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DEMAND FOR GOVERNMENT SPENDING: DO OUR BELIEFS ABOUT PUBLIC DEBT MATTER?

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Abstract: Macroeconomic expectations play a major role in predicting individual choices and behavior. This paper examines the effects of public debt expectations and knowledge on demand for government spending measured by individual preferences. Using a unique survey dataset applied in Central and Eastern Europe, the results show that the most knowledgeable citizens tend to support the increase in public spending. Debt expectations also have a significant impact on public spending preferences: citizens who have negative debt expectations are less likely to support public spending increases. The results shed light on the importance of economic knowledge and information provision for shaping public attitudes about future taxation.

JEL classification: D14, D91, H31, H53

Keywords: public spending preferences, public debt expectations, economic knowledge, CESEE, public finance

1. Introduction

Government spending increased drastically over the last decades triggering controversial debates about what drives the household demand for public expenditure (Hayo and Neumeier, 2019; Roth et al., 2021; Rudolph and Evans, 2005). Whether adaptive or rational, economic expectations are of central importance for how fast price adjustments occur in the business cycles. A great deal of theoretical studies focuses on modeling expectations, while limited research is provided by experimental or survey evidence. This letter contributes to the ongoing

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research efforts uncovering households' expectations about government spending. We focus on two main questions: (Q1) How do the public debt expectations impact the preferences for government spending? and (Q2) To what extent does the level of public debt knowledge contributes to citizens' preferences for future public spending?

Most of the empirical research emphasizes how knowledge about financial facts can shape citizens' opinions of fiscal policy, including spending preferences (Blinder and Krueger, 2004). Higher levels of financial knowledge allow citizens to rationally assess the costs and benefits of government spending, as well as the potential benefits of debt accumulation (Sargent, 2013). However, research on the topic is limited as individual decision-making process is susceptible to cognitive biases and bounded rationality (García, 2013). When attempting to predict their future behavior, citizens encounter a certain level of uncertainty, which is reflected in the degree of difference in expectations about the future state of a certain variable, such as inflation, GDP, exchange rates, or public debt.

Applied to public debt, positive or negative expectations reflect an attempt to understand the future behavior in terms of expenditure and saving (Mankiw et al., 2003; Montes et al., 2016). Despite the potential difficulty in comprehending fiscal policy, individuals tend to base their expectations on various economic indicators, irrespective of their level of awareness regarding public debt. For instance, if they notice a rise in public investments or financial assistance during a particular period, it may result in pessimistic anticipations about taxes in the subsequent period. This interpretation is supported by a large number of papers studying how households react to fiscal shocks (Hayo and Neumeier, 2019; Shapiro and Slemrod, 2009). It is argued that citizens who are worse off are more open to living at the expense of future generations. In this sense, politicians may be inclined to spend more today than adopt a long-term perspective on. However, the role of expectations and knowledge opens multiple strategic possibilities for policymakers to model a game focused on public finance sustainability. Although restrictive to a geographical area and timespan, this letter brings region-specific evidence for how policymakers could improve public perception measurement tools to improve public budgeting.

The remaining of this paper is structured as follows. In the next section, we briefly review the literature on government spending focusing on public debt knowledge and public debt expectations. Section 3 presents the dependent and independent variables of the analysis and the empirical strategy employed for testing our hypotheses. Section 4 presents the results of the ordered probit regression models, while Section 5 discusses the findings of empirical analysis aimed at explaining the relationship between public spending preferences and public debt knowledge and expectations and concludes by presenting further research directions.

2. Related literature

The rapidly increased in government spending and the controversial debates of what drives the household demand for public expenditure, created room for mixed empirical evidence. Several studies sustain the role of electoral cycles in influencing budgetary and political decisions because incumbent seeking re-election manipulate economic policies before elections (de Haan and Klomp, 2013; Dubois, 2016; Philips, 2016; Rogoff, 1988). Going further, other studies investigated the importance of the ideological orientation of the government on the budget size and

on the composition of the public spending. Herwartz and Theilen (2014) emphasize that the ideological behaviour of politicians plays an important role in explaining the short-term dynamics of social spending. For instance, Potrafke (2011) argues that left-wing governments tend to spend more on public services and education than the right-wing ones (Potrafke, 2011). To attract voters from low income environment left-wing parties favour policies that redistribute income from citizens with higher income to the one with lower income (Herwartz and Theilen, 2017). In contrast, right – wing parties promote policies that deregulate the public sector and reduce public expenditure (Herwartz and Theilen, 2017).

The differences between right – wing and left – wing governments lead to the development of empirical evidence focusing on the individual behaviour of citizens. According to the literature, citizens are fiscally conservative, despise government debt, and favor balanced budgets. (Alesina et al., 2019; Arias and Stasavage, 2019; Bansak et al., 2021; Barnes and Hicks, 2022; Stix, 2013). Citizens support governments' efforts to reduce the public deficit and debt without applying electoral penalties for governments that follow restrained fiscal policies (Alesina et al., 2019; Arias and Stasavage, 2019; Brender et al., 2008; Giger and Nelson, 2011; Kalbhenn and Stracca, 2020). In contrast, other recent empirical evidence shows that citizens normally support government expenditure (Bremer and Bürgisser, 2022). When citizens resist tax and spending increases, governments become less popular and incumbents' chances of winning elections are harmed. (Bojar et al., 2022; Fetzer, 2019; Hübscher et al., 2021; Jacques and Haffert, 2021). Therefore, the literature agrees on the existence of a correlation between government expenditure and government debt, but the magnitude of its determinants is still an ongoing debate.

According to several studies, the average citizens assesses fiscal policies based on their costs and benefits, as well as their temporal proximity. (Campbell, 2012; Soss and Schram, 2007). Public debt is more of an abstract concept to the average citizen than taxes, which they regularly pay, or government spending on public goods and services, which they frequently utilize or receive. The cost of government debt to the general population is negligible when compared to other aspects of fiscal policy. Only when countries face a sovereign debt crisis, the costs of debt increase, and citizens directly feel adverse economic consequences. In all other cases, the average citizen's income is not much impacted by government debt, thus they shouldn't be overly concerned about it. According to the Ricardian equivalence theorem, other studies present public debt as a form of future taxation. However, we know from the literature on intertemporal trade-offs that citizens are myopic (Jacobs, 2011): when people evaluate government policies, they give less weight to long-term consequences than those that emerge in the short term. Hence, it is reasonable to assume that budgetary decisions that affect current costs and benefits have a larger impact on citizens' priorities than budgetary decisions affecting future costs and benefits. They should not care very much about public debt, especially when governments face low borrowing costs due to low interest rates (Blanchard, 2019). In this context the debate about whether citizens support the increase in public spending during periods of high public debt levels is ongoing.

We weigh in on these debates by explicitly studying citizens' debt expectations and the level of debt knowledge as one of the main determinants of individual public spending preferences. We contribute to a literature on the role of

citizens' expectations about public debt and on the role of citizens' knowledge about public debt in determining their preferences for government spending. Several studies investigated the determinants of public spending preferences. However, restrained research has been undertaken on these topics as the measurement of debt knowledge and expectations lacks uniformity and clarity.

Empirical evidence argues that knowledge about economic and financial facts can shape citizens' opinion of financial policy (Blinder and Krueger, 2004). Higher levels of public debt knowledge allow citizens to accurately assess the costs of deficit financing. In an experimental study, Roth et al. (2021) concluded that most people are not able to appreciate the level of debt in their country, but once they are informed about the actual amount of debt, they turn less supportive about government spending (Roth et al., 2021). In a similar study, Hayo and Neumeier (2019) find out that economic well-being, trust in politicians, economic knowledge, time and party preferences are all statistically significant related to public spending preferences. In our article, we employ three questions in order to test the respondents' debt knowledge. We ask about (1) the constant increase of public debt over the past 10 years (i.e., since the outbreak of the global financial crisis in 2008/2009), (2) how high is the public debt (% of GDP), and (3) higher public debt levels make it possible to conduct necessary investments today (e.g., into public infrastructure like schools and streets). In the subsequent empirical analysis, we construct an index for the number of correct answers to assess the individual level of public debt knowledge. We expect that those with higher knowledge are more debt averse, as they have a better understanding of the costs of public debt.

Regarding the association of public debt expectations and public spending preferences, we form our hypothesis based on the literature on economic expectations formation. Expectations regarding public debt show an effort to comprehend how people would behave in the future regarding spending and saving, as public debt serves as a warning sign for potential future taxation. Even though it may be difficult to envision that people understand fiscal policy from a theoretical perspective, they may shape their expectations according to different economic variables regardless of their awareness about public debt: observing increased public investments or aid in one period may lead to increased negative about taxation in the next period of time. Because people tend to act on the knowledge they have, at least when they believe it to be reasonably correct, the future evaluation of economic situations by citizens may also be significant. On the one hand, a citizen may be more open to accept the accumulation of public debt if they perceive that debt servicing expenses or the prior year's deficit are minimal. On the other hand, a citizen may be more likely to favor fiscal consolidation if they believe that the government is spending excessively.

3. Methodology

We rely on individual data from the 2018 wave of the Euro Survey project of the Austrian Central Bank (OeNB). The survey collected information from households in 6 EU member countries (Bulgaria, Croatia, Poland, Romania, Czech Republic, and Hungary). Our dataset includes a sample of 6,035 individuals, aged 18 and over. Detailed descriptive statistics are presented in Table A1 and details about variables' measurement in Table A2 from Appendix A. We also present graphically the sample's distribution of answer (%) in terms of preferences for public spending priorities (Appendix B).

As an empirical strategy, we estimate an ordered probit regression. We control for several other factors and we estimate several checks to emphasize the robustness of our results. To account for country differences, we applied a jackknife test (Eller et al., 2021). We alternatively apply probit and logit regression models (Appendix C).

Considering expectations as a gathering instrument of available information, we anticipate that citizens with negative debt expectations are less likely to support the increase in public spending than citizens with positive debt expectations (Mankiw et al., 2003; Montes et al., 2016). We expect that those with higher debt knowledge are not necessarily against the increase in public spending, as they have a better understanding of the costs and benefits of debt accumulation (Sargent, 2013).

4. Results

This section presents the results. First, we include only the socio-economic characteristics (Table 1, Model 1). The results reveal that higher educated respondents are less likely to support an increase in public spending compared to those with lower education levels. Likewise, individuals responsible for managing household finances as well as parents are about 1.2 p.p and 0.8 p.p less likely to support an increase in public spending. The results indicate a preference for short-term fiscal consolidation and support for honoring outstanding debt. This brings more evidence to the theoretical literature uncovering intragenerational elements of fiscal policy (Hayo and Neumeier, 2019). Our findings suggest an altruistic perspective: individuals do not want to create a burden for future generations.

