDICATOR OF CHANGES IN BANKS' RISK EXPOSURES

TESTIRANJE HIPOTEZE USTREZNOSTI INDIKATORJA "ODDALJENOST DO PLAČILNE NEZMOŽNOSTI" KOT INDIKATORJA SPREMEMB V TVEGANOSTI BANČNEGA SISTEMA

BOŽO JAŠOVIČ

POVZETEK: *Indikator »oddaljenost do plačilne nezmožnosti« (distance to default) odraža oddaljenost tržne vrednosti sredstev, merjeno v standardnih odklonih, od točke plačilne nezmožnosti gospodarske družbe. Hipoteza, da indikator »oddaljenost do plačilne nezmožnosti« lahko pred odraža (predhaja) spremembe v tveganosti bančnega sistema izraženimi s kazalniki na osnovi računovodskih podatkov, je bila empirično testirana na izbranih finančnih kazalnikih poslovanja bank. Uporabljena je bila Toda Yamamoto nadgradnja standardnega testa Grangerjeve vzročnosti s katero smo poizkušali ugotoviti, ali obstaja Grangerjeva vzročnost med prirejenim indikatorjem »oddaljenost do plačilne nezmožnosti« in izbranimi finančnimi kazalniki poslovanja bančnega sistema. V nasprotju s pričakovanji smo lahko Grangerjevo vzročnost dokazali le med odloženimi vrednostmi indikatorja »oddaljenost do plačilne nezmožnosti« (6 – 12 mesecev) in kazalnikom finančnega vzvoda, medtem ko pri ostalih kazalnikih nismo mogli potrditi podobne zveze.*

Ključne besede: finančna stabilnost, tržna disciplina, oddaljenost do plačilne nezmožnosti, tveganje neplačila, nadgrajena Grangerjeva vzročnost

CORPORATE FINANCIAL REPORTING IN SLOVENIA: HISTORICAL DEVELOPMENT, CONTEMPORARY CHALLENGES AND POLICY IMPLICATIONS

RAČUNOVODSKO POROČANJE DRUŽB V SLOVENIJI: ZGODOVINSKI RAZVOJ, TRENUTNI IZZIVI IN POTREBNE REGULATIVNE SPREMEMBE

MAJA ZAMAN GROFF, METKA DUHOVNIK

POVZETEK: *Slovenija zgodovinsko pripada kontinentalnemu pravnemu sistemu, medtem ko njen okvir računovodskega poročanja temelji na načelih merjenja in pripoznavanja, ki v pretežni meri izhajajo iz angloameriškega sistema. Namen članka je predstaviti razvoj računovodenja in kritično oceniti trenutni okvir računovodskega poročanja družb v Sloveniji. Pri tem uporabljamo kontingenčni pristop, ki poudarja, da so najboljše rešitve odvisne od širšega institucionalnega okolja: rešitve, ki se izkažejo za učinkovite v nekaterih državah, so lahko v drugih državah neprimerne. V članku predstavljamo nekatere izzive na področju računovodskega poročanja družb, ki so povezani z manj razvitim slovenskim kapitalskim trgom in slabostmi, ki izvirajo iz neskladnosti pravnega sistema z okvirom računovodskega poročanja. Čeprav menimo, da bodo novi računovodski standardi 2016 odpravili nekatere omenjene probleme in povečali preglednost računovodskega poročanja, izpostavljamo področja, kjer so za izboljšanje kakovosti računovodskega poročanja družb v Sloveniji potrebne dodatne regulativne spremembe.*

Ključne besede: računovodsko poročanje družb, računovodski poklic, zgodovinski razvoj, politika, Slovenija

VALUE INVESTING WITHIN THE UNIVERSE OF S&P500 EQUITIES

OBLIKOVANJE NALOŽBENE STRATEGIJE S POMOČJO TESTIRANJA ZGODOVINSKIH PODATKOV DELNIC INDEKSA S&P 500

GAŠPER SMOLIČ, ALEŠ BERK SKOK

POVZETEK: *S pomočjo testitanja zgodovinskih finančnih podatkov na delnicah S&P 500 dokazujemo, da je možno vzpostaviti donosno naložbeno strategijo. Uporabljamo preprosto rangiranje delnic, na podlagi štirih kriterijev za katere verjamemo da imajo vpliv na donose vrednostnih papirjev – razmerja med knjigovodsko in tržno ceno, donosnosti na kapital, tržne kapitalizacije in tveganja stečaja. Po pričakovanjih portfelj oblikovan na osnovi vseh štirih kriterijev, konsistentno vrača donosnosti, višje od tržnih. To nas usmerja k zaključku, da z uporabo klasičnih modelov tveganja, investitorji neučinkovito določajo ceno delnic in to v okviru najrazvitejšega trga kapitala na svetu. Donosnost naložbene strategije primerjamo s tržnimi donosnostmi in ga prilagodimo za tveganje po konvencionalnih modelih CAPM in trifaktorskim Fama & French. Ko testiramo donosnost strategij, oblikovanih na podlagi posameznega kriterija, ugotovimo da se te odražajo v še višjih donosnostih. Posamezne strategije pa so manj značilne in tudi bolj nestanovitne od strategije oblikovane na podlagi kombinacije štirih kriterijev.*

Ključne besede: model določanja cen dolgoročnih naložb, donosnost naložb, naložbena strategija

THE EFFECTS OF OUTSOURCING AND OUTWARD FDI ON SKILL STRUCTURE IN SLOVENIA: EVIDENCE ON MATCHED FIRM-EMPLOYEE DATA

VPLIV OUTSOURCINGA IN NETO TUJIH INVESTICIJ NA STRUKTURO ZNANJA V SLOVENSKIH PODJETJIH: ANALIZA PODATKOV NA RAVNI PODJETIJ IN ZAPOSLENIH

MOJCA LINDIČ

POVZETEK: *Članek proučuje vpliv outsourcinga in neto tujih investicij (NTI) na strukturo znanja v slovenskih podjetjih. Glavni doprinos analize je diferenciacija med outsourcingom in NTI v visoko in nizko razvite države ter vključitev nove dimenzije pri opredelitvi znanj in spretnosti posameznika, ki vključuje tudi vrsto poklica. Za potrebe analize so bili uporabljeni panelni podatki na ravni zaposlenih in podjetij v predelovalnih ter storitvenih dejavnostih med leti 1997 in 2010. Rezultati kažejo, da imajo NTI v visoko in nizko razvite države pozitiven vpliv na strukturo znanja podjetij v predelovalnih dejavnostih. Rezultati tudi kažejo, da so podjetja pri določenih poklicnih skupinah bolj naklonjena zaposlovanju bolj izobraženih posameznikov.*

Ključne besede: struktura znanja, neto tuje investicije, outsourcing, diferenciacija znanja, storitvene dejavnosti, predelovalne dejavnosti