Financial Theory & Practice

1/2015

Vol. 39, No. 1 | pp. 1-113
March 2015 | Zagreb

UDC 336
ISSN 1846-887X

Institute of Public Finance

Publisher
Institute of Public Finance, Smičiklasova 21, Zagreb, Croatia

Editor-in-Chief
Katarina Ott

Production Editor
Marina Nekić

Financial Theory and Practice is abstracted and indexed in:
DOAJ (Directory of Open Access Journals, Lund University, Sweden)
EBSCO Publishing Database
EconLit (American Economic Association's electronic database), JEL (Journal of Economic Literature, Pittsburgh, Pennsylvania, USA)
HRČAK (Portal of Scientific Journals of Croatia)
IBSS (International Bibliography of the Social Sciences, ProQuest, Cambridge, UK)
RePEc (Research Papers in Economics)

Financial Theory & Practice 1/2015

Reviewed scientific journal

Vol. 39, No. 1 | pp. 1-113 | March 2015 | Zagreb

Institute of
Public Finance

Financial Theory and Practice publishes scientific articles in the field of public sector economics, and also welcomes submissions of applied and theoretical research papers on a broader set of economic topics such as economic growth and development, the role of institutions, transition to the market economy and EU integration. Empirical analysis is preferably related, but not limited, to the experience of countries in Central and Eastern Europe and Southeast Europe.

Submission of papers

Submission of a paper will be held to imply that it contains original unpublished work and is not being submitted for publication elsewhere. All papers have to pass through a double blind peer-reviewing process.

Guidelines for authors can be found at www.fintp.hr.

Financial Theory and Practice is published in accordance with the highest level of professional ethics and standards. *Ethical guidelines for journal publication* can be found at www.fintp.hr.

Financial Theory & Practice 1/2015

TABLE OF CONTENTS

The direction of causality between exports and firm performance: microeconomic evidence from Croatia using the matching approach

MILJANA VALDEC, MSc*
JURICA ZRNC, mag. oec.*

Article**
JEL: D21, F12, F14, L25, L6
doi: 10.3326/fintp.39.1.1

* The authors would like to thank two anonymous referees for their useful comments and suggestions. The views expressed in this paper are those of the authors and do not necessarily reflect the view of the Croatian National Bank.
** Received: June 1, 2014
Accepted: November 23, 2014

The article was awarded as the best regular category paper in the annual award of the Prof. Dr. Marijan Hanžeković Prize for 2014.

Miljana VALDEC
Croatian National Bank, Trg hrvatskih velikana 3, 10000 Zagreb, Croatia
e-mail: miljana.valdec@hnb.hr

Jurica ZRNC
Croatian National Bank, Trg hrvatskih velikana 3, 10000 Zagreb, Croatia
e-mail: jurica.zrnc@hnb.hr

FINANCIAL THEORY AND PRACTICE
39 (1) 1-30 (2015)

Abstract

This paper contributes to the literature by using propensity score matching to test for causal effects of starting to export on firm performance in Croatian manufacturing firm-level data. The results confirm that exporters have characteristics superior to those of non-exporters. In the main sample specification there is pervasive evidence of self-selection into export markets, meaning that firms are successful years before they become exporters. Using multiple firm performance indicators, panel and cross section data models together with various sample specifications there is scant evidence on learning-by-exporting which holds true only in a few cases. On the other hand, higher sales growth is found to be a more conclusive distinguishing characteristic of new exporters. As in similar studies, we find that a part of the results depends on the number of export starters in the estimation sample.

Keywords: exports, learning-by-exporting, propensity score matching, productivity, self-selection

1 INTRODUCTION

A strong export base is one of the key ingredients in generating sustainable long term growth. This is especially the case in developing and transition countries, where the well established link between the growth of real exports and real GDP has been influential in promoting outward-looking trade strategies. Although most of the evidence for the link between growth and exports is based on macro-level data, the characteristics of firms that actually export and most of the measures that policymakers have at their disposal are essentially microeconomic. Accordingly, it is crucial to determine the characteristics of exporters, why it is that some firms export and others do not, and how differences in export behaviour relate to productivity differences among firms.

In this paper we present the results of an extensive investigation of exporters by using a firm-level dataset covering the Croatian manufacturing sector which spans the period from 2002 until 2012. The novelty of the paper arises from the fact that this is one of the first analyses that examines closely the productivity and trade nexus on a firm-level basis in Croatia. In this paper we try to determine what kind of firms enter export markets and how exporting affects their performance (total factor productivity, sales, wages, labour productivity, etc.) and how this compares with that of non-exporters. Each empirical section consists of multiple robustness checks along various dimensions, including a number of econometric models, variables and sample specifications.

While it is well established that exporters tend to outperform non-exporters, the direction of causality is still not fully investigated. This paper proceeds to document the so called exporter premium, and then tests for two usual hypotheses in the trade literature; self-selection and learning-by-exporting. Firstly, firms may exhibit strong productivity growth years before they enter the export market, so

FINANCIAL THEORY AND PRACTICE
39 (1) 1-30 (2015)

their success as exporters may be due to good performance before they started to export. On the other hand, the theoretical and empirical trade literature suggests various positive effects of exporting on firm performance.

To tackle the problem of self-selection into export markets we construct a sample of treated and control firms by using propensity score matching. The matching approach deals with the causality issue by pairing exporters and non-exporters with similar observable firm characteristics, summarized by the probability to export indicator. Assuming that a vector of observable firm characteristics can capture all the differences between export starters and non-exporters, this procedure allows testing a counterfactual proposition: are firms more productive after they start to export than they would be if they did not export?

The results confirm the exceptional performance of exporters when compared to non-exporters. Moreover, the self-selection hypothesis is confirmed in the main sample specification, meaning that many of the superior characteristics of new exporters precede their entrance into the export market. Using multiple firm performance indicators, panel and cross section data models together with various sample specifications there is scant evidence for learning-by-exporting, which obtains only in few cases. On the other hand, higher sales growth is found to be a more conclusive distinguishing characteristic of the new exporters, presumably because after paying the sunk cost of entry to foreign markets, export starters have access to larger markets than non-exporters.

The remainder of the paper is organized as follows. Section 2 reviews the literature on exporting and productivity. Section 3 describes the data. Section 4 outlines the empirical strategy and results, while section 5 concludes.

2 LITERATURE REVIEW

In 1995 Bernard and Jensen published the first in a series of papers that use comprehensive longitudinal data for the US to look at differences between exporters and their counterparts in various dimension of firm performance, particularly productivity. Following this seminal paper a growing body of empirical work has focused on the microeconomic aspects of a firm's performance in order to study its export activity and the causes and consequences of that activity. A common result is that exporting firms are generally different from non-exporting firms in being technologically more sophisticated, tending to be larger, more productive, paying higher wages and so on.

While the differences between exporters and non-exporters are widely documented, the direction of causality is still not fully investigated. Two different hypotheses, which are not mutually exclusive, about how firms' performance is related to export market participation, have been put forward. The first hypothesis points to the self-selection of the more productive firms into export markets. The logic be-

hind that hypothesis lies in the fact that there are sunk costs associated with selling goods in foreign markets (like transportation, distribution, marketing costs or cost of changes in personnel or domestic products for foreign consumption) and that less productive firms will be less capable of absorbing them. Roberts and Tybout (1997), Bernard and Jensen (1999), and Bernard and Wagner (2001) find evidence for the existence of sunk costs associated with exporting. Therefore, differences between exporters and non-exporters can be partly explained by ex-ante differences between firms. An alternative theoretical explanation for the firm-level linkage between exporting and productivity is that firms may become more efficient after they begin exporting through learning experience or effects of economies of scale. This implies that exporting makes firms more productive and this hypothesis is usually called the learning-by-exporting hypothesis. In more detail, the differences between exporters and non-exporters may partially arise from ex-post differences between firms.

The literature is quite unanimous on the self-selection hypothesis and empirical evidence is rather robust, while results of the learning effect are mixed in the literature. Bernard and Wagner (1997) find evidence of self-selection of exporters for the case of Germany, while Bernard and Jensen (1999) find that exporters have all their desirable characteristics before taking up exporting in the US as well. In 2005 Arnold and Hussinger confirm that high-productivity German firms self-select themselves into export markets, while exporting itself does not play a significant role in productivity. Clerides et al. (1998) also find strong evidence for self-selection in their data from Colombia, Mexico and Morocco. For Taiwan, Aw et al. (2000) find that export starters outperform other firms even before entry, but that in some industries there may be some productivity improvement associated with exporting. While, these results are consistent with the self-selection hypothesis, they give only limited support to the learning hypothesis. On the other hand, Aw et al. (2000) show that for Korea the correlation between export status and firm productivity is less pronounced and they find no support for the learning hypothesis. Delgado et al. (2002) apply nonparametric methods to a panel of Spanish firms and their results support the self-selection hypothesis, and only when limiting their sample to young firms do they find that post-entry growth is greater for young entering exporters compared to young non-exporting counterparties.

The International Study Group on Exports and Productivity (ISGEP, 2008) used comparable micro-level panel data for 14 countries and a set of identically specified empirical models to determine the linkage between exports and productivity. The results show that exporters are more productive than non-exporters for the set of analysed countries. They find strong empirical evidence for the self-selection hypothesis, but almost no evidence in favour of the learning-by exporting hypothesis.

Although, most studies fail to find that presence in international markets enables firms to achieve further productivity improvements, there are exceptions. Kraay

(1999) and Bigsten et al. (2004) find evidence for learning effects for China and several sub-Saharan African countries. Castellani (2002) finds that Italian firms with a very high exposure to foreign markets experience learning effects, while below the export intensity threshold this is not the case. Girma et al. (2004) also find learning effects for export market entrants in Great Britain.

Some of the most convincing evidence of ex-post productivity improvement was found in studies for Slovenia. Damijan, Polanec and Prasnikar (2004) find that Slovenian firms' productivity depends on the number of destinations they serve, and that sunk costs seem to be higher for exporters to developed destinations. Also they find evidence of post-export market entry productivity gains, but they state that exporters can benefit from exporting only when serving more demanding advanced markets. De Loecker (2007) uses a similar dataset of Slovenian firms, and applies matching methodology in order formally to evaluate the causal effect of exports on productivity. He finds that firms exporting to low-income and high-income countries enjoy productivity gains with respect to non-exporters, but additional gains are smaller for firms that export only to low-income destinations.

In recent empirical studies, authors use new empirical approaches and are investigating new dimensions like the relationships between: exports and productivity taking into account export market characteristics, import and productivity, international trade and productivity in services sector, and outward foreign direct investment and productivity (Wagner, 2011). In 2008, Pisu finds that exporters in Belgium that sell their products to more developed economies have superior ex-ante productivity levels than firms exporting to less developed countries and non-exporters, while there is no causal effect of exporting on productivity. Positive correlation of ex-ante productivity measures with the development level of the export destination country is also documented for Spain (Blanes-Cristobal et al., 2007), Italy (Serti and Tomasi, 2009), and Portugal (Silva et al., 2010a). On the other hand, evidence for different causal effects of exporting on productivity by destination of exports is rare and inconclusive. Silva et al. (2010b) finds that learning effects are higher for new exporters that are also importers.

A similar study for Croatia is Lukinić-Čardić (2012), which explored various firm-level aspects of Croatian exports. Among other results, the robust export premium of manufacturing firms in Croatia is confirmed, while evidence for self-selection and learning by exporting is found to be sparse. We build on this analysis, adding more performance measures, additional sample periods, broader sample specification and employing different econometric models which results in somewhat different conclusions.

3 DATA

The firm-level analysis in this paper is based on the data from financial reports that Croatian non-financial companies are obliged to provide to the Financial Agency (FINA). The dataset spans eleven years, from 2002 until 2012. Although, FINA data go back as far as 1993, 2002 is chosen because there were considerable methodological and regulatory changes prior to that year. The most important change was the introduction of fines for firms that do not send their financial reports to FINA, which resulted in inflation of firms in the dataset in 2002 as compared to 2001. The dataset covers manufacturing companies in Croatia, so combined with eleven years this amounts to 80,256 observations. The variables included in the analysis are the following: sales, number of employees, wage bill, intermediate inputs, capital and value of exports. The sales variable excludes financial revenue in order to estimate revenue from business operations. Number of employees is defined as the average number of workers based on hours of work during the year, so that possible effects of longer working hours per employee and possible changes in employment at the end of the year are controlled for. Value added is deflated with the implicit gross value added deflator for manufacturing. Energy costs are deflated with the gross value added deflator for electricity, gas, steam and air conditioning supply sector. Capital is deflated with the GDP deflator.

Table 1

Comparison of exporters and non-exporters

Non exporters				
	1-49 employees	**50-249 employees**	**250 and more**	**Total**
Turnover	316	4,079	17,134	450
Capital	189	2,439	8,915	266
No. of workers	7	94	437	10
Value added	221	2,548	10,722	304
Wages	7.59	8.47	9.64	7.62
No. of observations	51,083	1,348	116	52,547
Exporters				
	1-49 employees	**50-249 employees**	**250 and more**	**Total**
Turnover	991	7,217	64,480	6,272
Capital	408	3,716	32,692	3,120
No. of workers	13	113	691	76
Value added	679	4,204	34,131	3,508
Wages	9.85	10.02	11.32	9.98
No. of observations	20,625	5,299	1,785	27,709

Note: The measurement unit is thousands of EUR except for labour which represents number of workers. The entries in this table are averages across the sample period. The number of observations is the number of firm years, that is $\Sigma_i^n i\,\theta_i$, *where* i *represents a firm and* θ_i *represents the number of years a firm* i *operated during the sample period. This measurement is due to the fact that firms stop existing or new firms start operating at a given year.*

Source: Own calculations based on the FINA database.

Intermediate inputs are calculated as the sum of material costs and energy costs and capital is defined as tangible assets. The full dataset is equal to around 80% of goods exports in the studied period, after excluding firms that do not employ any workers. Firm-level data are usually corrected for outliers, because, inter alia, the information is based on firm self-reporting so errors in reports are possible. The outlier observations are treated in two stages following ECB (2014). Firstly, observations with negative value-added are replaced as missing values and secondly, observations with growth rates belonging to the 1st or 99th percentile are dropped.

After data preparation and outlier cleaning, we proceed to describe the characteristics of the dataset along basic variables. For detailed discussion of the characteristics of exporters versus non-exporters we direct the reader to Lukinić-Čardić (2012) who provides detailed descriptive characteristics on various dimensions regarding the firm export status. Table 1 shows that the basic divide between exporters and non-exporters is quite vivid in every firm performance measure. Exporting firms of all sizes employ more factors of production and have higher output than non-exporters.

4 EMPIRICAL STRATEGY AND RESULTS

In the following sections we test for superior characteristics of exporters, then provide possible reasons for this by testing the self-selection and learning-by-exporting hypotheses using micro data on Croatian manufacturing firms from 2002 until 2012.

4.1 EXPORT PREMIUM

In this step the extent of exceptional exporter performance will be estimated. Usually, better exporter performance according to various measures is called the export premium. Export premium is defined as the ceteris paribus percentage difference of specific firm characteristics between exporters and non-exporters. The main firm characteristics of our interest are TFP, two measures of labour productivity (one with value added, the other with turnover in the numerator), capital, sales, wages and unit labour cost (ULC). Unit labour cost is obtained by dividing total labour cost by the value of real output. The generalized methods of moments (GMM) framework utilized in this paper to estimate TFP is described in the appendix. A common approach in the empirical literature is to estimate export premiums by regressing multiple firm performance indicators on an export dummy and a set of control variables (usually including industry, firm size measured by the number of employees, and year). Specifically, the export premium is estimated from a regression of the following form:

$$\ln X_{it} = \alpha + \beta Export_{it} + \gamma Control_{it} + \varepsilon_{it} \quad (1)$$

where i is the index of the firm, t is the index of the year, X_{it} represents the firm characteristics of interest, namely productivity measures in form of TFP, LP1

(value added based labour productivity), LP2 (revenue-based labour productivity) and other performance measures such as capital, sales, wages and ULC; *Export* is a dummy of the current export status (1 if firm *i* is an exporter in year *t*, 0 otherwise); *Control* is a vector of firm-specific controls that include sector-, time- and size-dummies; *e* is the random error. The export premium, computed from the estimated coefficient βas100(*exp(β)* – 1), shows the average percentage difference between exporters and non-exporters after controlling for the characteristics included in the vector of controls.

Table 2

Export premium estimates from pooled OLS

Firm characteristic	TFP	LP1	LP2	Capital	Sales	ULC	Wages
Estimated coefficient	0.47***	0.52***	0.50***	0.65***	0.74***	-0.32***	0.19***
Transformed coefficient	60.5	68.8	65.4	91.3	109.0	-27.7	21.2
Observations	80,256	80,256	80,150	80,256	80,150	79,548	79,548
R^2	0.36	0.31	0.13	0.48	0.64	0.35	0.15

Note:, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. The transformed coefficient was calculated as 100(exp(β)-1). The panel regression is corrected for first order autocorrelation.*

Source: Own calculations based on FINA database.

Throughout the different firm performance measures, the β coefficients from the equation (1) are highly significant and imply stark differences in performance between exporters and non-exporters. Taking into account the size of the firm, the sector and the time when a firm operated, exporters are on average more productive according to various measures, have higher sales and more capital. Moreover they pay higher wages, but have lower unit labour costs than non-exporters.

Furthermore, if additional observables are included in the analysis like whether a firm is an importer and whether it is at least partially foreign owned, the export premium drops but still remains highly significant and positive (appendix, table A1).

Although the analysis presented above documents the different characteristics of exporters and non-exporters, it is insufficient for the identification of causality. Better-performing firms can self-select into export markets and thus it is not certain if these estimates show the effects of exporting on firm performance. In order to examine the validity of the self-selection hypothesis, in the next section the ex-ante productivity premium of future export starters will be analysed.

4.2 SELF-SELECTION HYPOTHESIS

To shed light on the empirical validity of the hypothesis that more productive firms self-select into the export market, the pre-entry differences in firm performance between export starters and non-exporters will be analysed below.

In the literature, exporter-starters are defined in different ways, mostly influenced by data restrictions. In this analysis, an export-starter is defined as a firm that exports for the first time and continues to export for three consecutive years. The sample on which we base the analysis in this section consists only of export starters and firms that never exported during the period under study. The empirical model that we estimate is:

$$\ln X_{it} = \alpha + \beta_1 Starter_{it+1} + \beta_2 Starter_{it+2} + \beta_3 Starter_{it+3} + \gamma Control_{it} + \varepsilon_{it}, \qquad (2)$$

where i is the index of the firm, t is the index of the year, *Starter* is a dummy variable that is equal to one if the firm starts to export at time t, X_{it} are the firm characteristics of interest in year t which include productivity measures in form of TFP, value added based labour productivity (LP1), sales based labour productivity (LP2), capital, sales, wages and ULC; *Control* is a vector of firm specific controls which include sector, time and size dummies; e is the random error. Regression results (table 3) confirm the extraordinary performance of new exporters years prior to entry in the foreign markets. Future exporters are generally more productive according to all measures of productivity employed in the analysis. Additionally, they have more capital, have higher sales, usually pay higher wages and have lower unit labour costs after controlling for firm size and sector. Moreover, this superiority remains even after controlling for more firm-level observables such as whether a firm is an importer and whether foreign capital is involved (appendix, table A2).

Table 3

Self-selection estimates from pooled OLS

	t-1	t-2	t-3	Observations	R^2
TFP	0.55***	0.49***	0.31**	43,137	0.31
LP1	0.62***	0.55***	0.36**	43,137	0.27
LP2	0.63***	0.55***	0.42***	43,069	0.07
Capital	0.75***	0.74**	0.69***	43,137	0.31
Sales	0.85***	0.76***	0.67***	43,069	0.47
ULC	-0.40***	-0.35***	-0.22***	42,624	0.32
Wages	0.21***	0.20***	0.14***	42,624	0.09

Note:, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Regression errors are heteroscedasticity robust.*

Source: Own calculations based on FINA database.

Lukinić-Čardić (2012) also tests for self-selection on Croatian manufacturing firm-level data, but arrives at scant evidence supporting the self-selection hypoth-

esis. The reason is that Lukinić-Čardić (2012) uses a different sample specification, including only firms with ten or more employees. Moreover, the data are not pooled; instead, multiple cross-section regressions are used, which results in a substantial reduction of export starters in each cross section specification. As in similar studies (for example, ISGEP, 2008), parameter significance heavily depends on the number of export starters employed in the analysis. In order to check for the robustness of our results first we employ a specification as in Lukinić-Čardić (2012) but on the sample used in this paper which includes firms with one or more workers and minor differences in control variables (for example we measure size with size dummies corresponding to the number of workers a firm employs, but Lukinić-Čardić measures size by total assets numerical variable).

Table 4

Ex-ante export premium, estimated for six samples and seven firm performance measures

Beginning year	Comparison year	TFP	Capital	Sales	ULC	LP1	LP2	Wages	Observ.
2005	2002	0.47***	0.56**	0.80***	-0.36***	0.50***	0.59***	0.14*	3,271
	2003	0.72***	0.38	0.90***	-0.49***	0.72***	0.65***	0.22***	3,380
	2004	0.54***	0.65***	0.79***	-0.44***	0.56***	0.52***	0.13**	3,256
2006	2003	0.23	0.87***	0.75***	-0.11	0.28	0.30*	0.14**	3,288
	2004	0.11	0.45	0.36**	-0.08	0.11	0.15	0.06	3,155
	2005	0.28*	0.47*	0.54***	-0.20	0.30*	0.29**	0.09	3,105
2007	2004	0.48**	0.79**	0.91***	-0.35**	0.55**	0.62***	0.19**	3,096
	2005	0.38*	1.00**	0.87***	-0.31***	0.50**	0.57***	0.19*	3,039
	2006	0.32	0.75*	0.75***	-0.42**	0.40*	0.62***	0.10	3,454
2008	2005	-0.07	0.71	0.46*	0.12	-0.05	0.13	0.65	2,968
	2006	0.14	1.14***	0.65***	-0.09	0.21	0.30*	0.11	3,358
	2007	0.20	1.00***	0.53***	-0.28*	0.28*	0.35**	0.04	3,540
2009	2006	0.29	0.89**	0.54	-0.19	0.48*	0.50*	0.28**	3,300
	2007	0.36	0.81**	0.59**	-0.42*	0.47*	0.40	0.15	3,472
	2008	0.64**	0.53	0.92***	-0.42**	0.69***	0.63***	0.53**	3,657
2010	2007	0.19	0.62**	0.34*	-0.24	0.24	0.25	-0.00	3,430
	2008	0.55***	0.82***	0.77***	-0.30**	0.62***	0.62***	0.30***	3,602
	2009	0.45***	0.87***	0.76***	-0.33**	0.49***	0.45***	0.96	3,714

*Note: *, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Number of export-starters for years 2005, 2006, 2007, 2008, 2009 and 2010 is 165, 234, 127, 137, 144, 157 respectively.*

Source: Own calculations based on FINA database.

The specification is the following cross section OLS:

$$\ln X_{it-3} = \alpha + \beta Starter_{it} + \gamma Control_{it-3} + \varepsilon_{it}, \quad (3)$$

$$\ln X_{it-2} = \alpha + \beta Starter_{it} + \gamma Control_{it-2} + \varepsilon_{it}, \quad (4)$$

$$\ln X_{it-1} = \alpha + \beta Starter_{it} + \gamma Control_{it-1} + \varepsilon_{it}, \quad (5)$$

where each of the specifications (3), (4) and (5) are repeated for each t = 2005, 2006, ..., 2010 which represents the time a cohort of export starters began to export. In our time period, from 2002 to 2012, there are six possible time points a firm could start to export given our definition of an export starter: 2005, 2006, 2007, 2008, 2009 and 2010. Thus the regressions (3) to (5) are repeated six times, which amounts to eighteen cross section regressions for each of the seven firm performance variables; the results are presented in table 4. The results clearly indicate a strong presence of self-selection throughout different time periods. Only after excluding firms that employ fewer than ten workers, which results in not more than twenty export starters present in each sample period, the self-selection estimates become mostly insignificant (appendix, table A3).

4.3 LEARNING-BY-EXPORTING HYPOTHESIS

This subsection tests the second hypothesis, learning-by-exporting, which suggests that firm productivity increases after entry into the export market. As can be seen in the table A4 in appendix, export starters maintain higher *levels* of performance indicators even after starting to export. This is expected as it would be surprising that exporting reduced previously achieved levels of productivity, sales, capital, etc. Thus, it is necessary to test whether performance indicators changed significantly after firms started to export. Hence, we employ a fixed effects model as in Silva et al. (2010b) which allows us to take into account unobserved heterogeneity between firms, although it does not deal with the endogeneity issue but is considered a useful starting point. The specification is the following:

$$\%\Delta X_{it+s} = \alpha + \beta Starter_{it} + \gamma Control_{it} + a_i + \varepsilon_{it} \quad (6)$$

where i, t and $Starter_{it}$ are defined as previously. $\%\Delta Xi_{t+s}$ represents growth rate of a performance variable$s$ periods ahead. There are s different growth rates for which separate fixed effects regressions are undertaken: (1) $\%\Delta X_{it+0} = \frac{X_{it}}{X_{it-1}} - 1$, (2) $\%\Delta X_{it+1} = \frac{X_{it+1}}{X_{it}} - 1$, and (3) $\%\Delta X_{it+2} = \frac{X_{it+2}}{X_{it+1}} - 1$. $Control_{it}$ is a vector of the same firm-specific controls as in the equation (2), a_i is a firm specific effect and e is an error term. Hence, the post-entry differences in *growth* of performance indicators between exporters and firms that keep selling their products on domestic market only will be estimated. The results in table A5 in the appendix indicate that firm productivity performance did not significantly change after starting to export. The results provide no evidence for learning by exporting, even when including more observables like FDI and import status (appendix, table A6). Moreover, the coef-

ficient of determination is extremely low, which is not unexpected given the general specification employed and the intrinsic difficulty of predicting firm-level outcomes. Galac (2014) searches for a benchmark firm growth model using diverse specifications and a multitude of available determinants of firm growth but does not arrive at much higher values (usually from 2% to 10%).

On the other hand, the only other similar study on Croatian data (Lukinić-Čardić, 2012) arrives at some weak evidence of learning by exporting with repeated cross section regressions. In this spirit we test the following specification:

$$\%\Delta X_{t+2} = \alpha + \beta Export_{it} + \gamma Control_{it} + \varepsilon_{it}, \quad (7)$$

where $\%\Delta X_{t+2} = \frac{X_{t+2}}{X_t} - 1$ represents a change in performance measure during the two periods from starting to export. Again, the results show no signs of learning by exporting (table 5). With this specification, there is some evidence that following entry into export markets, export starters experience higher sales growth and negative growth in unit labour cost, which may be due to access to relatively large foreign markets with their concomitantly relatively higher competitive pressures.

Table 5

Ex-post growth rates premiums

Beginning year	TFP	Capital	Sales	ULC	LP1	LP2	Wages	Observations
2005	-2.33	11.32	45.37	0.15	-2.26	-3.73	0.002	2,501
2006	-0.02	6.85	70.59**	-0.37**	-0.56	0.06*	0.003***	2,695
2007	-4.41	4.82	14.00	-0.22	-4.96	-2.56	0.000	2,523
2008	-4.91	-9.94	27.33**	-0.25**	-5.60	-2.87	-0.003	2,804
2009	-5.96	15.48	33.63**	-0.46	-5.90	-0.95	0.003***	2,760
2010	-1.65	1.60	8.77	-0.14*	-1.86*	-0.84	0.000	2,832

*Note: *, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Number of export starters for years 2005, 2006, 2007, 2008, 2009 and 2010 is 165, 234, 127, 137, 144, 157 respectively.*

Source: Own calculations based on FINA database.

Nonetheless, there is some doubt about the robustness of these results. Firstly, the coefficient of determination remains low (usually around 2%). Secondly, as mentioned in the previous section, similar studies find that a relatively small number of observed export starters usually render export premium coefficients insignificant. To check for robustness regarding the number of observations and different sample construction strategies, equation (7) was estimated on two additional sample specifications.

FINANCIAL THEORY AND PRACTICE
39 (1) 1-30 (2015)

Firstly, the equation was re-estimated on a restricted sample that contains firms which operated during all the sample years prior to starting to export. This specification ensures that all firms existed three years before starting to export, which resulted in a considerable reduction of the sample (appendix, table A7). The estimated coefficients changed markedly and the export premium for sales is not significant, unlike the main specification. On the other hand, there is still some evidence of negative ULC growth after exports are started, but the coefficients are evidently different from the previous specification.

Another possible sample specification is to restrict the sample so that it only includes firms that employ 10 or more workers as in Lukinić-Čardić (2012). This sample specification resulted in a substantial loss of observations and again considerable differences in coefficients (appendix, table A8). In this sample, there are visible productivity improvements of new exporters relative to non-exporters, but there is no significant superior performance in ULC and sales as in the main specifications.

Although there are differences in estimated coefficients throughout the sample specifications, some form of export starter premium can be discerned in each of the specifications. The main issue with these robustness checks is that they significantly reduce the number of export starters and thus may influence the significance of parameter estimates.

Again, the above analysis can only document the differences between export starters and non-exporters. Equation (7) does not take into account the possibility of self-selection of better-performing firms into export markets so the estimated parameters cannot reveal any causal relationship between exporting and firm performance but can only document the average differences between the two groups under study. In the following section this issue will be addressed.

4.4 PROPENSITY SCORE MATCHING AND LEARNING EFFECTS

As stated above, a comparison of the average performance of export starters and non-exporters cannot uncover any causal relationship, due to the self-selection of better-performing firms into exporting. The effect of exporting can be viewed as a standard problem of program evaluation with non-experimental data. If participants in the program, in this case exporters, are not selected randomly from a population but are selected or self-select accordingly to some criteria, the effect of treatment cannot be compared just by observing average performance of the treated and non-treated group. The problem is known in the literature as selection bias. Therefore, a control group from the non-exporters has to be selected so it can be compared with the export-starters in which the distribution of observed characteristics of control group is as similar as possible to the distribution in the starter group. In more details, for every export starter a non-exporter has to be selected based on observable characteristics.

One of the approaches to the evaluation of non-experimental data in social sciences is the matching method. This has become a very popular approach for estimating causal treatment effects, especially when evaluating labour market policies, but it is also used in diverse fields of study. In order to correct for selection bias, the matching method needs to account for all the systematic differences relevant to both the exporting decision and firm productivity. The examination of the causal relationship between starting to export on productivity using matching techniques was introduced in the literature by Wagner (2002) and Girma et al. (2003, 2004), and since then has been widely used.