Table 1. Baseline models

Public spending preferences	**(1)**	**(2)**	**(3)**	**(4)**
Socio-economic characteristics				
Gender: Female	-0.0022	-0.0007	0.0005	-0.0012
	(0.0037)	(0.0037)	(0.0038)	(0.0037)
Age	-0.0001	-0.0001	-0.0001	-0.0000
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Education (primary)	0.0096	0.0100	0.0108	0.0050
	(0.0070)	(0.0070)	(0.0070)	(0.0069)
Education (tertiary)	-0.0085*	-0.0103**	-0.0103 **	-0.0045
	(0.0049)	(0.0049)	(0.0050)	(0.0049)
Income (low)	-0.005	-0.0052	-0.0026	0.0015
	(0.0054)	(0.0054)	(0.0054)	(0.0054)
Income (high)	-0.0009	-0.0021	-0.0051	-0.0040
	(0.0060)	(0.0060)	(0.0060)	(0.0060)
Head of the household	-0.0127***	-0.0124***	-0.0134***	-0.0146***
	(0.0041)	(0.0040)	(0.0041)	(0.0042)

Public spending preferences	**(1)**	**(2)**	**(3)**	**(4)**
Employed	-0.001	-0.0016	-0.0028	-0.0019
	(0.0039)	(0.0039)	(0.0039)	(0.0039)
Having children	-0.0089**	-0.0090**	-0.0084*	-0.0093**
	(0.0040)	(0.0040)	(0.0041)	(0.0041)
Exploratory variables				
Debt knowledge (1/0)		0.0236***	0.0231***	0.0190 ***
		(0.0652)	(0.0055)	(0.0055)
Debt expectations (negative)			-0.0476***	-0.0387***
			(0.0052)	(0.0055)
Debt expectations (positive)			0.0061	0.0045
			(0.0125)	(0.0125)
Control variables				
Financial expectations			-0.0030	-0.0021
			(0.0039)	(0.0040)
Current financial situation			-0.0012	-0.0100**
			(0.0040)	(0.0042)
Trust in Government (high)				-0.0036
				(0.0053)
Trust in Government (low)				-0.0055
				(0.0046)
Economic interest				-0.0155***
				(0.0049)
Political interest				-0.0034
				(0.0049)
Public service delivery satisfaction				0.0485***
				(0.0079)
Nagelkerke	0.025	0.031	0.059	0.089
LogLik	-5421.47	-5405.183	-5330.947	-5250.345
Observations	5,988	5,988	5,988	5,988

Note: Average marginal effects with standards errors in parentheses;
*p<0.1; **p<0.05; ***p<0.01

Second, we gradually include our exploratory variables: public debt knowledge and public debt expectations (Model 2), followed by two groups of control variables. The results indicate a negative association between negative debt expectations and public spending increases: a respondent with negative expectations is around 4 p.p

less likely to support the increase in public spending. While the previous results suggest a policy reliance on intragenerational preferences, these findings indicate the existence of a credibility constraint for policy elaboration: the intended consequences of fiscal policy could be hindered through an expectations-resource channel.

Moreover, the model testing for public debt knowledge indicates a positive and significant association between a higher level of public debt knowledge and an increase in public spending preferences: individuals with higher levels of public debt knowledge are around 2 p.p more likely to support the increase in public spending. This suggests the formation of rational expectations as debt accumulation allows governments to increase spending. In contrast to other findings describing how debt awareness leads to preferences for lower levels of government spending (Roth et al., 2021), our findings open the door for multiple strategic interactions between policymakers and individuals at different points in time. On the one hand, individuals consider themselves richer than they acutally are when government accumulates debt, phenomen known as Ricardo illusion. Debt illusion does not necessarily imply the absence of awareness regarding future tax liabilities. Even if individuals understand that a current increase in assets will create future repayments, 'they entertain an illusion of wealth where a temporary increase in assets' value is preferred over taxation (Döring and Oehmke, 2019). On the other hand, financially literate individuals are able to reason about macroeconomics depending on specific cognitive abilities (Lin and Bates, 2022). For the link between public debt and economic growth, we test if individuals with higher levels of public debt knowledge understand the sustainability of public debt.[1] The results from Appendix D indicate that, indeed, individuals understand how prudent public debt level can lead to economic growth, in turn, increasing the support for public spending.

Additionally, we include several control factors. Having an interest in economics is negatively associated with the support for an increase in public spending. Surprisingly, trust in government and interest in politics do not have any significant impact on public spending preferences. As expected, respondents with higher satisfaction towards public services' delivery are 4 p.p more likely to support the increase in public spending preferences.

As perceptions of economic consequences re-enter the public policy cycle through individual policy preferences, we estimate how the various factors explain households'preferences for spending increases in various policy areas (Table 2). The model estimates are similar to the previous ones. For instance, respondents who perceive themselves as being financially better – off in the future are less likely to support the increase in public spending for infrastructure, compared to other policy areas.

[1] We estimate ordinal probit models separately (Appendix D) for countries that maintain a normal debt level (below 60% of GDP as imposed by the Maastricht) or an excedentary debt level (above 60% of GDP). Only Hungary and Croatia have a debt level above Maastricht threshold.

Table 2. Preferences for government spending on policy area

Public spending preferences	Social security	Infrastructure	Education	Health	Defense	Development
Debt knowledge (1/0)	0.0184*** (0.0047)	0.0139*** (0.0046)	0.0097*** (0.0028)	0.0071*** (0.002)	0.0195*** (0.0073)	0.0182*** (0.0045)
Debt expectations (negative)	-0.0327*** (0.0051)	-0.0168*** (0.0038)	-.0209*** (0.0033)	-0.0231*** (0.004)	-0.0347*** (0.0063)	-0.0323*** (0.0047)
Debt expectations (positive)	-0.0010 (0.0096)	0.0078 (0.0105)	-0.0021 (0.0059)	0.0018 (0.006)	0.0065 (0.0179)	-0.0044 (0.0093)
Trust government (low)	0.0013 (0.0040)	-0.0054 (0.0039)	-0.0051** (0.0023)	0.0051* (0.003)	0.0016 (0.0067)	-0.0038 (0.0035)
Trust government (high)	-0.0083** (0.0042)	-0.0034 (0.0045)	-0.0027 (0.0026)	-0.0026 (0.0028)	-0.0107 (0.0074)	-0.0034 (0.0040)
Public services satisfaction	0.0373 *** (0.0067)	0.0365*** (0.0065)	0.0306*** (0.0052)	0.0275*** (0.0054)	0.0222*** (0.0072)	0.0381*** (0.0064)
Economic interest	0.0053 (0.0041)	-0.0110*** (0.0042)	-0.0021 (0.0024)	-0.0049* (0.0027)	-0.0133** (0.0067)	-0.0099*** (0.0038)
Political interest	-0.0053 (0.0040)	-0.0042 (0.0041)	-0.0013 (0.0025)	0.0031 (0.0028)	-0.0146** (0.0068)	-0.0031 (0.0037)
Economic expectations	0.0054 (0.0036)	-0.0075** (0.0035)	-0.0008 (0.0021)	0.003 (0.0023)	-0.0047 (0.0058)	0.0034 (0.0033)
Current economic situation	0.0125*** (0.0041)	0.0034 (0.0036)	-0.0005 (0.0021)	0.0018 (0.0024)	0.0095** (0.0060)	-0.0017 (0.0032)
Nagelkerke	0.114	0.060	0.134	-3203.195	0.039	0.109
LogLik	-4245.976	-4910.402	-4043.597	0.121	-5801.773	-4658.687
Observations	5,988	5,988	5,988	5,988	5,988	5,988

Note: Average marginal effects with standards errors in parentheses;
*p<0.1; **p<0.05; ***p<0.01

Before concluding, we also highlight some observed shortcomings of our study and some potential directions for further research. First, the study is based on a survey dataset conducted in Central and Eastern Europe, which may not be generalizable to other regions. Future research could employ a larger and more diverse sample to increase the generalizability of the findings. Second, the study only measures individual preferences for government spending and does not account for actual behavior. It is possible that there may be discrepancies between what individuals claim to prefer and what they actually do when faced with actual policy decisions. Examine the actual behavior of individuals in response to government spending policies can provide a more accurate representation of public spending preferences. Future studies may consider exploring this approach. Moreover, as the study highlights the importance of economic knowledge and information provision in

shaping public attitudes about future taxation, further research can explore effective ways of disseminating economic information to the public. This can include examining the role of media and educational programs in improving public economic literacy.

Despite its limitations, the article offers valuable insights. On one hand, we contribute to the ongoing debate about whether public debt has negative or positive impact on government spending, and in consequence if citizens with negative debt expectations should be more or less likely in favour of increase government spending. Our findings strengthen the empirical evidence of previous research that positive (negative) debt expectations are strongly and positively (negatively) associated with increase (decrease) in public spending. On the other hand, the results extend the literature by showing, contrary to recent empirical evidence, that most knowledgeable citizens tend to support more the increase in public spending compared to citizens having a low level of public debt knowledge.

5. Conclusions

The role of expectations has been extensively acknowledged in the theoretical literature. In this paper, we contribute to the growing efforts to understand, from an empirical standpoint, the effects of expectations on citizens' demand for government spending. Although survey measurements on expectations are prone to misapprehension, they are a good method to practically evaluate individuals' beliefs opening doors for designing efficient policy communication tools.

We contribute to the literature in two respects. First, we improve the existing studies by providing survey evidence on fiscal expectations. Second, we bring insights into the role of knowledge in shaping citizens' demand for public spending. Our results indicate the existence of a debt illusion showing the importance of increasing, through other policy tools, individuals' economic knowledge and abiltities to understand macroeconomic complexity.

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References

Alesina, A., Favero, C., Giavazzi, F. (2019) Effects of Austerity: Expenditure- and Tax-based Approaches, Journal of Economic Perspectives, 33(2), 141 - 162

Arias, E., Stasavage, D. (2019) How Large Are the Political Costs of Fiscal Austerity?, The Journal of Politics, 81, 1517–1522

Bansak, K., Bechtel, M.M., Margalit, Y. (2021) Why Austerity? The Mass Politics of a Contested Policy, American Political Science Review, 115, 486–505

Barnes, L., Hicks, T. (2022) Are Policy Analogies Persuasive? The Household Budget Analogy and Public Support for Austerity, British Journal of Political Science, 52, 1296–1314

Blanchard, O. (2019) Public Debt and Low Interest Rates, American Economic Review, 109, 1197–1229

Blinder, A.S., Krueger, A.B. (2004) What Does the Public Know about Economic Policy, and How Does It Know It?, NBER Working Paper 10787

Bojar, A., Bremer, B., Kriesi, H., Wang, C. (2022) The Effect of Austerity Packages on Government Popularity During the Great Recession, British Journal of Political Science, 52, 181–199

Bremer, B., Bürgisser, R. (2022) Do citizens care about government debt? Evidence from survey experiments on budgetary priorities, European Journal of Political Research, 62, 239 - 263

Brender, A., Drazen, A., Lach, S., Klor, E. (2008) How do budget deficits and economic growth affect reelection prospects? Evidence from a large panel of countries, American Economic Review, 2203–2220

Campbell, A.L. (2012) Policy Makes Mass Politics, Annual Review of Political Science, 15, 333–351

de Haan, J., Klomp, J. (2013) Conditional political budget cycles: a review of recent evidence, Public Choice, 157, 387–410

Döring, T., Oehmke, R.D. (2019) About the Economic Psychology of Public Debt, Intereconomics, 297–303

Dubois, E. (2016) Political business cycles 40 years after Nordhaus, Public Choice, 166, 235–259

Eller, M., Jovanovic, B., Scheiber, T. (2021) What do people in CESEE think about public debt?, Focus on European Economic Integration, 35–58

Fetzer, T. (2019) Did Austerity Cause Brexit?, American Economic Review, 109, 3849–86

García, M.J.R. (2013) Financial Education and Behavioral Finance: New Insights into the Role of Information in Financial Decisions, Journal of Economic Surveys, 27, 297–315

Giger, N., Nelson, M. (2011) The electoral consequences of welfare state retrenchment: Blame avoidance or credit claiming in the era of permanent austerity?: the electoral consequences of welfare state retrenchment, European Journal of Political Research, 50, 1–23

Hayo, B., Neumeier, F. (2019) Public Preferences for Government Spending Priorities: Survey Evidence from Germany, German Economic Review, 20, e1–e37
Herwartz, H., Theilen, B. (2017) Ideology and redistribution through public spending, European Journal of Political Economy 46, 74–90
Hübscher, E., Sattler, T., Wagner, M. (2021) Voter Responses to Fiscal Austerity, British Journal of Political Science, 51, 1751–1760
Jacobs, A.M. (2011) Governing for the Long Term: Democracy and the Politics of Investment, Cambridge University Press
Jacques, O., Haffert, L. (2021) Are governments paying a price for austerity? Fiscal consolidations reduce government approval, European Political Science Review, 13, 189–207
Kalbhenn, A., Stracca, L. (2020) Mad about Austerity? The Effect of Fiscal Consolidation on Public Opinion, Journal of Money, Credit and Banking, 52, 531–548
Lin, C.-A., Bates, T.C. (2022) Smart people know how the economy works: Cognitive ability, economic knowledge and financial literacy, Intelligence 93, 101667
Mankiw, N.G., Reis, R., Wolfers, J. (2003) Disagreement about Inflation Expectations. NBER Macroeconomics Annual 18, 209–248
Montes, G.C., Oliveira, L.V., Curi, A., Nicolay, R.T.F. (2016) Effects of transparency, monetary policy signalling and clarity of central bank communication on disagreement about inflation expectations, Applied Economics 48, 590–607
Philips, A.Q. (2016) Seeing the forest through the trees: a meta-analysis of political budget cycles, Public Choice, 168, 313–341
Potrafke, N. (2011) Does government ideology influence budget composition? Empirical evidence from OECD countries, Econ Gov, 12, 101–134
Rogoff, K. (1988) NBER Working paper 44
Roth, C., Settele, S., Wohlfart, J. (2021) Beliefs about public debt and the demand for government spending, Journal of Econometrics, 231(1), 165-187
Rudolph, T.J., Evans, J. (2005) Political Trust, Ideology, and Public Support for Government Spending, American Journal of Political Science, 49, 660–671
Sargent, T.J. (2013) Rational Expectations and Inflation: Rational Expectations and Inflation, Princeton University Press, 3rd edition
Shapiro, M.D., Slemrod, J. (2009) Did the 2008 Tax Rebates Stimulate Spending?, American Economic Review, 99, 374–379
Soss, J., Schram, S.F. (2007) A Public Transformed? Welfare Reform as Policy Feedback, Am Polit Sci Rev, 101, 111–127.
Stix, H. (2013) Does the Broad Public Want to Consolidate Public Debt? - The Role of Fairness and of Policy Credibility: Does the Broad Public Want to Consolidate Public Debt?, Kyklos, 66, 102–129

Appendix A

Table A 1. Descriptive statistics

	Min/ Max	BG	CR	CZ	HU	PL	RO	Total
Public spending preferences	1/3	2.501	2.349	2.136	2.662	2.337	2.687	2.445
		(0.019)	(0.021)	(0.021)	(0.017)	(0.020)	(0.017)	(0.008)
Debt knowledge	0/1	0.095	0.061	0.099	0.256	0.181	0.090	0.130
		(0.009)	(0.008)	(0.009)	(0.014)	(0.012)	(0.009)	(0.004)
Debt expectations (positive)	0/1	0.014	0.008	0.049	0.037	0.016	0.015	0.023
		(0.003)	(0.003)	(0.007)	(0.006)	(0.004)	(0.004)	(0.002)
Debt expectations (negative)	0/1	0.818	0.761	0.390	0.515	0.654	0.846	0.664
		(0.012)	(0.013)	(0.015)	(0.016)	(0.015)	(0.011)	(0.006)
Debt expectations (moderate)	0/1	0.168	0.231	0.561	0.448	0.330	0.139	0.313
		(0.011)	(0.013)	(0.016)	(0.016)	(0.015)	(0.011)	(0.006)
Public satisfaction delivery	0/1	0.117	0.036	0.409	0.292	0.317	0.224	0.232
		(0.010)	(0.006)	(0.016)	(0.014)	(0.015)	(0.013)	(0.005)
Trust in government (low)	0/1	0.615	0.637	0.332	0.359	0.463	0.703	0.518
		(0.015)	(0.015)	(0.015)	(0.015)	(0.016)	(0.014)	(0.006)
Trust in government (medium)	0/1	0.165	0.238	0.312	0.299	0.235	0.149	0.233
		(0.011)	(0.013)	(0.015)	(0.014)	(0.013)	(0.011)	(0.005)
Trust in government (high)	0/1	0.220	0.125	0.356	0.342	0.302	0.147	0.249
		(0.013)	(0.010)	(0.015)	(0.015)	(0.014)	(0.011)	(0.006)
Economic interest	0/1	0.393	0.389	0.319	0.405	0.382	0.529	0.403
		(0.015)	(0.015)	(0.015)	(0.016)	(0.015)	(0.016)	(0.006)
Political interest	0/1	0.363	0.326	0.304	0.347	0.366	0.319	0.338
		(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.006)
Satisfaction with current financial situation	0/1	0.482	0.494	0.566	0.506	0.572	0.641	0.544
		(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.015)	(0.006)
Short-term financial expectations	0/1	0.364	0.481	0.400	0.425	0.456	0.610	0.456
		(0.015)	(0.016)	(0.015)	(0.016)	(0.016)	(0.015)	(0.006)
Gender	0/1	0.543	0.556	0.502	0.569	0.516	0.545	0.539

	Min/ Max	BG	CR	CZ	HU	PL	RO	Total
		(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.006)
Age	18/88	49.84	44.084	47.686	47.274	45.879	46.294	46.835
		(0.494)	(0.484)	(0.543)	(0.459)	(0.550)	(0.504)	(0.208)
Education (primary)	0/1	0.016	0.072	0.060	0.106	0.235	0.022	0.086
		(0.004)	(0.008)	(0.008)	(0.010)	(0.013)	(0.005)	(0.004)
Education (secondary)	0/1	0.728	0.722	0.807	0.770	0.591	0.770	0.731
		(0.014)	(0.014)	(0.012)	(0.013)	(0.015)	(0.013)	(0.006)
Education (tertiary)	0/1	0.256	0.206	0.133	0.124	0.174	0.209	0.184
		(0.014)	(0.013)	(0.011)	(0.010)	(0.012)	(0.013)	(0.005)
Income (low)	0/1	0.192	0.220	0.118	0.106	0.120	0.239	0.166
		(0.012)	(0.013)	(0.010)	(0.010)	(0.010)	(0.013)	(0.005)
Income (medium)	0/1	0.195	0.503	0.245	0.177	0.264	0.243	0.271
		(0.013)	(0.016)	(0.014)	(0.012)	(0.014)	(0.014)	(0.006)
Income (high)	0/1	0.088	0.096	0.123	0.153	0.117	0.107	0.114
		(0.009)	(0.009)	(0.010)	(0.011)	(0.010)	(0.010)	(0.004)
Head of the household	0/1	0.298	0.341	0.375	0.585	0.403	0.442	0.407
		(0.015)	(0.015)	(0.015)	(0.016)	(0.016)	(0.016)	(0.006)
Employed	0/1	0.483	0.520	0.588	0.664	0.460	0.492	0.534
		(0.016)	(0.016)	(0.016)	(0.015)	(0.016)	(0.016)	(0.006)
Having children	0/1	0.295	0.308	0.371	0.285	0.373	0.306	0.323
		(0.0140	(0.015)	(0.015)	(0.014)	(0.015)	(0.014)	(0.006)

Note: The table indicates the sample means and standard deviations of respective variables. Column *Total* refers to the entire sample of observations without adjusting for country size.

Table A 2. Description of the variables

Variable name	Measure
Public spending preferences	Six items measure the attitudes towards spending on social security, infrastructure, education, health, defense, and development. All six items were measured using a similar format in which respondents were asked whether the government should 'increase', 'maintain', or 'lower' the spending on a given policy. The final value of the variable is computed for each respondent as an average for all six questions. Responses are coded based on Likert intervals. Higher scores indicate support for greater spending.
Public debt expectations	Categorical variable taking three different values: "positive", "moderate", "negative". The variable is based on the four different questions: 1. "Higher public debt levels imply that I will have to pay more taxes in the future." 2. "Higher public debt levels imply that I will receive lower state pensions and/or lower welfare benefits in the future." 3. "The development of public debt over the past 10 years is worrisome." 4. "Public debt will increase strongly over the next 10 years." All questions are based on 6 points Likert scales. The final value of the variable is computed for each respondent as an average for all four questions.
Public debt knowledge	Dummy variable taking two values based on respondent's knowledge about public debt: "correct", and "incorrect". The values are coded as "correct" or "incorrect" based on the following question: 1. "Currently, how high is this percentage in your country?" The respondent hat to correctly identify the interval of public debt's level to be in the "correct" category. The interval of public debt level is verified by the actual level of debt knowledge in 2018 taken from World Bank database.
Short-term financial expectations	Dummy variable equal to one if the respondent expects a better financial situation over the next 12 months, zero otherwise.
Satisfaction with current financial situation	Dummy variable equal to one if the respondent is satisfied with his/ her current financial satisfaction, zero otherwise.

Variable name	Measure
Economic interest	Dummy variable equal to one if respondent states having an interest in economics. The variable is based on the following question: “I am very interested in economic questions.”
Politics interest	Dummy variable equal to one if respondent states having an interest in politics. The variable is based on the following question: “I am very interested in politics.”
Trust (high, medium, low)	Dummy variables are based on the following question (5 points Likert scale question): “How much you trust the government/ cabinet of ministers”? Omitted category: medium trust.
Public service delivery satisfaction	Dummy variable based on respondents’ answers to the following question: “How satisfied are you with the delivery of public services in these areas: a) social security (e.g., unemployment compensation, public pension, benefits for families and children) b) public infrastructure (e.g., road and town construction, railway network, public transport) c) Education (e.g., public kindergartens, schools, or universities) d) Health (e.g., public hospitals) e) Defence and public safety (e.g., police, justice system) f) Economic development (e.g., support for small- and medium-sized companies, investment allowances, financial support for disadvantaged regions)”. All questions are based on 6 points Likert scales. The final value of the variable is computed for each respondent as an average for all four questions.
Age	The age of the respondent.
Education (low, medium, high)	Dummy variables assessing the degree of education of each respondent (primary education level, secondary education level, primary education level). Omitted category: education medium
Employed	Dummy variable equal to one if respondent is employed, zero otherwise.
Female	Dummy variable equal to one if respondent is female, zero otherwise.
Manages HH finances	Dummy variable equal to one if respondent oversees managing household finances, zero otherwise.
Parent	Dummy variable equal to one if respondent has children, zero otherwise.
Income (high, medium, low, no answer)	Dummy variables which take value one for each net household income terciles (high, medium, low). For those respondents who did not give an answer an additional dummy variable is defined (refused income). Omitted category: income low