In this analysis, for every export starter a non-exporter has to be selected, as similar as possible to the export starter in *t-1* period. To do so, we utilize the method of Rosenbaum and Rubin (1983) called propensity score matching. First, the probability of exporting is estimated using a probit regression which relates a dummy variable indicating whether or not a firm is an export starter to all relevant firm characteristics in the previous period. In order to estimate the export decision, we specify an empirical probit model in which export behaviour depends on a variety of observed, firm-specific characteristics:

$$P(EXPdummy_{i,t} = 1) = F(X_{i,t-k}, Control_{i,t-k}), \tag{8}$$

where *EXPdummy* represents an indicator weather firm *i* is an export starter, *k* is the number of lags, *F* is a normal cumulative density function, and X_i stands for different productivity variables as already defined in the paper. The control variables include sector, size and time dummies, a dummy indicating if the firm imports, and a dummy indicating if the firm has a foreign component in its capital, and so on. In equation (8) sector dummies are defined according to Eurostat aggregation of manufacturing industry according to technological intensity in 4 respective sectors (high-technology, medium-high-technology, medium-low-technology, and low-technology).

The number of lags *k* varies between 0 and 2 across specifications in order to satisfy the balancing property of the propensity score matching. Bootstrapped standard errors are used to test the significance of the coefficients, and matching is restricted to common support region. This means that matching will be performed using propensity scores that belong to the intersection of the supports of the propensity score of treated and controls (see for more details Becker and Ichino, 2002). Although those conditions reduce the number of treated and controls used in matching process, they are necessary in order to ensure that only firms with similar characteristics are matched.

The estimated probability of a firm becoming an export starter is then used as a propensity score in the matching procedure. Let P_{it} denote the predicted probability of exporting at *t* for firm *i*, which is an export starter. Then, non-exporting firm *j*, which is as similar as possible in terms of its estimated propensity score, is se-

lected as a match for the exporting firm, using the "nearest-neighbour" matching method. Specifically, this matching method requires that at each point in time, a non-exporting firm *j* is chosen based on the following criteria:

$$\left|p_{i,t} - p_{j,t}\right| = \min_{j \epsilon \{EXPdummy_{i,j}=0\}} \left(p_{i,t} - p_{j,t}\right) \tag{9}$$

The proposed type of matching procedure is preferable to choosing the comparison group randomly or indiscriminately, because it is less likely to suffer from selection bias.

In this paper the matching procedure will be performed following Becker and Ichino's (2002) STATA algorithm. Namely, the sample is split into *k* equally spaced intervals with respect to the propensity score p_i, and then we test whether the average propensity score of treated and control units does not differ in every interval. If the test fails in one interval, the interval is split up in half and the test of difference in means is repeated again until it holds in every interval. After that we test for the necessary condition of the balancing hypothesis. This condition is considered satisfied if, within each interval, the means of each characteristic do not differ between treated and control units. On the other hand, if the means of one or more characteristics differ we employ a richer set of observables in equation (8).

Table 6

Average treatment effect on the treated (ATT), all variables are in levels

Firm characteristic		s	s+1	s+2
TFP	No. of controls	246	227	207
	ATT	0.20	0.30**	0.29**
LP1	No. of controls	249	209	195
	ATT	0.21	0.27	0.21
LP2	No. of controls	246	217	203
	ATT	0.21**	0.25**	0.24**
Capital	No. of controls	246	227	207
	ATT	0.43**	0.46**	0.40**
Sales	No. of controls	251	223	200
	ATT	0.57***	0.62***	0.74***
ULC	No. of controls	248	207	190
	ATT	-0.12	-0.12	-0.09
Wages	No. of controls	272	222	198
	ATT	0.11***	0.17***	0.17***

*Note: *, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Standard errors are bootstrapped.*

Source: Own calculations based on FINA database.

After obtaining the matched sample based on the probability of becoming an export starter, we proceed to estimate the differences in means within the matched pairs according to various firm performance measures. The difference in means is calculated as follows:

$$\beta_{LBE}^{s} = \frac{1}{N_s}\sum_{i}(X_{is}^{starter} - \sum_{j \in C(i)} w_{ij} X_{js}^{control}) \quad (10)$$

where N denotes the number of firms that started to export and $C(i)$ the set of control firms that are matched to an export starter i. As there can be multiple control units ascribed to each treated unit, the number of control units matched to an export starter i is denoted as N_i^C and the weight for the control unit is equal to $w_{ij} = 1/N_i^C$ if $j \in C(i)$ and zero otherwise. The outcome variables $X^{starter}$ and $X^{control}$ are the usual firm performance variables used throughout this paper, s is the number of years after starting to export and $s=0,1,2,$ while X_s represents the performance variable s periods after starting to export.

Table 7

Average treatment effect on the treated (ATT), all variables are in growth rates

Firm characteristic		s	s+1	s+2	cum
TFP	No. of controls	246	227	203	203
	ATT	0.42	0.16	-0.03	0.16
LP1	No. of controls	249	209	185	185
	ATT	0.58***	0.07	-0.09	0.52
LP2	No. of controls	246	217	193	193
	ATT	0.40**	0.15*	0.00	0.17**
Capital	No. of controls	246	227	203	203
	ATT	22.56	0.04	0.09	0.90
Sales	No. of controls	251	223	194	194
	ATT	1.85***	0.25*	0.15***	0.54***
ULC	No. of controls	253	207	179	179
	ATT	0.02	-0.11	-0.14	-0.16
Wages	No. of controls	272	221	188	187
	ATT	0.11***	0.10***	0.01	0.11***

*Note: *, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Standard errors are bootstrapped.*

Source: Own calculations based on FINA database.

Results in table 6 show that even after controlling for firm specific characteristics using propensity score matching, exporters remain superior in some aspects. Higher sales are the most distinguishing characteristic of export starters, even just a few years after starting to export. These results also hold true when the sample

is restricted to larger firms (appendix, table A10) and to a lesser extent in a specification when the sample is restricted to firms that existed three years prior to starting to export (appendix, table A9). Additionally, there is some evidence that exporters have higher productivity levels (measured by sales-based labour productivity indicators and total factor productivity), higher capital and wages; however, this result is not robust through sample specifications. Thus, once the self-selection into the exporter group is appropriately controlled for, higher sales remain a characteristic that will differentiate the two groups.

Again we have confirmed that exporters have some characteristics superior to non-exporters, but do they grow faster? In order to answer this question we change the outcome variable X in the specification (10) with growth rates relative to the previous period. Additionally, we add a cumulative growth rate outcome variable, which gathers growth rates from starting to export until two year after entry as in de Loecker (2007). Results in table 7 again reveal higher sales growth as a significant difference between export starters and non-exporters; this might be because export starters have access to larger markets than non-exporters. On the other hand, learning effects of exporting are present in some periods but are not pervasive throughout sample specifications (appendix, tables A11 and A12).

5 CONCLUDING REMARKS

In this paper, we examine the causal relationship between export behaviour and different measures of performance at the firm-level, using a sample of Croatian manufacturing firms. Firstly, this study confirms that exporters are on average more productive, have higher sales, pay higher wages, utilize more capital in the production process, etc. After establishing the superior characteristics of exporters we proceed to examine the origins of an exporter's better performance.

In the main sample specification there is strong evidence that exporters' performance predates their entry into export markets. This may be due to the fact that in order to become an exporter a firm needs to pay various sunk costs such as transportation, distribution, marketing costs or cost of changes in personnel or domestic products for foreign consumption. After starting to export, firms have higher growth rates of some performance measures which vary based on sample specification and the period under study, but the self-selection of better performing firms into export markets does not allow any causal interpretation of these results.

Further exploring the direction of causality between exports and firm performance, the issue of self-selection is tackled by pairing exporters and non-exporters with similar observable firm characteristics. This is achieved by utilizing the propensity score matching framework and testing differences in means of various performance variables between export starters and non-exporters in matched samples. The results show that learning effects are present only in some periods, and

that the most distinguishing characteristic of export starters is higher sales growth. This suggests that export starters, after paying for the sunk cost of exporting, have access to larger markets, which enable them to grow faster than they otherwise would. On the other hand, new exporters do not show robust productivity improvements, implying that there are limited effects of starting to export on aggregate productivity developments.

APPENDIX

TOTAL FACTOR PRODUCTIVITY ESTIMATION

Total factor productivity is usually estimated as a residual in a standard Cobb-Douglas production function:

$$Y_{it} = A_{it} K_{it}^{\beta_K} L_{it}^{\beta_L} M_{it}^{\beta_M}$$

To facilitate the empirical estimation all variables are converted into the logarithm form:

$$y_{it} = a_{it} + \beta_K k_{it} + \beta_L l_{it} + \beta_M m_{it},$$

where the residual can be decomposed into three parts:

$$\ln\left(A_{it}\right) = a_{it} = \beta_0 + \omega_{it} + u_{it}$$

so that β_0 represents the mean level of efficiency common to all firms and time periods, ω_{it} is a firm specific deviation from mean which is known to the firm, but unobserved by the econometrician and u_{it} is an unobserved firm-specific deviation from the mean that is a result of an unexpected shock (ECB, 2014). The difference between ω_{it} and u_{it} is that the former is observed by the firm and thus it influences input choices. On the other hand u_{it} represents an independent and identically distributed random variable which does not affect explanatory variables. Since it is very unlikely that the level productivity ω_{it} is not observed by the firm it will influence the optimal bundle of inputs thus causing the so-called "simultaneity bias". Generally, it can be assumed that the higher the firm-level productivity, the larger the quantities of the inputs chosen by firm. This will result in an upward bias in the technology coefficients of all variable inputs and downward bias of all inputs that are quasi-fixed (Levinsohn and Petrin, 2003). One approach that tries to deal with this problem can be found in Olley and Pakes (1996), who show that under certain conditions, investment and capital stock can be used as a proxy variable for firm-level productivity. This approach may have been appropriate for their analysis of the telecommunication sector in the US but in later applications the choice of investment as an instrument proved to be problematic. Specifically, investment tends to be "lumpy", characterized with volatile growth rates and a lot of firms do not invest in a given year so there is a loss of efficiency in estimation. Taking this into account, Levinsohn and Petrin (2003) instrumented unobserved productivity (ω_{it}) with capital stock and material inputs, arguing that, as with investment, more productive firms in manufacturing will tend to have higher capital stock and material inputs. Ackerberget et al. (2006) build on the mentioned approaches and add labour as a deterministic function of unobserved productivity and state variables. In Woolridge (2009) these approaches are implemented in the GMM framework

which results in efficiency gains. GMM uses cross-equation correlation and multiple moment conditions in order to gain efficiency, while at the same time accounting for serial correlation and heteroscedasticity with the use of the optimal weighting matrix. Woolridge framework for estimating TFP is utilized in this paper following ECB (2014) implementation and STATA code.

Table A1

Export premium estimates from POLS, with FDI and import dummies

Firm characteristic	TFP	LP1	LP2	Capital	Sales	ULC	Wages
Estimated coefficient	0.28***	0.31***	0.29***	0.40***	0.78***	-0.19***	0.12***
Transformed coefficient	32.6	36.3	33.1	49.6	117.6	-17.0	12.7
Observations	80,256	80,256	80,150	80,256	80,150	79,548	79,548
R^2	0.39	0.35	0.19	0.50	0.67	0.37	0.18

Note:, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. The transformed coefficient was calculated as 100(exp(β)-1). Regression errors are heteroscedasticity robust.*

Source: Own calculations based on FINA database.

Table A2

Self-selection estimates from POLS, with FDI and import dummies

	t-1	t-2	t-3	Observations
TFP	0.34***	0.27***	0.18**	43,137
LP1	0.38***	0.31***	0.22***	43,137
LP2	0.38***	0.30***	0.28***	43,069
Capital	0.43***	0.41***	0.51***	43,137
Sales	0.52***	0.44***	0.48***	43,069
ULC	-0.23***	-0.18***	-0.12*	42,624
Wages	0.13***	0.12***	0.10	42,624

Note:, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. The transformed coefficient was calculated as 100(exp(β)-1). Regression errors are heteroscedasticity robust.*

Source: Own calculations based on FINA database.

TABLE A3

Ex-ante export premium, estimated for six samples and seven firm performance measures (l >10)

Beginning year	Comparison year	TFP	Capital	Sales	ULC	LP1	LP2	Wages	Observations
2005	2002	0.59**	0.35	0.62***	-0.47*	0.61**	0.63***	0.14	584
	2003	0.65***	0.23	0.61***	-0.40**	0.66***	0.56***	0.24***	595
	2004	0.20	0.04	0.25	-0.17	0.21	0.25	0.04	574
2006	2003	0.20	-0.42	0.01	-0.04	0.16	0.05	0.12	558
	2004	0.06	-0.30	0.14	0.06	0.04	0.18	0.16**	533
	2005	0.18	-0.39	0.24	0.05	0.14	0.25	0.20**	500
2007	2004	0.14	0.45	0.49	-0.15	0.15	0.33*	0.00	517
	2005	0.08	0.36	0.33	-0.14	0.09	0.21	-0.04	485
	2006	0.09	-0.42	0.12	-0.15	0.00	0.08	-0.09	736
2008	2005	-0.07	-0.04	0.10	0.17	-0.14	-0.03	0.03	469
	2006	0.20	0.57*	0.41*	-0.19	0.23	0.30	0.03	704
	2007	0.13	0.86***	0.45***	-0.17	0.18	0.34**	0.00	777
2009	2006	0.16	0.76*	0.29	-0.28	0.25	0.29	-0.03	740
	2007	0.17	0.93*	0.26	-0.28	0.29	0.32	-0.00	800
	2008	0.04	0.35	0.20	-0.14	0.06	0.11	-0.08	784
2010	2007	0.02	1.49***	1.24	-0.07	0.21	0.14	0.13	736
	2008	0.26	1.24*	0.51***	-0.15	0.44*	0.47**	0.29**	797
	2009	0.22	1.24**	0.40	-0.11	0.37	0.27	0.14	777

*Note: *, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Number of export-starters for years 2005, 2006, 2007, 2008, 2009 and 2010 is 165, 234, 127, 137, 144, 157 respectively.*

Source: Own calculations based on FINA database.

Table A4

Ex-post exporter premium, levels

Beginning year	Comparison year	TFP	Capital	Sales	ULC	LP1	LP2	Wages	Observations
2005	2005	0.55***	0.75***	0.85***	-0.48***	0.59***	0.65***	0.14***	3,307
	2006	0.64***	0.82***	0.92***	-0.42***	0.69***	0.66***	0.27***	3,756
	2007	0.51***	0.64***	0.76***	-0.32***	0.54***	0.51***	0.21***	3,975
2006	2006	0.39***	0.78***	0.67***	-0.38***	0.47***	0.48***	0.09***	3,711
	2007	0.44***	0.87***	0.78***	-0.35***	0.54***	0.57***	0.18***	3,903
	2008	0.40***	0.87***	0.70***	-0.31***	0.50***	0.51***	0.18***	4,160
2007	2007	0.50***	0.58***	0.80***	-0.44***	0.53***	0.57***	0.11**	3,716
	2008	0.57***	0.91***	0.89***	-0.39***	0.65***	0.67***	0.25***	3,956
	2009	0.40***	0.77***	0.66***	-0.29***	0.47***	0.49***	0.21***	4,120
2008	2008	0.45***	0.94***	1.08***	-0.31***	0.51***	0.51***	0.21***	3,855
	2009	0.53***	1.08***	0.94***	-0.35***	0.59***	0.64***	0.23***	3,991
	2010	0.54***	1.07***	0.95***	-0.39***	0.61***	0.64***	0.21***	4,213
2009	2009	0.60***	0.65*	0.78***	-0.49***	0.61***	0.57***	0.12***	3,886
	2010	0.70***	0.73***	0.99***	-0.49***	0.76***	0.73***	0.26***	4,075
	2011	0.67***	0.89***	0.99***	-0.44***	0.74***	0.71***	0.29***	4,117
2010	2010	0.77***	0.74***	1.12***	-0.70***	0.84***	0.85***	0.18***	4,001
	2011	0.78***	0.95***	1.18***	-0.64***	0.88***	0.89***	0.23***	4,006
	2012	0.65***	0.98***	1.10***	-0.45***	0.75***	0.79***	0.28***	3,938

*Note: *, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Number of export-starters for years 2005, 2006, 2007, 2008, 2009 and 2010 is 165, 234, 127, 137, 144, 157 respectively.*

Source: Own calculations based on FINA database.

TABLE A5

Ex-post exporter premium, fixed effects, growth rates

	t	t+1	t+2	Observations	R^2
TFP	25.84	4.60	12.75	24,134	0.00
LP1	25.46	6.64	11.94	24,134	0.00
LP2	4.31	7.12	-0.25	24,075	0.00
Capital	305.49*	-454.41***	-2.17	24,134	0.00
Sales	31.41***	-10.13	1.91	24,075	0.01
ULC	17.52	-5.88	-9.23	23,730	0.00
Wages	5.73*	3.64	-2.91	23,730	0.02

*Note: *, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. The transformed coefficient was calculated as 100(exp(β)-1). The panel regression is corrected for first order autocorrelation.*

Source: Own calculations based on FINA database.

TABLE A6

Ex-post exporter premium with FDI and importer dummies, fixed effects, growth rates

	t	t+1	t+2	Observations	R^2
TFP	25.60	4.99	13.56	24,134	0.00
LP1	26.10	7.11	12.86	24,134	0.00
LP2	4.69	7.48	0.12	24,075	0.00
Capital	304.13*	-449.15***	-2.31	24,134	0.00
Sales	31.21***	-9.85	2.39	24,075	0.01
ULC	18.10	-5.17	-8.30	23,730	0.00
Wages	5.67	3.67	-2.87	23,730	0.02

*Note: *, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. The transformed coefficient was calculated as 100(exp(β)-1). The panel regression is corrected for first order autocorrelation.*

Source: Own calculations based on FINA database.

TABLE A7

Ex-post export premium estimates on a sample restricted to firms that existed three years prior to starting to export

Beginning year	TFP	Capital	Sales	ULC	LP1	LP2	Wages	Observations
2005	-0.73	275.57	5.24	-9.92**	0.03	1.92	-1.02	1,517
2006	4.43	-5.35	-0.81	-5.34	4.82	-4.27	-4.11*	1,220
2007	5.30*	-49.15	4.91	-15.29**	4.36	0.27	3.42	987
2008	7.55	-6.56	12.16	20.96*	6.17	4.19	2.73	846
2009	0.83	24,381	6.67*	-12.33	2.42	2.58	0.68	720
2010	-7.54	-4.56	10.25	-6.91	-6.88	3.72	7.36	612

*Note: *, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Number of export-starters for years 2005, 2006, 2007, 2008, 2009 and 2010 is 31, 17, 14, 9, 9, 9 respectively.*

Source: Own calculations based on FINA database.

TABLE A8

Ex-post export premium estimates on a sample restricted to firms that employ ten or more workers

Beginning year	TFP	Capital	Sales	ULC	LP1	LP2	Wages	Observations
2005	-8.91	305.78	32.69	100.58	-6.11	4.13	2.88	764
2006	5.55*	265.69*	63.12	22.12*	4.67	5.49*	9.39**	805
2007	11.80	271.63	3.21	4.99	12.13	7.17*	1.58	805
2008	16.81***	143.53	32.49**	-8.18	16.30***	13.40	2.23	842
2009	1.65	263.53	13.00	-3.67	3.52	6.65**	6.07***	772
2010	3.82	660.94	2.10	24.42	5.78	4.25	1.64	737

*Note: *, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Number of export-starters for years 2005, 2006, 2007, 2008, 2009 and 2010 is 23, 27, 14, 16, 18, 14 respectively.*

Source: Own calculations based on FINA database.

TABLE A9

Levels ex-post export premium estimates on a matched sample restricted to firms that existed three years prior to starting to export

Firm characteristic		s	s+1	s+2
TFP	No. of controls	88	82	74
	ATT	-0.04	0.06	0.13
LP1	No. of controls	88	73	68
	ATT	0.11	0.25	0.22
LP2	No. of controls	88	74	68
	ATT	-0.01	0.04	0.09
Capital	No. of controls	88	82	74
	ATT	0.03	0.11	0.24
Sales	No. of controls	86	73	69
	ATT	0.12	0.42*	0.37**
ULC	No. of controls	88	78	69
	ATT	-0.14	-0.22	-0.15
Wages	No. of controls	88	74	65
	ATT	0.06	0.11	0.09

*Note: *, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Standard errors are bootstrapped.*

Source: Own calculations based on FINA database.

TABLE A10

Levels ex-post export premium estimates on a matched sample restricted to firms that employ ten or more workers

Firm characteristic		s	s+1	s+2
TFP	No. of controls	103	95	87
	ATT	0.02	0.14	-0.02
LP1	No. of controls	102	94	90
	ATT	-0.02	0.15	0.02
LP2	No. of controls	103	94	87
	ATT	-0.04	0.00	-0.01
Capital	No. of controls	103	95	87
	ATT	0.39	0.46**	0.53**
Sales	No. of controls	105	94	87
	ATT	0.38***	0.19***	0.41**
ULC	No. of controls	102	96	83
	ATT	0.07	0.05	-0.05
Wages	No. of controls	105	95	86
	ATT	0.07	0.09*	0.06

*Note: *, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Standard errors are bootstrapped.*

Source: Own calculations based on FINA database.

Table A11

Growth rate ex-post export premium estimates on a matched sample restricted to firms that existed three years prior to starting to export

Firm characteristic		s	s+1	s+2	cum
TFP	No. of controls	88	82	74	74
	ATT	0.02	0.07	0.02	0.10
LP1	No. of controls	88	73	66	66
	ATT	0.07	0.21	-0.07	0.08
LP2	No. of controls	88	74	66	66
	ATT	0.11	0.00	0.04	0.00
Capital	No. of controls	88	82	74	74
	ATT	0.75	0.30	0.45	3.10
Sales	No. of controls	86	73	64	64
	ATT	0.26*	0.19***	0.08	0.26***
ULC	No. of controls	88	77	64	64
	ATT	-0.22	0.06	-0.17	-0.19
Wages	No. of controls	88	74	61	61
	ATT	0.10	0.09**	-0.01	0.07

*Note: *, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Standard errors are bootstrapped.*

Source: Own calculations based on FINA database.

Table A12

Growth rate ex-post export premium estimates on a matched sample restricted to firms that employ ten or more workers

Firm characteristic		s	s+1	s+2	cum
TFP	No. of controls	103	95	84	84
	ATT	0.11	0.17	-0.08	0.02
LP1	No. of controls	102	94	86	86
	ATT	0.06	0.20	-0.09	0.06
LP2	No. of controls	103	94	83	83
	ATT	0.05	0.09	0.00	0.05
Capital	No. of controls	103	95	84	84
	ATT	48.95	0.14	0.32	2.58
Sales	No. of controls	105	94	84	84
	ATT	2.11***	0.11	0.05	0.11**
ULC	No. of controls	102	96	83	83
	ATT	0.39	0.00	-0.06	-0.15
Wages	No. of controls	105	95	83	83
	ATT	0.12	0.03	-0.02	0.01

*Note: *, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Standard errors are bootstrapped.*

Source: Own calculations based on FINA database.

REFERENCES

1. Ackerberg, D., Caves, K. and Garth, F., 2006. Structural identification of production functions. *MPRA Paper,* No. 38349. Available at: <http://mpra.ub.uni-muenchen.de/38349/>.
2. Alvarez, R. and López, R. A., 2005. Exporting and Performance: Evidence from Chilean Plants. *Canadian Journal of Economics*, 38(4), pp. 1384-1400. doi: 10.1111/j.0008-4085.2005.00329.x
3. Arnold, J. H. and Hussinger, K., 2005. Export Behavior and Firm Productivity in German Manufacturing: A Firm-Level Analysis. *Review of World Economics*, 141(2), pp. 219-243. doi: 10.1007/s10290-005-0026-8
4. Aw, B. Y., Chung, S. and Roberts, M. J., 2000. Productivity and Turnover in the Export Market: Micro-level Evidence from the Republic of Korea and Taiwan (China). *The World Bank Economic Review,* 14(1), pp. 65-90. doi: 10.1093/wber/14.1.65
5. Baldwin, R., 2000. Trade and Growth: Still Disagreement about the Relationships. *Organisation for Economic Co-operation and Development Working Paper.* ECO/WKP(2000)37. Available at: <http://www.oecd.org/eco/growth/1885708.pdf>.
6. Becker, S. O. and Ichino, A., 2002. Estimation of average treatment effects based on propensity scores. *The Stata Journal*, 2(4), pp. 358-377. Available at: <http://www.stata-journal.com/sjpdf.html?articlenum=st0026>.
7. Bernard, A. B. and Jensen, B., 1995. Exporters, Jobs, and Wages in U.S. Manufacturing: 1976-1987. *Brookings Papers on Economic Activity. Microeconomics,* pp. 67-119. doi: 10.2307/2534772
8. Bernard, A. B. and Jensen, B., 1999. Exceptional Exporter Performance: Cause, Effect, or Both? *Journal of International Economics,* 47(1), pp. 1-25. doi: 10.1016/S0022-1996(98)00027-0
9. Bernard, A. B. and Jensen, B., 2004a. Exporting and Productivity in the USA. *Oxford Review of Economic Policy,* 20(3), pp. 343-357. doi: 10.1093/oxrep/grh020
10. Bernard, A. B. and Jensen, B., 2004b. Why Some Firms Export. *Review of Economics and Statistics,* 86(2), pp. 561-569. doi: 10.1162/003465304323031111
11. Bernard, A. B. and Wagner, J., 1997. Exports and Success in German Manufacturing. *Review of World Economics/Weltwirtschaftliches Archiv*, 133(1), pp. 134-137. doi: 10.1007/BF02707680
12. Bernard, A. B. and Wagner, J., 2001. Export Entry and Exit by German Firms. *Review of World Economics/WeltwirtschaftlichesArchiv*, 137(1), pp. 105-123. Available at: <http://link.springer.com/article/10.1007%2FBF02707602#page-1>.
13. Bigsten, A. [et al.], 2004. Do African Manufacturing Firms Learn from Exporting? *Journal of Development Studies*, 40(3), pp. 115-141. doi: 10.1080/00220380420002132 29

14. Blanes-Cristóbal, J. V. [et al.], 2008. Do sunk exporting costs differ among markets? Evidence from Spanish manufacturing firms. *Economics Letters,* 101(1), pp. 110-112. doi: 10.1016/j.econlet.2008.06.012
15. Blundell, R. and Costa Dias, M., 2000. Evaluation Methods for Non-Experimental Data. Fiscal Studies, 21(4), pp. 427-468. doi: 10.1111/j.1475-5890.2000.tb00031.x
16. Castellani, D., 2002. Export Behavior and Productivity Growth: Evidence from Italian Manufacturing Firms. *Review of World Economics/Weltwirtschaftliches Archiv*, 138(4), pp. 605-628. doi: 10.1007/BF02707654
17. Clerides, S. K., Lach, S. and Tybout, J., 1998. Is Learning-by-Exporting Important? Micro Dynamic Evidence from Colombia, Morocco, and Mexico. *Quarterly Journal of Economics*, 113(3), pp. 903-947. doi: 10.1162/003355398555784
18. CGD – Commission on growth and development, 2008. *The Growth Report Strategies for Sustained Growth and Inclusive Development*. Available at: <http://siteresources.worldbank.org/EXTPREMNET/Resources/489960-1338997241035/Growth_Commission_Final_Report.pdf>.
19. Damijan, J. P., Polanec, S. and Prasnikar, J., 2004. Self-selection, Export Market Heterogeneity and Productivity Improvements: Firm-level Evidence from Slovenia. *LICOS Discussion Paper*, No. 148. Available at: <http://www.econ.kuleuven.be/licos/publications/dp/dp148.pdf>.
20. Damijan, J. P. and Kostevc, C., 2006. Learning-by-exporting: Continuous productivity improvements or capacity utilization effects? Evidence from Slovenian Firms. *Review of World Economics,* 142(3), pp. 599-614. doi: 10.1007/s10290-006-0083-7
21. Damijan, J. P., Polanec, S. and Prasnikar, J., 2007. Outward FDI and Productivity: Micro-evidence from Slovenia. *The World Economy,* 30(1), pp. 135-155. doi: 10.1111/j.1467-9701.2007.00876.x
22. De Loecker, J., 2007. Do exports generate higher productivity? Evidence from Slovenia. *Journal of International Economics,* 73(1), pp. 69-98. doi: 10.1016/j.jinteco.2007.03.003
23. Delgado, M., Farinas, J. C. and Ruano, S., 2002. Firm Productivity and Export Markets: A Nonparametric Approach. *Journal of International Economics*, 57(2), pp. 397-422. doi: 10.1016/S0022-1996(01)00154-4
24. ECB, 2014. Micro-based evidence of EU competitiveness: The COMPNET database. *ECB Working paper series,* No. 1634. Available at: <http://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1634.pdf>.
25. Eurostat. *Aggregations of manufacturing based on NACE Rev. 2*. Available at: <http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/Annexes/htec_esms_an3.pdf >.
26. Galac, T., 2014. *Mikroekonomski aspekti utjecaja globalne krize na rast nefinancijskih poduzeća u RH*. Zagreb: Hrvatska narodna banka.
27. Girma, S., Greenaway, D. and Kneller, R., 2003. Export market exit and performance dynamics: a causality analysis of matched firms. *Economics Letters,* 80, pp. 181-187. doi: 10.1016/S0165-1765(03)00092-2
28. Girma, S., Greenaway, D. and Kneller, R., 2004. Does Exporting Lead to Better Performance? A Microeconometric Analysis of Matched Firms. *Review of*

International Economics, 12(5), pp. 855-866. doi: 10.1111/j.1467-9396.2004.00486.x

29. Giles, J. A. and Williams, C. L., 2000a. Export-led growth: a survey of the empirical literature and some non-causality results. Part I. *Journal of International Trade & Economic Development,* 9(4), pp. 261-337. doi: 10.1080/09638190050086177
30. Giles, J. A. and Williams, C. L., 2000b. Export-led growth: a survey of the empirical literature and some non-causality results. Part II. *Journal of International Trade & Economic Development,* 9(4), pp. 445-470. doi: 10.1080/09638190750056867
31. ISGEP-International Study Group on Exports and Productivity, 2008. Understanding Cross-Country Differences in Exporter Premia: Comparable Evidence for 14 Countries. *Review of World Economics*, 144(4), pp. 596-635. 10.1007/s10290-008-0163-y
32. Kraay, A., 1999. Exportations et Performances Economiques: Etude d'un Panel d'Entreprises Chinoises. *Revue d'Economie du Développement,* 7(1-2), pp. 183-207. Available at: <http://siteresources.worldbank.org/DEC/Resources/ExportsandEconomicPerformance.pdf>.
33. Levinsohn, J. and Petrin, A., 2003. Estimating Production Functions Using Inputs to Control for Unobservables. *Review of Economic Studies*, 70(2), pp. 317-341. doi: 10.1111/1467-937X.00246
34. Lukinić-Čardić, G., 2012. *Proizvodnost i izvoz u Hrvatskoj*. Magistarski rad.
35. Olley, G. S. and Pakes, A., 1996. The dynamics of productivity in the telecommunications equipment industry. *Econometrica*, 64(6), pp. 1263-1297. doi: 10.2307/2171831
36. Roberts, M. J. and Tybout, J., 1997. The Decision to Export in Colombia: An Empirical Model of Entry with Sunk Costs. *American Economic Review,* 87(4), pp. 545-564. Available at: <http://www.econ.psu.edu/~mroberts/pubaer.pdf >.
37. Rosenbaum, P. R. and Rubin, D., 1983. The Central Role of the Propensity Score in Observational Studies for Causal Effects. *Biometrika*, 70(1), pp. 41-55. doi: 10.1093/biomet/70.1.41
38. Serti, F. and Tomasi, C., 2007. Self-Selection and Post-Entry effects of Exports: Evidence from Italian Manufacturing firms. *LEM Papers Series.* No. 2007/20. Available at: <http://www.lem.sssup.it/WPLem/files/2007-20.pdf>.
39. Serti, F. and Tomasi, C., 2009. Self-selection along different export and import markets. Laboratory of Economics and Management – Sant'Anna School of Advanced Studies LEM. *Working Paper 2009/18*. Available at: <http://econpapers.repec.org/paper/ssalemwps/2009_2f18.htm >.
40. Silva, A., Afonso, O. and Africano, A. P., 2010a. Do Portugese Manufacturing Firms Self Select to Exports? Universidade de Porto FEP. *Working Papers* No. 371. Available at: <http://www.fep.up.pt/investigacao/workingpapers/10.04.22_wp371.pdf >.