Appendix B

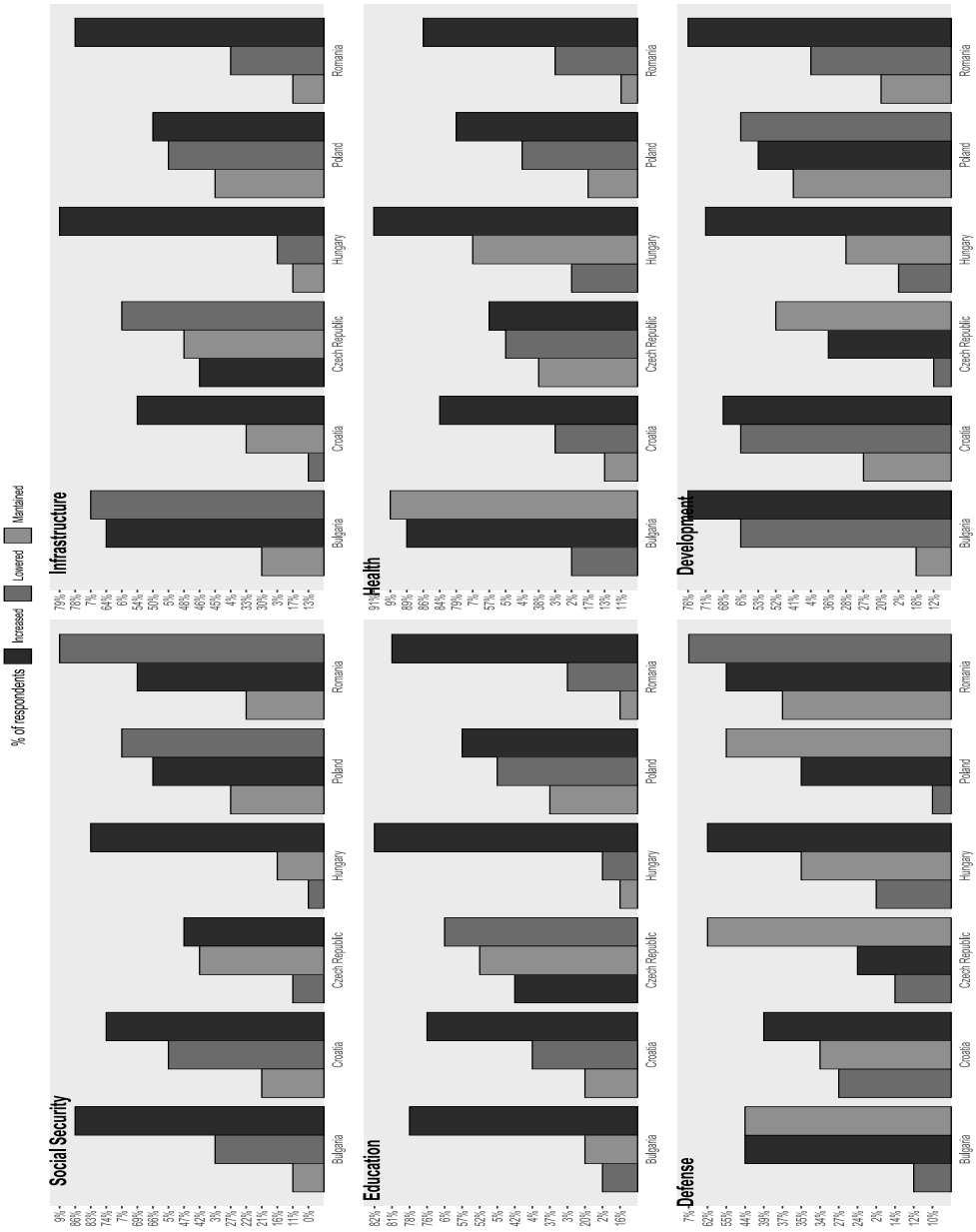

Figure B1. Preferences for public spending priorities – distribution of answer (%)
Source: OeNB Euro Survey 2018.Note: Respondents were asked:
In which areas should the level of state spending be increased,
maintained or lowered over the next 10 years?

Appendix C

Table C 1. Robustness by excluding each country at a time

Public spending preferences overall	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Gender: Female	-0.0038	-0.0031	-0.0024	-0.0040	-0.0018	-0.0018
	(0.0031)	(0.0033)	(0.0030)	(0.0034)	(0.0031)	(0.0031)
Age	-0.0003***	-0.0003***	-0.0002***	-0.0003***	-0.0002**	-0.0002***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Education (primary)	0.0096*	0.0111*	0.0131**	0.0207***	-0.0042	-0.0042
	(0.0056)	(0.0060)	(0.0058)	(0.0068)	(0.0069)	(0.0069)
Education (tertiary)	-0.0002	-0.0017	-0.0086**	-0.0075*	-0.0071*	-0.0071*
	(0.0042)	(0.0046)	(0.0044)	(0.0045)	(0.0042)	(0.0042)
Income (low)	0.0041	0.0003	-0.0051	-0.0043	0.0044	0.0044
	(0.0048)	(0.0049)	(0.0047)	(0.0048)	(0.0045)	(0.0045)
Income (high)	-0.0028	-0.0041	-0.0017	0.0084	-0.0016	-0.0016
	(0.0049)	(0.0053)	(0.0048)	(0.0056)	(0.0049)	(0.0049)
Head of the household	-0.0051	-0.0054	-0.0038	0.0044	-0.0049	-0.0049
	(0.0034)	(0.0036)	(0.0032)	(0.0038)	(0.0033)	(0.0033)
Employed	0.0009	-0.0002	-0.0004	0.0080**	0.0016	0.0016
	(0.0034)	(0.0036)	(0.0033)	(0.0041)	(0.0034)	(0.0034)
Having children	-0.0105***	-0.0063*	-0.0034	-0.0082**	-0.0048	-0.0048
	(0.0034)	(0.0036)	(0.0034)	(0.0037)	(0.0034)	(0.0034)
Debt knowledge (1/0)	0.0125 ***	0.0176***	0.0166***	0.0132	0.0110**	0.011***
	(0.0044)	(0.0050)	(0.0047)	(0.103)	(0.0044)	(0.0044)
Debt expectations	-0.0305***	-0.0372***	-0.0347***	-0.0130*	-0.0366***	-0.0026***
(negative)	(0.0049)	(0.0058)	(0.0056)	(0.098)	(0.0060)	(0.006)
Debt expectations	-0.0007	0.0028	0.0050	-0.0047	-0.0026	-0.0026
(positive)	(0.0096)	(0.0104)	(0.0091)	(0.101)	(0.0093)	(0.0039)
Future financial	-0.0007	-0.0007	-0.0035	-0.0488***	0.0003	0.0003
expectations	0.0034)	(0.0036)	(0.0033)	(0.094)	(0.0033)	(0.0033)
Current economic situation	-0.0065*	-0.0085**	-0.0042	0.021	-0.0107**	-0.0107***
	(0.0035)	(0.0037)	(0.0034)	(0.253)	(0.0036)	(0.0036)
Trust in Government (high)	-0.0055	-0.0039	-0.0060	-0.0038	-0.0082**	-0.0082
	(0.0042)	(0.0046)	(0.0041)	(0.118)	(0.0043)	(0.0043)
Trust in Government (low)	-0.0014	-0.0001	-0.0042	0.0048	-0.0050	-0.005
	(0.0039)	(0.0042)	(0.0038)	(0.114)	(0.0037)	(0.0037)
Economic interest	-0.0040	-0.0088**	-0.0075*	-0.0052	-0.0074*	-0.0074*
	(0.0041)	(0.0043)	(0.0040)	(0.119)	(0.0041)	(0.0041)
Political interest	-0.0066	-0.0040	-0.0014	-0.0180**	0.0013	0.0013
	(0.0041)	(0.0043)	(0.0040)	(0.119)	(0.0041)	(0.0041)
Public service delivery	0.0462***	0.0469***	0.0490***	0.0649***	0.0474***	0.0474***
satisfaction	(0.0080)	(0.0081)	(0.0087)	(0.0980	(0.0086)	(0.0086)
AIC	7569.937	7594.321	7118.317	7583.276	7120.225	6599.592
Nagelkerke	0.113	0.117	0.148	0.146	0.120	0.092
LogLik	-3761.968	-3774.16	-3536.158	-3768.638	-3537.112	-3276.796
Observations	5,035	5,028	5,035	5,035	5,018	5,024

Source: Authors' calculations based on OeNB Euro Survey 2018. Ordered probit models: Model (1): Excluding Romania from the sample. Model (2): Excluding Bulgaria from the sample. Model (3) excluding Czech Republic from the sample. Model (4): Excluding Hungary from the sample. Model (5): Excluding Poland from the sample.
Note: Average marginal effects with standards errors in parentheses;
*p<0.1;**p<0.05;***p<0.01

Table C 2. Robustness with binary probit models

Public spending preferences overall	**(1)**	**(2)**	**(3)**
Gender: Female	-0.0165	0.0218**	-0.0052
	(0.0117)	(0.0111)	(0.0058)
Age	-0.0013***	0.0014***	-0.0001
	(0.0004)	(0.0004)	(0.0002)
Education (primary)	0.0434**	-0.0353*	-0.0090
	(0.0209)	(0.0198)	(0.0101)
Education (tertiary)	-0.0073	-0.0166	0.0264***
	(0.0154)	(0.0145)	(0.0086)
Income (low)	0.0020	-0.0036	0.0007
	(0.0167)	(0.0159)	(0.0084)
Income (high)	-0.0093	0.0138	-0.0043
	(0.0185)	(0.0176)	(0.0091)
Head of the household	-0.0165	0.0120	0.0042
	(0.0123	(0.0117)	(0.0062)
Employed	-0.0027	0.0124	-0.0100
	(0.0124)	(0.0117)	(0.0063)
Having children	-0.0261**	0.0197	0.0061
	(0.0132)	(0.0126)	(0.0067)
Debt knowledge (1/0)	0.0667***	-0.0569***	-0.0096
	(0.0148)	(0.0140)	(0.0074)
Debt expectations (negative)	-0.1280***	0.0693***	0.0547***
	(0.0125)	(0.0121)	(0.0065)
Debt expectations (positive)	0.0082	0.0025	-0.0082
	(0.0377)	(0.0359)	(0.0157)
Future financial expectations	-0.0088	0.0129	-0.0044
	(0.0129)	(0.0122)	(0.0064)
Current economic situation	0.0026	-0.0144	0.0111*
	(0.0128)	(0.0122)	(0.0064)
Trust in Government (high)	-0.0343**	0.0248	0.0078
	(0.0167)	(0.0157)	(0.0085)
Trust in Government (low)	-0.0216	0.0387***	-0.0151**
	(0.0146)	(0.0138)	(0.0074)
Economic interest	-0.0256*	0.0169	0.0076
	(0.0148)	(0.0140)	(0.0073)
Political interest	-0.0192	0.0268*	-0.0085
	(0.0150)	(0.0141)	(0.0078)
Public service delivery satisfaction	0.2064***	-0.2085***	0.0083
	(0.0132)	(0.0122)	(0.0073)
Nagelkerke	0.121	0.113	0.069
LogLik	-3467.039	-3208.321	-1182.509
Observations	5,988	5,988	5,988

Source: Authors' calculations based on OeNB Euro Survey 2018.
Binary logit models: Model (1): Dummy variable where 1 = increased, and 0 = otherwise. Model (2): Dummy variable where 1 = maintained, and 0 = otherwise. Model (3) Dummy variable where 1 = lowered, and 0 = otherwise.
Note: Average marginal effects with standards errors in parentheses;
*p<0.1; **p<0.05; ***p<0.01

Table C 3. Robustness with binary logit models

Public spending preferences overall	**(1)**	**(2)**	**(3)**
Gender: Female	-0.0158	0.0211*	-0.0053
	(0.0117)	(0.0111)	(0.0058)
Age	-0.0013***	0.0014***	-0.0001
	(0.0004)	(0.0004)	(0.0002)
Education (primary)	0.0433**	-0.0339*	-0.0089
	(0.0207)	(0.0196)	(0.0099)
Education (tertiary)	-0.0093	-0.0141	0.0268***
	(0.0155)	(0.0145)	(0.0091)
Income (low)	0.0017	-0.0026	0.0008
	(0.0168)	(0.0161)	(0.0085)
Income (high)	-0.0095	0.0137	-0.0039
	(0.0184)	(0.0175)	(0.0091)
Head of the household	-0.0170	0.0127	0.0044
	(0.0124)	(0.0118)	(0.0062)
Employed	-0.0018	0.0118	-0.0109*
	(0.0124)	(0.0117)	(0.0064)
Having children	-0.0263**	0.0199	0.0064
	(0.0132)	(0.0125)	(0.0068)
Debt knowledge (1/0)	0.0671***	-0.0571***	-0.0091
	(0.0146)	(0.0137)	(0.0073)
Debt expectations (negative)	-0.1268***	0.0686***	0.0574***
	(0.0123)	(0.0119)	(0.0067)
Debt expectations (positive)	0.0070	0.0051	-0.007
	(0.0366)	(0.0350)	(0.0143)
Future financial expectations	-0.0096	0.0139	-0.0034
	(0.0129)	(0.0122)	(0.0064)
Current economic situation	0.0025	-0.0147	0.0119*
	(0.0129)	(0.0122)	(0.0064)
Trust in Government (high)	-0.0346**	0.0253*	0.0078
	(0.0165)	(0.0154)	(0.0086)
Trust in Government (low)	-0.0203	0.0389***	-0.0189**
	(0.0146)	(0.0138)	(0.0075)
Economic interest	-0.0262*	0.0173	0.0085
	(0.0148)	(0.0141)	(0.0072)
Political interest	-0.0191	0.0267*	-0.0079
	(0.0150)	(0.0141)	(0.0078)
Public service delivery satisfaction	0.2022***	-0.2026***	0.0092
	(0.0127)	(0.0116)	(0.0074)
Nagelkerke	0.121	0.113	0.072
LogLik	-3467.218	-3208.183	-1179.564
Observations	5,988	5,988	5,988

Source: Authors' calculations based on OeNB Euro Survey 2018.
Binary logit models: Model (1): Dummy variable where 1 = increased, and 0 = otherwise. Model (2): Dummy variable where 1 = maintained, and 0 = otherwise. Model (3) Dummy variable where 1 = lowered, and 0 = otherwise.
Note: Average marginal effects with standards errors in parentheses;
*p<0.1; **p<0.05; ***p<0.01

Appendix D

Table D 1. Robustness with country individual probit models

Public spending preferences overall	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Gender: Female	0.0017	-0.0020	-0.0046	0.0053	-0.0089	0.0048
	(0.0073)	(0.0036)	(0.0073)	(0.0043)	(0.0074)	(0.0130)
Age	-0.0001	-0.0001	-0.0002	-0.0002***	-0.0006**	-0.0003
	(0.0002)	(0.0001)	(0.0002)	(0.0001)	(0.0002)	(0.0004)
Education (primary)	-0.0102	-0.0035	0.0035	-0.0059	0.0299***	0.0289
	(0.0254)	(0.0149)	(0.0146)	(0.0061)	(0.0131)	(0.0293)
Education (tertiary)	-0.0252*	-0.0020	0.0136	-0.0063	0.0145	-0.0263
	(0.0157)	(0.0045)	(0.0105)	(0.0056)	(0.0108)	(0.0200)
Income (low)	-0.0052	0.0022	0.0124	-0.0034	-0.0089	0.0023
	(0.0091)	(0.0053)	(0.0111)	(0.0059)	(0.0117)	(0.0212)
Income (high)	0.0119	0.0047	0.0111	-0.0120	-0.0005	0.0123
	(0.0135)	(0.0066)	(0.0136)	(0.0083)	(0.0112)	(0.0197)
Head of the household	0.0058	-0.0025	0.0049	0.0044	-0.0003	-0.0049
	(0.0080)	(0.0044)	(0.0084)	(0.0038)	(0.0077)	(0.0033)
Employed	-0.0085	0.0010	0.0084	-0.0021	0.0003	0.0290**
	(0.0074)	(0.0040)	(0.0089)	(0.0030)	(0.0077)	(0.0174)
Having children	0.0132	-0.0054	-0.0158*	-0.0048	-0.0172**	-0.0327***
	(0.0111)	(0.0045)	(0.0089)	(0.0036)	(0.0080)	(0.0140)
Debt knowledge (1/0)	0.0296*	0.0027*	0.0175	0.0006	0.0262**	-0.0256**
	(0.0044)	(0.0052)	(0.0126)	(0.0041)	(0.0119)	(0.0154)
Debt expectations	-0.0459**	-0.0122**	-0.0285***	-0.0097 *	-0.0242***	-0.0527 ***
(negative)	(0.0208)	(0.0060)	(0.0118)	(0.0057)	(0.0090)	(0.0173)
Debt expectations	0.0486	0.0066	0.0012	-0.0154	0.0495	-0.0137
(positive)	(0.0378)	(0.0134)	(0.0384)	(0.0114)	(0.0339)	(0.0297)
Future financial	0.0188	-0.0038	0.0082	-0.0006	-0.0044	-0.0169
expectations	(0.0132)	(0.0043)	(0.0091)	(0.0033)	(0.0078)	(0.0138)
Current economic	-0.0103	0.0011	-0.0099	-0.0001	0.0137	-0.0311*
situation	(0.0058)	(0.0046)	(0.0086)	(0.0036)	(0.0097)	(0.0142)
Trust in Government	-0.0236	-0.0156*	-0.0048	0.0055	-0.0021	-0.0014
(high)	(0.0148)	(0.0080)	(0.0129)	(0.0050)	(0.0100)	(0.0156)
Trust in Government	0.0012	-0.0112*	-0.0021	-0.0061	0.0077	0.0158
(low)	(0.0100)	(0.0060)	(0.0086)	(0.0049)	(0.0102)	(0.0176)
Economic interest	-0.0006	0.0014	0.0052	-0.0022	-0.0020	- -0.0032
	(0.0082)	(0.0050)	(0.0098)	(0.0040)	(0.0084)	(0.0182)
Political interest	0.0056	0.0013	-0.0160	0.0016	-0.0238**	0.0152
	(0.0095)	(0.0050)	(0.0105)	(0.0041)	(0.0106)	(0.0193)
Public service delivery	0.0495*	0.0218*	0.0169	0.0205*	0.0305***	0.0982***
satisfaction	(0.0266)	(0.0050)	(0.0198)	(0.0050)	(0.0130)	(0.0297)
Nagelkerke	0.173	0.108	0.070	0.204	0.160	0.107
LogLik	-534.722	-557.835	-774.4916	-418.5152	-782.2023	-927.8541
Observations	1,011	1,000	1,007	1,000	1,017	1,000

Source: Authors' calculations based on OeNB Euro Survey 2018.
Ordered probit models: Model (1): Romania. Model (2): Bulgaria. Model (3) Czech Republic. Model (4): Hungary. Model (5): Poland. Model (6): Czech Republic.
Note: Average marginal effects with standards errors in parentheses;
*p<0.1; **p<0.05; ***p<0.01

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HERDING BEHAVIOR IN FRONTIER NORDIC COUNTRIES

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Abstract: This paper investigates herding behavior of investors in three frontier Nordic countries from July 1, 2002 until July 30, 2021, under different market conditions and during three crises that occurred in this period. As estimation methods, we use both OLS and quantile regression and determine that both up and down market, high and low volatility induce a weak herding behavior for at least one quantile in almost all Nordic countries examined, except for Latvia. At the same time, we find that crises determine a more prominent herding behavior in Nordic countries, but do not influent the behavior of investors from Latvia, that tend to remain rational even in stressful conditions.

JEL Classification: G01, G14, G40

Keywords: Herding behavior; Market states; Financial Crises; Cross-sectional absolute deviation of returns.

1. Introduction

As the researchers start doubting Efficient Market Hypothesis and the fact that all investors act rational while make a decision when to sell or to buy a stock, a new field appears, Behavioral Finance, that attempts to observe and explain how people perform in real life, and not how they should act.

One of the discussed and studied topic is herding behavior, which consist in ignoring own information and mimicking the other market players' actions or following the market consensus. This behavior may be caused by informational cascades, concern for reputation and/or compensation scheme, the main reason of offering so much attention to this behavioral bias is due to the consequences induced by it in the financial markets, such as leading to misevaluation of asset prices and bubbles, destabilizing market stability and its efficiency.

The paucity of previous studies concentrating on investor herding behavior in Nordic countries inspired us to conduct this research. Therefore, this paper contributes to the existing herding literature by examining herding behavior in three

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emerging Nordic countries under various market states, specifically up or down market, high or low volatility. Furthermore, we fill the gap in the literature by analyzing how crises affect the herding behavior in Nordic countries, such as Global Financial Crisis, the European Sovereign Debt, and the Covid-19 crisis.

To the best of our knowledge, this is the first study to look into and disclose the incidence of herding behavior in emerging Nordic countries during market ups and downs, high and low volatility, the Global Financial Crisis, European Sovereign Debt, and Covid-19 pandemic.

The study is structured as follows: section 1 presents the theoretical background regarding herding behavior and reviews some of the scientific articles written on the subject of interest, the second section evokes the data used and describes the way of methods and regressions used for estimating the occurrence of this phenomenon, the following section reports the obtained results and highlights the main ideas concerning the presence of herding behavior in examined Nordic countries. The study ends with conclusions and an overview of future research pursuits. The supporting materials are to be found within the Appendices.

2. Literature Review

Herding behavior is defined as being present in a market when investors opt to replicate the trading practices of those, they assume to be well-informed and more experienced or mimic the market consensus, rather than acting upon their own knowledge and beliefs (Blasco et al., 2012), even if they are unsure that other investors have made the correct decision (Banerjee, 1992).

Herding also necessitates a coordination mechanism, according to Devenow and Welch (1996), which can be either a widely diffused rule to coordinate based on some signal, such as price movement, or a direct ability to observe other decision makers.

Due to the importance of herd behavior implications, such as asset price misevaluation, risk management, performance evaluations, and the threat to financial market stability and efficiency, a growing body of literature has explored the prevalence and causes of herding in recent years (Hirshleifer and Teoh, 2003; Hwang and Salmon, 2004; Chiang and Zheng, 2010). Galariotis et al. (2016), for example, claim that irrational herding is a major cause of financial instability and increasing yield discrepancies. Furthermore, herding may exacerbate the financial system's vulnerability and lead to bubbles (Galariotis et al., 2016).

The studies that have already investigated this subject concluded that the occurrence of herding behavior may be observed in a variety of markets, such as stock markets, commodity markets, cryptocurrency markets, oil markets, REITs in different volatility regimes (Coskun et al., 2020). Irrespective of the market in which the rational type of herding behavior can be observed, it is determined mainly by one of the three potential causes conceived by Bikhchandani and Sharma (2000), specifically the imperfect information, concern for reputation and compensation structures.

On the other hand, Choijil et al. (2021) conclude in their study of the literature review available regarding this subject that there is no yet a general agreement explaining the causes of the herding behavior. Nonetheless, the emergence of the new perspectives and issues inspires the specialists in developing and elaborating new studies on this phenomenon. All the new researches start from the fundamental theories and previous assumptions, and after that investigate new suppositions,

observe various markets, and drag a conclusion. The basic theoretical framework on the subject of herding behavior involves also the causes mentioned above and described further.

The consequences of imperfect information on asset prices are amplified through a mimicking investment behavior during a transmission mechanism commonly known as an “informational cascade” (Filip et al., 2015).

This concept of “informational cascade” was introduced by Bikhchandani et al. (1992). According to them, this occurs when an individual, after observing the actions of investors ahead of him, determines that it is best to follow the previous individual’s behavior regardless of his own information. In case of stock markets, the investment decisions of early individuals are reflected in the subsequent price of the investment. Consequently, in a sequential decision model, agents herd rationally when they believe that other investors have better information and this fact is reflected in their investment decision, so they ignore their private information and act only based on the knowledge obtained from the previous decisions.