41. Silva, A., Afonso, O. and Africano, A. P., 2010b. International trade involvement and performance of Portuguese manufacturing firms: causal links. *InstitutoPolitécnico do Porto – ESEIG*, mimeo. Available at: <http://www.eseig.ipp.pt/docentes/amn/wp-content/uploads/2010/07/Silva.pdf >.
42. Wagner, J., 1995. Exports, Firm Size, and Firm Dynamics. *Small Business Economics,* 7(1), pp. 29-39. doi: 10.1007/BF01074314
43. Wagner, J., 2002. The causal effect of exports on firm size and labour productivity: First evidence from a matching approach. *Economics Letters,* 77(2), pp. 287-292. doi: 10.1016/S0165-1765(02)00131-3
44. Wagner, J., 2007. Exports and productivity: a survey of the evidence from firm-level data. *The World Economy,* 30(1), pp. 60-82. doi: 10.1111/j.1467-9701.2007.00872.x
45. Wagner, J., 2011. International trade and firm performance: A survey of empirical studies since 2006. *University of Lüneburg Working Paper Series in Economics*, No. 210. Available at: <http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1918234>.
46. Wooldridge, J. M., 2009. On estimating firm-level production functions using proxy variables to control for unobservables. *Economics Letters*, 104(3), pp. 112-114. doi: 10.1016/j.econlet.2009.04.026

Risk analysis of the proxy life-cycle investments in the second pillar pension scheme in Croatia

RENATA KOVAČEVIĆ, univ. spec. actuarial science*
MLADEN LATKOVIĆ, MSc*

Article**
JEL: G11, G18, G19, G23
doi: 10.3326/fintp.39.1.2

* The authors thank three anonymous reviewers for their helpful comments and suggestions for improvement of the article. The views expressed in this paper are solely those of the authors and do not necessarily represent those of the company in which they are employed.
** Received: June 1, 2014
Accepted: November 4, 2014
The article was submitted for the 2014 annual award of the Prof. Dr. Marijan Hanžeković Prize.

Renata KOVAČEVIĆ
Raiffeisen Mandatory and Voluntary Pension Funds Management Company Plc, Heinzelova 44, 10000 Zagreb, Croatia
e-mail: renata.kovacevic@rmf.hr

Mladen LATKOVIĆ
Raiffeisen Mandatory and Voluntary Pension Funds Management Company Plc, Heinzelova 44, 10000 Zagreb, Croatia
e-mail: mladen.latkovic@rmf.hr

FINANCIAL THEORY AND PRACTICE
39 (1) 31-55 (2015)

Abstract

In this article we analyze the expected risk of pension funds with different risk profiles in the proxy life-cycle model of investments for the 2nd pillar pension scheme in Croatia. The benefits of implementing proxy life-cycle investments, compared to the previous model of mandatory pension funds investments, are clearly visible in the total expected amount of accumulated savings from the risk/return perspective. However, those benefits are partially diminished by the fact that the expected risk of a pension fund with the lowest risk profile is not substantially different from the expected risk of a pension fund with a medium risk profile, due to the lack of diversification. Additionally, we analyze the robustness of the proxy life-cycle model to a sudden and severe market shock, where we determine the presence of risk for those members who choose to switch to a pension fund with a lower risk profile at an unfavorable moment.

Keywords: defined contribution system, pension funds, life-cycle investing, portfolio risk

1 INTRODUCTION

The design of the pension model in the mandatory pension insurance system (2nd pillar) based on individual investments, i.e. the defined contribution model, has experienced a significant change in recent years in many of the countries in which it has been implemented (Impavido et al., 2010). The basis for such changes is academic studies that have shown that life-cycle investment models of pension fund assets in the accumulation phase, which are based on the change in the allocation of the portfolio of a pension fund as time passes, have a specific benefit to the members (Bodie et al., 2008; Viceira, 2007). The changes that occur in the 2nd pillar are based on the substitution life-cycle investment model (proxy life-cycle), which allows changes in the allocation of portfolios, as time passes, by switching accumulated savings of members from a pension fund of higher expected risk to a pension fund of lower expected risk.

An exact (dynamic) life-cycle model enables the gradual adjustment of asset allocation of members as time passes, i.e. the continuous change in the ratio of investment into equity and bonds in a pension fund portfolio, which is not easily feasible for collective investment schemes. In practice we have discontinuous changes in the allocation of portfolios by a small number of pension funds with different target allocations, which results in different expected returns and expected risk profiles of these funds.

The basic idea of a life-cycle investment model is that at the beginning of the accumulation phase it is easier for members to bear riskier investments while for members with fewer years to retirement, security of investment is more important than high returns. In the beginning of the accumulation phase the members have much lower retirement savings in their personal savings account than at the end of

the accumulation phase, so any decrease in the value of assets does not significantly affect the amount of total expected accumulation.

Those members who have been in the pension system for a longer period have large savings, and in that period every fall in the value results in significant losses in the total amount of expected savings. Therefore, within the framework of a life-cycle investment model, for those members with a shorter period of accumulation it is recommended that assets are invested in financial instruments with a higher expected risk (for example, equity), which should bring higher long term returns, while for members with a longer period of accumulation it is recommended that assets are invested in financial instruments with lower expected risks (for example, government bonds).

The 2nd pillar in the pension system of Republic of Croatia started in 2002 and it assumed the same risk profile for all the members of a mandatory pension fund. The only flexibility in asset allocation was in the discretionary decisions of pension fund managers to adjust the structure of investments to market conditions. Given that the minimum share of domestic government bonds in mandatory pension funds in Croatia (till joining the European Union) had to be 50% of the net assets, the maximum allowed investment in financial instruments of higher expected risk (equity and investment funds that invest in equity instruments) was 50% of the net assets of the fund (Mandatory and Voluntary Pension Funds Act, 1999). However, in practice, the maximum level of investment in equity was never able to be achieved due to the investment restrictions of 20% of pension fund assets in foreign markets and the lack of suitable investment opportunities in the domestic equity market. Historical levels of investment in domestic and foreign equity markets fluctuated around the level of 25% of pension fund assets with a greater share in domestic equity than in foreign equity (source: Monthly reports by Croatian Agency for Supervision of Financial Services – HANFA).

The proxy life-cycle model of investments for the Croatian 2nd pillar was introduced in 2014 by the definition of three mandatory pension funds of different risk categories, i.e. different investment strategies: A, B and C (Mandatory Pension Funds Law, 2014). The category A fund has the highest risk profile, with the maximum exposure to equity being 55% of fund assets (theoretically 65%, if all alternative investments create exposure to the equity market) and it can be characterized as a fund with a balanced risk profile. The category B fund has a maximum exposure to equity of 35% of fund assets and it can be considered as a fund with a moderately conservative risk profile. The category C fund may not create exposure to the equity markets and can be considered a fund with a conservative risk profile.

Considering the somewhat surprising lack of research into the risks that mostly derive from the different investment strategies of the proxy life-cycle investment

model in 2nd pillar pension funds (with the exception of Scheuenstuhl et al., 2010), we started an analysis of the expected returns and risk of mandatory pension funds of various risk categories. The goal of this research is to determine the efficacy of the model employed in Croatia, i.e. the proxy life-cycle investment model, in comparison to the previous model of the 2nd pillar and to draw certain conclusions able to help with improvement of the newly applied model or possibly help in a future redesign of the 2nd pillar in other countries that have implemented it.

The paper is organized as follows: in the second chapter we describe a life-cycle investment model, its proxy version with reference to its application in the world and to specifics related to Croatia. The third chapter describes the parametric model for the calculation of accumulated savings adjusted for the proxy life-cycle investment model along with the method of calculating the impact of market shocks on the accumulated savings. In the fourth chapter we analyze the expected returns and risks of mandatory pension funds of different risk categories, while in the fifth chapter we analyze the expected accumulated savings in a variety of life-cycle scenarios and the robustness of those scenarios on the occurrence of a market shock. In the sixth chapter we analyze the risk arising from members changing the category of a pension fund at an unfavorable moment. Finally, the last chapter presents an analysis of the research results.

2 LIFE-CYCLE INVESTMENT MODEL

When setting up investment strategies for pension funds in the long term, the question is how to achieve an appropriate return of the fund and at the same time protect the fund's members from the risks associated with investments in the capital market. In the case of a one-time payment to the fund and a very long horizon of investing, the modern portfolio theory clearly states that the optimal allocation of the portfolio between different asset classes is made unambiguously for a defined risk aversion of an investor, as it is defined with a set of parameters such as the expected returns, risks and correlation between different asset classes, risk-free interest rate, in addition to being time-independent.

However, the time horizon of investments in a pension fund typically ranges from 35-45 years, and payments, which are on average of a slowly increasing intensity, commonly occur at regular intervals. Furthermore, the members' risk aversion, as would be expected, rises towards the end of the savings accumulation phase, when the pension payments phase begins. In such circumstances it is possible that the optimal structure of investment has a time-dependent dynamic. Research shows that the optimal investment strategy of a pension fund should be described with a life-cycle model that allows gradual adjustment of the allocation of a pension fund portfolio in time, i.e. continuous change in the ratio of investment in equity and bonds (for review see, e.g., Bagliano et al., 2009; Potočnjak and Vukorepa, 2012).

Most of the research into life-cycle pension fund investments models (Castañeda et al., 2011) shows that at the beginning of the accumulation phase of investment

the fund's assets should be allocated predominantly in equity, with a lower share of bonds in the portfolio (a moderately aggressive investment structure), while at the end of the accumulation phase allocation in equity should be reduced significantly, and assets should mostly be invested in bonds (a moderately conservative investment structure). The basic idea is that at the beginning of entering the pension system it is easier for members to bear a risky investment because they have fewer accumulated funds, have more time to retirement and are more likely to reduce and compensate for any losses. On the other hand, at the end of the accumulation phase members prefer safer investments against returns, given the large amount of funds accumulated and the short term available to offset potential losses.

Therefore, members should have the ability to change the allocation between equity and bonds as time passes and the question is how to perform such a reallocation within the mechanism of collective investment schemes. One of the solutions is life-cycle modeling of investments with a continuous adjustment in allocation. Such a mechanism can be achieved by defining the cohort groups of members with approximately the same retirement date. In practice it means that all members within a range of, e.g. five years until retirement, invested in the same fund in which the allocation throughout the accumulation phase is adjusted continuously according to the life-cycle model of investment. This almost exact life-cycle investment model means a far greater number of pension funds in practice, and consequently, increased management costs.

A solution to the problem of implementing a life-cycle investment model can be found by defining a certain number of pension funds that invest in assets of various risk classes, and the optimal allocation for a member can be achieved by investing his savings in different pension funds in a certain percentage. Here there is the obvious problem of determining the optimal allocation for each member, which can be delegated to the member himself, or on the legislator through an automatic allocation system. Also, the administrative costs of such schemes are increased due to the additional management of members' units register for each of the funds and the complex mechanism for the schedule of contributions for each of the funds.

Finally, a life-cycle investment model can be approximately achieved by forming several pension funds of different risk profiles and by automatically changing the membership from the higher risk profile fund to the lower risk profile fund as members get closer to their retirement date. This alternative life-cycle investment model (proxy life-cycle) simulates the optimal change in asset allocation of the fund in the accumulation phase by introducing several funds with approximately constant risk profiles for a certain phase of the accumulation and pre-defines the moments at which changes to a lower risk profile fund are mandatory. Note that the stability of the risk profile is approximate due to the ability of the fund manager to change the allocation of assets depending on market conditions. Also, it

should be possible to allow the members to change funds of different risk profiles themselves at a specific moment, depending on their personal preferences towards risk, which may not be caused by market conditions.

For the purpose of optimizing the cost of the system on the one hand and efforts to approximate the true life-cycle investment model with the proxy model, as far as possible, in practice there are only three to five pension funds of various risk categories. Depending on the number of funds, for a member it is necessary to define the moment of the automatic switch to a lower risk profile fund, and if members are also able to change the risk profile of a fund in general, it is necessary to define the conditions under such change can be done. Note that in both cases the change in the riskiness of a fund induces a risk of switching at an unfavorable moment, i.e. during periods of falling prices in the capital market when a decrease in the value of members' accumulated savings occurs and cannot be compensated for if a member switches to a lower risk profile fund after the fall. In this article we will concentrate especially on such unfavorable scenarios and analyze their impact on the total accumulated funds.

According to the World Bank data, the proxy life-cycle investment model with pension funds of different risk profiles has been introduced in a dozen countries, including Chile, Estonia, Hungary, Mexico, Peru, Slovakia and Poland (Castañeda et al., 2011), while Bulgaria and Colombia are preparing to introduce a proxy life-cycle model (Impavido et al., 2010). Most countries have chosen a system with three different funds of conservative, balanced and aggressive risk profiles, which are mostly defined by the investment limits for the various asset classes, and where the members can only be in one fund at any moment. However, there are exceptions in some countries which have introduced up to five different funds of different expected risks (such as Chile and Mexico), providing great flexibility to the members in selecting those funds.

Chile, for example, allows members to allocate their savings in two funds in an arbitrary ratio, in order to reduce the risk of switching from one fund to another. The Chilean system also allows members to switch from the current fund to a fund of lower or higher expected risk, with the exception of those members who are close to their retirement date and who are not allowed to switch to the most risky fund. Despite the wide selection of funds, as well as the flexibility and ease of selection, about 65% of members in Chile are automatically assigned to a fund, according to the legal restrictions on membership in a particular fund (Impavido et al., 2010).

Table 1 gives us an overview of funds' investment limits into equity for those countries that have adopted the proxy life-cycle pension fund investment model, while table 2 presents the criteria for automatic allocation of members to a specific risk profile fund in each country.

Table 1

Investments limits into equity for pension funds in countries with a proxy life-cycle investment model (in terms of % of funds' net asset value)

	Fund A	Fund B	Fund C	Fund D	Fund E
Chile	80	60	40	20	5
Mexico	30	25	20	15	0
Peru	80	45	10	–	–
Hungary	<40,100>	<10,40>	10	–	–
Slovakia	80	50	0	–	–
Estonia	75	25	0	–	–
Poland	75	35	7,5	–	–

Source: Castañeda and Rudolph (2011), except for Poland where the benchmark allocations for funds of different risk profiles are given (Wojcieh, 2011), and Chile (Arthur, 2009).

Table 2

The regulatory limits on the duration of membership in a particular fund, considering the age of members

	Fund A	Fund B	Fund C	Fund D	Fund E
Chile	–	Men and women under 35 years of age	Men from 35 to 55 years of age	Men above 55 years of age	–
	–	–	Women from 35 to 50 years of age	Women above 50 years of age	–
Mexico	Men and women 26 years of age	Men and women from 26 to 37 years of age	Men and women from 37 to 45 years of age	Men and women from 45 to 55 years of age	Men and women above 55 years of age
Peru	–	Men and women under 60 years of age	Men and women above 60 years of age	–	–
Hungary	Men and women under 47 years of age	Men and women from 47 to 57 years of age	Men and women above 57 years of age	–	–
Slovakia	Men and women under 47 years of age	Men and women under 55 years of age	–	–	–
Estonia	Default membership in the conservative profile fund (C), no age restrictions	–	–	–	–
Poland	Men and women under 55 years of age	Men and women above 55 years of age – all further payments go to fund C, twice a year the assets are gradually transferred to fund C	–	–	–

Source: Impavido et al. (2010) for Chile, Mexico and Peru; Arthur (2009) for Hungary, Slovakia and Estonia; and Wojcieh (2011) for Poland.

Automatic allocation of members in Chile, Mexico, Peru, Poland and Hungary is based on some form of life-cycle model, and limitations on the duration of membership in a particular fund depend on the members' age. On the other hand, in Estonia there is no age limit on the duration of membership in a particular fund, and if the member doesn't choose a fund himself, he will be automatically allocated to the conservative fund. Slovakia does not have an automatic selection of funds for the members, and the members themselves must decide in which fund they want to participate, if they want to be in the system (Arthur, 2009).

In Croatia, the proxy life-cycle investment model was introduced in 2014 (The Mandatory Pension Funds Act, 2014), and it is designed through the formation of three pension funds of different risk profiles, i.e. different categories: A, B and C. In table 3 the limitations to exposure to equities and alternative investment funds for pension funds of different categories are given. In accordance with those limits, we can assert that the category A fund has a balanced investment strategy, the category B fund has a moderately conservative investment strategy and the category C fund can be considered a conservative risk profile fund.

Table 3

Maximum exposure to equities and alternative investment funds for category A, B and C pension funds in Croatia

Asset class	A	B	C
Equity	55%	35%	0%
Alternative investment funds	15%	10%	0%

Automatic transfer from category A fund to category B fund occurs when the member has fewer than 10 years to his retirement date, while the next automatic switch occurs when the member has fewer than 5 years to retirement. Also, members can change fund categories only in the years when they reach the age that is a multiple of the number three, and only in the calendar month in which they were born. In a case of a market decline this should prevent the expected switching of a larger number of members to funds with lower risk profiles. However, this mechanism does not prevent the switching of members who do qualify to make a change in their fund category, which raises the risk of switching fund categories in an unfavorable moment.

3 PARAMETRIC MODEL FOR CALCULATION OF ACCUMULATED SAVINGS IN THE PROXY LIFE-CYCLE INVESTMENT MODEL

In this chapter we present the extended parametric model for the calculation of total accumulated savings in the 2nd pillar (Šorić, 2000) which is adapted to the proxy life-cycle investment model. In this approximate model, which assumes payment of contributions at equal time intervals, the total amount of accumulated savings depends on only a few factors: the length of the saving period in a pension

fund category, the return of a pension fund category and the income growth rate, which is assumed to be constant as time passes.

In case of savings in the former model of the 2nd pillar, where members contribute n years in the pension fund whose expected long term real return is p and where they have the expected long term real growth of gross wages i, it is shown that the expected total amount of accumulated savings M is equal to (Šorić, 2000):

$$M = R \cdot \frac{r-1}{r^{1/12}-1} \cdot \frac{r^n - s^n}{r-s}, \tag{3.1}$$

where R is the current contribution to the 2nd pillar, paid at the end of the month, and r and s are indices for pension fund return and income growth rate:

$$r = 1+p\,, \quad s = 1+i. \tag{3.2}$$

We will also assume that the contribution R is equal to one and that it has already been reduced by the entry fee of the pension fund. Detailed analysis of the influence of various parameters on the total accumulated savings from the 2nd pillar is described in the work of Latković and Liker (2009).

Calculation of total savings in the proxy life-cycle model is somewhat more complicated given that there are three saving periods with arbitrary duration and with different expected returns of particular pension funds. Therefore, for the purpose of calculating the total expected accumulated savings we have to obtain accumulated savings in particular categories of funds, and therefore we introduce the following notation:

- M_i … accumulated savings from the beginning of the membership period until exit from the category i fund, where i represent the category of the fund (A, B or C),
- t_0 … age of a member at the time of entering the pension system,
- t_1 … age of a member when switching from category A to category B fund,
- t_2 … age of a member when switching from category B to category C fund,
- T … age of a member at the time of retirement,
- t_A … total participation time in category A fund,
- t_B … total participation time in category B fund,
- t_C … total participation time in category C fund,
- p_i … average annual return of the fund of category i, and
- $r_i = 1+p_1$… index for the annual rate of return of category i fund,
- $r_{im} = r_i^{1/12}$… index for the monthly rate of return of category i fund.

According to equation (3.1) the expected accumulated savings in fund A, at the end of the savings period, are:

$$M_A = \frac{r_A - 1}{r_A^{1/12} - 1} \cdot \frac{r_A^{t_A} - s^{t_A}}{r_A - s}. \tag{3.3}$$

When a member reaches t_1 years of age, he switches from fund A to fund B and he begins to pay his contributions into fund B. At the same time, his previously accumulated savings from fund A represent a one-time payment to fund B, and this amount is being capitalized at the rate equal to the expected return of fund B up to the moment of exit from fund B, i.e. until the moment t_2. The expected accumulated savings in fund B at the end of the period of savings in that fund are:

$$M_B = M_A \cdot r_B^{t_B} + s^{t_A} \cdot \frac{r_B - 1}{r_B^{1/12} - 1} \cdot \frac{r_B^{t_B} - s^{t_B}}{r_B - s}. \tag{3.4}$$

Accordingly, the expected accumulated savings in fund C at the end of the period of savings in that fund are:

$$M_C = M_B \cdot r_C^{t_C} + s^{(t_2 - t_0)} \cdot \frac{r_C - 1}{r_C^{1/12} - 1} \cdot \frac{r_C^{t_C} - s^{t_C}}{r_C - s}. \tag{3.5}$$

After including equations (3.3) and (3.4) into the equation (3.5), we get the following expression for the total expected amount of accumulated savings, M_{PLC}, in the proxy life-cycle investment model:

$$\begin{aligned} M_{PLC} = {} & \frac{r_A - 1}{r_A^{1/12} - 1} \cdot \frac{r_A^{t_A} - s^{t_A}}{r_A - s} \cdot r_B^{t_B} \cdot r_C^{t_C} + s^{t_A} \cdot \frac{r_B - 1}{r_B^{1/12} - 1} \cdot \frac{r_B^{t_B} - s^{t_B}}{r_B - s} \cdot r_C^{t_C} \\ & + s^{(t_2 - t_0)} \cdot \frac{r_C - 1}{r_C^{1/12} - 1} \cdot \frac{r_C^{t_C} - s^{t_C}}{r_C - s}. \end{aligned} \tag{3.6}$$

We mention some special cases of equation (3.6) when a member spends the entire time in category A fund ($t_1 = t_2 = T$):

$$M_{PLC}^A = \frac{r_A - 1}{r_A^{1/12} - 1} \cdot \frac{r_A^{(T - t_0)} - s^{(T - t_0)}}{r_A - s}, \tag{3.7}$$

or in category B fund ($t_0 = t_1$; $t_2 = T$):

$$M_{PLC}^B = \frac{r_B - 1}{r_B^{1/12} - 1} \cdot \frac{r_B^{(T - t_0)} - s^{(T - t_0)}}{r_B - s}, \tag{3.8}$$

or in category C fund ($t_0 = t_1 = t_2$):

$$M_{PLC}^C = \frac{r_C - 1}{r_C^{1/12} - 1} \cdot \frac{r_C^{(T - t_0)} - s^{(T - t_0)}}{r_C - s}. \tag{3.9}$$

For simplicity, we assume that there is no real growth of gross wages, which further simplifies the equation for the expected amount of accumulated savings given by the equations (3.3) to (3.9). This assumption can be justified by the fact that, in the event of a positive real rate of income growth, which corresponds to the range of average historical real rate of gross salary growth in Croatia, the results of the analysis presented are analogous.

4 THE EXPECTED RETURNS AND RISKS OF PENSION FUNDS OF VARIOUS CATEGORIES

In order to compare the calculations for total accumulated savings under the previous and the new law and to determine the expected risks, below we will define the expected long term returns of basic asset classes that are part of the pension funds' portfolios of different risk profiles, their expected risks and mutual correlations.

The expected long term returns of pension funds mostly depend on the strategic asset allocation of their portfolios, i.e. the ratio between debt securities (bonds) and equity securities (shares) in their portfolios. With the help of the average realized returns over the long term for these two basic asset classes, it is possible to set expectations for their future values. The same applies to the expected risks and correlations.

By analyzing historical returns of bonds and equities in developed markets (Dimson et al., 2014), it is possible to estimate the expected returns and risks for those markets, as well as to provide an estimate of the expected returns and risks for the Croatian capital market (table 4). Due to the short history of the domestic equity market and the unreliability of statistical estimates of its average historical returns, for the Croatian equity market we use estimates for expected returns (Latković and Liker, 2009) that are based on the spreads in historical returns between emerging markets (12.5%) and developed markets (10.8%) achieved since World War II (Dimson et al., 2014). Therefore, for the expected real return of equity in the domestic market, we use the historical real rate of return for foreign equity markets plus a premium of 2 percentage points.

Since it is not possible to give an estimate of the spread in premium for bonds in emerging markets and developed markets on a longer time scale (the history of debt issuing for emerging markets, in foreign currencies, starts at the beginning of the 1990s), we assume that the spread should be less than the difference between the equity premium due to the generally lower risk of bonds versus equity. Therefore, for the sake of simplicity, we estimate that the real return of bonds in the foreign (outside Croatia) market should be increased by 1 percentage point to get the expected real return on the domestic (Croatian) bond market.

The results of the analysis presented in this paper depend only on specific quantitative estimates of expected returns for the Croatian capital market, but not qualitatively as long as the premiums for the Croatian market are larger than the corresponding premiums for developed markets. Expected risks for foreign equity

FINANCIAL THEORY AND PRACTICE
39 (1) 31-55 (2015)

and bond markets are estimated based on historical volatility (Dimson et al., 2014) while for the Croatian market the historical volatility for emerging markets was taken. Assumptions about the correlations we use in the analysis are given in table 5, and they are estimated by observing the trends in the movement of correlation of returns on various asset classes.

Table 4

The expected returns and risks for basic asset classes in the domestic (HR) and international (INO) capital markets (in %, annualized)

Asset class	Expected real return	Expected risk
HR bond market	2.8	10
HR equity market	7.2	27
INO bond market	1.8	7
INO equity market	5.2	18

Source: Dimson et al. (2014) and calculations by the authors.

Table 5

*Assumptions for correlations of basic asset classes in the domestic and international capital markets**

Correlations	HR O	HR D	INO O	INO D
HR O	1	0.25	0.3	0.2
HR D	0.25	1	0.1	0.6
INO O	0.3	0.1	1	0.2
INO D	0.2	0.6	0.2	1

** HR O, HR D, INO O and INO D respectively denote Croatian bond market, Croatian equity market, foreign bond market and foreign equity market.*

Source: Calculations by the authors.

Taking into account the legal restrictions on the exposure to equity for pension funds of various categories (table 3), we assume the targeted asset allocation in equity and bonds for funds A, B and C and define the targeted allocation for a pension fund that operated by the previous law (based on historical asset allocation in equities and bonds of mandatory pension funds in Croatia in the period from late 2006 to the end of 2013; source: HANFA). Assumptions about the asset allocations are shown in table 6.

Table 6

Assumed asset allocation of pension funds in stocks and bonds (in % of the net asset value of a fund)

	Previous law	A	B	C
Equity market	25	50	25	0
Bond market	75	50	75	100

Note that the moderately conservative asset allocation of category B fund is identical to the asset allocation of the pension fund operated under the previous law. For category A fund we have selected a balanced asset allocation, while the allocation for the category C fund is completely conservative. Furthermore, we assume that funds invest their assets in Croatian and foreign markets, according to the allocation shown in table 7.

Table 7

Assumed asset allocation of pension funds (in % of the net asset value of a fund)

	Previous law	A	B	C
HR bond market	65	40	65	90
HR equity market	15	30	15	0
INO bond market	10	10	10	10
INO stock market	10	20	10	0

Based on the assumptions on expected real returns, risks, correlations and the asset allocations of pension funds portfolios, shown in tables 4 to 7, and by using the equation for portfolio total return, R_P, and portfolio risk, σ_P:

$$R_p = \Sigma_i w_i R_i, \tag{4.1}$$

$$\sigma_P^2 = \Sigma_{i,j} w_i w_j \sigma_i \sigma_j \rho_{ij}, \tag{4.2}$$

where w_i represents the share of an asset class in the portfolio, R_i and σ_i are its expected return and expected risk respectively, while ρ_{ij} is the expected correlation between the *i*th and *j*th asset classes, we calculate the expected real returns and risks for a particular fund. Table 8 shows the results obtained.

Table 8

The expected real returns and risks of pension funds under the previous and the new law (in %, annualized)

	Previous law	A	B	C
Expected real return	3.60	4.50	3.60	2.70
Expected risk	9.63	12.48	9.63	9.23

The results presented in table 8 show that the expected real returns and risks are the highest for category A fund, and by decreasing the share of equity in the portfolios of category B and C funds their expected real returns and risks decline. Note that the expected real returns and risks of the pension fund operated by the previous law and for category B fund are identical given the same assumed asset allocation. However, note that the expected reduction of risk in category C fund with respect to category B fund is not in proportion to the reduction of the expected risk of category B fund versus category A fund, despite the proportional reduction in

the allocation of equity. The expected risk of category B fund decreases by 22.8% compared to the expected risk of category A fund, while the expected risk of category C fund decreases by only 4.1% compared to the expected risk of category B fund.

The reason lies primarily in the insufficient diversification of investments in the category C fund which is caused by the large, 90%, proportion of Croatian bonds in the portfolio. If we reduce the share of Croatian bonds to 80% and increase the share of foreign bonds to 20% in the category C fund, the reduction of expected risk is 11.5% while the expected real return is reduced by only a tenth of a percentage point. If we allow investments into equities in the category C fund and assume a targeted asset allocation in this segment in the amount of 10% (5% in Croatian equity and 5% in foreign equity), with an appropriate reallocation of investments in bonds in the amount of 75% for Croatian bonds and 15% for foreign bonds, the expected risk would be slightly higher than in the previous case, with a reduction of 10.3% compared to the risk of category C fund with a 90/10 allocation to domestic and foreign bonds. Also, the expected real return increases to 3%, which is 0.3 percentage point higher than the expected real return of the category C fund with 90/10 allocation in bonds.

From the analysis above we can conclude that the diversification potential of different asset classes is probably not fully utilized in category C fund and that with a slight increase in the exposure to equity markets it would be possible to obtain a larger reduction of portfolio risk while increasing returns. However, the portfolio risk depends primarily on the assumed asset allocation of a pension fund, the expected risks of individual asset classes as well as their mutual correlations and therefore the resulting reduction of portfolio risk has to be viewed as an indication (not quantification) of diversification insufficiency in category C fund.

5 EXPECTED TOTAL ACCUMULATED SAVINGS AND THE IMPACT OF MARKET SHOCKS

Next, we analyze the expected total accumulated savings in the proxy life-cycle investment model obtained on the basis of expected returns of pension funds of various categories and make a comparison with expected returns of a pension fund operated under the previous law.

Furthermore, we have to assume the total duration of the accumulation phase and the savings period in a particular fund category (A, B and C). We assume that a member enters the pension scheme at 25 years of age and retires at 65 years of age, i.e. the total working period is 40 years. We are interested in changes of the total expected accumulated savings, M_{PLC}, as we change the age of a member at the moment of switching from fund A to fund B, t_1, i.e. from fund B to fund C, t_2, and how it differs from the expected total accumulated savings under the previous law, M.

FINANCIAL THEORY AND PRACTICE
39 (1) 31-55 (2015)

Also, we are interested in the impact of a market shock on the total expected accumulated savings for A, B and C funds at the end of the accumulation phase, i.e. we calculate the worst losses in which the probability of observations of a larger loss is less than the pre-defined probability (Scheuenstuhl et al., 2010). This concept is called the Value-at-Risk (VaR) of the portfolio, and is defined as:

$$P\left(L > VaR\right) \leq 1 - c, \tag{5.1}$$

where c is the confidence level and L is the expected loss of the fund. For simplicity we assume that returns of a pension fund are independent and identically distributed normal random variables.

Based on the assumption that the accumulation phase lasts 40 years and assuming an isolated market shock in those 40 years, we define a confidence level c = 1-1/40 = 97.5%, i.e. we determine the probability of 2.5% for the occurrence of a greater loss than VaR. An example of such an event in the capital markets occurred in 2008, when the decline in foreign equity markets, measured by the MSCI World index (including dividend yield), was 37.25% measured in Croatian currency kuna, while the decline in domestic stock markets, measured by the CROBEX index, was 63.74%. The average decline in the returns of Croatian mandatory pension funds in 2008, as measured by the MIREX index, was 12.50%. According to the assumptions in tables 7 and 8 the worst loss defined by formula (5.1) for the fund under the previous law amounts to 15.28% and is comparable to the average realized decline of MIREX in 2008.

For the case of normally distributed pension fund returns and a confidence level of 97.5%, the expected VaR of a fund is:

$$\text{VaR} = M \cdot (1.96 \cdot \sigma_P - R_P), \tag{5.2}$$

where R_P and σ_P represent the expected return and risk of a fund, and M is the total amount of expected accumulated savings. This expression allows us to determine the loss that would arrive from a market shock at the time of retirement.

We consider the case when a member spends the entire employment period in the pension fund operated under the previous law, in funds of particular categories in the proxy life-cycle model with age-dependent constraints of switching between funds starting with the category A fund at the beginning of employment (A-B-C scheme: the transition from fund A to fund B in 10 years before retirement and from fund B to fund C in 5 years before retirement), and starting with fund B at the beginning of employment (B-C scheme: the transition from fund B to fund C in 5 years before retirement). The results for the total expected accumulated savings and the corresponding VaR are shown in table 9.

FINANCIAL THEORY AND PRACTICE
39 (1) 31-55 (2015)

Table 9

The calculation of total expected accumulated savings and VaR for one unit of contribution

	Expected real return (%)	Expected risk (%)	Expected accumulated savings (kn)	VaR (kn)
Previous law	3.6	9.63	1,055.4	161.3
Only fund A	4.5	12.48	1,310.6	261.7
Only fund B	3.6	9.63	1,055.4	161.3
Only fund C	2.7	9.23	856.1	131.8
A-B-C scheme*	4.16	9.23	1,157.6	161.4
B-C scheme**	3.49	9.23	1,011.7	147.8
Life-cycle model	3.01	8.51	1,139.3	155.7

**Average expected real return in accordance with the period of participating in fund A, B and C and the expected risk for fund C.*
*** Average expected real return in accordance with the period of participating in fund B and C and the expected risk for fund C.*

Note that the total expected accumulated savings would be the largest if a member could spend his total accumulation phase in fund A, however, he would also have the largest expected risk and expected VaR. Nevertheless, a member is free to choose to spend all of his employment period in fund C where the expected risk is the smallest, although with significant penalization of total expected accumulated savings. The proxy life-cycle investment model allows a member to achieve an average return that is higher than the return of the fund under the previous law, and the return in the case of membership only in fund B or only in fund C. However, the expected risk at the time of his retirement is the risk of fund C while VaR is almost identical to VaR of the fund under the previous law. Therefore, even in the case of a market shock at the time of retirement, a member is better off in the proxy life-cycle investment model (A-B-C scheme) than in the case of investment under the previous law.

If a member who participates in the proxy life-cycle investment model decides not to participate in fund A at all, i.e. he chooses or is assigned by law to fund B and remains a member of fund B up until the membership age restriction (B-C scheme; transition from fund B to fund C 5 in years before retirement), he can expect a smaller amount of total accumulated savings and a lower VaR than in the pension scheme under the previous law. In the event of a market shock at the time of retirement, a member would (in this case) have been better off in the model of investments under the previous law.

Next, we analyze one of the exact life-cycle investment models and compare it with the proxy life-cycle model in Croatia. In the second chapter we mentioned that there are multiple ways of implementing life-cycle portfolio modeling. Studies show that there is an age span at which a member should be almost fully ex-

posed to equity markets, and after that age the exposure to equity should be gradually reduced until the time of retirement (Schiller, 2006). Some of the possible scenarios for life-cycle portfolio modeling provide the following investment ratios in equity and bond markets:

- *basic portfolio*: the initial allocation of equity is equal to 85% of fund assets and is fixed until a member reaches 29 years of age, after which the exposure to equities is gradually reduced to 15% by the time of retirement,
- *conservative bond portfolio*: similar to the basic portfolio, only the initial exposure to equity is 70% and the final is 10%,
- *aggressive portfolio*: similar to the basic portfolio, only the initial exposure to equity is 90% and the final is 40%.

Of these three scenarios we select the conservative bond portfolio for further analysis, given that it best describes the A-B-C scheme of investments in Croatia. Due to the simplicity of calculating the allocation of equity and bonds over time, we decrease exposure to equity linearly from the moment when a member reaches 29 years of age until the time of his retirement. Also, we assume a fixed ratio of 4:1 for bonds and 3:2 for equity between investment in Croatian and foreign markets for the entire period of investment (the initial allocation is 42% in Croatian equities, 28% in foreign equities, 24% in Croatian bonds and 6% in foreign bonds). The result of this selected exact life-cycle investment model is shown in table 9. From the results we see that the proxy life-cycle investment model in Croatia is comparable with the selected exact model of life-cycle investment both in terms of accumulated savings and by the amount of VaR.

6 THE RISK OF CHANGING A FUND CATEGORY IN AN UNFAVORABLE MOMENT

As we mentioned in the introduction, the proper selection of the moment of switching from a pension fund of higher risk to a fund of lower risk is an important factor in determining the expected total accumulated savings in the proxy life-cycle model in the 2nd pillar. In this article we do not optimize this process in order to achieve the maximum amount of accumulated savings in relation to risk at retirement, and we focus on the analysis of scenarios of voluntary transition to a fund of lower risk in an unfavorable time.

Below, an unfavorable moment of transition to a lower risk fund presents a scenario where, after a market shock, a member can change fund categories and decide to transfer his previously accumulated savings to a lower risk fund, immediately after the occurrence of a market shock. The expectation for the realization of such a scenario is based on the large number of membership terminations from voluntary pension funds after the collapse of the market at the end of 2008 (according to HANFA's monthly reports on the status of membership in voluntary pension funds). Furthermore, in all of the following examples we use legal age restrictions on the membership duration in fund A and the minimum duration in

fund B and C. The reason for this inert transition dynamics from one fund category to another fund category is found in the previous inertness of choosing a pension fund in the first place, i.e. when members enter the pension scheme, as well as in the inertness of members about changing pension funds because of their performance.

In the following analysis we continue to use the expectations for a market shock occurrence once in 40 years, i.e. we consider the VaR with a confidence level of 97.5%. Market shock of a portfolio P is defined as:

$$S^P = 1.96 \cdot \sigma_P - R_P, \tag{6.1}$$

where R_P and σ_P are the expected return and risk of a fund. We apply a market shock on accumulated savings in fund A or B and observe how these savings behave at retirement, depending on the moment of the transition from fund A to B or from B to C (depending on which fund the member is in at that moment).

The equation for the total expected accumulated savings in the proxy life-cycle investment model can be expressed as:

$$M_{PLC} = M^A + M^B + M^C, \tag{6.2}$$

where:

$$M^A = R \cdot \frac{r_A - 1}{r_A^{1/12} - 1} \cdot \frac{r_A^{t_A} - s^{t_A}}{r_A - s} \cdot r_B^{t_B} \cdot r_C^{t_C}, \tag{6.3}$$

$$M^B = R \cdot s^{t_A} \cdot \frac{r_B - 1}{r_B^{1/12} - 1} \cdot \frac{r_B^{t_B} - s^{t_B}}{r_B - s} \cdot r_C^{t_C}, \tag{6.4}$$

$$M^C = R \cdot s^{(t_2 - t_0)} \cdot \frac{r_C - 1}{r_C^{1/12} - 1} \cdot \frac{r_C^{t_C} - s^{t_C}}{r_C - s}. \tag{6.5}$$

If a member of fund A decides to switch to fund B at an unfavorable moment, then equation (6.3) becomes:

$$M_S^A = R \cdot \frac{r_A - 1}{r_A^{1/12} - 1} \cdot \frac{r_A^{t_A} - s^{t_A}}{r_A - s} \cdot (1 - S^A) \cdot r_B^{t_B} \cdot r_C^{t_C}, \tag{6.6}$$

and the expression for his expected total accumulated savings becomes:

$$M_{PLC}^{S,A} = M_S^A + M^B + M^C. \tag{6.7}$$

Analogously, if a member of fund B decides to switch to fund C at an unfavorable moment, then equation (6.4) becomes:

$$M_S^B = R \cdot s^{t_A} \cdot \frac{r_B - 1}{r_B^{1/12} - 1} \cdot \frac{r_B^{t_B} - s^{t_B}}{r_B - s} \cdot (1 - S^B) \cdot r_C^{t_C}, \tag{6.8}$$

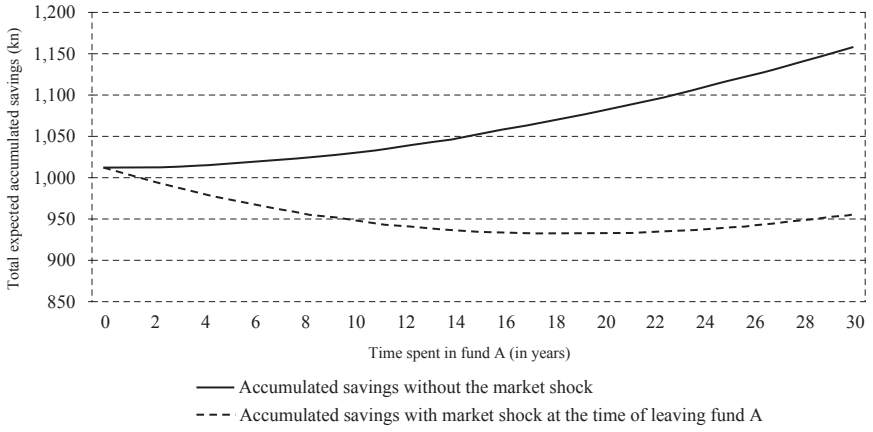
and the expression for his expected total accumulated savings becomes:

$$M_{PLC}^{S,B} = M^{A} \cdot (1 - S^{B}) + M_{S}^{B} + M^{C}. \tag{6.9}$$

Next, we calculate the expected total accumulated savings in the event of an unfavorable moment of changing the fund and in a case when the shock does not happen. Consider the situation where a shock occurs at the moment of transition from fund A to B. Suppose that the change from fund A to B is possible at any time.

Figure 1

The total expected accumulated savings (for a one unit of contribution) without shock and with the shock in fund A

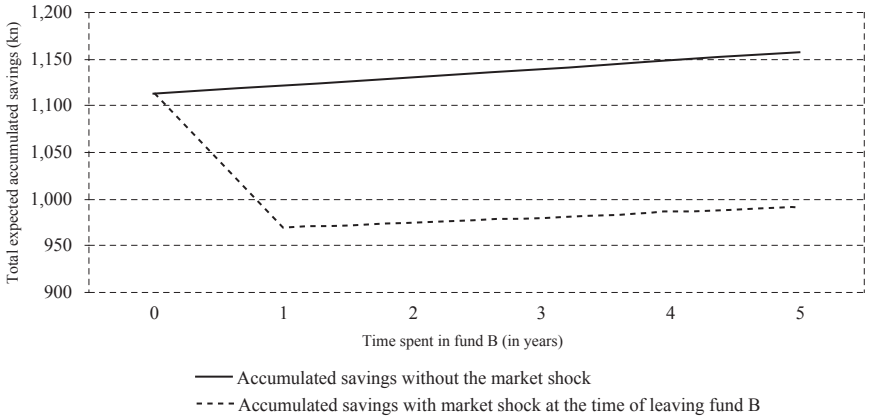


It is evident that a shock at the time of transition from fund A highly affects the expected total accumulated savings and that the difference between the accumulated savings without a shock and with a shock after which a member decides to change the fund, grows according to the time spent in fund A. If the shock occurs in the initial years of membership in fund A, and a member decides to switch to the lower risk fund, there is an opportunity cost, i.e. the risk of missed earnings that would be realized if he remained in fund A. This opportunity cost increases in the initial years of the accumulation phase as the time remaining until retirement, in which a member is no longer a member of the fund A, is significant. In this case, at about half of the maximum legally expected time of membership in fund A, there is a mutual influence of opportunity cost and previously accumulated savings which results in the lowest amount of total expected accumulated savings in a case in which a member leaves the fund immediately after the market shock.

Furthermore, we study the situation when a shock occurs at the moment of transition from fund B to C. Suppose that the change from fund B to C is possible at any time.

FIGURE 2

Total expected accumulated savings (for one unit of contribution) without shock and with the shock in fund B



As mentioned earlier, after a period of membership in fund A, the accumulated savings in fund A are transferred to fund B and this amount increases at the rate of the expected return of fund B. In this example, we assume that a market shock occurred at a moment when a member is in fund B, i.e. when he has a significant amount of savings on his personal account. In figure 2 we see a significant and sudden loss of previously accumulated savings. Also, it is evident that the difference between the accumulated savings without a shock and with a shock, after which a member decides to change the fund, grows according to the time spent in fund B.

Consider the situation when a market shock occurs and the member decides not to change funds, i.e. he remains in the fund until the age restrictions for membership in a particular fund apply. Let m be the moment when a shock occurs and a member decides to stay in a fund until he switches automatically to the next fund. If a shock occurs during the membership in fund A then instead of equation (6.3) we have:

$$M_{S,m}^{A} = R \cdot \frac{r_A - 1}{r_A^{1/12} - 1} \cdot \left(\frac{r_A^{(m-t_0)} - s^{(m-t_0)}}{r_A - s} \cdot (1 - S^A) \cdot r_A^{(t_1 - m)} + s^{(m-t_0)} \cdot \frac{r_A^{(t_1-m)} - s^{(t_1-m)}}{r_A - s} \right) \cdot r_B^{(t_2-t_1)} \cdot r_C^{(T-t_2)}, \tag{6.10}$$

and the expression for the total expected accumulated savings are:

$$M_{PLC,m}^{S^A} = M_{S,m}^{A} + M^B + M^C. \tag{6.11}$$

If the shock occurs during the membership in fund B, then instead of equation (6.4) we have:

$$M^{B}_{S,m} = R \cdot s^{t_A} \cdot \frac{r_B - 1}{r_B^{1/12} - 1} \cdot \left(\frac{r_B^{(m-t_1)} - s^{(m-t_1)}}{r_B - s} \cdot \left(1 - S^B\right) \cdot r_B^{(t_2-m)} + s^{(t_2-m)} \cdot \frac{r_B^{(t_2-m)} - s^{(t_2-m)}}{r_B - s} \right) \cdot r_C^{t_C}, \tag{6.12}$$

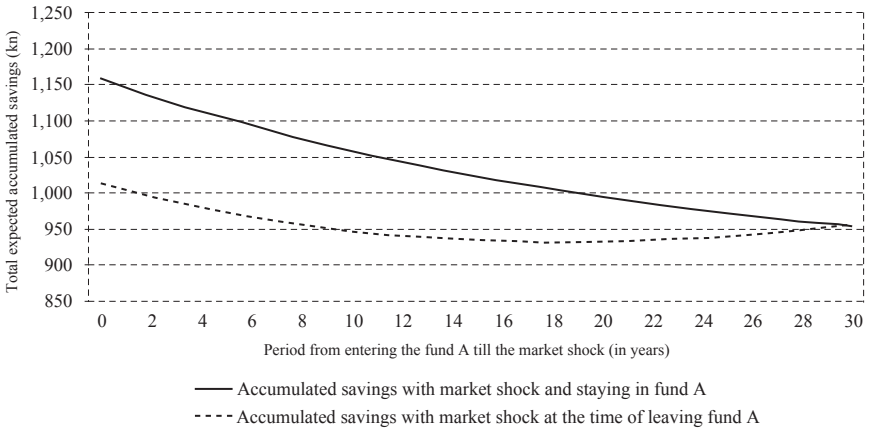
and the expression for the total expected accumulated savings are:

$$M^{S^B}_{PLC,m} = M^{A} \cdot \left(1 - S^B\right) + M^{B}_{S,m} + M^{C}. \tag{6.13}$$

Let us observe the situation when a shock occurs during membership in fund A. We are interested in how this affects the total expected accumulated savings if a member remains in fund A after the market shock, and in relation to the scenario in which he chooses to switch from fund A to fund B at an unfavorable moment.

FIGURE 3

Total expected accumulated savings (for one unit of contribution) in the event of staying in fund A after the shock and of leaving the fund A after the shock



It is evident that for any moment that the shock occurs m, $t_0 \leq m < t_1$, it is better to stay in fund A than to move to fund B in the year when the shock occurred. If the moment of shock corresponds to the moment of mandatory transition from fund A to B, $m = t_1$, the total expected accumulated savings is equal for both cases.

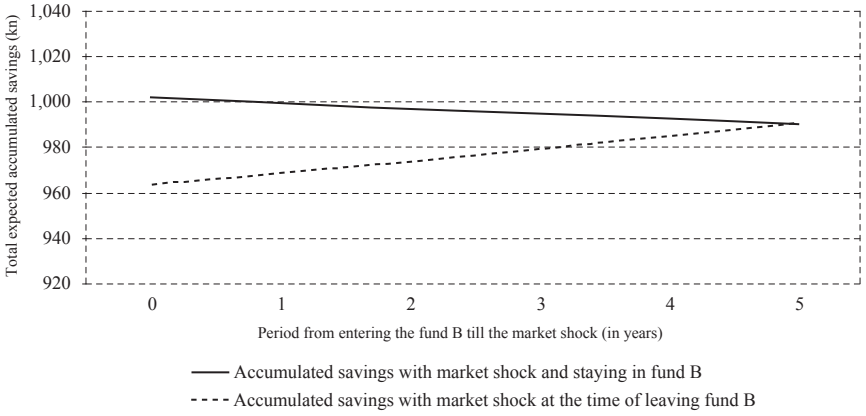
Let us observe the situation when a shock occurs during membership in the fund B. We are interested in how this affects the total expected accumulated savings in a case in which a member remains in fund B after a shock as compared to the scenario in which he chooses to switch from fund B to fund C, at an unfavorable moment.

It is evident that for any moment of shock m, $t_1 \leq m < t_2$ it is better to stay in fund B than to switch to fund C in the year when the shock occurred. If the moment of

shock corresponds to the moment of mandatory transition from fund B to C, $m = t_2$, the total expected accumulated savings is equal for both cases.

FIGURE 4

Total expected accumulated savings (for one unit of contribution) in the event of staying in fund B after the shock and of leaving fund B after the shock



7 CONCLUSION

This article offers a brief overview of the new model of the 2nd pillar pension scheme in Croatia, which, for the first time, introduces a proxy life-cycle model of investment in the portfolios of mandatory pension funds, where members have the opportunity to choose funds of different risk profiles with specific age restrictions on membership.

Given the assumptions on the expected returns, risks and correlations between different asset classes and allocations of pension fund portfolios, we calculated the expected real return and risk for category A, B and C funds and gave a comparison with the results obtained on the basis of the investment structure under the previous law. The results were in line with expectations that life-cycle investment models would perform better than other models in terms of expected return and risk.

However, the analysis shows that the expected risk for fund C as compared to that of fund B is not proportionally smaller, given the reduction in the exposure to equity. The reason for this is primarily the lack of diversification of investments in the category C fund. In case of a minimal change in asset allocation in the category C fund, in terms of the possibility of a low exposure to equity and increasing limits on exposure to foreign markets, the expected real return of the fund would have increased, while the expected risk, due to the increase of diversification, is expected to be reduced. Since the magnitude of the reduction of risk depends on the estimates of several key factors, the amount of risk reduction should be seen only as an indication of lack of diversification in the category C fund.

In this article we analyze the total expected accumulated savings for different models of proxy life-cycle investment and for one possible exact model of life-cycle investment. In addition to the total expected accumulated savings, we calculated the value of the worst loss, which we do not expect to be exceeded in more than 2.5% cases, i.e. the amount of loss that we expect to achieve once in 40 years. The length of membership in the category A fund has proved to be the most important factor in determining the total expected accumulated savings, even in case of a market shock, i.e. in of the event of the realization of the worst loss. We show that for the case of investments based on the maximum duration of membership in the category A, B and C fund, with the age restrictions on membership in a particular fund (A-B-C scheme), the member is better off in the proxy life-cycle investment model than in the model of the previous law, even in the event of a market shock at the time of retirement.

As the right choice of the moment of transition from a higher risk pension fund to a lower risk pension fund is a very important factor in determining the total expected accumulated savings in the proxy life-cycle model of investments in the 2nd pillar, we show the effect of a market shock on the total expected accumulated savings in cases in which the shock occurs at moments when a member is in category A fund and when he is in category B fund. Our result is that a member is better off if he does not make a decision to change the fund and instead decides to remain in the fund in which he is currently a member, until he reaches the age limit for membership of that fund.

The results of this study show that there are possible further improvements of the 2nd pillar of pension funds in Croatia, especially in the final phase of accumulation, primarily in setting investment limits for category C fund, which should result in a mandatory pension fund with a better risk/return ratio and a further reduction in VaR. Also, it is necessary to consider the conditions for the transitions from a fund of higher risk to a fund of a lower risk at an arbitrary moment, given the identified risk of changing funds at an unfavorable moment, i.e. in the occurrence of a market shock that could discourage the members from staying in the higher risk fund. For the purpose of further research of the risk of changing funds of various categories, it is necessary to explore the opportunity of the members to change the funds in the opposite direction from that here analyzed, i.e. a change from the lower risk fund to the higher risk fund. If a member decides to change the fund in such a way and if at some point a market shock occurs, it is possible that there will not be enough time to cover the losses until the next legal possibility of switching to the lower risk fund. The risk analysis of such transition from the lower risk fund to the higher risk fund is a logical extension of the overall analysis of the proxy life-cycle model of pension fund investments. The analysis made above of all the risks identified in the new proxy life-cycle model of investments in the 2nd pillar pension scheme in Republic of Croatia can only be applied within the legislative framework for possible changes that might result in further improvements of the Croatian pension system.

REFERENCES

1. Arthur, G., 2009. Multifunds: *Lessons from experience*. Presentation on the International Conference on "Multifunds – Implementation and Prospects in the Pension System of the Central and Eastern European Countries", Sofia, Bulgaria.
2. Bagliano, F. C., Fugazza, C. and Nicodan, G., 2009. *Life-Cycle Asset Allocation and Performance Evaluationon.* Torino: Dipartimento di Scienze Economiche e Finanziarie "G. Prato" Università di Torino Torino : CeRP.
3. Bodie, Z., McLeavey, D. and Siegel, L. B., 2008. *The Future of Life-Cycle Saving and Investing.* Charlottesville*:* The Research Foundation of CFA Institute.
4. Castañeda, P. and Rudolph, H. P., 2011. Upgrading Investment Regulations in Second Pillar Pension Systems – A proposal for Colombia. *The World Bank, Policy Research Working Paper.*
5. Dimson, E., March, P. R. and Staunton, M., 2014. Credit Suisse Global Investment Returns Yearbook 2014. Zurich: Credit Suisse Research Institute.
6. HANFA (Croatian Agency for Supervision of Financial Services). Available at: <www.hanfa.hr>.
7. Impavido, G., Lasagabaster, E. and García-Huitrón, M., 2010. *New Policies for Mandatory Defined Contribution Pensions*. Washington: The World Bank.
8. IOPS, 2012. Supervising default investment funds. *Working Papers on Effective Pensions Supervision*, No. 18. Available at: <http://www.iopsweb.org/WpNo18Web.pdf>.
9. Latković, M. and Liker, I., 2009. Sensitivity Analysis of the Pension System. *Financial Theory and Practice*, 33(4), 445-461. Available at: <http://fintp.hr/upload/files/ftp/2009/4/latkovic-liker.pdf>.
10. Potočnjak, Ž. and Vukorepa, I., 2012. Modeling of life-cycle portfolios in capital-funded pension systems with defined contributions. *Economic Trends and Economic Policy,* (130), pp. 29-59.
11. Scheuenstuhl, G. [et al.], 2010. Assessing Investment Strategies for Defined Contribution Pension Plans under various Payout Options. *(A Background Paper to the OECD Policy Report).*
12. Shiller, R. J., 2006. Life-cycle personal accounts proposal for Social Security: An evaluation of President Bush's proposal. *Journal of Policy Modeling,* (28), pp. 427-444. doi: 10.1016/j.jpolmod.2005.10.010
13. Šorić, K., 2000. The calculation of pensions based on individual capitalized savings. *Accounting and Finance*, (5), pp. 75-87.
14. UMFO, 2011. Pension reform in the Republic of Croatia – current effects, the current situation and recommendations for the future. Zagreb: The Association of Pension Funds and Pension Insurance.
15. Viceira, L., 2009. Life cycle funds In: A. Lusardi, ed. *Overcoming the saving slump: How to Increase the Effectiveness of Financial Education*". University of Chicago Press and Saving Programs.

16. Wojciech, O., 2011. *Redesigning fees and capital requirements For Polish Open Pension Funds*. Available at: <http://www.actuaries.org.uk/sites/all/files/documents/pdf/d01-redesigning-fees-and-capital-requirements-polish-open-pension-funds.pdf>.
17. Zakon o obveznim i dobrovoljnim mirovinskim fondovima (Mandatory and Voluntary Pension Funds Act), NN 49/99, 63/00, 103/03, 177/04, 140/05, 71/07, 124/10, 114/11, 51A/13, 19/14. Zagreb: Narodne novine.

Characteristics of bank financial intermediation in Croatian counties

JAKŠA KRIŠTO, PhD*
IVA MANDAC, univ. bacc. oec.*

Article**
JEL: G21, O16, O18
doi: 10.3326/fintp.39.1.3

* The authors would like to thank two anonymous referees for their useful comments and suggestions.
** Received: July 15, 2014
Accepted: November 11, 2014

Jakša KRIŠTO
University of Zagreb, Faculty of Economics and Business, J. F. Kennedy 6, 10000 Zagreb, Croatia
e-mail: jkristo@efzg.hr

Iva MANDAC
Croatia bank Ltd., Roberta Frangeša Mihanovića 9, 10000 Zagreb, Croatia
e-mail: iva.mandac@gmail.com

FINANCIAL THEORY AND PRACTICE
39 (1) 57-82 (2015)

Abstract

Research on bank financial intermediation in a country's narrower territorial units is scarce, in both domestic and international literature. Banks are almost the only financial intermediaries in narrower territorial units and their role is substantial, ranging from participating in regional development to the successful running of their own business. Hence, the main objective of this paper is to examine the characteristics of the financial intermediation of banks in the counties of the Republic of Croatia, both through a comparison between their economic development levels and the general presence of financial intermediation, and a more specific analysis of their deposit and credit policies. The article uses hierarchical and non-hierarchical (k-means) cluster analyses to identify relatively homogeneous groups of counties based on sets of indicators of: economic environment, financial development and infrastructure and, at a more detailed level, the deposit and credit policies of banks. The research results suggest heterogeneity and diversity of bank policies across the counties and sets of indicators. Differences have been observed between developed and developing counties, as well as in approaches to banks' deposit and credit policies. The paper's findings encourage further research into these issues.

Keywords: bank financial intermediation and banks' business policies, counties, Republic of Croatia, cluster analysis

1 INTRODUCTORY NOTES

The importance of bank financial intermediation, as well as its contribution to and influence on economic growth and development have been the subjects of numerous studies. Theories about this matter range from there being no direct link between bank financial intermediation and economic growth to "the role of bank financial intermediation is neutral", to "it has a significant influence on economic growth". Bank financial intermediation at the regional level has been underrepresented in the research on contributions to regional economic growth and development. Commercial banks, as well financial institutions in private or state ownership, justifiably take as the purpose of their business the maximisation of shareholders' wealth, whereas regional development and balancing the levels of development of regions are left to the government's targeted regional policy. In the traditional European and underdeveloped bank-based financial sectors, banks are dominant financial intermediaries and, observed at the level of narrower territorial units, banks are the most important financial intermediaries. This is also due to a high concentration of financial flows around major financial centres and markets. The regional dimension of bank financial intermediation is primarily reflected in an efficient credit policy, deposit collection, performance of other financial transactions and provision of financial services. A bank's regional business policy is associated with the bank's overall business strategy, expansion of branches, investment in bank infrastructure, use of information technology, financial exclusion, profitability of certain smaller territorial units, regulatory framework and other

business determinants, as well as the determinants of a relevant narrower territorial unit. The overall characteristics and importance of the banking business call for a revision of banking policies in the narrower territorial units of a country.

The main goal of this paper is to examine bank financial intermediation in the counties of the Republic of Croatia with respect to the economic development level, degree of financial intermediation and characteristics of the deposit and credit policies of banks. The objective of the statistical analysis is to identify relatively homogeneous groups of countries on the basis of four sets of indicators, in order to gain a picture of the territorial distribution and (inter)dependence of various characteristics of bank financial intermediation and economic environment. The paper uses descriptive statistics to analyse the created indicators, employing the hierarchical and non-hierarchical (k-means) cluster analysis method. According to the authors' knowledge, this is the first research paper in the Republic of Croatia to analyse the sectoral financial intermediation of banks and general operations of some of Croatian financial institutions at the county level. The results of such an approach and more extensive research may be used for the formulation of a regional economic policy, but they also reveal market potential and possibilities for creating better targeted banking policies at the county level in Croatia.

The paper consists of five parts. Part two, following the introductory notes, provides a broad overview of the domestic and international literature dealing with the issues of bank financial intermediation in narrower regional areas. Part three presents data and the research methodology, and part four sets out the research results, their interpretation and discussion. The conclusion summarizes key findings of the paper and recommendations for further research.