Banerjee (1992) emphasizes that these informational cascades can influence rational people and lead to the creation of bubbles. A bubble appears when an asset price is significantly different from its fundamental value, that is based on the discounted sum of expected future earnings (Cuñado et al., 2007). Kaliva and Koskinen (2008) believe that, generally, a bubble is followed by a crash. At the same time, Kreuser and Sornette (2017) affirms that even if the market price blows up, it is always possible that the price will reverse smoothly without a crash, but it is a scenario that becomes less and less probable the higher the price is.

On the other hand, herding can occur being determined by reputational reasons. Fernández et al. (2011) maintain that concern for reputation is a relevant explaining factor only for money managers who invest on behalf of others. Additionally, Lao and Singh (2011) enumerate traders, fund managers and analysts, that are employees or agents in a financial institution, because their performance evaluation is done on a comparative basis, being a relative measure rather than absolute one.

Therefore, when a manager is not sure regarding his professional skills, he might mimic the actions of other managers, completely ignoring his private information, in order to protect his reputation. Based on the statement of Scharfstein and Stein (1990) that money managers herd due to their fear of being poorly assessed or judged by others if they make the wrong decision, Spyrou (2013) asserts that this type of herding is driven also by psychological incentives and restraints, such as “pressure from social circles and/or social conventions”.

At the same time, the wages of the analysts are assumed to increase linearly with the reputation of the analyst. Consequently, in order to maximize his income, the analyst choose a strategy that increases the probability that investors will think he is smart and high-skilled. Due to the fact that the analyst is uncertain about his own ability and the risk to lose his reputational capital in the market, he does not take a decision contrary to another analyst, even if his private information tells otherwise.

Villatoro (2009) argues that financial intermediaries with a good reputation are more likely to invest in information, whereas those with a bad reputation will are more likely to copy the portfolio decisions of other financial intermediaries (Khan, 2011). Devenow and Welch (1996), on the other hand, claim that if enough bad managers herd on a bad decision, even better managers will herd instead of taking the risk of

being the lone manager investing in what might turn out to be an ex-post poor decision. Demirer and Kutan (2006) affirm that it may also occur among individual investors, in order to obtain a performance that is not below the market average.

Both information-based and reputation-based herding are more likely to occur in emerging and frontier markets, according to Pochea et al. (2017), due to factors such as weak reporting requirements, poorer accounting standards, ambiguous regulatory enforcements, and costly information, all of which contribute to a lack of transparency.

As previously mentioned, the performance of money managers is more a relative measure rather than an absolute one and therefore, their compensation structures are also competitive with respect to a benchmark, either it is a similar group of professionals or a market index. Thus, another important issue causing herding behavior is the incentives provided by the compensations scheme.

According to Maug and Naik (1995), the compensation contracts, which are optimal for the employer of the money manager, induce herding. This type of compensation contracts is, in fact, relative performance contract in which the bonus paid to the money manager depends on how well he does relative to the benchmark. In case the benchmark is a separate group of investors, then an intentional herding occurs: the benchmark investor, that similarly with the agent, has imperfect, private information about stock return, makes his decision first. Then, the agent being motivated by the fact that his reward decreases if he underperforms the benchmark causes the agent to imitate the benchmark's actions. Conversely, in case the benchmark is a market index, then a spurious herding occurs.

As acknowledged formerly, herding is a subject of interest for researchers and the number of already written articles prove this fact. Furthermore, Choijil et al. (2021) consider that the subprime crisis represents the critical point for the analysis of this concept. For instance, from 1990 until 2007, during a period of 18 years were published only 65 articles with 1944 citations, while in the following 5 years, specifically from 2008 until 2012, 74 articles with 2913 citations that were published. This represents a 14% increase in case of the published article regarding herd behavior and 67% increase if referring to the number of citations. Additionally, Choijil et al. (2021) show that during 2014 – 2020 another 168 articles with 10,155 citations were issued, that exceed the 161 articles and 5,745 citations published in earlier 24 years, from 1990 until 2013.

It is important to mention that this enhancement of publications and citations enabled the researchers to develop sub-areas of interest in order to study herding. Choijil et al. (2021) enumerate five groups. The first one tries to obtain a wider understanding of herding behavior. The second group focuses on evidencing the occurrence of this phenomenon in various financial markets and concentrates on find the motives in order to explain this behavior. There are also researchers, belonging to the third group, that analyses herding behavior in period of financial crisis. The fourth group examines how the profile of investor influences the herding behavior, while the fifth group investigates the effects of herding behavior on portfolio management.

Regardless the increasing number of articles written on this subject, the great majority of them assess the occurrence of herding behavior in markets from the US (Guo et al., 2020), the UK (Galariotis et. al, 2015), and Asian countries, such as South Korea (Yao and Li, 2020; Choi, 2016), China (Demirer and Kutan, 2006),

Taiwan (Chen et al., 2020), Pakistan (Javed et al., 2017). There are also studies regarding herding behavior in ten stock markets from Central and Eastern Europe (Filip et al., 2015; Pochea et al., 2017).

Furthermore, there are comparative studies between different countries. For instance, Chiang and Zheng (2010) estimates herding behavior under asymmetric market conditions in 18 countries: Australia, France, Germany, Hong Kong, Japan, the UK, the US; Latin American markets, such as Argentina, Brazil, Chile, and Mexico; Asian markets, such as China, Indonesia, Malaysia, Singapore, South Korea, Taiwan and Thailand.

Determined by the lack or previous studies focusing on herding behavior in Nordic countries, we aim to estimate the herding behavior in Latvia, Lithuania, and Iceland. As far as we are concerned, our paper represents the first work in revealing the herding behavior in emerging Nordic countries, under up and down market, high and low volatility, in case of Global Financial Crisis, European Sovereign Debt Crisis, and Covid-19 pandemic.

3. Methodology

For detecting herding behavior in Nordic countries, we applied the cross-sectional absolute deviation (CSAD) of returns, developed by Chang et al. (2000). This is one of the most common measures used in this sense, providing a more robust data and the possibility to estimate herding behavior during the all period considered even if the market is calm or under extreme conditions, experiencing large price fluctuations. In order to determine CSAD, firstly, should be computed the daily logarithmic rates of returns for the equity market indices and for each company that constitutes the index, by using the following formulas:

$$R_{i,t} = ln\ (\frac{P_{i,t}}{P_{i,t-1}}) \tag{1}$$

$$R_{m,t} = ln\left(\frac{P_{m,t}}{P_{m,t-1}}\right) \tag{2}$$

where $\mathrm{P_{i,t}}$ and $\mathrm{P_{m,t}}$ represent the closing price of day t for stock i, respectively market index m. The CSAD is calculated as follows:

$$CSAD_t = \frac{1}{n}\sum_{i=1}^{n}|R_{i,t} - R_{m,t}| \tag{3}$$

where n represents the number of observations, $R_{i,t}$ and $R_{m,t}$ are the return of the company i at time t and, respectively return of the market m, at time t, for which the computation formulas, (1) and (2), were presented previously.

For estimating herding behavior, Chang et al. (2000) developed the following model that measures the relationship between the CSAD and the market return:

$$CSAD_t = \beta_0 + \beta_1 \cdot |R_{m,t}| + \beta_2 \cdot R_{m,t}^2 + \varepsilon_t \tag{4}$$

The explanation behind this regression is related to the Capital Asset Pricing Model, according to which if investors are fully rational, then the stocks return and market return are linearly related, so that the coefficient β_2 is positive and statistically significant in the absence of herding behavior. On the other hand, a non-linear

negative relationship between these two variables reveals the existence of herding behavior in the analyzed market. Consequently, the negative and statistically significant coefficient β_2 denotes the presence of herding behavior in market under examination.

According to Barnes and Hughes (2002), the quantile regression analysis is more appropriate than OLS in analyzing CSAD in the distribution tails. This is due to the fact that, OLS estimators being based on the mean as a measure of location, do not consider the information regarding the tail of the distribution. Therefore, in this study, we also consider the quantile regression analysis for estimating the $CSAD_t$, expressed as follows:

$$Q_\tau(\tau|CSAD_t) = \beta_{0,\tau} + \beta_{1,\tau} \cdot |R_{m,t}| + \beta_{2,\tau} \cdot R_{m,t}^2 + \varepsilon_{t,\tau} \quad (5)$$

where $CSAD_t$ denominates the cross-sectional absolute deviation of returns of quantile τ, which can take values between 0 and 1.

Asymmetric Effects of Market Return on Herding Behavior

Previous studies demonstrated that herding behavior is more probable to occur during extreme market fluctuations, which create uncertainty, fear, and determine the traders to follow the observed trend, leading in this way, to a more prominent herding behavior. At the same time, according to Economou et al. (2018), there is also evidence of asymmetric herding behavior during up-market periods.

Due to these reasons, we analyze in this subsection the impact of upward and downward trends on herding behavior in the Nordic countries. We create a dummy variable, D^{up}, that takes the value 1, if the market is up, and 0, if the market is down.

$$CSAD_t = \beta_0 + \beta_1 \cdot D^{up} \cdot |R_{m,t}| + \beta_2 \cdot (1 - D^{up}) \cdot |R_{m,t}| + \beta_3 \cdot D^{up} \cdot R_{m,t}^2 + \\ + \beta_4 \cdot (1 - D^{up}) \cdot R_{m,t}^2 + \varepsilon_t \quad (6)$$

We consider that market is up, if the market return in that day is greater than the average of market returns in previous 30 days, and is down, otherwise. We also performed a quantile regression to estimate the herding behavior under up and down market, using the following empirical specification:

$$Q_\tau(\tau|CSAD_t) = \beta_{0,\tau} + \beta_{1,\tau} \cdot D^{up} \cdot |R_{m,t}| + \beta_{2,\tau} \cdot (1 - D^{up}) \cdot |R_{m,t}| + \beta_{3,\tau} \cdot D^{up} \cdot R_{m,t}^2 + \\ + \beta_{4,\tau} \cdot (1 - D^{up}) \cdot R_{m,t}^2 + \varepsilon_{t,\tau} \quad (7)$$

If there is herding behavior, then the coefficients β_3 and β_4 are negative and statistically significant.

Asymmetric Effects of Market Volatility on Herding Behavior

Another subject of interest is the market volatility, which is a statistical measure of the tendency of a market or security to rise or fall sharply within a short period of time. According to Pochea et al. (2017), the tendency of investors to herd is more remarkable when there is an increased volatility, which is determined usually by wide and rapid price fluctuations along with heavy trading.

In order to assess the asymmetric effects of market volatility on herding behavior, we created a dummy variable D^{vol}, that takes the value 1, if the volatility is high, and the value 0, if the volatility is low. According to Pochea et al. (2017), we assumed that market volatility is high when the volatility in that day is higher than the average volatility of market over the previous thirty days. We use the regressions presented below. Regression (8) was used in case of OLS estimation and regression (9) in case of quantile regression.

$$CSAD_t = \beta_0 + \beta_1 \cdot D^{vol} \cdot |R_{m,t}| + \beta_2 \cdot (1 - D^{vol}) \cdot |R_{m,t}| + \beta_3 \cdot D^{vol} \cdot R_{m,t}^2 + \\ + \beta_4 \cdot (1 - D^{vol}) \cdot R_{m,t}^2 + \varepsilon_t \quad (8)$$

$$Q_\tau(\tau|CSAD_t) = \beta_{0,\tau} + \beta_{1,\tau} \cdot D^{vol} \cdot |R_{m,t}| + \beta_{2,\tau} \cdot (1 - D^{vol}) \cdot |R_{m,t}| + \\ + \beta_{3,\tau} \cdot D^{vol} \cdot R_{m,t}^2 + \beta_{4,\tau} \cdot (1 - D^{vol}) \cdot R_{m,t}^2 + \varepsilon_{t,\tau} \quad (9)$$

The negative and statistically significant coefficients β_3 and β_4 suggest the presence of herding behavior in the examined market.