2 LITERATURE REVIEW

The subject of this paper is multidisciplinary and it includes a wide range of areas, from banks' business policies to financial intermediation and its connection with regional growth. International literature points to a lack of research on the impact of financial intermediation on regional development (Rodriguez-Fuentes, 1996; Dow, 1987; Crocco et al., 2010; and Burgstaller, 2013). This is due to limited access to data, but also due to the theoretical perception of a neutral role of money and financial intermediation in achieving economic growth. Relevant international and domestic studies can be divided into the groups of studies on:

1) the importance of bank financial intermediation for economic growth and, in narrower terms, the impact of bank financial intermediation on regional development;
2) banks' territorial business policies by banking activity;
3) the performance of economic policies in achieving regional development and reducing regional disparities, as well as in ensuring an optimal division of regions into narrower territorial units.

The first group of studies, dealing with the importance of bank financial intermediation for economic growth, were mainly conducted at the levels of different countries and financial systems. Among the most prominent works on this subject are those by Allen and Gale (1999), Levine (2002), Demirgüç-Kunt and Levine (2001), and Arestis et al. (2005). Levine provides one of the proofs that the structure and type of the financial sector are irrelevant and have no influence on economic growth. Neither the bank-based financial systems, predominantly oriented to financial intermediation through banks, nor the market-based ones, oriented to financial intermediation through the financial market, are directly correlated with economic growth. Instead of, importance of financial services and markets in whole is relevant for economic growth. He forms his conclusions using econometric testing on the regression models of growth (Levine, 2002).

Bađun (2009) made a thorough presentation and analysis of research on the influence of bank financial intermediation on economic growth. In her study, she indicates the conclusions of both research works demonstrating a positive impact of the degree of financial intermediation on economic growth and those showing no significant correlation in this respect. She concludes that, given the prevailing opinion that financial intermediation has a positive influence on economic growth, further research is necessary, with efforts focused on the study of the relationship between banks and the state (Bađun, 2009).

Valverde et al. (2007) examine the impact of financial intermediation on economic growth in the territorial units – the regions of Spain. They underline that such an analysis by regions of a country is more relevant, since regional data are more homogeneous, the regulatory and legal frameworks are the same and the financial systems are clearly defined and implemented. The research results obtained using the dynamic panel model on the example of the regions of Spain confirm a positive and significant correlation between the depth of bank intermediation and regional growth (Valverde et al., 2007). Rodriguez-Fuentes (1998) shows different perceptions of the impact of banking business on regional development. He argues that monetary and financial variables and their effects on regional economic growth are often excluded from studies dealing with regional policy, due to the acceptance of the perception that monetary policy is neutral to economic growth and a lack of monetary policy instrument at the regional level, as well as due to the assumption of a perfectly open market and capital mobility. He concludes, using the simple linear regression model, that banks can nevertheless influence regional development through credit availability.

Dow made a significant contribution to the study of financial intermediation and regional development, exploring the influence of monetary variables and financial intermediation on regional development. Based on a comprehensive presentation and analysis of different theoretical approaches and orientations, Dow (1987a) concludes that monetary policy and financial institutions have an active role in

uneven regional development. She emphasizes that uneven regional development is the consequence of a series of economic policies and influences, including money and bank intermediation. Headquarters of banks located in financial centres create difficulties in borrowing funds for business entities in other regions, while households and enterprises in underdeveloped regions express a stronger preference for liquidity. She indicates that underdeveloped regions also prefer saving and liquidity maintenance in financial centres, thus further weakening their financial positions, given the lower availability of loans. She points to differences among regionally-specific banks and bank branches in financial centres with respect to liquidity management, credit policy and investment in securities (Dow, 1987a).

Crocco et al. (2010) analyse differences in the regional strategy of banks in Brazil. By means of an analysis of own indicators based on the accounting data on banking operations, they prove that the strategies of banks within the Brazilian banking system are heterogeneous by region, which increases disparities in regional development. Fernandez de Guevara and Maudos (2009) analysed and mathematically modelled the influence of regional financial development and bank competition on company growth, using the example of Spanish counties (NUTS[1] 3). They concluded that companies in financially more developed counties with relatively considerable foreign funding grow faster. Burgstaller (2013) uses spatial regression analysis to explore bank penetration, market structure and bank operations in Austrian counties. He argues that less developed counties show higher borrowing rates and lower saving rates, whereas bank concentration has no effect on differences in interest rates among counties, profitability or bank efficiency. He emphasizes the importance of promoting uniform and equitable banking coverage in the counties. Colombo and Turati (2014) provide evidence of a strong and direct effect of economic and social characteristics of the NUTS 2 regions on bank industry concentration in Italy, as well as the agglomeration of acquiring banks in well-developed regions. Their methodology includes the probit and count data models.

The second group of papers is focused on the geographic aspect of the banking policy and the financial exclusion problem. Literature dealing with banking business does not attach too much importance to regional specificities of banks' business policies. There are studies on the geography of banking, information technologies, spatial price discrimination, asymmetric information problem, etc. (see Allesandrini et al., 2005; and Allesandrini et al. (ed.), 2009).

Using data from credit agreements of a major Belgian bank and a series of multiple regression analyses with and without dummy variables, Degryse and Ongena (2005) explore the impact of geographic distance on credit, taking into account the distance between a commercial borrower and its bank and between a commercial borrower and another (competitive) bank. Using a sample of over 15 thousand

[1] "Nomenclature of territorial units for statistics (NUTS)" relates to a statistical classification system used for the collection, processing, analysis and publication of territorial statistical data at the European Union level.

loans, mainly to small businesses, they notice a marked increase in interest rates on loans as the distance between borrowers and competitive banks grew, whereas an inverse relationship is observed between the costs of borrowing and the distance of the business entity from the crediting bank. They conclude that transportation costs, rather than asymmetric information, are likely to be the main source of the spatial price discrimination.

Leko (2011) points to the problems of regional development funding, as one of the issues of public interest. He demonstrates systematic approaches to funding for all purposes of public interest, employing different models, techniques and instruments including the state, specialized government financial institutions, as well as privately-owned financial institutions and financial markets. Egalitarian regional policy of banks is directly connected with the problems of financial exclusion and the conscious neglect of certain less profitable or riskier territories or population groups by private commercial banks (for more information, see Leko and Stojanović, 2011).

The third group of studies includes domestic papers on regional policy, most of them dealing with an optimal regional division into counties, as well as with a statistical division into NUTS 2 regions or criticism of the regional division of the Republic of Croatia (Lovrinčević et al., 2005; Kurnoga Živadinović, 2007; Žuljić, 2011; and Rašić Bakarić, 2005 and 2012). Most of the works rely on the methodology of multivariate statistical analysis, typically cluster analysis. There are also studies in the field of local finances, i.e. on fiscal equalisation and reducing disparities between municipalities and cities, city financing systems and decentralisation issues in cities, local budgets, fiscal relations between different levels of government and fiscal decentralisation (for more information, see Rašić Bakarić et al., 2014). Regional development in the Republic of Croatia has been the subject of numerous research works, e.g. Baletić et al. (1999), Čavrak (2002, 2003 and 2012), Puljiz (2009), etc. The aforementioned domestic papers do not use variables and data on financial intermediation at the county level, and the financial institutions and market segments are excluded from the analyses. One of the reasons for this is limited access to the data disclosed in statistical publications which still do not cover the financial institutions' operations at the level of narrower territorial units of the Republic of Croatia.

3 DATA AND RESEARCH METHODOLOGY

The objective of the statistical analysis is to identify relatively homogeneous groups of counties on the basis of four sets of indicators, in order to gain a picture of the territorial distribution and (inter)dependence of the economic environment characteristics, the level of financial intermediation development and banks' credit and deposit policies. The following methodological approach is used:

1) 17 out of 23 indicators were selected and classified into four sets of indicators;
2) a descriptive statistical analysis of data was carried out;
3) standardisation of data was applied for the purpose of a cluster analysis using a standardised value *z*;
4) hierarchical cluster analyses were carried out for the sets of indicators, including and excluding the City of Zagreb;
5) the robustness of the results was tested by using another measure of distance;
6) based on the number of clusters obtained through the hierarchical analysis and identified outliers, a non-hierarchical k-means cluster analysis was carried out; and
7) the results were statistically and economically processed, research limitations were highlighted and recommendations for further research were made.

Twenty Croatian counties including the City of Zagreb (hereinafter: counties) are analysed on the basis of 17 indicators classified into four groups standing for: (1) economic environment; (2) financial development level and infrastructure; (3) banks' deposit policies; and (4) banks' credit policies. Individual indicators in the aforementioned groups of indicators are usually used for measuring economic development, the degree of financial intermediation and banks' business policies, or have been created in order to take account of the specific characteristics of data and financial intermediation in the Republic of Croatia. All the indicators relate to 2011, because, given the limited access to data, this is the only year and the most recent period in which all the data overlap.[2] Selected studies, conducted in narrower territorial units in Croatia applying multivariate statistical analysis, also use data for a single year (Lovrinčević et al., 2005; Rašić Bakarić, 2005; Kurnoga Živadinović, 2007; and Rašić Bakarić, 2012).

Banking business indicators were obtained on a written request from the Croatian National Bank.[3] In addition to the banking business indicators, obtained from the Croatian National Bank, which make the bulk of data for the analysis, part of the data come from the publications and Internet sites of the Croatian Bureau of Statistics and Croatian Employment Service. While some of the indicators used in the

[2] On 14 February 2014, the Croatian Bureau of Statistics published on its Internet site the GDP data for 2011 by county.

[3] The data on assets and gross loans relate to counterparties from the Republic of Croatia, established or resident in a relevant county. In certain counties, net assets of banks are lower than the amount of gross loans. This discrepancy is due to the fact that banks' assets are expressed in net book amounts (reduced by value adjustments), while loans are expressed in gross book amounts in order to be used in the calculation of loan quality indicators. (Net) loans granted account for an average (arithmetic mean) of 94% of a county's assets. The assignment of counterparties (i.e. their seats or places of residence) to counties is based on a list published by Hrvatska pošta d.d. (Croatian Post) on its Internet site. However, there are certain instruments (e.g. cash, goodwill, general reserves for risk category A placements, etc.), where the bank is obliged to indicate itself as the counterparty. Therefore, these instruments are allocated to the county where the relevant bank has its seat). Furthermore, some instruments (such as deposits with the Croatian National Bank) are fully allocated to a single county, in our case the City of Zagreb (CNB, 2014).

analysis are presented in an explicit form, others have been created by putting the collected data into a relationship. The selection of indicators within the sets of indicators was theory-based, but the intention was also to select indicators with lower mutual correlation coefficients. The correlation coefficients of the selected indicators were lower than 0.7, whereas a correlation coefficient higher than that specified, but lower than 0.8, was recorded in only two cases.

A descriptive statistical analysis of the applied indicators has been carried out using the MS Office Excel program and the results are presented in table 1. The descriptive analysis showed a great variety of counties observed on the basis of four sets of indicators. The variation coefficient of the population is as high as over 80%. The net salary data dispersion is small, but the mean GDP values per capita and unemployment rates are not representative. The indicator of the share of investments in long-term assets intended for financial and insurance activities in GDP reveals extremely large differences among counties with respect to the financial development level and infrastructure. The minimum value is 0.01 and the maximum is as high as 3.2%.

Table 1

Descriptive statistical analysis results by set of indicators, by county

Set of indicators	Indicator	Average	Median	Standard deviation	Min.	Max.	Variation coefficient %
Economic environment	Gross domestic product per capita, in thousands of HRK (the 2011 census)	76.8	60.1	24.5	43.7	137.6	32.0
	Net salary, in HRK	5,014	4,985	440	4,380	6,359	8.8
	Population, in thousands	204.0	158.3	165.5	50.7	790.9	81.2
	Unemployment rate, %	22.4	22.3	7.0	9.4	33.8	31.4
Financial development level and infrastructure	Net assets/GDP, %	112.1	69.6	0.4535	52.0	187.3	40.5
	Number of inhabitants per branch, in thousands	3.4	3.3	1.1	1.1	6.0	33.8
	Number of inhabitants per ATM, in thousands	1.1	1.4	0.6	0.3	2.2	52.8
	Banks' assets per capita, in thousands of HRK	86.0	41.3	57.7	29.8	257.6	67.1
	Investments in new long-term assets intended for financial and insurance activities/ GDP, %	1.2	0.1	0.0111	0.01	3.2	94.0

Set of indicators	Indicator	Average	Median	Standard deviation	Min.	Max.	Variation coefficient %
Deposit policies	Loans/deposits	1.28	1.36	0.3730	0.79	2.07	29.1
	Deposits per capita, in thousands of HRK	52.8	31.3	26.2	17.4	110.4	49.6
	Foreign exchange deposits in total deposits, %	66.6	68.7	0.0629	59.2	78.7	9.4
Credit policies	Share of loans to households in total loans, %	44.0	60.3	0.1543	27.1	72.1	35.1
	Share of CHF-denominated loans in total loans, %	10.9	13.2	0.0431	7.3	22.7	39.5
	Share of EUR-denominated loans in total loans, %	63.6	58.5	0.0562	54.3	69.3	8.8
	Share of non-performing loans in total loans, %	12.4	13.4	0.0219	10.9	17.8	17.7
	Share of mortgage loans in total loans to households, %	49.3	43.2	0.0981	32.3	59.0	19.9

Source: Authors' compilation.

All the other indicators from this group confirm regional disparities. The range of variation in deposits per capita stands at 93 thousand, suggesting a relatively large territorial disparity in the deposit policy characteristics. However, deposit transactions of banks in terms of currency features are not characterised by spatial disparity. The indicators of the share of non-performing loans in total loans, the share of euro-denominated loans in total loans and the share of mortgage loans in total loans to households suggest relative territorial consistency of the credit policy. By contrast, as shown by indicators of the share of loans to households in total loans and the share of Swiss Franc-denominated loans in total loans, data dispersion around the mean value is significant. The territorial consistency of the currency features of deposit and credit policies, measured by a lower amount of the variation coefficient, confirms a high share in and the relatively uniform distribution of dollarization (euroisation) across the Croatian banking system.

While carrying out a cluster analysis account should be taken of the units of variable measurement. If they are different, any measure of distance will affect the contribution of variables measured by larger units of measurement. Therefore, the standardisation of data for the analysis was carried out using the standardised value z, which is why the deviations of the variable values from its mean value are expressed in terms of units of standard deviation.

In order to classify Croatian counties as the observed units into larger and more homogeneous (as concerns the observed characteristics) spatial units, the hierarchical cluster analysis method was initially applied. Hierarchical cluster analysis methods are characterised by hierarchy development; it should be differentiated between agglomerative and divisive methods. This paper uses the agglomerative method which consists of four basic steps (Rašić Bakarić, 2010):

1) The algorithm starts with *n* clusters, each containing one object and a symmetric distance matrix with a row $n \times n$, $D = [d_{ik}]$.
2) Within the distance matrix the closest (most similar) pair of clusters is looked for. Let the distance between the "most similar" clusters U and V be marked with d_{UV}.
3) The U and V clusters merge and the elements of the distance matrix are calculated again in the way that rows and columns corresponding to clusters U and V are deleted, and rows and columns containing the elements of the value of distance between the U and V clusters and the remaining clusters are added.
4) Steps 2 and 3 are repeated *n-1* times. After the algorithm terminates, all objects will be in a single cluster.

Ward's variance method was used, with clusters defined by minimising the variance within a cluster. This method involves computing the information loss incurred when objects are grouped into clusters, and is based on the application of squared Euclidean distance where the distance between objects is expressed as a sum of squared differences between the values of objects:

$$u_{AB} = \sum_{i=1}^{v} \left(A_i - B_i \right)^2 .$$

Ward's method of the distance between two clusters is expressed as follows:

$$u_{AB} = \frac{| \bar{x}_A - \bar{x}_B |^2}{\frac{1}{N_A} + \frac{1}{N_B}}$$

where $\bar{x}_A$ is the mean of cluster A, $\bar{x}_B$ is the mean of cluster B, N_A is the number of objects in cluster A, and N_B the number of objects in cluster B. Ward's method involves the calculation of the mean of all variables for each cluster. Then, the squared Euclidean distance between the cluster centres is calculated for each cluster and the obtained distances for all objects are summed up. As the number of defined clusters grows the total sum of squares of deviations increases. In each step, two clusters are merged into a new cluster whose merging contributes the least to an increase in the total sum of squared Euclidean distances within the new cluster (Kurnoga Živadinović, 2007).

The results of the hierarchical cluster analysis are shown in a dendrogram. Despite the lack of strict rules on determining the number of clusters, which has often been

subject to review, the number of clusters in a hierarchical analysis can be determined using a cut-off value, either by means of an inconsistency ratio or a distance-based criterion (Halaj and Zochowski, 2009). Kurnoga Živadinović (2007) offers some guidance on determining the number of clusters, given that a hierarchical analysis results in multiple solutions. She first specifies theoretical and practical knowledge that can help in deciding on the number of clusters. Then she suggests the use of a dendrogram to identify a great change in the distance at which clusters are merged, noting than the relative size of clusters may also be relevant. She emphasizes that the final choice of the number of clusters is subject to the subjectivity of the researcher and that it is therefore necessary to supplement the empirical opinion by theoretical knowledge that may suggest a natural number of clusters. The number of clusters is identified on the dendrogram based on the distance criterion, i.e. a great change of distance during the cluster merger. In this respect, the second greatest change of distance on the dendrogram was identified and taken as a critical change. The second greatest change of distance determines the number of clusters in the way that the clustering that it generates is not considered satisfactory, i.e. the number of clusters is determined by moving a step backwards.

The robustness of the hierarchical cluster analysis using Ward's method with squared Euclidean distances can be tested by applying another measure of distance (Halaj and Zochowski, 2009). In our case, the testing was done by means of a hierarchical cluster analysis based on Ward's method using Chebyshev's distance, and the obtained results were compared. Chebyshev's distance is the maximum absolute difference between the values of two objects (Kurnoga Živadinović, 2007):

$$u_{ab} = MAX_t \mid A_t - B_t \mid.$$

A non-hierarchical (k-means) cluster analysis was conducted in accordance with the results of the hierarchical cluster analyses. A k-means analysis requires a predefined number of clusters, and its main characteristic is the possibility for objects to move from one cluster to another.

The clustering process using the k-means method consists of several steps. First, objects are partitioned into *k* initial clusters, and then each object is assigned to a cluster with the closest centre. Once an object joins or leaves the cluster, a new centre of the cluster and new distances are calculated, and the assigning is performed. This operation is repeated until the goal of minimising variability within clusters and maximising variability between clusters is accomplished (Rašić Bakarić, 2010). The described procedure is repeated until the selection of the centres of clusters enabling the grouping of all objects into *k* clusters, which results in the highest significance of ANOVA results (Lovrinčević et al., 2005). To calculate inter-cluster distances using the k-means method, the Euclidean distance is calculated on the basis of the centres the clusters have in distance dimensions.

The distance between two objects or cluster centres is the following:

$$D_{ij} = \sqrt{\frac{\sum (x_i - x_j)^2}{BD}}$$

where x_i is the value of an object variable i, x_j the value of an object variable j, and BD is the number of dimensions (Rašić Bakarić, 2010).

Unlike the hierarchical method, the non-hierarchical method allows an object to leave a cluster and join another one, if this contributes to meeting the clustering criteria. Consequently, the stability and reliability of results appear to be the main advantages of the hierarchical approach (Rašić Bakarić, 2010). Moreover, this method allows the analysis of more data and ensures more accuracy, since the starting point is given. A disadvantage is lower flexibility, i.e. a limited possibility to apply different distance measures, so that it is sometimes difficult to determine *a priori* the number of clusters (Kurnoga Živadinović, 2007). However, a combination of the two methods yields the best results, i.e. first the hierarchical method is used to determine the number of clusters and outliers and then, after removing the outliers, a k-means analysis is carried out (Rašić Bakarić, 2010). This approach has been applied in our research work.

4 RESEARCH RESULTS AND DISCUSSION

Hierarchical and non-hierarchical cluster analyses were conducted using SPSS software tools. The hierarchical cluster analyses was carried out by means of two groups of data, where one group was obtained by leaving out one observed unit from the other group, i.e. one group of data included all the 21 counties, whereas the City of Zagreb was excluded from the other group. In the first testing (including the City of Zagreb), using the hierarchical cluster analysis based on Ward's method with squared Euclidean distances, the City of Zagreb was singled out into a separate cluster and an outlier in all sets of indicators, except the set "deposit policies", where the City of Zagreb shared the same cluster with the Istria County. Consequently, table 2 shows the results of the second cluster analysis testing excluding the City of Zagreb for all sets of indicators, except that of "deposit policies" which included the City of Zagreb. According to a cut-off value based on the second greatest change of distance, a three-cluster solution has been acceptable for all the sets of indicators.

Robustness testing of the hierarchical cluster analysis using Ward's method with squared Euclidean distances produced satisfactory results. The three-cluster solution was partially called into question for the set of indicators "economic environment", because the application of Ward's method using Chebyshev's distance based on the criterion of the second greatest change of distance on the dendrogram resulted in identifying four clusters. The tests fully confirmed the first cluster; only one new member was added to the second cluster, and the third cluster was divided into two smaller ones. Clusters formed in the set of indicators "financial development level and infrastructure" were fully confirmed by the tests. Clustering based

on Chebyshev's distance fully confirmed the obtained number of clusters and 75% of the cluster assignment of counties according to the deposit policy characteristics. The robustness tests of grouping of the set of indicators "credit policies" confirmed three clusters, with deviations in cluster assignments for only two counties (10%).

Table 2

Cluster assignment of counties in a hierarchical cluster analysis

Cluster	County			
	Economic environment	**Financial development level and infrastructure**	**Deposit policies**	**Credit policies**
I	Bjelovar-Bilogora	Bjelovar-Bilogora	Dubrovnik-Neretva	Karlovac
	Brod-Posavina	Karlovac	Karlovac	Koprivnica-Križevci
	Osijek-Baranja	Krapina-Zagorje	Lika-Senj	Lika-Senj
	Požega-Slavonia	Koprivnica-Križevci	Međimurje	Sisak-Moslavina
	Sisak-Moslavina	Međimurje	Primorje-Gorski Kotar	Split-Dalmatia
	Virovitica-Podravina	Osijek-Baranja	Split-Dalmatia	
	Vukovar-Srijem	Požega-Slavonia	Šibenik-Knin	
		Sisak-Moslavina	Zadar	
		Varaždin		
		Virovitica-Podravina		
II	Krapina-Zagorje	Brod-Posavina	City of Zagreb	Brod-Posavina
	Međimurje	Vukovar-Srijem	Istria	Krapina-Zagorje
	Varaždin			Međimurje
				Šibenik-Knin
				Varaždin
				Vukovar-Srijem
				Virovitica-Podravina
III	Dubrovnik-Neretva	Dubrovnik-Neretva	Bjelovar-Bilogora	Bjelovar-Bilogora
	Istria	Istria	Brod-Posavina	Dubrovnik-Neretva
	Karlovac	Lika-Senj	Koprivnica-Križevci	Istria
	Koprivnica-Križevci	Primorje-Gorski Kotar	Krapina-Zagorje	Osijek-Baranja
	Lika-Senj	Split-Dalmatia	Osijek-Baranja	Požega-Slavonia
	Primorje-Gorski Kotar	Šibenik-Knin	Požega-Slavonia	Primorje-Gorski Kotar
	Split-Dalmatia	Zadar	Sisak-Moslavina	Zadar
	Šibenik-Knin	Zagreb	Varaždin	Zagreb
	Zadar		Virovitica-Podravina	
	Zagreb		Vukovar-Srijem	
			Zagreb	

Note: The results for the set of indicators "deposit policies" include the City of Zagreb; the results for all the other sets of indicators exclude the City of Zagreb.

Source: Authors' compilation.

FINANCIAL THEORY AND PRACTICE
39 (1) 57-82 (2015)

The findings of the hierarchical cluster analysis relating to the number of clusters and outliers were used for the development of a non-hierarchical k-means cluster analysis. The non-hierarchical k-means analysis of all sets of indicators was carried out for three clusters; the City of Zagreb, as an outlier, was excluded from the analyses with respect to all sets of indicators except the set "deposit policies". The clustering process using the k-means method was carried out in two iterations for the sets of indicators "economic environment" and "deposit policy characteristics", whereas the grouping in the set of indicators "credit policies" was done in three, and in the set of indicators "financial development level and infrastructure" in five iterations. The analysis of the classification of Croatian counties in three clusters using the non-hierarchical k-means method provided the results of the cluster assignment of counties shown in table 3; a more detailed presentation is given in an ANOVA table in the appendix.

In the set of indicators "economic environment", unemployment rate (with the highest F-ratio) contributes the most to the clustering solution. All the indicators are significant at a significance level of 5%, except for the indicator of population. In the set of indicators "financial development level and infrastructure", the largest contributors to the clustering solution are "number of inhabitants per branch" and "number of ATMs per branch"; the variables "net assets/GDP" and "investments in new long-term assets intended for financial activity" are not significant at the significance levels of 5% and 10% respectively. The set of indicators "deposit policies" is greatly determined by the indicator "deposits per capita", although all the indicators have high F ratios. Therefore, differences among clusters are significant. In the group of indicators "credit policies", the largest contributors to the clustering solution are the "share of non-performing loans in total loans" and the "share of CHF-denominated loans in total loans". The variables "share of EUR-denominated loans in total loans" and "share of loans to households in total loans" are not significant at the significance level of 5%, and the latter variable is additionally insignificant at the significance level of 10%. A possible explanation for this is greater diversity of counties, which is also shown by the hierarchical cluster analysis dendrogram where the third, and even fourth and fifth greatest distance changes are still relatively great.

A comparison of the results, obtained through the hierarchical and non-hierarchical k-means cluster analyses, shown in tables 2 and 3, suggests partial correspondence between the results. Full correspondence exists with respect to the set of indicators "financial development level and infrastructure" in the third cluster and the set of indicators "deposit policies" in the part of the cluster relating to the City of Zagreb and Istria County. Overlapping can be observed in all sets of indicators and the created indicators. However, clusters differ in the number of counties assigned to them and in structure. Since the hierarchical cluster analysis, as part of the methodology employed in this research, was primarily used to select the number of clusters for a non-hierarchical k-means method and to identify outliers (according to Rašić Bakarić, 2010), the results and clustering solutions based on the k-means method will have the overriding importance in the economic interpretation of results.

TABLE 3

Cluster assignment of counties in a non-hierarchical k-means cluster analysis

Cluster	County			
	Economic environment	**Financial development level and infrastructure**	**Deposit policies**	**Credit policies**
I	Dubrovnik-Neretva	Koprivnica-Križevci	City of Zagreb	Bjelovar-Bilogora
	Istria	Međimurje	Istria	Karlovac
	Primorje-Gorski Kotar	Osijek-Baranja		Koprivnica-Križevci
	Split-Dalmatia	Požega-Slavonia		Lika-Senj
	Zadar	Varaždin		Osijek-Baranja
		Virovitica-Podravina		Primorje-Gorski Kotar
				Sisak-Moslavina
				Split-Dalmatia
				Varaždin
				Zadar
				Zagreb
II	Bjelovar-Bilogora	Bjelovar-Bilogora	Bjelovar-Bilogora	Brod-Posavina
	Brod-Posavina	Brod-Posavina	Koprivnica-Križevci	Krapina-Zagorje
	Karlovac	Karlovac	Krapina-Zagorje	Međimurje
	Osijek-Baranja	Krapina-Zagorje	Osijek-Baranja	Šibenik-Knin
	Požega-Slavonia	Sisak-Moslavina	Sisak-Moslavina	Virovitica-Podravina
	Sisak-Moslavina	Vukovar-Srijem	Varaždin	Vukovar-Srijem
	Šibenik-Knin		Virovitica-Podravina	
	Virovitica-Podravina		Vukovar-Srijem	
	Vukovar-Srijem			
III	Koprivnica-Križevci	Dubrovnik-Neretva	Brod-Posavina	Dubrovnik-Neretva
	Krapina-Zagorje	Istria	Dubrovnik-Neretva	Istria
	Lika-Senj	Lika-Senj	Karlovac	Požega-Slavonia
	Međimurje	Primorje-Gorski Kotar	Lika-Senj	
	Varaždin	Split-Dalmatia	Međimurje	
	Zagreb	Šibenik-Knin	Požega-Slavonia	
		Zadar	Primorje-Gorski Kotar	
		Zagreb	Split-Dalmatia	
			Šibenik-Knin	
			Zadar	
			Zagreb	

Note: The results for the set of indicators "deposit policies" include the City of Zagreb; the results for all the other sets of indicators exclude the City of Zagreb.

Source: Authors' compilation.

Based on the analysis carried out, the following economic and financial interpretations of the results can be discussed:

– The City of Zagreb stands out as an outlier and the most developed narrower territorial unit in the Republic of Croatia according to all indicators. Only in the set of indicators "deposit policies" it formulates a clustering solution together with the Istria County. This is due to the economic power of the City of Zagreb, and, primarily, to the structure of the banking sector and the headquarters of banks that are predominantly located in the City of Zagreb, and are only rarely located regionally. Consequently, as concerns banking operations, the City of Zagreb provides a great number of additional financial services, whereas the business of banks in other territorial units has generally been reduced to deposit and credit transactions.
– The Dubrovnik-Neretva, Istria, Primorje-Gorski Kotar, Split-Dalmatia, and Zadar Counties can be generally characterised as developed counties, according to both the set of indicators of economic environment and other sets of financial indicators. With respect to financial intermediation, these counties are characterised by well-developed financial infrastructures, loan-to-deposit ratio lower than 1, larger shares of foreign exchange deposits in total deposits and larger shares of CHF-denominated loans in total loans than other counties. However, no major differences compared with other counties have been observed in the quality of the loan portfolio and the sectoral structure of loans. The increase in the share of CHF-denominated loans can be accounted for by the economic cycle in the Republic of Croatia and growth in residential construction during the pre-crisis years, and, after the outbreak of the financial and economic crisis and its escalation, by high non-performing loan ratios in these counties.
– Counties that are underdeveloped in terms of economic characteristics and financial development level and infrastructure generally record higher loan-to-deposit ratio, larger shares of non-performing loans in total loans, lower deposit amounts per capita, poorer financial infrastructure and lower levels of development. These findings correspond to the findings of international studies (Burgstaller, 2013), and they necessitate further review of the impact of banks' credit policies and inflows of funds into underdeveloped counties and the ensuing potential influence on economic growth. Moreover, they highlight an interesting aspect of banks' operations in the Republic of Croatia, i.e. that banks do not avoid underdeveloped counties, but rather invest in them and feed additional funds to them in excess of these counties' collected deposit bases. The above said is contrary to some studies (Dow, 1987a) on the outflows of funds from periphery areas to the cities where banks' headquarters are, as well as to the prevailing public opinion in the Republic of Croatia; hence, it should be further reviewed, including additional variables and indicators.
– Common characteristics of the banking system as concerns high dollarization (euroisation) of banks' deposit and credit policies are consistent at the county level.

– According to the k-means analysis results for individual sets of indicators, clusters can be assigned characteristics, depending on the counties they represent (developed, medium-developed and underdeveloped counties). However, in all sets of indicators counties are not always included in clusters representing the same level of development. This confirms that counties are specific in respect of the observed sets of indicators, which is the consequence of the counties' economic development, their demographic characteristics and economic structures, as well as of the banking policy targeting and differences in the market potential, expressed in the set of indicators "financial development level and infrastructure". This finding emphasizes the importance of undertaking further more specific and targeted research.
– There are pronounced disparities and discrepancies in clustering solutions and cluster assignments of counties for the sets of indicators "deposit policies" and "credit policies".
– Heterogeneity of counties according to different sets of indicators has been observed, which also highlights the importance of further research.
– The results point to a need to include the data on the financial intermediation of financial institutions in regular statistics and to publish it, as well as to stress the importance of financial intermediation of banks and other financial institutions for regional development.

Notice should be taken of the limitations and drawbacks of this research. They arise from the comprehensiveness of the analysis and necessity of further specialised studies, the need to conduct multi-year analyses, subject to data availability, in order to test the reliability of results, and the need to select additional indicators to enable a complete analysis of all relevant factors of banking operations across counties.

5 CONCLUSIONS

This study provides a comprehensive review of the characteristics of bank financial intermediation in the counties of the Republic of Croatia, using hierarchical and non-hierarchical k-means cluster analyses. The study results show pronounced heterogeneity of the counties with respect to various sets of indicators from "economic environment" and "financial development level and infrastructure" to "banks' deposit and credit policy characteristics". Differences between developed and underdeveloped counties in Croatia primarily exist in the characteristics of the financial development level and infrastructure and deposit policies. The City of Zagreb stands out as an outlier and it is the most developed narrower territorial unit according to all the sets of indicators. The Dubrovnik-Neretva, Istria, Primorje-Gorski Kotar, Split-Dalmatia and Zadar counties, as relatively advanced counties with respect to financial intermediation, have sound and substantial deposit sources of funds. The results further show that Croatian banks do not avoid underdeveloped counties, but rather invest in them and feed additional funds to them in excess of these counties' collected deposit bases, notwithstanding lower

levels of financial intermediation development, suggested by other indicators. A contribution of this study consists in starting to evaluate banking operations and financial intermediation at the level of narrower territorial units, which provides a basis for conclusions on the impact of banking operations on economic growth, specific business policies of banks and the potential to provide banking services at the county level. All this also contributes to a debate on the regional division and well-designed regional policy of the Republic of Croatia which must be based, among other things, on effective financial intermediation of banks.

In addition, the presented results and discussion underline the importance of undertaking further more specific and targeted research in the following areas: (a) examining the specificities of banks' credit policies and their impact on the counties' economies and their growth, (b) a detailed analysis of banks' deposit policies and interdependence on demographic and economic characteristics of counties; (c) reviewing the problem of financial exclusion by county; and (d) finding a link between the regional headquarters of banks and the efficiency of county economies. The research conducted in this paper is one of the first attempts to describe and examine financial intermediation of banks across the counties using a cluster analysis.

Moreover, the research conclusions and methodology may be of use to banks in the Republic of Croatia in the formulation of targeted regional business policies and evaluation of different market approaches to the counties in the Republic of Croatia. Finally, banks as institutions with characteristic of public good are among the main catalysts of economic growth in all territorial units. Therefore, it is necessary to include both the financial and banking sectors in the analyses and formulation of the counties' strategic frameworks.

APPENDIX

Table A1

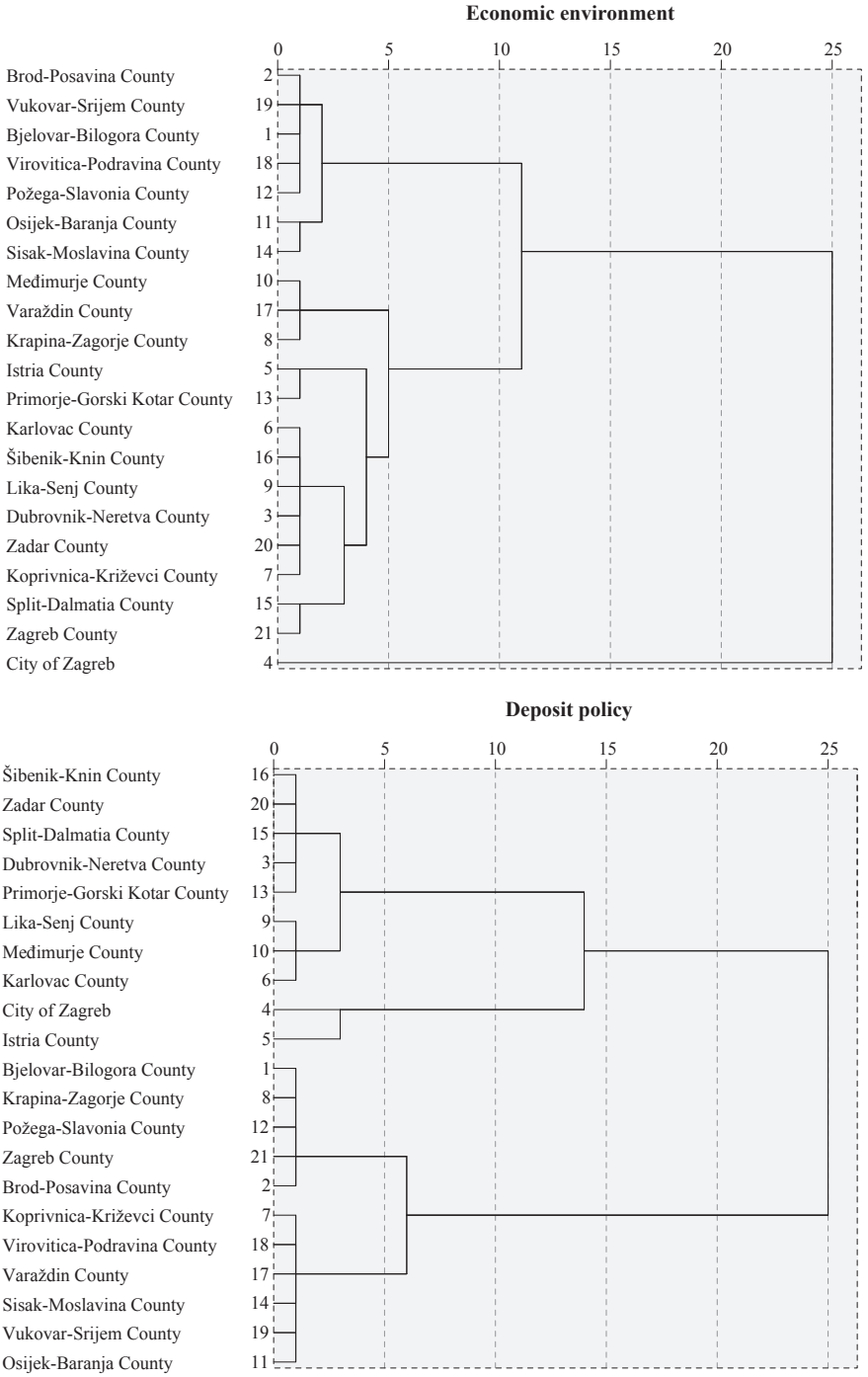
ANOVA table results for a k-means cluster analysis

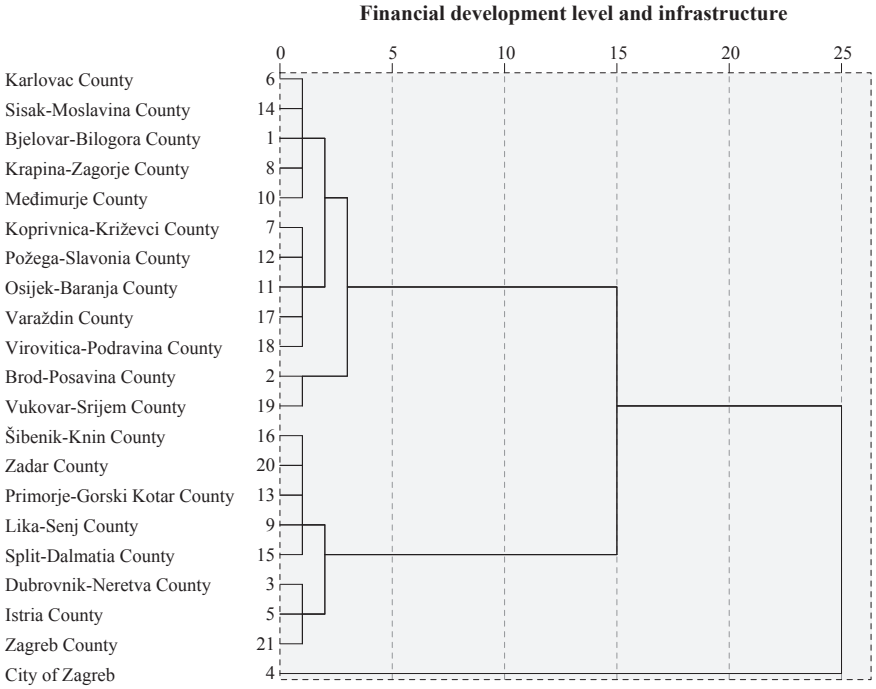
Set of indicators	Indicator	Cluster		Error		F	Sig.
		Mean square	df	Mean square	df		
Economic environment	Gross domestic product per capita, in thousands of HRK (the 2011 census)	1.614	2	0.178	17	9.065	0.002
	Net salary in HRK	2.432	2	0.313	17	7.758	0.004
	Population, in thousands	0.700	2	0.317	17	2.206	0.141
	Unemployment rate, %	5.891	2	0.272	17	21.683	0.000
Financial development level and infrastructure	Net assets/GDP, %	0.119	2	0.059	17	2.025	0.163
	Number of inhabitants per branch, in thousands	7.957	2	0.288	17	27.669	0.000
	Number of inhabitants per ATM, in thousands	5.808	2	0.203	17	28.579	0.000
	Banks' assets per capita, in thousands of HRK	0.225	2	0.026	17	8.587	0.003
	Investments in new long-term assets intended for financial and insurance activities, in thousands of HRK	0.012	2	0.012	17	0.956	0.404
Deposit policy	Loans/deposits	6.483	2	0.432	18	15.019	0.000
	Deposits per capita, in thousands of HRK	6.075	2	0.214	18	28.358	0.000
	Foreign exchange deposits in total deposits, %	6.400	2	0.255	18	25.076	0.000
Credit policy	Share of non-performing loans in total loans, %	4.217	2	0.187	17	22.517	0.000
	Share of loans to households in total loans, %	0.030	2	0.300	17	0.101	0.904
	Share of EUR-denominated loans in total loans, %	0.792	2	0.294	17	2.695	0.096
	Share of mortgage loans in total loans to households, %	1.857	2	0.491	17	3.780	0.044
	Share of CHF-denominated loans in total loans, %	4.464	2	0.228	17	19.581	0.000

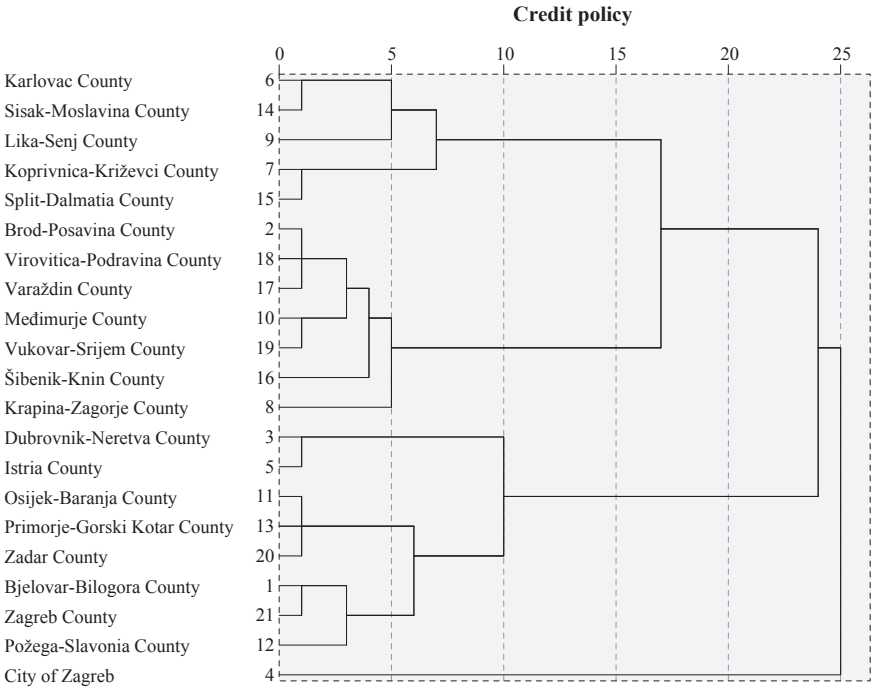
Source: Authors' compilation.

GRAPH A1

Dendrograms for the hierarchical analysis carried out, by set of indicators, the City of Zagreb included



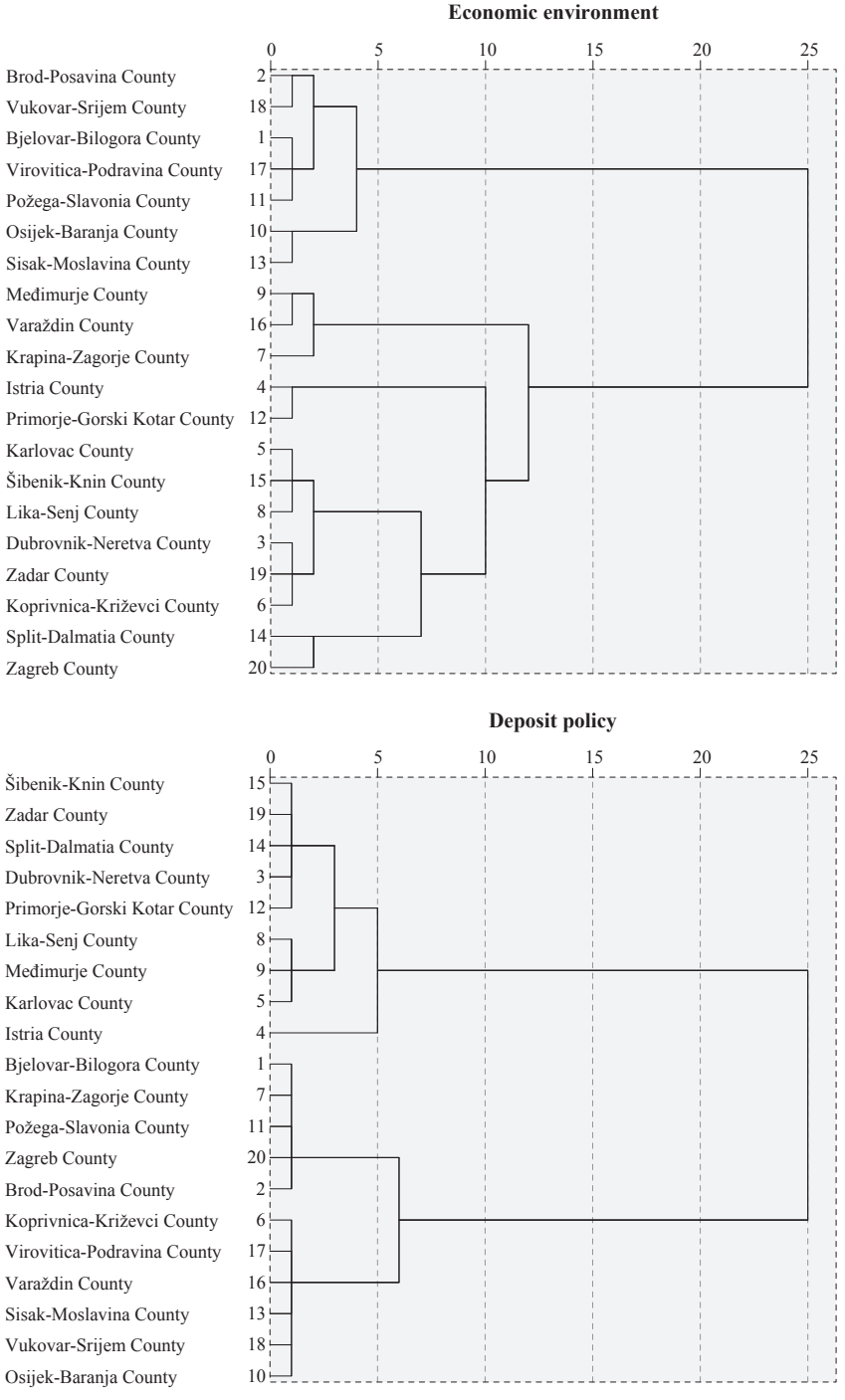


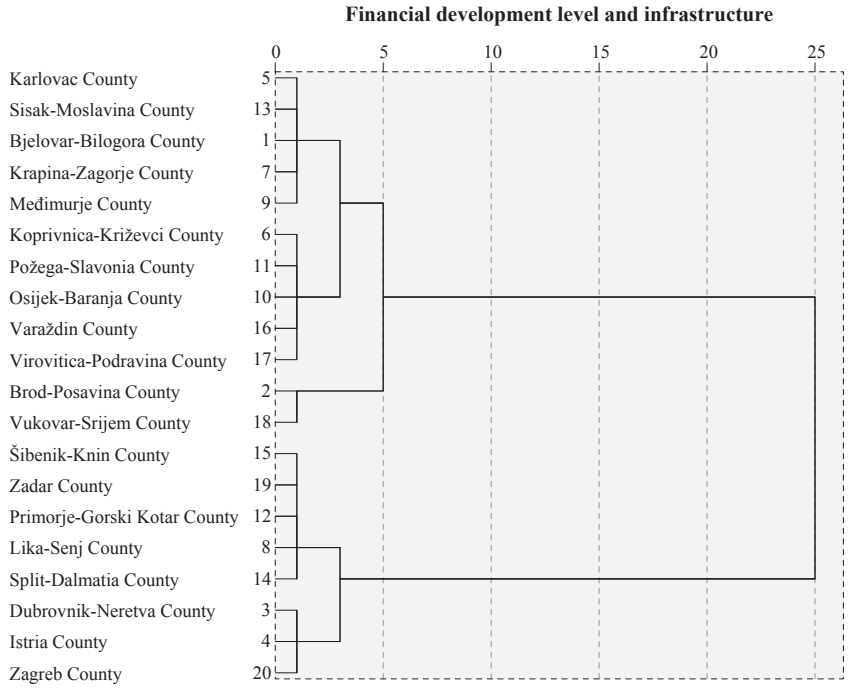


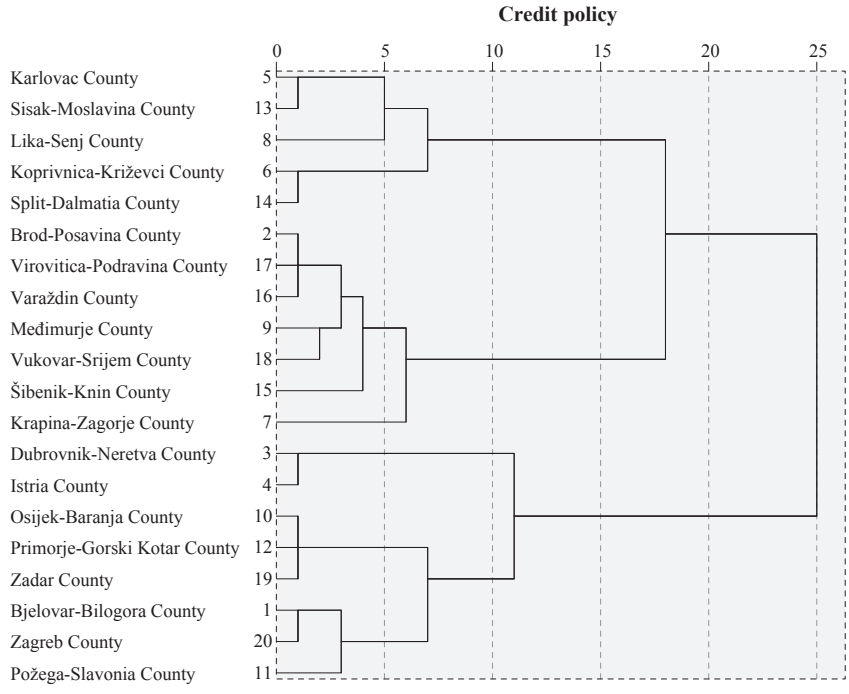
Source: Authors' compilation.

GRAPH A2

Dendrograms for the hierarchical analysis carried out, by set of indicators, the City of Zagreb excluded







Source: Authors' compilation.

REFERENCES

1. Allen, F. and Gale, D., 1999. *Comparing Financial Systems.* Cambridge: MIT Press.
2. Allesandrini, P. [et al.] (ed.), 2009. *The Changing Geography of Banking and Finance.* Springer.
3. Allesandrini, P. [et al.], 2005. The geography of banking power: the role of functional distance. *BNL Quartely Review*, 43(235), pp. 129-167.
4. Arestis, P. [et al.], 2005. Financial Structure and Economic Growth. *Cepp Working Paper,* No. 06/05.
5. Bađun, M., 2009. Financial intermediation by banks and economic growth: a review of empirical evidence. *Financial Theory and Practice*, 33(2), pp. 12-152. Available at: < http://www.ijf.hr/eng/FTP/2009/2/badjun.pdf>.
6. Baletić, Z. [et al.], 1999. *Koncepcija regionalnog gospodarskog razvitka Republike Hrvatske.* Zagreb: Institute of Economics.
7. Burgstaller, J., 2013. Bank Office Outreach, Structure and Performance in Regional Banking Markets. *Regional Studies*, 47(7), pp. 1131-1155. doi: 10.1080/00343404.2011.607809
8. Čavrak, V., 2002. Strategy and Regional Policy Development of Croatia. *Ekonomija/Economics*, 9(3), pp. 645-661.
9. Čavrak, V., 2003. Sustainable Development of Rural Areas in Croatia. *Collection of Papers of the Faculty of Economics and Business Zagreb*, 1(1).
10. Čavrak, V., 2012. Sustainable Development of Rural Areas in Croatia. *Collection of Papers of the Faculty of Economics and Business Zagreb*, 10(2).
11. CBS, 2013. *Statistical Yearbook of the Republic of Croatia.* Zagreb: CBS.
12. CBS, 2014. Gross Domestic Product Data for the Republic of Croatia, NUTS 2 Level and Counties, 2011. First Release, 60(12), No. 12.1.2. Available at: <http://www.dzs.hr/Hrv_Eng/publication/2014/12-01-02_01_2014.htm>.
13. CES, 2014. *Labour Market Indicators for Croatia.* Available at: <http://trzisterada.hzz.hr>.
14. CNB, 2014. Official data provided at a written request.
15. Colombo, L. V. A. and Turati, G., 2014. Why do Acquiring Banks in Mergers Concentrate in Well-Developed Areas? Regional Development and Mergers and Acquisitions (M&As) in Banking. *Regional Studies*, 48(2), pp. 363-381. doi: 10.1080/00343404.2011.653337
16. Crocco, M., Figueiredo, A. and Santos, F., 2010. Differentiated Banking Strategies Across the Territory: an Exploratory Analysis. *Journal of Post-Keynesian Economics*, 33(1), pp.127-150. doi: 10.2753/PKE0160-3477330107
17. Degryse, H. and Ongena, S., 2005. Distance, Lending Relationships, and Competition. *The Journal of Finance,* 50(1).
18. Demirguc-Kunt, A. and Levine, R., 2001. *Financial Structures and Economic Growth: A Cross-Country Comparison of Banks. Markets and Development*. Cambridge: MIT Press.

19. Dow, S. C., 1987a. Money and Regional Development. *Studies in Political Economy*, 23(2), pp. 73-74.
20. Dow, S. C., 1992. The Regional Financial Sector: The Scottish Case Study. *Regional Studies*, 26(7), pp. 619-631. doi: 10.1080/00343409212331347261
21. Dow, S.C., 1987b. The Treatment of Money in Regional Economics. *Journal of Regional Science*, 27(1), pp. 13-24. doi: 10.1111/j.1467-9787.1987.tb01141.x
22. Fernández de Guevara, J. and Maudos, J., 2009. Regional Financial Development and Bank Competition: Effects on Firms' Growth. *Regional Studies*, 43(2), pp. 211-228. doi: 10.1080/00343400701808907
23. Halaj, G. and Zochowski, D., 2009. Strategic Groups and Banks' Performance. *Financial Theory and Practice*, 33(2), pp.153-186. Available at: <http://www.fintp.hr/upload/files/ftp/2009/2/halaj.pdf>.
24. Kurnoga Živadinović, N., 2007. *Klasifikacija prostornih jedinica prema stupnju ekonomske razvijenosti*. PhD thesis. Zagreb: Faculty of Economics and Business.
25. Kurnoga Živadinović, N., 2007. *Multivariate Classification of Croatian Counties*. *Collection of Papers of the Faculty of Economics and Business Zagreb*.
26. Leko, V. and Stojanović, A., 2011. *Financial Exclusion* in: A. Stojanović, and V. Leko. *Models of Financing Purposes with Public Interest.* Zagreb: Grafit-Gabrijel d.o.o., pp. 23-35.
27. Leko, V., 2011. Financing of Special Purposes with Public Interest in: A. Stojanović, and V. Leko. *Models of Financing Purposes with Public Interest.* Zagreb: Grafit-Gabrijel d.o.o., pp. 1-22.
28. Leko, V., 2012. The Relative Significance of Financial Institutions in: D. Jakovčević and J. Krišto, ed. *Insurance Industry in Croatia – Contemporary Changes, New products, Regulation and Risk Management.* Zagreb: Grafit-Gabrijel d.o.o., pp. 3-19.
29. Levine, R., 2002. Bank-based or market-based financial systems: which is better? *Journal of Financial Intermediation*, 11(4), pp. 398-428. doi: 10.1006/jfin.2002.0341
30. Lovrinčević, Ž. [et al.], 2005. How to Optimally Regionalise Croatia? *Economic Review*, 56(12), pp. 1109-1160.
31. Puljiz, J., 2009. *Factors of Regional Development and Regional Inequalities in Croatia.* PhD thesis. Split: Faculty of Economics.
32. Rašić Bakarić, I. [et al.], 2014. The Economic Performance of Croatian Cities – a Statistical Analysis. *Economic Review*, 65(2), pp. 115-138.
33. Rašić Bakarić, I., 2006. Uncovering Regional Disparities – the Use of Factor and Cluster Analyses. *Privredna kretanja i ekonomska politika*, 15(105), pp. 52-76.
34. Rašić Bakarić, I., 2010. *Statistical and Methodological Bases for Definition of Spatial and Economic Entities in the Republic of Croatia.* PhD thesis. Zagreb: Faculty of Economics and Business.

35. Rašić Bakarić, I., 2012. A proposal for a new administrative-territorial division of the Republic of Croatia. *Economic Research – Ekonomska istraživanja*, 25(2), pp. 397-412.
36. Rodríguez-Fuentes, C. J., 1998. Credit availability and regional development. *Papers in Regional Science*, 77(1), pp. 63-75.
37. Valverde, S. C. [et al.], 2007. Financial Innovations in Banking: Impact on Regional Growth. *Regional Studies*, 41(3), pp. 311-326. doi: 10.1080/00343400600928350
38. Žuljić, S., 2001. Regionalism and Territorial Structure of Croatia in the Period 1945-2000. *Economic Review*, 52(1-2), pp. 3-28.

Impact of labour market reforms on economic activity in European Union: short term costs and long term benefits

MARTINA BASARAC SERTIĆ, PhD*
ANITA ČEH ČASNI, PhD*
VALENTINA VUČKOVIĆ, PhD*

Article**
JEL: J88, C33, C54, H11
doi: 10.3326/fintp.39.1.4

* The authors would like to thank two anonymous referees for their useful comments and suggestions.
** Received: June 1, 2014
Accepted: November 7, 2014

The article was submitted for the 2014 annual award of the Prof. Dr. Marijan Hanžeković Prize.

Martina BASARAC SERTIĆ
Croatian Academy of Sciences and Arts, Strossmayerov trg 2, 10000 Zagreb, Croatia
e-mail: mbasarac@hazu.hr

Anita ČEH ČASNI
University of Zagreb, Faculty of Economics and Business, J. F. Kennedy 6, 10000 Zagreb, Croatia
e-mail: aceh@efzg.hr

Valentina VUČKOVIĆ
University of Zagreb, Faculty of Economics and Business, J. F. Kennedy 6, 10000 Zagreb, Croatia
e-mail: vvuckovic@efzg.hr

FINANCIAL THEORY AND PRACTICE
39 (1) 83-107 (2015)

Abstract

The main objective of this paper was to quantify the long- and short-term impacts of labour market reforms on economic activity in EU countries, including Croatia. Therefore, we derived a model using the pooled mean group estimator (PMG) for the period from 2000 to 2011. Before performing dynamic panel analysis based on the PMG estimator, the unit root and panel cointegration tests were performed. According to the results, labour market reforms have positive and statistically significant long-term impact on GDP per capita. On the other hand, labour market reforms also have a statistically significant and negative effect on GDP per capita in the short-run. Control variables (industrial production and the rate of the active population) also have significant impacts on GDP per capita. In addition to econometric analysis, we also present an overview of empirical and theoretical research on labour market reforms in developed, developing and transition countries.

Keywords: labour market reforms, European Union, economic crisis, PMG estimator

1 INTRODUCTION

In the period from 2008 to 2013, the economic and financial crisis in European Union (EU) resulted in the loss of nearly ten million jobs. However, the impact of the crisis on the labour market significantly varies among EU countries, and has resulted in total unemployment rates ranging from 5.3% in Germany to 26.4% in Spain (according to data for 2013). These differences can be only partially explained by differences in the economic slowdown in the countries, and debates are currently being more and more diverted towards understanding the role of various factors in the labour market as well as their implications for future economic development (ECB, 2012). At the same time, this has resulted in initiatives for the implementation of structural reforms aimed at increasing labour market flexibility.

Labour market reforms, which are at the centre of research in this paper, are currently being extensively theoretically and empirically analysed on different samples of countries and through the use of different methodologies. Nevertheless, this paper contributes to the field of research through analysis of the impact of the reforms on the level of economic activity in 28 EU countries, including Croatia as its newest member state. In this sense, the main objectives are defined as follows: (1) to analyse the impact of labour market reforms on economic activity in the EU-28, and (2) to investigate whether there are some differences between the 15 "old" and 13 "new" EU member states. For this purpose, following the methodology of Pesaran, Shin and Smith (1999), the pooled mean group (PMG) estimator is used.