The Impact of Crises on Herding Behavior

At the same time, according to Christie and Huang (1995), the phenomenon of herding behavior is expected to be more prominent during periods of extreme market conditions, because of significant market fluctuations and increasing uncertainty, which induce agents to mimic other agents' choices. These extreme market conditions are usually associated or determined by the period of crises. Due to this reason, we also investigated the impact of crises on herding behavior in Nordic countries during July 1, 2002 – July 30, 2021. We have considered 3 crises that occurred during the analyzed period, specifically the Global Financial Crisis, the European Sovereign Debt crisis, and the Covid-19 pandemic crisis.

The Impact of Global Financial Crisis on Herding Behavior

In accordance with Economou et al. (2018), we considered as a timespan of Global Financial Crisis the timespan starting with January 1, 2007 until December 31, 2009. We create a dummy variable, D^{GFC}, that takes value 1 during this period, and 0, otherwise.

In case of analyzing the impact of crises on herding behavior, we also performed both OLS and quantile regressions, using the following empirical specifications:

$$CSAD_t = \beta_0 + \beta_1 \cdot D^{GFC} \cdot |R_{m,t}| + \beta_2 \cdot (1 - D^{GFC}) \cdot |R_{m,t}| + \beta_3 \cdot D^{GFC} \cdot R_{m,t}^2 + \\ + \beta_4 \cdot (1 - D^{GFC}) \cdot R_{m,t}^2 + \varepsilon_t \quad (10)$$

$$Q_\tau(\tau|CSAD_t) = \beta_{0,\tau} + \beta_{1,\tau} \cdot D^{GFC} \cdot |R_{m,t}| + \beta_{2,\tau} \cdot (1 - D^{GFC}) \cdot |R_{m,t}| + \\ + \beta_{3,\tau} \cdot D^{GFC} \cdot R_{m,t}^2 + \beta_{4,\tau} \cdot (1 - D^{GFC}) \cdot R_{m,t}^2 + \varepsilon_{t,\tau} \quad (11)$$

The same rule as previously is applied in the interpretation of the regressions' output: herding behavior occurs in the market if coefficients β_3 and β_4 are negative and statistically significant.

The Impact of European Sovereign Debt Crisis on Herding Behavior

In case of setting the start date and ending date of European Sovereign Debt crisis used in our analysis, we follow Duygun et al. (2021), in accordance with which the considered interval is May 2, 2010 until December 31, 2012. The dates correspond to the following events: the bailout package received by Greece from European Union and the International Monetary Fund; and the purchase of the issued earlier sovereign bonds by Greece, which lead to the debt ratio decrease by 21.1 billion euro, as stated by Duygun et al. (2021). We used the same estimation models as in case of measuring the impact of Global Financial Crisis, but the dummy variable D^{GFC} was substituted by D^{ESD} and takes value 1 during European Sovereign Debt crisis and 0, otherwise:

$$CSAD_t = \beta_0 + \beta_1 \cdot D^{ESD} \cdot |R_{m,t}| + \beta_2 \cdot (1 - D^{ESD}) \cdot |R_{m,t}| + \beta_3 \cdot D^{ESD} \cdot R_{m,t}^2 + \\ + \beta_4 \cdot (1 - D^{ESD}) \cdot R_{m,t}^2 + \varepsilon_t \quad (12)$$

$$Q_\tau(\tau|CSAD_t) = \beta_{0,\tau} + \beta_{1,\tau} \cdot D^{ESD} \cdot |R_{m,t}| + \beta_{2,\tau} \cdot (1 - D^{ESD}) \cdot |R_{m,t}| + \\ + \beta_{3,\tau} \cdot D^{ESD} \cdot R_{m,t}^2 + \beta_{4,\tau} \cdot (1 - D^{ESD}) \cdot R_{m,t}^2 + \varepsilon_{t,\tau} \quad (13)$$

The Impact of Covid-19 Pandemic Crisis on Herding Behavior

In case of assessing the impact of Covid-19 pandemic crisis on herding behavior, we have considered 2 cases. Firstly, we consider for all analyzed countries, the time same starting day of Covid-19 pandemic, namely the 11th of March 2020. On this day, the World Health Organization declared the start of Covid-19 pandemic. The created dummy variable D^{CoWHO} takes the value 1 from this date and until de end of the sample, and 0, otherwise. Below are presented the OLS and quantile regression used for estimation:

$$CSAD_t = \beta_0 + \beta_1 \cdot D^{CoWHO} \cdot |R_{m,t}| + \beta_2 \cdot (1 - D^{CoWHO}) \cdot |R_{m,t}| + \beta_3 \cdot D^{CoWHO} \cdot R_{m,t}^2 + \\ + \beta_4 \cdot (1 - D^{CoWHO}) \cdot R_{m,t}^2 + \varepsilon_t \quad (14)$$

$$Q_\tau(\tau|CSAD_t) = \beta_{0,\tau} + \beta_1 \cdot D^{CoWHO} \cdot |R_{m,t}| + \beta_{2,\tau} \cdot (1 - D^{CoWHO}) \cdot |R_{m,t}| + \\ + \beta_{3,\tau} \cdot D^{CoWHO} \cdot R_{m,t}^2 + \beta_{4,\tau} \cdot (1 - D^{CoWHO}) \cdot R_{m,t}^2 + \varepsilon_{t,\tau} \quad (15)$$

For both regressions presented above, the negative and statistically significant coefficient β_3 point out that there is herding behavior in the market during crisis. In Table 1 are presented all the variable used in our estimations and also their short description.

Table 1. The Description of Variables

Variable	Description	Source
$R_{m,t}$	Daily returns of stock market indices. $R_{m,t} = ln\left(\frac{P_{m,t}}{P_{m,t-1}}\right)$ for market m on day t. The stock market indices are OMXC20, OMXS30, OMXH, OSEAX, OMXRGI, OMXVGI, and OMX Iceland.	Refinitiv Eikon Datastream

Variable	Description	Source
$R_{i,t}$	Daily return of company *i* on day *t*, computed as: $R_{i,t} = ln\ (\frac{P_{i,t}}{P_{i,t-1}})$.	Refinitiv Eikon Datastream
$CSAD_t$	The cross-sectional absolute deviation of returns at time *t,* computed as: $CSAD_t = \frac{1}{n}\sum_{i=1}^{n}\|R_{i,t} - R_{m,t}\|$.	Author's estimate
D^{up}	Dummy variable that takes the value 1 if the market is up and the value 0, if the market is down.	Pochea et al. (2017)
D^{vol}	Dummy variable that takes the value 1 if the market volatility is high and value 0, if the market volatility is low.	Pochea et al. (2017)
D^{GFC}	Dummy variable that takes the value 1 between January 1, 2007 and December 31, 2009 and 0, otherwise.	Economou et al. (2018)
D^{ESD}	Dummy variable that takes the value 1 between May 2, 2010 and December 31, 2012 and 0, otherwise.	Duygun et al. (2021)
D^{CoWHO}	Dummy variable that takes the value 1 starting with March 11, 2020, when the World Health Organization declared a pandemic, until the end of our sample timespan and 0, otherwise.	World Health Organization

4. Data

This section reveals the data used in the study for assessing herding behavior in three frontier Nordic countries. We have obtained the daily closing stock price from July 1, 2002 to July 30, 2021 of corporations listed in three Nordic countries: Latvia, Lithuania, and Iceland. The dataset also contains the daily closing price of the market indices, namely: OMXRGI, OMXVGI, and OMX Iceland for the same time. The data are expressed in EUR and were extracted from Refinitiv Eikon Datastream database. In Table 2 are highlighted the mean and the standard deviation of the cross-sectional standard deviations and for the market return for each country analyzed in the study. Furthermore, the table contains data regarding the Augmented Dickey-Fuller test, that are statistically significant for both variables, meaning that the series are stationary.

Table 2. Descriptive Statistics of the CSAD and Daily Returns

Country (Market Index)	Observations	Variables	Mean	Std. Dev.	ADF
Iceland (OMX Iceland)	4719	$CSAD$ R_m	0.015 0.000	0.025 0.021	-14.819*** -16.392***
Latvia (OMXRGI)	4790	$CSAD$ R_m	0.018 0.000	0.017 0.011	-14.666*** -76.267***
Lithuania (OMXVGI)	4739	$CSAD$ R_m	0.015 0.001	0.011 0.009	-8.057*** -13.607***

*Note: *** denotes statistical significance at the 1% level.*

5. Empirical Results

Estimates of Herding Behavior in Nordic Countries

In Table 3 are reported the sign and statistical significance of herding coefficients at market level for all three Nordic countries examined. The extended results of both OLS and quantile regression estimates are presented in Appendix 1. A negative and statistically significant coefficient β_2 points out the occurrence of herding behavior in the examined market. As it can be observed in Table 3, most of the coefficients are positive and statistically significant, meaning there is no herding behavior in analyzed markets. We have also performed a quantile regression analysis, which provides a more thorough idea regarding the conditional distributions of the CSAD of returns. Following the results, we detect no herding behavior in frontier Nordic countries analyzed, except for Lithuania for which the coefficient of interest is negative and statistically significant at the 1% level for the quantile 10%.

Table 3. Estimates of Herding Behavior in Nordic Countries

$CSAD_t = \beta_0 + \beta_1 \cdot \lvert R_{m,t} \rvert + \beta_2 \cdot R_{m,t}^2 + \varepsilon_t$						
Methodology	***OLS***	***Q*** $(\tau = 10\%)$	***Q*** $(\tau = 25\%)$	***Q*** $(\tau = 50\%)$	***Q*** $(\tau = 75\%)$	***Q*** $(\tau = 90\%)$
Herd coefficient	β_2	β_2	β_2	β_2	β_2	β_2
Iceland	(+)***	(+)***	(+)***	(+)***	(+)***	(+)***
Latvia	(+)***	(+)	(+)***	(+)***	(+)	(+)***
Lithuania	(+)	(-)***	(+)*	(+)	(+)	(+)***

*Note: ***, **, * denote statistical significance at the 1%, 5%, and 10% level.*

The fact we do not detect herding behavior can be related to the timespan considered and examining the phenomenon as a long-term behavior, while herding behavior is more likely to be a short-term one, as it occurs during extreme market conditions or fluctuations. Consequently, we investigate further this behavioral bias under asymmetric market conditions, namely up or down market, and high or low volatility.

Estimates of Herding Behavior in Nordic Countries Under Asymmetric Market Conditions

In Table 4 are presented the sign and statistical significance of herding coefficients under up or down market, high or low volatility, while in Appendix 2 (up or down market in frontier Nordic countries) and Appendix 3 (high or low volatility in frontier Nordic countries) are revealed the detailed results of our estimates.

According to the OLS estimates, in frontier Nordic countries herding behavior is present under up market in case of Iceland and Lithuania, except for Latvia where no herding behavior is detected. The quantile regression reveals herding behavior under up market both in Lithuania for the quantile of 10% and in Iceland for all quantile levels. The homogenous herding behavior detected in Iceland can be explained by investors' overenthusiasm, meaning they are prone to purchase stocks when the market follows an increasing trend.

In accordance with our results obtained by using the OLS method, volatility does not affect the CSAD in markets under examinations. On the other hand, using quantile regressions, we identify herding behavior, but as an isolated phenomenon. For instance, in Lithuania in case of high volatility for $\tau = 10\%$ and low volatility for $\tau = 90\%$; in Iceland under low volatility for quantile of 10%.