The paper is structured as follows. Section 2 provides an overview of selected empirical evidence as well as theoretical arguments from the literature focused on

FINANCIAL THEORY AND PRACTICE
39 (1) 83-107 (2015)

labour market reforms. Section 3 brings a descriptive analysis of labour market reforms implemented in EU member states using two databases. These are LABREF database of the European Commission and that of the Fraser Institute, which in combination provide an insight into countries' reform activities. Section 4 describes the model used for the analysis, as well as the reasons behind the choice of the PMG estimator. Section 5 delivers the results of the econometric analysis and their interpretation. Finally, section 6 provides concluding remarks and describes the limitations of existing and recommendations for future research in this area.

2 REVIEW OF CONTEMPORARY RESEARCH ON THE IMPACT OF LABOUR MARKET REFORMS

There is a general consensus on the necessity of implementing structural reforms with the goal of improving countries' economic and social development. However, there is a gap between the theoretical discussions of the potential benefits of reforms and the results of specific empirical analyses that indicate the heterogeneity of the results (for details see Babetskii and Campos, 2007; IMF, 2004). While the reforms were successful in some countries, in others they did not result in the expected outcomes which brought into question whether the reforms had affected the economic progress of the country? It is important to bear in mind that there is no universal "recipe" for the implementation of reforms. They must be tailored to the specific circumstances in individual countries and based on high-quality research in terms of their expected final outcomes (Bergsten and Williamson, 1994). Thorough economic analysis of reform effects can provide a useful insight into the possible long-term effects of reforms on economic performance, as well as insights into the adjustment process after their implementation and potential spillovers across countries (Arpaia et al., 2007).

Therefore, we offer a review of recent research on labour market reforms, and describe various empirical approaches used for the analysis of correlation between labour market reforms and economic growth and development. In this regard, Barnes et al. (2013) emphasize that the largest benefits for GDP per capita in the long run can be achieved through the implementation of reforms to increase labour market competition, reduce the level and/or duration of unemployment benefits and reduce regulations on the employment protection. Moreover, the authors also stress that although there is a general consensus on the benefits of various structural reforms in the long run, one must take into account the potential short-term costs associated with them. Therefore, this aspect of the research should also be further analysed, since the short-term costs may result in reversing the reforms later in the process of their implementation.

Cacciatore, Duval and Fiori (2012), using the DSGE models investigate short-term effects of labour and product market reforms. Although they indicate that reforms stimulate growth even in the short term, some reforms result in an in-

crease in unemployment, which causes high costs in the short term. In particular, job protection reform initially increases more layoffs than it creates jobs. Furthermore, they show that product market reform can also temporarily lead to net job destruction as incumbents downsize, while the reallocation of laid-off workers takes time. However, the application of the broad range of measures of labour and product market reforms allows governments to reduce and/or mitigate such transitional costs. The authors conclude that it takes several years for reforms to pay off, which can be partially explained by the fact that their benefits materialize through the entry of new enterprises and increased employment, both of which are gradual processes, while any reform-driven layoffs are immediate.

Furthermore, according to a study of the OECD (2012), while some structural reforms can rather quickly boost growth, on the other hand, there are reforms that can be harmful in "bad" times. In terms of labour market reforms, Bouis et al. (2012) based on an empirical analysis of structural reforms in OECD countries in the last 30 years, pointed out that reforms (particularly in the area of unemployment benefits and employment protection) are more quickly paid off in good than in bad times, which can result in significant short-term losses in economies that are in recession. They also point out that the benefits of reforms are visible only in the long run.

Gomes et al. (2011), using the dynamic general equilibrium model, estimate macroeconomic effects of increased competition in the labour and services markets in Germany and the rest of the eurozone, and alternatively, in Portugal (as a small economy) and the rest of the eurozone. The main results indicate that: (1) gradual implementation of reforms in the period of five years allows a new level of output to be attained, in the long run, in seven years, (2) coordination of reforms across countries provides additional benefits for each country in the euro area (i.e. spillover effects), and finally (3) coordination between countries is essential to achieve more homogeneous economic outcomes (i.e. coordination results in higher and more evenly distributed positive effects).

Bouis and Duval (2011) examined the impact of structural reforms of product and labour markets on potential GDP for a period of 5-10 years. Their research shows that reforms in the product market may increase the level of overall labour productivity by a few per cent over a period of 10 years in OECD countries, and more than 5% in most countries of continental Europe, as well as in the BRIICS countries[1]. Furthermore, higher labour market flexibility can also increase productivity in many OECD countries, although the authors estimate that these effects are small in comparison to the effects of product market reforms. According to the scenario in which reform of the labour market (in the areas of unemployment benefit systems, active labour market policies, labour taxes and pension system) are implemented relatively quickly, the employment rate would increase by sev-

[1] BRIICS comprises Brazil, Russia, India, Indonesia, China and South Africa.

eral percentage points in the OECD countries over a 10-year horizon. Furthermore, the authors estimate that in such a scenario there would be an increase in potential GDP of 10% in 10 years, which indicates a significant potential of structural reforms in terms of compensation of losses caused by the economic crisis.

Then, Hobza and Mourre (2010) explore scenarios of the Europe 2020 strategy, with the aim of perceiving possible gains. Results indicate that progress in implementing structural reforms in line with the main priorities defined in the EU 2020 strategy can generate significant benefits in terms of increased production and job creation. According to the authors, by 2020, GDP may increase from about 1.5% to 7% compared to the initial level, due to the implementation of policy reforms (i.e. between 400 and 2,000 euro of additional output per person). Furthermore, under the ambitious scenario, gains in employment would be significant: about 0.5% and 4.5%, which means the creation of an additional 1.6 to almost 11 million jobs. At the same time, progress in structural reforms would have a positive impact on the unemployment rate, which could fall to between 0.5 and 5 percentage points.

Everaert and Schule (2008) on the basis of the calibrated model examined long-term gains in output and employment from boosting competition in product and labour markets. The authors conclude that the combination of reforms could avoid a fall in real wages. Moreover, they conclude that in the short term, stand-alone reforms cause inflation to fall and real interest rates to increase in the reforming country, slowing the investment response and deferring consumption. However, synchronization of reforms would prevent a temporary fall in consumption and reforms in a monetary union would prevent a transitory decline in GDP and consumption.

Arpaia et al. (2007), using different economic models, examine the impact of the reforms implemented in the period from 1995 to 2003 within the framework of the strategy of the European Commission "Growth and Jobs Strategy" in which the product and labour markets were at the centre of the reform agenda. The authors estimate that the reforms in the areas of unemployment benefits, taxes and the ease of entry for new companies reduce the structural unemployment rate by almost 1.4 percentage points and increase GDP in the EU-15 by 2% since 1995. They also emphasize that a positive outcome is largely the result of the interaction of product market reforms when creating new jobs (i.e. facilitating wage moderation and the entry of new companies to markets). The authors believe that these benefits would have been even higher if the simulation took account of the positive impact of the reforms on the participation rate.

We can conclude that the literature finds a positive long term correlation between structural reforms in the labour markets and economic performance; while in the short term the impact of reforms can be small or even negative due to adjustment

costs. As has been presented, authors proxy economic activity through a fairly large number of indicators such as GDP per capita, productivity, (un)employment, GDP growth rates, etc. On the other hand, the results vary among authors due to several factors: (1) the selected indicators of reforms; (2) the characteristics of the data used for the analysis; (3) choice of econometric model; (4) the size and heterogeneity of the sample; and (5) selection of different control variables. All of this reinforces the point that with interpretation of results, one should take into account all the potential methodological limitations.

3 LABOUR MARKET REFORMS IN EUROPEAN UNION MEMBER STATES

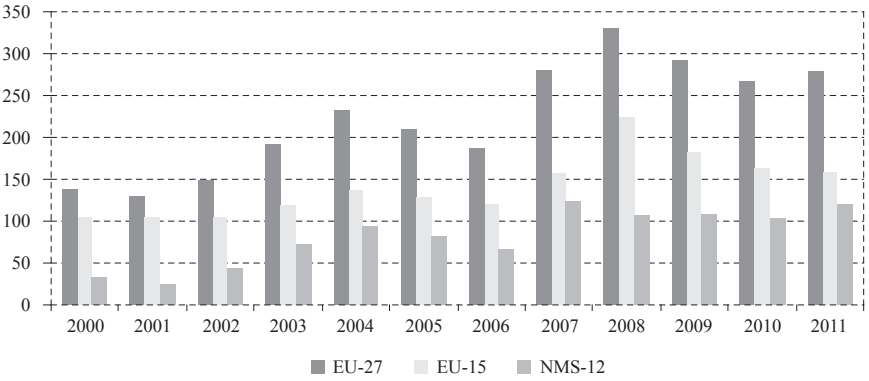
For the analysis of labour market reforms implemented in EU, we use in parallel two databases: the LABREF database of European Commission, which contains information on the policy measures related to labour market institutions, and the Fraser Institute database of Economic Freedom of the World[2]. Accordingly, we can combine two approaches to measuring reforms (see Buti, Turrini and Van den Noord, 2010:12-13): *ex ante* and *ex post*. The first (*ex ante*) approach refers to the construction of different indicators based on reforms implemented in different countries; measuring the occurrence of legislative changes. An example of this approach is the LABREF database of the European Commission, which is organized around nine policy areas: labour taxation, unemployment, welfare-related benefits, active labour market programmes, job protection, disability and early retirement schemes, wage bargaining, working time organisation, immigration and mobility. The indicators of this type are then constructed as *dummy* variables that provide information about the number of actions (reforms) taken and are silent on the impact of policy measures. The second approach (*ex post*) consists of indicators measuring the existing distortions associated with the government policies whereby the effect of the reforms is then measured as the change in their levels. Examples of this approach are the indicators developed by the OECD (Employment Protection Legislation Index) and the Fraser Institute (Economic Freedom of the World). While the first approach gives an insight into the actions taken by policy makers in order to reform the existing market or state institutions; the second approach does not account directly for government reform initiatives, but permits us to gauge the impact of such initiatives on the structural conditions of the different sectors, also permitting assessment of the extent to which reforms are needed.

Based on the data from LABREF, figure 1 shows the total number of reform measures in the EU member states in the period from 2000 to 2011, with the aim of analysing the timing of reforms by groups of countries.

[2] See: http://www.freetheworld.com/.

Figure 1

The number of reform measures in the EU member states (EU-27, EU-15 and NMS-12), 2000-2011



Source: Authors' calculation according LABREF database (2014).

The figure shows that the total number of reform measures in the EU-27 countries varies over time. The minimum number of measures implemented by EU-27 member states was recorded in the year 2001, while the most measures were implemented in 2008, followed by a decrease in the number of reforms, mostly due to the effects of the global economic crisis. Economic crises can generally stimulate or slow down the implementation of reforms. While an economic downturn implies that existing policies are no longer sustainable thus encouraging reforms (Drazen and Easterly, 2001; Alesina, Ardagna and Trebbi, 2006; Høj et al., 2006; IMF, 2004), there is also the view that reforms are easier to implement under favourable macroeconomic conditions since the costs of the reforms are less painful and distributional effects are less visible when aggregate income is growing rapidly (IMF, 2004:114-115).

This is confirmed by the analysis carried out in Turrini et al. (2014). Using the LABREF database, the authors analyse the determinants and impact of the labour market reforms in the European Union for the period from 2000 to 2011. Their results suggest that countries with similar institutional settings tend to follow analogous reform patterns and that the 2008 crisis spurred reforms in most of the policy domains on labour markets in a number of EU countries. Furthermore, they show that reforms are more likely when the environment is characterized by under-performance of the labour market (particularly by high and rising unemployment) and by high initial levels of regulation or fiscal burden. Other macroeconomic and fiscal factors have a less clear role.

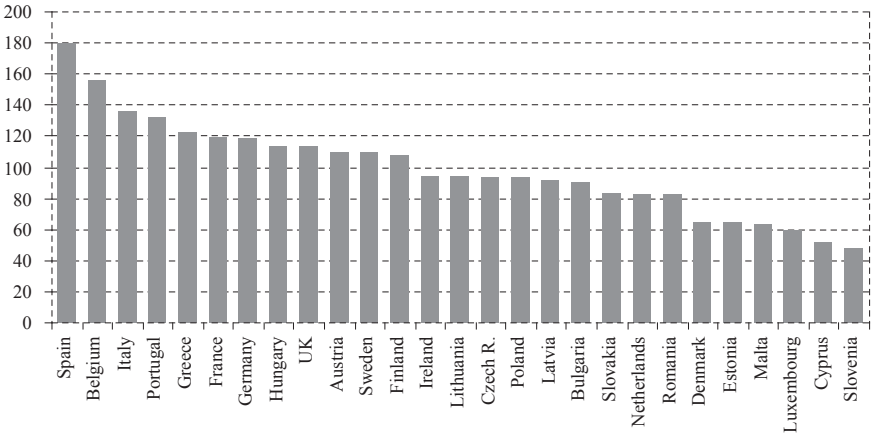
If we look at the differences between the groups of the EU-15 and NMS-12 we can also observe some variations. The years in which the new member states implemented the largest number of reforms are the years of EU enlargement (i.e. 2004

and 2007), indicating the strong international influence on reform intensity during the process of economic integration. According to the political economy aspects of reforms, pressure to reform can also come from a variety of binding rules, such as meeting the criteria for joining the EU where the EU's influence is especially significant from the aspect of "hard" policy instruments (such as the criteria for entering the European Monetary Union) and "soft" forms of coordination within which different strategies indicate desirable changes in the labour market (Thompson and Dang, 2010). Also, in terms of changes in the number of reforms after the year 2008, we note that in the NMS-12 countries there has been no significant reduction in the number of reforms, implying that in this group of countries (compared to the EU-15) the crisis was an incentive to the implementation of further reforms in labour markets.

Further analysis of labour market reform measures by individual EU countries (figure 2) shows that the most measures in the observed period were implemented in Spain, Belgium, Italy, Portugal and Greece versus Slovenia, Cyprus and Luxembourg, which carried out the smallest number of reform measures. The data also reflect the differences between the EU-15 and NMS-12 countries, where new member states implemented only just over half the number of measures. Data for Croatia are not available within the LABREF database for the entire period from 2000 to 2011[3]. However, although at this stage of research Croatia is not included in the analysis, experience of the NMS-12 regarding the implementation of reforms is significant for Croatia as the newest member of the EU.

Figure 2

The number of reform measures in the labour market, data by member states in the period from 2000 to 2011



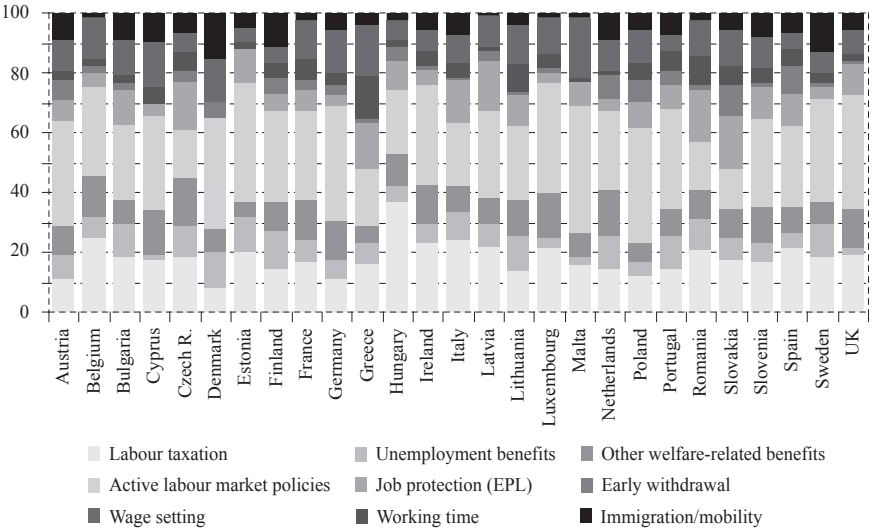
Source: Authors' calculation according to LABREF database (2014).

[3] Data for Croatia are available only for two years (2010 and 2011).

It is also interesting to analyse reform measures in the each of the nine policy areas, expressed as a share in the total number of reforms (i.e. the reform profile of countries). The figure 3 shows that member states implemented the largest number of reforms in the area of active labour market policies and labour taxation, while the smallest number of reforms is recorded in the area of policies related to the labour market exit.

Figure 3

Reform profile of EU-27 member states



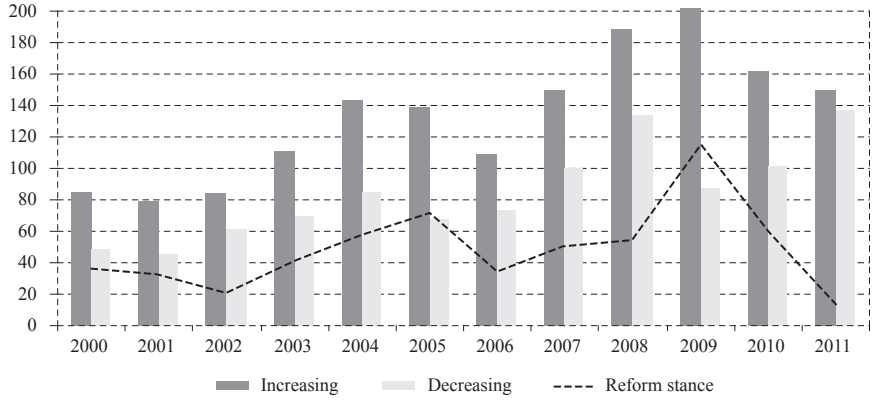
Source: Authors' calculation according to LABREF database (2014).

Since the reform measures contained in the database can be heterogeneous in terms of their impact on labour market institutions (e.g. regulatory requirements, taxes and contributions), it is recommended to take into account the definition of the reform direction, which is also presented in the database for each of the individual policy domains[4]. Reforms "increasing" ("decreasing") underlying policy settings are those that increase (decrease) the scope and level of corresponding taxes, monetary benefits or the stringency of corresponding regulations (Turrini et al., 2014:9). It is therefore necessary to take into account the fact that in a given year and in a given country, reforms with different directions can co-exist. With this goal, Turrini et al. (2014) construct a variable *reform stance* expressed as the difference between the reforms with increasing direction and reforms with decreasing direction. Thus, the following figure shows the ratio between the number of "decreasing" and "increasing" reform measures, as well as their differences. The obtained numbers show that in the observed period from 2000 to 2011, the EU member states (on average) implemented the larger number of reforms with growing direction of their effects on labour market institutions.

[4] Coverage and structure of the Labour Market Reform (LABREF) Database (2014), available under: http://ec.europa.eu/economy_finance/db_indicators/labref/documents/guide_en.pdf.

FIGURE 4

Number of reforms according to their direction



Source: Authors' calculation according to LABREF database (2014).

Taking into account the previously described trends, it can be concluded that reform activity varies among individual EU member states as well as over the course of time. It is expected, therefore, that these measures also had an effect on the quality of the labour market approximated by the composite index of labour market regulations which is published annually by the Fraser Institute as part of the Economic Freedom of the World project[5]. It provides a composite measure of labour market flexibility and more specifically indicators of labour market flexibility in the six policy areas: (1) the minimum wage; (2) the regulation of hiring and firing; (3) centralized wage bargaining; (4) the cost of hiring; (5) cost of dismissal; and (6) recruitment. The index takes values ranging from zero to ten, where higher numbers indicate a higher level of economic freedom in the labour markets. Therefore, figure 5 shows the correlation between the total number of implemented reforms in the EU-27 countries and labour market regulation index from the Fraser Institute database (for the period from 2000 to 2011).

We conclude that, at the level of the EU-27, there is a significant correlation between the two indictors, as indicated by the calculated coefficient of correlation coefficient (0.81)[6]. Thus, it is apparent that increased reform activity resulted in an increase of labour market flexibility. However, the key question that arises is that concerning the efficiency of the reforms implemented from the aspect of economic activity, which is

[5] Economic Freedom of the World database provides extensive information on the various dimensions of economic freedom through the use of more than 40 variables with the aim of calculating the index which measures the degree of economic freedom in 5 areas. These are: the size of government, the legal structure and security of property rights, access to sound money, freedom to trade internationally and regulation of credit, labour and business. Reports have been published since 1996, and are based on the definition of economic freedom, according to which individuals possess economic freedom when the property they acquire without the use of force, fraud or theft is physically protected from other individuals and when their assets are free to be used, shared or given to others, provided that this does not violate the equal rights of other persons (Gwartney, Lawson and Block, 1996).

[6] The correlation coefficient between these two indicators for NMS-12 is even higher, amounting to 0.90.

further investigated in the following section through an econometric analysis of the short- and long-term effects of labour market reforms (approximated by the change in the level of index of labour market regulation) on the GDP per capita.

Figure 5

Total number of reforms and the index of labour market regulation (EU-27), 2000-2011

Source: Authors' calculation according to LABREF and Fraser Institute database (2014).

4 METHODOLOGY

In order to estimate the dynamic and cointegrated panels there are usually two procedures used. These are the Mean Group Estimator (MG) and traditional Pooled estimators, each of which has its own advantages and disadvantages (for details see Pesaran and Smith, 1995).

In this paper, the pooled mean group (PMG) estimator is used, since it includes pooling imposed by restrictions on the homogeneity of long-term coefficients and averaging through groups, in order to obtain the mean of the estimated coefficients to correct errors and other current parameters in the model. In addition, the estimator allows constant members, short-run coefficients and error variances to differ by groups, while at the same time constraints long run coefficients to be identical in groups.

4.1 DATA AND VARIABLES

Initial panel model analyses the impact of labour market reforms on economic activity in 28 European Union member states (including Croatia). In addition, with the goal of comparing the variations in effects of labour market reforms on economic performance, the EU-28 member states are divided into two groups (i.e. sub-panels): the EU-15 and NMS-13[7]. Based on the analysis of reform patterns

[7] More specifically, the new member states include the countries that joined the European Union in 2004 (Cyprus, Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Slovakia, Slovenia and Malta) and in 2007 (Bulgaria and Romania), as well as Croatia, which joined the European Union on 1 July 2013. EU-15 countries encompass Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and the United Kingdom.

carried out in section 3, we assume that there is a different impact of reforms in these two groups of states. The analysis includes the period from 2000 to 2011. The years after 2011 are not included in the analysis since the latest available data on labour market flexibility were published in 2013, and refer to the year 2011, thereby excluding the reform measures implemented in the last two years. Further on, labour market reforms are proxied by the composite index of labour market regulations published by the Fraser Institute[8]. Although these indexes entail the same disadvantages that are attributed to composite indices in general (for details see OECD, 2008) and although aware of all the shortcomings of the index in question[9], we emphasize several advantages. First, the advantage of the approach used in this work is reflected in the application of the aggregate index. The government is potentially affected by the series of policy actions and changes in one of the areas are often correlated with changes in other policy areas (according to Buti et al., 2010). Thus, the key advantage of aggregated in relation to individual indicators and methods that evaluate the effect of various reforms on economic outcomes is that the use of individual indicators can result in methodological problems as a result of attributing the effects of excluded or unobserved measures to those that are included in the analysis. Moreover, regarding the criticism that such indexes do not encompass real reform process, it has been highlighted (in section 3 of the paper) that in a sample of EU countries, there is a positive correlation between the number of the reforms and the value of the Fraser Index of labour market regulations on the other hand. Finally, critics also focus on the use of the indexes developed by organizations that are biased towards free-market policies (an example is such index is also the Economic Freedom of the World index used in this paper) (Chang, 2011). However, in this paper, the authors do not give value judgements regarding the desired degree of flexibility and freedom in the labour market, but the research focuses on the *ex post* analysis of the impact of reforms on economic activity. According to the economic literature, it is expected that the reforms that increase economic freedom and flexibility in the labour market have a positive effect on economic activity in the long and negative in the short term.

Structural reforms are considered to contribute to growth potential, creating the conditions for sustainable and balanced growth and leading to improvements in employment and living standards (European Commission, 2014). Therefore, as the dependent variable in the model we use GDP per capita. Independent variables included in the model, in addition to the index of labour market regulation, are the

[8] From the aspect of economic freedom, there is also the "Index of Economic Freedom" (Heritage Foundation; http://www.heritage.org/index/book/chapter-7) database according to which economic freedom is seen as the condition in which individuals can act with autonomy, and in economically free society, decision-making by the government is transparent and guarantees equal opportunity for all. However, the goal of economic freedom is not simply an absence of government coercion or constraint, but the creation and maintenance of a mutual sense of liberty for all in which individuals have the responsibility to respect the economic rights and freedoms of others within the rule of law. This index comprises ten specific components of economic freedom: property rights, freedom from corruption, fiscal freedom, government spending, business freedom, labour freedom, monetary freedom, trade freedom, investment freedom and financial freedom. However, the database is limited in terms of availability of long time series in the components of freedom in the labour market.

[9] For more detail overview see Aleksynska (2014).

FINANCIAL THEORY AND PRACTICE
39 (1) 83-107 (2015)

dummy variable for the economic crisis, industrial production and the share of the active population in the total population. The dummy variable for economic crisis takes the value 1 when the value of the output gap is -4% of GDP or higher (according to Duval and Elmeskov, 2006; Høj et al., 2006). Furthermore, a dynamic manufacturing sector is considered a prerequisite for an innovative and fast-growing economy (European Commission, 2013), making it an important determinant of economic activity. Moreover, the new approach of the European Commission to industrial policy is based on the revival of the role of industry in Europe, from the share of about 16% of GDP (in 2012) to 20% by 2020. In addition, industry accounts for more than 80% of European exports, private R&D and innovation. Finally, about one of four jobs in the private sector, is located in the industry sector (European Commission, 2013). Therefore, by including the indicator of industrial production in the empirical analysis, the paper also explores the extent to which macroeconomic policies influence the short-term and long-term impact of reforms on economic growth. In addition to industrial production, the activity rate (expressed as the proportion of the active population (15-64) in the whole of the population aged 15-64) is also used as a control variable in the model. The variables of per capita GDP and industrial production are expressed in log values, while the activity rate is expressed as a percentage. The sources of the data used and the expected signs of the estimated coefficients are given in appendix.

4.2 MODEL SELECTION

Empirical analysis starts with the following equation:

$$BDP\_pc_{it} = \gamma_{0i} + \gamma_{1i} ind\_pro_{it} + \gamma_{2i} lm\_reg_{it} + \gamma_{3i} act\_r_{it} + crisis + \varepsilon_{it}, \quad i = 1, 2, ..., N,\ t = 1, 2, ..., T_i \tag{1}$$

where: BDP_pc_{it} is the logarithm of gross domestic product *per capita*, ind_pro_{it} is the logarithm of industrial production index; lm_reg_{it} is the labour market regulation index, *act_r* is the activity rate and *crisis* is binary (dummy) variable for economic crisis. Subscripts *i* and *t* denote country and time period, respectively[10]. The error term (ε_{it}) represents the effects of unexpected shocks to economic activity, approximated by gross domestic product *per capita*.

Coefficients γ_{1i}, γ_{2i} and γ_{3i} denote the effects of permanent changes on gross domestic product *per capita*, sustainable in the long run that can be interpreted as the elasticities. Deviations from the long run relationship given in equation (1) are possible in the short run. Namely, there are various reasons for such deviations that preclude instant adjustment of gross domestic product *per capita* to changes in its determinants, thus they should be taken into account.

[10] Since *T* has a subscript *i*, the analysed panel is unbalanced.

Accordingly, econometric specification in this paper allows for different short run effects (for each country within a sample) of selected determinants on gross domestic product *per capita*, which is formally implemented in the model by choosing lag length for each variable according to standard statistical criteria. After choosing appropriate lag length according to Schwarz Bayesian Criterion (SBC)[11] for each variable[12], panel *ARDL(1,0,0,0)* model, showed to be adequate for the empirical analysis, and it is given in by:

$$BDP\_pc_{it} = \delta_i + \beta_{10i} ind\_pro_{it} + \beta_{20i} lm\_reg_{it} + \beta_{30i} act\_r_{it} + \gamma_i BDP\_pc_{i,t-1} + crisis + \eta_{it} \quad (2)$$

Since Pesaran and Shin (1995) have shown that modelling approach using *ARDL* model is not reasonable unless all the variables in equation (2) are integrated of order one, reparametrisation of equation (2), expression (3) or *panel error correction model* is obtained:

$$\Delta BDP\_pc_{it} = \phi_i \left(BDP\_pc_{i,t-1} - \gamma_{0i} - \gamma_{1i} ind\_pro_{it} - \gamma_{2i} lm\_reg_{it} - \gamma_{3i} act\_r_{it} - crisis \right) - \beta_{11i} \Delta ind\_pro_{it} - \beta_{21i} \Delta lm\_reg_{it} - \beta_{31i} \Delta act\_r_{it} + \eta_{it} \quad (3)$$

Whereas Δ is the first difference operator, so:

$$\phi_i = -(1-\gamma_i), \gamma_{0i} = \frac{\delta_i}{1-\gamma_i}, \gamma_{1i} = \frac{\beta_{10i} + \beta_{11i}}{1-\gamma_i}, \gamma_{2i} = \frac{\beta_{20i} + \beta_{21i}}{1-\gamma_i}, \gamma_{3i} = \frac{\beta_{30i} + \beta_{31i}}{1-\gamma_i} \quad (4)$$

Since according to the Engle and Granger (1987) theorem, there is a clear connection between the cointegration mechanism and the error correction mechanism, equation (3) represents the basis for the estimation of the long run relationship between economic activity (gross domestic product *per capita*) on one side and selected independent variables on the other side.

In the defined framework, Pesaran, Shin and Smith (1999) suggest that coefficients of long run relationship in equation (3) be equal across countries (long-run homogeneity restriction) whereas constant terms, adjustment coefficient, short run coefficients and error variances can vary among countries[13].

[11] The Schwarz Bayesian criterion (SBC) is the criterion for the model selection based on the parsimony principle. It is considered to be most rigorous criterion, since it gives the models with least number of parameters. It is defined by the following formulae: $SBC = -2 \cdot ln(L) + M\, ln(T)$, whereas L denotes maximum of the likelihood function, M is the number of estimated parameters ARMA(p,q) model and T is the number of data used in the estimation and it doesn't have to be the same length as the length of array, n. (For more details please refer to Bahovec and Erjavec, 2009.)

[12] Results of the analysis where the adequate number of lags is selected for every variable of interest are not presented here, but they are available from the authors upon the request.

[13] In other words, there are *(N-1)*k* restrictions on model given in equation (4), namely: $\gamma_i = \gamma$ for every i. Estimator based on the maximum likelihood method is called *PMG estimator* and it has asymptotically normal distribution in case of stationary as well as non-stationary regressors.

Also, under the homogeneity of the slope assumption, the *PMG* estimator is consistent and efficient, whereas the *MG* estimator is consistent, but it is not efficient, so in order to compare these two estimators, a test of a Hausman type can be employed (Pesaran, Shin and Smith, 1999). Furthermore, with the aim of checking robustness, the main panel of EU-28 is divided into two sub-panels, namely: panel EU-15 and panel of the new member states (NMS-13). Also, we employ the *dynamic fixed effects estimator*, DFE in order additionally to check the robustness of the results of the empirical analysis.

5 RESULTS OF THE EMPIRICAL ANALYSIS

As a first step of the empirical analysis panel unit root tests were conducted and the results are presented in table A2. Accordingly, all the variables of interest are integrated of order one, so the next step of the empirical analysis was to test the existence of the cointegrating relationship among them. For this, we use four new tests developed by Westerlund (2007)[14]. According to the results of panel cointegration tests (given in table A3), there is a cointegrating relationship between analysed variables.

Since all the variables of interest are unstationary and cointegrated, estimation of equation (3) using the *PMG* estimator allows for the reliable inference of long run and short run effect of reforms on the labour market on economic activity (GDP *per capita*). In table A4 the results of the empirical analysis[15] along with the Hausman specification test and standard errors of estimate (given in brackets) for the whole panel EU-28[16] are presented.

The results of the Hausman specification test show that the appropriate estimator in our case is the *PMG* estimator[17] and that the model specification is appropriate, so the results can be interpreted.

Long run coefficient of the labour market regulation is statistically significant at the 1% significance level, suggesting that the elasticity of GDP per capita to changes in market regulation is 0.251. Furthermore, industrial production and the rate of activity are statistically significant on 1% significant level, with the elasticity coefficients of GDP per capita to changes in aforementioned variables of 1.290, and 0.022, respectively. Binary (dummy) variable economic crisis in the long run has significant impact on GDP per capita with the elasticity coefficient of -0.581.

[14] These tests are based on structural dynamics and are not residual-based, so they do not impose *common-factor restriction*. Two tests are designed to test the alternative hypothesis of cointegration of whole panel (P_α and P_τ), while the rest two tests, test the alternative hypothesis that at least one unit of a panel is, G_α and G_τ (Persyn and Westerlund, 2008).

[15] The reported short-run coefficients and the speed of adjustment are simple averages of country-specific coefficients.

[16] The empirical analysis is performed using statistical software STATA 12.

[17] Since it allows for the heterogeneity of parameters in the short run.

Furthermore, the adjustment factor[18] is -0.357[19], with the appropriate negative sign and is statistically significant on 1% significance level, so it can be concluded that the long run cointegrating relationship between economic activity and selected independent variables is reached in a bit less than three years. Also, GDP per capita adjusts to its long run equilibrium with lags.

In the short run, the reform of the labour market has the expected negative sign and is statistically significant at the significance level of 10% with the elasticity coefficient of -0.0375. Other variables have no statistically significant impact on economic activity in the short run.

Furthermore, within our econometric exercise, the model given in equation (4) is estimated for two sub-panels, that is, for panel of old member states (EU-15) and a panel of new member states (NMS-13), in order to determine the influence of labour market reforms on economic activity in the aforementioned groups of countries. The results of empirical analysis are given in table A5. Accordingly, it can be concluded that for both groups of countries in the long run there is a statistically significant influence of labour market reforms on economic activity at the 1% significance level. Furthermore, in the case of the EU-15 panel the coefficient of elasticity of economic activity to the changes in labour market reforms is 0.291, suggesting a higher impact of labour market reforms on economic activity in the old member states (EU-15) than in the new member states (NMS-13), where the coefficient is much lower and has the value of 0.074. Interestingly, the impact of crisis on economic activity in the long run is more pronounced in the case of new member states (in comparison to EU-15) with statistically significant and negative coefficient of -0.523 (in the case of EU-15 that coefficient has the value of -0.362). In contrast, in the long run, industrial production and the rate of activity of the population influence economic activity more significantly in the NMS-13 than in the EU-15, with the coefficients of 1.720 and 0.044, respectively (the coefficients for EU-15 are 1.338 and 0.032, respectively).

Furthermore, speed of adjustment in the case of old member states is -0.295, whereas for the new member states it has the value of -0.442. Both coefficients have the correct negative sign and are statistically significant at the 1% significance level. Moreover, they imply that the long run equilibrium given by the cointegrating relationship between GDP per capita, industrial production, market regulation and the rate of activity is reached more quickly in the new member states than in the old member states. Also, labour market reforms in the short run have a statistically significant coefficient just in the case of old member states.

[18] Error correction term is given in table A4 and is calculated as a simple arithmetic mean corresponding error correction terms for 28 countries in a panel (which are heterogeneous according to PMG procedure).

[19] Error correction term or the speed of adjustment (ϕ) is statistically significant in the estimated model and it has expected negative value since it is expected (and estimated model proves it) that the deviation between economic activity and selected independent variables from their long run equilibrium is gradually decreasing. Since the quarterly data are used, long run equilibrium is reached in a bit less than three years (detail description of error correction model is given in Bahovec and Erjavec, 2009).

Other analysed variables do not have a statistically significant impact on economic activity in the short run.

In order to check the robustness of the estimated models apart from PMG estimator, we used the DFE estimator (*dynamic fixed effects estimator*), that presumes that the coefficients of cointegrating vector are equal across all countries within a panel and that all short run coefficients and the speed of adjustment are equal for all countries. Only constant terms can vary between countries. Results of the estimation of the whole panel (EU-28) and the two sub-panels are given in table A6. According to the results of estimated DFE model, it is obvious that in the case of all three panels there is a statistically significant long run effect of labour market reforms on economic activity, which confirms the results of the estimated PMG model. However, the only exception noticed is for the variable industrial production; the short run coefficients for industrial production are statistically significant, but they have different signs for the two sub-panels. This can be explained by the fact that production suffered losses caused by long term economic crisis, which can lead to permanent loss of production capacities, especially in the new member states. Other results of the empirical analysis given in table A6, confirm the robustness of the baseline model.[20]

6 CONCLUSION

The global economic crisis has changed the perception of the role of structural reforms in the economy, especially at the EU level, considering that the traditional measures of economic policies are being "exhausted". Hence, the current crisis represents a major challenge in terms of structural reforms, and not for the EU countries alone. One of these challenges is the reform of labour markets which is, due to its complexity and high short-term costs, often delayed.

According to the obtained results of empirical analysis performed in this paper, labour market reforms which increase flexibility and economic freedom have a positive and statistically significant long-term impact on GDP per capita in the EU-28 countries. Furthermore, also in the long run, reforms have a statistically significant positive effect on GDP per capita both in the EU-15 and in the 13 new EU member states. However, in the short run, the reforms have a statistically significant but negative impact on the GDP per capita in the EU-27 and EU-15 countries, while in the 13 new member states the short-term effect is not statistically significant. The obtained results for NMS-13 could be explained by the fact that timing of reforms in these countries differs from that in EU-15. We can conclude that the results obtained in this paper are consistent with the economic theory and

[20] *Dynamic Fixed Effects Estimato*r, DFE as well as Pooled Mean Group Estimator, PMG impose the restriction of equal coefficients of the cointegrating vector for every country within a panel. However, according to DFE the speed of adjustment and short run coefficients are equal for each country (cross-section unit) as well. Since, according to strict DFE estimator, all coefficients have the right sign and are comparable in magnitude with the coefficients resulting from PMG estimator for each country in a panel, it can be concluded that the model according to PMG estimator is robust (details of estimators MG, PMG and DFE can be found in Blackburne and Frank, 2007).

previous research described in the paper (e.g. Banes et al., 2013; Cacciatore, Duval and Fiori, 2012) which point out that the benefits of labour market reforms are seen only in the long run.

Finally, we can also conclude that, since they are among the more "painful" reforms due to their short term costs, labour market reforms should be the responsibility of all the key actors: governments, the business community, employees and trade unions. In fact, just like every reform, labour market reforms produce winners (in the long run) and losers (in the short run), and policy makers are sometimes not even aware of the widespread resistance to reforms. This resistance could stem from the lack of understanding of why a specific reform should be implemented. The issue of how to ensure political support for reforms by taking into account the results of econometric analysis conducted in this paper is seen as one of the pathways for future research in this complex area.

APPENDIX

TABLE A1

Data sources and expected signs

Variable	Variable description	Data source	Expected sign
BDP pc	GDP per capita (nominal prices)	World Economic Outlook	Positive
Lm_reg	Proxy variable for labour market reform (labour market regulation)	Economic Freedom of the World (Fraser Institute)	Negative in short run, positive in long run
crisis	Dummy variable for economic crisis (gap between the real and potential GDP per capita)	AMECO	Negative
Ind_pro	Industrial production (industrial production index; processing industry)	Eurostat	Positive
Act_r	Rate of activity (15-64)	Eurostat	Positive

Source: Calculation of the authors.

TABLE A2

Results of panel unit-root tests

Variable		Method	Prob.*	Obs.
BDP_pc_{it}	Constant and trend	Levin, Lin & Chu t	0.0000	280
		Im. Pesaran and Shin W-stat	0.7383	280
		ADF-Fisher Chi-square	0.9732	280
		PP-Fisher Chi-square	0.9977	308
lm_reg_{it}	Constant and trend	Levin, Lin & Chu t	1.0000	298
		Im. Pesaran and Shin W-stat	1.0000	298
		ADF-Fisher Chi-square	1.0000	298
		PP-Fisher Chi-square	1.0000	300
Ind_pr_{it}	Constant and trend	Levin, Lin & Chu t	0.0000	299
		Im. Pesaran and Shin W-stat	0.8610	299
		ADF-Fisher Chi-square	0.9051	299
		PP-Fisher Chi-square	0.9302	308
act_r_{it}	Constant and trend	Levin, Lin & Chu t	0.0000	267
		Im. Pesaran and Shin W-stat	0.3089	267
		ADF-Fisher Chi-square	0.1383	267
		PP-Fisher Chi-square	0.8899	278

** probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality. Im, Pesaran and Shin, ADF-Fisher and PP-Fisher test-Null Hypothesis: Unit Root (Individual Unit Root process), Levin, Lin & Chu Test-null Hypothesis: Unit Root (common Unit Root process). Automatic lag length selection based on Schwarz Criterion and Barlett Kernel.*

Source: Calculation of the authors.

TABLE A3

Results of panel cointegration tests

Test	Nul hypothesis	Alternative hypothesis	Test statistic	p-value
Westerlund	No cointegration	All panels contain EC	Gt	0.00
			Ga	0.00
		At least one panel unit is cointegrated	Pt	0.00
			Pa	0.00

Source: Calculation of the authors.

TABLE A4

PMG estimates of effects of the labour market reforms on GDP per capita for the EU-28 panel

Variable	Panel EU-28
Long run coefficients	
lm_reg	0.251** [0.017]
crisis	-0.581** [0.114]
Ind_pro	1.290** [0.074]
act_r	0.022** [0.008]
Short run coefficients	
Adjustment coefficient	-0.357** [0.054]
Δ*Ind_pro*	-0.336 [0.421]
Δ*lm_reg*	-0.0375* [0.021]
Δ*act_r*	0.028 [0.091]
constant	-1.553** [0.247]
Hausman specification test	
Chi square test statistics	0.51 [0.97][a]

[a] *p-value is given in parenthesis and it denotes that on 0.05 significance level the null hypothesis cannot be rejected, so the parameters are homogeneous in the long run.*

*All equations include a constant term; standard errors are in brackets, p-value for Hausman specification test is in parenthesis; ***, **, * denote significance at 1, 5 and 10 percent significance level, respectively.*

Source: Calculation of the authors.

Table A5

PMG estimates of effects of the labour market reforms on GDP per capita for two sub-panels: EU-15 and NMS-13

Variable	EU-15	NMS-13
	PMG estimates of long run coefficients	
lm_reg	0.291*** [0.187]	0.074*** [0.019]
crisis	-0.362*** [0.104]	-0.523** [0.204]
Ind_pro	1.338*** [0.168]	1.720*** [0.063]
act_r	0.032** [0.014]	0.044** [0.010]
	PMG estimates of short run coefficients	
Adjustment coefficient	-0.295*** [0.046]	-0.442*** [0.087]
Δ*Ind_pro*	0.161 [0.154]	-0.939 [0.919]
Δ*lm_reg*	-0.071*** [0.019]	0.009 [0.035]
Δ*act_r*	0.002 [0.021]	0.042 [0.029]
constant	-1.639*** [0.273]	-2.945*** [0.596]
	Hausman specification test	
value	0.27 [0.99][a]	0.28 [0.99][b]

[a] *p-value is given in parenthesis and it denotes that on 0.05 significance level the null hypothesis cannot be rejected, so the parameters are homogeneous in the long run, so the model is specified correctly.*

[b] *p-value is given in parenthesis and it denotes that on 0.05 significance level the null hypothesis cannot be rejected, so the parameters are homogeneous in the long run.*

*All equations include a constant term; standard errors are in brackets, p-value for Hausman specification test is in parenthesis; ***, **, * denote significance at 1, 5 and 10 percent significance level, respectively.*

Source: Calculation of the authors.

TABLE A6

Robustness check of the baseline model – DFE estimator

	EU-28	EU-15	NMS-13
Adjustment coefficient	-0.522***	-0.256***	-0.724***
	[0.050]	[0.040]	[0.086]
Long run coefficients			
lm_reg	0.178***	0.209***	0.145***
	[0.036]	[0.036]	[0.053]
crisis	-0.0354	-0.389***	0.065
	[0.102]	[0.114]	[0.156]
Ind_pro	1.321***	0.400	1.721***
	[0.197]	[0.270]	[0.247]
act_r	0.039**	0.059***	0.007
	[0.018]	[0.019]	[0.024]
Short run coefficients			
Δ*Ind_pro*	-0.174	0.198*	-0.608*
	[0.179]	[0.104]	[0.331]
Δ*lm_reg*	-0.061	-0.041***	-0.047
	[0.025]	[0.014]	[0.046]
Δ*act_r*	0.011	0.009	0.021
	[0.017]	[0.010]	[0.029]
constant	-2.822	-0.691	-3.469**
	[0.788]	[0.431]	[1.634]
Number of observations	299	163	136
Number of cross-section units	28	15	13

Source: Calculation of the authors.

REFERENCES

1. Aleksynska, M., 2014. Deregulating labour markets: How robust is the analysis of recent IMF working papers? *Conditions of Work and Employment Series*, No. 47. Geneva: International Labour Office.
2. Alesina, A., Ardagna, S. and Trebbi, F., 2006. Who adjusts and when? On the political economy of reforms. *IMF Staff Papers*, 53(Special Issue).
3. AMECO. Available at: <http://ec.europa.eu/economy_finance/db_indicators/ameco/index_en.htm>.
4. Arpaia A. [et al.], 2007. Quantitative assessment of structural reforms: Modelling the Lisbon strategy. *Industrial Policy and Economic Reforms Papers*, No. 5.
5. Babetskii, I. and Campos, N. F., 2007. Does Reform Work? An Econometric Examination of the Reform-Growth Puzzle. *IZA Discussion Paper*, No. 2638.
6. Bahovec, V. and Erjavec, N., 2009. *Uvod u ekonometrijsku analizu*. Zagreb: Element.
7. Barnes, S. [et al.], 2013. The GDP Impact of Reform: A Simple Simulation Framework. *OECD Economics Department Working Papers*, No. 834. Paris: OECD Publishing.
8. Bergsten, C. F. and Williamson, J., 1994. "Introduction" in J. Williamson, ed. *Political Economy of Policy Reform*, pp. 1-8. Washington, DC: Institute for International Economics.
9. Blackburne, E. F. and Frank, M. W., 2007. Estimation of nonstationary heterogeneous panels. *The Stata Journal*, 7(2), pp. 197-208.
10. Bouis, R. [et al.], 2012. The Short-Term Effects of Structural Reforms: An Empirical Analysis. *OECD Economics Department Working Papers*, No. 949. Paris: OECD.
11. Bouis, R. and Duval, R., 2011. Raining Potential Growth After the Crisis: A Quantitative Assessment of the Potential Gains from Various Structural Reforms in the OECD Area and Beyond. *OECD Economics Department Working Papers*, No. 835. Paris: OECD.
12. Buti, M. [et al.], 2010. Reforms and Re-Elections in OECD Countries. *Economic Policy*, 25(61), pp. 61-116. doi: 10.1111/j.1468-0327.2009.00237.x
13. Cacciatore, M., Duval, R. and Fiori, G., 2012. Short-Term Gain or Pain? A DSGE Model-Based Analysis of the Short-Term Effects of Structural Reforms in Labour and Product Markets. *OECD Economics Department Working Papers*, No. 948. Paris: OECD.
14. Chang, H., 2011. Institutions and economic development: theory, policy and history. *Journal of Institutional Economics*, 7(4), pp. 473-498. doi: 10.1017/S1744137410000378
15. Drazen, A. and Easterly, W., 2001. Do Crises Induce Reform? Simple Empirical Tests of Conventional Wisdom. *Economics and Politics*, 13(2), pp. 129-157. doi: 10.1111/1468-0343.00087

16. Duval, R. and Elmeskov, J., 2006. The Effects of EMU on Structural Reforms in Labor and Product Markets. *ECB Working Paper*, No. 596.
17. ECB, 2012. *Euro Area Labour Markets and the Crisis*. *Structural Issues Report*. Bruxelles: ECB.
18. Economic freedom of the world. Available at: <http://www.freetheworld.com/>.
19. Engle, R. F. and Granger, C. W. J., 1987. Co-integration and error correction: representation, estimation and testing. *Econometrica*, 55(2), pp. 251-76. doi: 10.2307/1913236
20. European Commission, 2013. *European Competitiveness Report: Towards Knowledge-Driven Reindustrialisation*. Commission Staff Working Document SWD(2013)347 final, European Union.
21. European Commission, 2014. *Reindustrialising Europe – Member States' Competitiveness Report 2014*. Commission staff working document, SWD(2014) 278, A Europe 2020 Initiative, European Union.
22. Eurostat. Available at: <http://http://epp.eurostat.ec.europa.eu>.
23. Everaert, E. and Schule, W., 2008. Why It Pays to Synchronize Structural Reforms in the Euro Area Across Markets and Countries. *IMF Staff Papers*, 55(2). doi: 10.1057/imfsp.2008.6
24. Gomes, S. [et al.], 2011. Structural Reforms and Macroeconomic Performance in the Euro Area Countries: A Model-based Assessment. European Central Bank. *Working Paper*, No. 1323.
25. Gwartney, J., Lawson, R. and Block, W., 1996. *Economic freedom of the world 1975-1995*. Vancouver, BC: Fraser Institute.
26. Hobza, A. and Mourre, G., 2010. Quantifying the potential macroeconomic effects of the Europe 2020 strategy: stylized scenarios. *ECFIN Economic Papers*, 424.
27. Høj, J. [et al.], 2006. An Empirical Investigation of Political Economy Factors Behind Structural Reforms in OECD Countries. *OECD Economic Studies*, No. 42.
28. IMF, 2004. *Fostering structural reforms in industrial countries*. World Economic Outlook. Advancing Structural Reforms.
29. LABREF, European Commission, Directorate General for Economic and Financial Affairs and Economic Policy Committee. Available at: <http://ec.europa.eu/economy_finance/db_indicators/labref/index_en.htm>.
30. OECD, 2008. Handbook on Constructing Composite Indicators: Methodology and User Guide. *OECD Statistics Working Paper*, STD/DOC (2005)3.
31. OECD, 2012. *OECD Economic Surveys Euro Area*. Paris: OECD.
32. Persyn, D. and Westerlund, J., 2008. Error Correction Based Cointegration – Tests for Panel Data. *Stata Journal*, pp. 8-2.
33. Pesaran, H., Shin, Y. and Smith, R. P., 1999. Pooled Mean Group Estimation of Dynamic Heterogeneous Panels. *Journal of the American Statistical Association*, 94, pp. 621-634. doi: 10.1080/01621459.1999.10474156

34. Pesaran, M. H. and Smith, R. P., 1995. Estimating Long-Run Relationships from Dynamic Heterogenous Panels. *Journal of Econometrics*, 68, pp. 79-113. doi: 10.1016/0304-4076(94)01644-F
35. Tompson, W. and Dang, T., 2010. Advancing Structural Reforms in OECD Countries: Lessons from Twenty Case Studies. *OECD Economics Department Working Papers*, No. 757.
36. Turrini, A. [et al.], 2014. A Decade of Labour Market Reforms in the EU: Insights from the LABREF Database. *IZA Policy Paper*, No. 88.
37. Westerlund, J., 2007. Testing for error correction in panel data. *Oxford Bulletin of Economics and Statistics*, 69, pp. 709-748. doi: 10.1111/j.1468-0084.2007.00477.x
38. World Bank, 2011. *Employment Protection Legislation and Labor Market Outcomes: Theory, Evidence and Lessons for Croatia. Croatia Policy Notes*. Washington: The World Bank Document.

Tax Reforms: Experiences and Perspectives

HELENA BLAŽIĆ, KATARINA OTT AND HRVOJE ŠIMOVIĆ (Eds.)
Institute of Public Finance, Zagreb, 2014, pp. 293

Book review by ANA GRDOVIĆ GNIP*[*]
doi: 10.3326/fintp.39.1.5

* Received: January 11, 2015
Accepted: January 20, 2015

Ana GRDOVIĆ GNIP, PhD
Juraj Dobrila University of Pula, Faculty of Economics and Tourism "Dr. Mijo Mirković", Preradovićeva 1/1, 52100 Pula, Croatia
email: agrdovic@unipu.hr

FINANCIAL THEORY AND PRACTICE
39 (1) 109-113 (2015)

Pursuing the maximization of revenue collection or public good provision, governments enact tax reforms. A tax reform can be addressed to improve the tax system or tax compliance (*fairness-oriented*), to tackle better macroeconomic performance (*growth-oriented*) or to reduce the incentive to take on debt (*sustainability-oriented*).

Since the country's independence, the Croatian tax system has undergone numerous tax changes, but it was with the tax reform enacted in 1994 that its foundations were laid. Marking its 20th anniversary in 2014, the Institute of Public Finance, the Faculty of Economics and Business Zagreb and Faculty of Economics Rijeka jointly organized a conference to discuss and understand the economic implications of tax reforms from different standpoints. The book entitled *Tax Reforms: Experiences and Perspectives*, edited by Helena Blažić, Katarina Ott and Hrvoje Šimović, is a collection of sixteen papers presented at the aforementioned conference held in Zagreb on June 20th, 2014. Beside the papers, the book contains a foreword written by the editors, the conference program, information about the organizers and a list of donors, making a total of 293 pages.

The sixteen papers are of a miscellaneous character and therefore the book is not organized into well-defined parts or sections. Some works discuss tax reform issues subject to one of the three main objectives – fairness, growth and sustainability, some present country case studies that detail a specific tax system before and after all the enacted reforms, while others show opinion survey results regarding the tax system and tax reforms. Accordingly, the review will try to cover the main results and conclusions of the majority of the papers without following the order presented in the book.

As previously mentioned, the 1994 tax reform is considered fundamental in the design of the modern Croatian tax system. The focal point of this reform was the introduction of consumption-based direct taxation (interest-adjusted personal and corporate income tax), a concept consistently implemented during the nineties. However, subsequent tax changes enacted in the 21st century reveal a switch, or a propensity to switch, to income-based direct taxation (saving-adjusted personal and corporate income tax). Challenged by that fact, as well as by the necessity objectively to evaluate the advantages and disadvantages of the two concepts, Šimović, Blažić and Štambuk (*Perspectives of tax reforms in Croatia: expert opinion survey*) conduct a broad opinion survey among Croatian experts. Their results indicate that experts from the academic sector are not particularly in favour of any of the direct taxation concepts, while experts from the government sector seem to prefer the income-based concept. Moreover, authors' results indicate that (all) experts in Croatia solve the traditional equity-efficiency trade-off in favour of equity, whereas the government sector (again) expresses higher social sensibility than academia.

FINANCIAL THEORY AND PRACTICE
39 (1) 109-113 (2015)

In a similar manner, Klun *(Slovenian experiences and lessons from tax reforms)* analyses the opinion of Slovenian experts about tax reform outcomes in Slovenia. She finds that all the experts are in great agreement that Slovenia's tax reforms were merely sustainability- rather than growth-oriented. As emphasized by Klun, it is interesting that all the experts point out that the effort to improve tax compliance falls down when it comes to the matter of enforcement and that the government is too loose with respect to tax avoidance, while being too hard with those willing to comply. Nerré, Dragojlović, Randjelović and Djenić (*Tax Reform in Serbia: experiences and perspectives*) suggest that reforming tax policy to improve sustainability and fairness or boost growth is worthless, if the tax administration stays unreformed. Although concentrating their analysis on the Serbian case, the authors pinpoint the fact that most of the transition economies focussed solely on tax policy reforms, neglecting the need to improve the tax administration at the same time. According to Nerré, Dragojlović, Randjelović and Djenić such a choice is positively correlated with the level of tax evasion and lack of transparency in transition economies.

Therefore, the fight against fraud and tax evasion presumes an efficient tax administration. Bronić and Bratić (*Can the efficiency of the Croatian tax authorities be improved?*) show that the efficiency level of tax authorities in Croatia improved in the 1997-2012 period. However, they proxy efficiency with the tax administration's costs-to-GDP ratio, which has to be distinguished from efficiency as measured in terms of the tax administrations' ability to detect and sanction tax evasion or to simplify tax compliance. Assessment of these is actually unfeasible, not only for Croatia, but also for most of the transition economies due to the insufficiency of statistical data. Nevertheless, finding an appropriate balance between tax avoidance and tax simplicity in practice proves to be difficult, especially if globalization and tax competition are brought into picture.

Gadžo and Klemenčić (*Time to stop avoiding the tax avoidance issue in Croatia? A proposal based on recent developments in the European Union*) show that Croatia can be considered an example that lacks a genuine and coherent anti-avoidance policy. They propose that as a first step Croatia should implement the so-called general anti-avoidance rule (GAAR) as endorsed by the European Commission. Gadžo and Klemenčić argue that GAAR, as a legislative framework, beside curbing tax avoidance, improves tax equity, tax efficiency and tax competitiveness. In contrast, Hybka (*Legislative proposal for controlled foreign companies regime in Poland from an international perspective*) writes that Poland introduced a number of measures to solve the tax avoidance problem. However, she finds the so-called controlled foreign company (CFC) legislation to be the most significant in controlling corporate income tax avoidance. Hybka explains that this measure applies to two specific groups of shareholders: those whose companies are located in countries using harmful tax competition, and those whose companies have registered offices in countries where passive income is taxed at a

FINANCIAL THEORY AND PRACTICE
39 (1) 109-113 (2015)

significantly lower rate than it would be if the shareholders' residence country tax rate is applied. Although she finds a number of benefits in this anti-avoidance measure, Hybka questions the overall net effect, fearing that the increased complexity of tax compliance could actually (again) favour tax avoidance.

Pendovska and Neshovska (*Tax reforms: experiences and perspectives – the case of the Republic of Macedonia*) show that the Macedonian tax system largely benefitted from the simplicity introduced with the flat tax reform: corporate income tax revenue in Macedonia grew much faster than planned and the enacted tax reforms provided significant economic stimulus to the private sector. Although focusing on personal income tax, Lazović-Pita (*Income, personal income tax and transition: case of Bosnia and Herzegovina*) shows that a flat tax system is the best solution for transition economies such as Bosnia and Herzegovina, at least during an "intermediate phase" before the enactment of a progressive income taxation system. She refers to the Slovak case, emphasizing that the move to a progressive income taxation is favourable only when the one percent of the wealthiest become visible.

The recent global economic crisis showed that a number of governments resorted to fiscal policies in stabilizing the economy, enacting thus growth- or sustainability-oriented tax reforms. Šimurina and Primorac (*The role of tax policy in the fiscal recovery of the European Union*) investigate the outcomes of tax policy measures implemented during the latest period of the Great Recession. They find that the tax measures enacted increased the overall tax burden in almost all EU member states. Moreover, Šimurina and Primorac show that income-, rather than consumption-taxation measures are more effective when the main objective is an increase in government revenues. Additionally, Jędrzejowicz and Sławińska (*Shifting from labour to consumption taxes: the impact on tax revenue volatility)* suggest that consumption (indirect) tax revenues are characterized by larger volatility, therefore shifting from income to consumption taxes increases the sensitivity of public finances to the business cycle.

Świstak, Wawrzak and Alinska (*In pursuit of tax progressivity: lessons from VAT rate structure adjustment in Poland*) seem to be in accord with Šimurina and Primorac. Namely, they argue that in Poland the increment in the standard VAT rate accompanied with the decrement in the reduced VAT rate only slightly improved the overall progressivity of the tax system, providing a minimal relief to the poor and a substantial subsidy to wealthier households. Świstak, Wawrzak and Alinska show that with a small change to the income tax structure the government could have secured more progressivity at a lower costs in terms of revenue foregone. On the other hand, Latvia's labour tax reform in response to the economic crisis served the targeted low-wage earners group (Šņucins and Kodoliņa-Miglāne in *Reform of Labour Taxes in Latvia*).

FINANCIAL THEORY AND PRACTICE
39 (1) 109-113 (2015)

Altogether, the book *Tax Reforms: Experiences and Perspectives* certainly makes a contribution to the better understanding of tax reforms in general. Since a tax reform, no matter what its objective, is always an economic and political issue, the book combines the economic arguments for a tax reform with political and legal aspects. The book's writing is not particularly difficult to read, but requires knowledge of basic economics and/or public sector economics. However, along with researchers, students and experts, the general public can also benefit from the practical approach of the book. From a reader's point of view three main strengths emerge: (1) the book gives a fairly good theoretical background for a variety of tax reform-related topics, (2) it discusses tax reform issues under the lenses of two important contemporary contexts: the great recession and the European Union, and (3) it gathers information about changes in the tax bases and/or tax rates for a notable number of (post)transition economies (Croatia, Slovenia, Bosnia and Herzegovina, Serbia, Macedonia, Poland and Latvia) in one place. On the other hand, both the enclosed papers and accordingly the book as a whole are very often short on empirical testing and proofs for given positive economics statements, or, if they are present, the robustness of the results remains uncertain. Moreover, a number of papers seem to stop where one expects them to actually begin, leaving the policy implications discussion rather scanty. To conclude, the book (and conference) aimed to (a) compare experiences, and (b) draw lessons from tax reforms in different countries. It is possible to conclude that the first goal has been successfully reached, while the second is still left open. Drawing lessons from tax reforms is an extremely ambitious multidisciplinary task since it involves not only economic, but also political, legal and social aspects, made all the more challenging by globalisation.

Editorial Office
Institute of Public Finance – Financial Theory and Practice
Smičiklasova 21, Zagreb, Croatia, P.O. BOX 320
phone: +385 (0)1 4886 444; 4819 363; fax: +385 (0)1 4819 365
web-site: www.fintp.hr; e-mail: fintp@ijf.hr

Subscription
Annual subscription amounts 400 kuna
Payments to account no. HR7024840081100661775, Institut za javne financije, Zagreb; quoting: subscription to Financial Theory and Practice, 2015

Printed in 115 copies

The journal comes out four times a year

The journal is co-financed by the Ministry of Science, Education and Sport of the Republic of Croatia

Computer typesetting and printing
Denona d.o.o., Zagreb, Marina Getaldića 1

Pursuant to the requirements of Article 34 Paragraph 3 of the Media Law (Official Gazette no. 59/2004, 84/2011, 81/2013), in 2014 the total income from sales of the journal Financial Theory and Practice was 32,380.80 kuna and the average print order was 115 copies.