Table 4. Estimates of Herding Behavior Under Different Market Conditions

$CSAD_t = \beta_0 + \beta_1 \cdot D^{up} \cdot \lvert R_{m,t}\rvert + \beta_2 \cdot (1 - D^{up}) \cdot \lvert R_{m,t}\rvert + \beta_3 \cdot D^{up} \cdot R_{m,t}^2 + \beta_4 \cdot (1 - D^{up}) \cdot R_{m,t}^2 + \varepsilon_t$												
Up/ Down Market	***OLS***		***Q*** $(\tau = 10\%)$		***Q*** $(\tau = 25\%)$		***Q*** $(\tau = 50\%)$		***Q*** $(\tau = 75\%)$		***Q*** $(\tau = 90\%)$	
Herd coefficient	β_3	β_4	β_3	β_4	β_3	β_4	β_3	β_4	β_3	β_4	β_3	β_4
Iceland	(-)***	(+)***	(-)***	(+)***	(-)***	(+)***	(-)***	(+)***	(-)***	(+)***	(-)***	(+)***
Latvia	(+)***	(+)***	(+)	(+)	(+)***	(+)***	(+)***	(+)***	(+)	(+)**	(+)	(+)
Lithuania	(-)**	(+)*	(-)***	(+)***	(-)	(+)***	(+)	(+)	(-)	(+)***	(-)	(+)
$CSAD_t = \beta_0 + \beta_1 \cdot D^{vol} \cdot \lvert R_{m,t}\rvert + \beta_2 \cdot (1 - D^{vol}) \cdot \lvert R_{m,t}\rvert + \beta_3 \cdot D^{vol} \cdot R_{m,t}^2 + \beta_4 \cdot (1 - D^{vol}) \cdot R_{m,t}^2 + \varepsilon_t$												
High/Low Volatility	***OLS***		***Q*** $(\tau = 10\%)$		***Q*** $(\tau = 25\%)$		***Q*** $(\tau = 50\%)$		***Q*** $(\tau = 75\%)$		***Q*** $(\tau = 90\%)$	
Herd coefficient	β_3	β_4	β_3	β_4	β_3	β_4	β_3	β_4	β_3	β_4	β_3	β_4
Iceland	(+)***	(+)***	(+)***	(-)***	(+)***	(+)***	(+)***	(+)***	(+)***	(+)***	(+)***	(+)***
Latvia	(+)***	(-)	(+)	(-)	(+)***	(+)	(+)***	(+)	(+)***	(-)	(+)***	(+)
Lithuania	(+)	(+)	(-)***	(+)***	(-)	(+)***	(+)	(+)	(+)	(+)***	(+)	(-)***

*Note: ***, **, * denote statistical significance at the 1%, 5%, and 10% level.*

Impact of Crises on Herding Behavior in Nordic Countries

Noticing that asymmetric market conditions induce herding behavior in some of the Nordic countries examined, we investigate further how crises affect the herding behavior, as in conformance to Christie and Huang (1995), the phenomenon of herding behavior is expected to be more prominent during periods of extreme market conditions, because of significant market fluctuations and increasing uncertainty, which induce agents to mimic other agents' choices. These extreme market conditions are usually associated or determined by the period of crises.

Table 5 reveals the sign and statistical significance of herding coefficients during crises and during normal market conditions, β_3 and β_4, respectively. In Appendix 4 are presented the detailed results pointing out the impact of Global Financial Crisis on herding behavior in examined markets, in Appendix 5 are reveled the influence of European Sovereign Debt on herding behavior in the same Nordic countries, and the extended results of our estimations regarding the influence of Covid-19 pandemic are reported in Appendix 6.

The OLS estimates detect herding behavior during Global Financial Crisis only in one out of three countries, namely Lithuania. Following the quantile regression results, we identify herding behavior also in Iceland. It must be mentioned that the subprime crisis induces herding behavior in Lithuania on all quantile levels.

Regarding the influence of European Sovereign Debt crisis, conforming to OLS results we do not identify overall herding behavior in any of the examined markets. Analyzing quantile regressions results, we confirm one more time that this is a

better method for estimating herding behavior in financial markets, as we detect herding behavior in all countries. For instance, we detect herding behavior during crisis in Latvia ($\tau = 75\%$), Iceland ($\tau = 90\%$). In Lithuania, we identify herding behavior for 10% and 75% quantiles, but this is not induced by the occurrence of crisis.

Another crisis and more recent one that leads to panic in the entire world and also in the financial markets is the one provoked by the Covid-19 pandemic. In Latvia and Lithuania, we do not identify any herding behavior according to OLS estimates. Performing quantile regressions, we identify herding behavior in all countries, excepting Latvia. Only in Lithuania, for the 10% quantile, we identify herding that was not induced by pandemic, while in all Iceland, pandemic explain the occurrence of the behavioral bias.

Table 5. The Impact of Crises on Herding Behavior in Nordic Countries

Global Financial Crisis												
$CSAD_t = \beta_0 + \beta_1 \cdot D^{GFC} \cdot \lvert R_{m,t} \rvert + \beta_2 \cdot (1 - D^{GFC}) \cdot \lvert R_{m,t} \rvert + \beta_3 \cdot D^{GFC} \cdot R_{m,t}^2 + \beta_4 \cdot (1 - D^{GFC}) \cdot R_{m,t}^2 + \varepsilon_t$												
	OLS		***Q*** ($\tau = 10\%$)		***Q*** ($\tau = 25\%$)		***Q*** ($\tau = 50\%$)		***Q*** ($\tau = 75\%$)		***Q*** ($\tau = 90\%$)	
Herd coefficient	β_3	β_4	β_3	β_4	β_3	β_4	β_3	β_4	β_3	β_4	β_3	β_4
Iceland	(+)***	(-)	(+)***	(-)***	(+)***	(-)***	(+)***	(-)***	(+)***	(-)	(+)***	(+)
Latvia	(+)	(+)***	(+)	(-)	(+)**	(+)***	(+)	(+)***	(+)	(+)***	(+)***	(+)
Lithuania	(-)***	(+)***	(-)***	(+)***	(-)***	(+)***	(-)***	(+)***	(-)***	(+)***	(-)***	(+)***
European Sovereign Debt Crisis												
$CSAD_t = \beta_0 + \beta_1 \cdot D^{ESD} \cdot \lvert R_{m,t} \rvert + \beta_2 \cdot (1 - D^{ESD}) \cdot \lvert R_{m,t} \rvert + \beta_3 \cdot D^{ESD} \cdot R_{m,t}^2 + \beta_4 \cdot (1 - D^{ESD}) \cdot R_{m,t}^2 + \varepsilon_t$												
	OLS		***Q*** ($\tau = 10\%$)		***Q*** ($\tau = 25\%$)		***Q*** ($\tau = 50\%$)		***Q*** ($\tau = 75\%$)		***Q*** ($\tau = 90\%$)	
Herd coefficient	β_3	β_4	β_3	β_4	β_3	β_4	β_3	β_4	β_3	β_4	β_3	β_4
Iceland	(+)***	(+)***	(+)***	(+)***	(+)**	(+)***	(+)***	(+)***	(+)***	(+)***	(-)**	(+)**
Latvia	(-)	(+)***	(-)	(+)	(-)	(+)***	(-)	(+)	(-)***	(+)	(+)	(+)***
Lithuania	(+)***	(-)	(+)	(-)**	(+)*	(+)***	(-)	(+)	(+)***	(-)	(+)	(-)***
Covid-19 Pandemic												
$CSAD_t = \beta_0 + \beta_1 \cdot D^{CoWHO} \cdot \lvert R_{m,t} \rvert + \beta_2 \cdot (1 - D^{CoWHO}) \cdot \lvert R_{m,t} \rvert + \beta_3 \cdot D^{CoWHO} \cdot R_{m,t}^2 + \beta_4 \cdot (1 - D^{CoWHO}) \cdot R_{m,t}^2 + \varepsilon_t$												
	OLS		***Q*** ($\tau = 10\%$)		***Q*** ($\tau = 25\%$)		***Q*** ($\tau = 50\%$)		***Q*** ($\tau = 75\%$)		***Q*** ($\tau = 90\%$)	
Herd coefficient	β_3	β_4	β_3	β_4	β_3	β_4	β_3	β_4	β_3	β_4	β_3	β_4
Iceland	(-)***	(+)***	(-)***	(+)***	(-)***	(+)***	(-)***	(+)***	(-)	(+)***	(-)	(+)**
Latvia	(-)	(+)***	(+)	(+)	(-)	(+)***	(-)	(+)***	(+)	(+)	(+)	(+)
Lithuania	(-)	(-)	(-)	(-)***	(-)	(+)*	(-)	(+)	(+)	(+)	(-)	(-)

*Note: ***, **, * denote statistical significance at the 1%, 5%, and 10% level.*

6. Conclusions

In this paper we approach one of the behavioral biases present in financial markets, namely the herding behavior. We estimate the evidence of this phenomenon in three frontier Nordic countries starting from 1st of July 2002 and ending on 30th of July 2021, employing CSAD as the testing methodology and the OLS and quantile regressions.

We perform comprehensive research of this phenomenon by analyzing how it is manifesting in general circumstances, being influenced by different market conditions, such as up or down market, high or low volatility, and during three crises that occurred in the examined period of time.

We consider this an important study, as from our best knowledge, it is the first one analyzing herding behavior in emerging Nordic countries, so we fill a gap in the existing literature regarding this subject of interest.

Overall, we do not detect herding behavior in the analyzed markets, which is not in conformance with the results obtained by Pochea et. al (2015), where was identified herding behavior in both Latvian and Lithuanian markets. We assume the lack of concordance of the results is due to the timespan implied in the studies, as we used a more extended time period, and according to theoretical background, herding behavior is a short-period phenomenon rather than a long-period one.

The asymmetric market conditions affect the frontier markets, namely Lithuania and Iceland in case of up market. The obtained outcomes are consistent with our a priori expectations, as it is assumed that financial markets from emerging markets are less transparent and efficient, if comparing to developed ones.

Regarding the impact of volatility on herding behavior, we can conclude this does not influence the behavioral bias studied in frontier, if interpreting the OLS estimates results. Following the quantile regressions estimates, we identify herding behavior for at least one quantile in two out of three countries examined.

Herding behavior seems to be more prominent during crises period, as we expected a priori, confirming in this way that in during extreme market conditions, investors tend to herd more than in case of normal market conditions. The only exception in our study is the Latvian market, where we do not identify herding behavior, indifferent of the estimating method used.

At the same time, performing both an OLS and quantile regression estimates, we confirm one more time that the second one is a more appropriate method of testing herding behavior for future studies.

During our research process, we have identified some limitations, specifically, we cannot decompose the CSAD into CSAD driven by fundamental and non-fundamental factors for frontier countries, because the Fama and French factors were only available for the developed countries. Consequently, we consider that it could be analyzed the intentional versus spurious herding behavior in Latvia, Lithuania, and Iceland in following studies regarding the occurrence of this phenomenon in Nordic countries. This subject can also be deepened through analyzing the impact of trading volume, monetary policy, unexpected events, high sentiments, Covid lockdowns, the war from Ukraine on herding behavior in Nordic countries.

References

Banerjee, A.V. (1992), A Simple Model of Herd Behavior, *Quarterly Journal of Economics*, 107 (3), pp. 797-817.

Barnes, M.L. and Hughes., A. (2002), A Quantile Regression Analysis of the Cross Section of Stock Market Returns, Working Paper, SSRN Electronic Journal.

Bikhchandani, S., Hirshleifer, D., Welch, I. (1992), A Theory of Fads, Fashion, Custom, and Cultural Change as Informational Cascades, *Journal of Political Economy,* 100, pp. 992-1026.

Bikhchandani, S. and Sharma, S. (2000), Herd Behavior in Financial Markets, Working paper, IMF Institute.

Blasco, N., Corredor, P., and Ferreruela, S. (2012), Does herding affect volatility? Implications for the Spanish stock market, *Quantitative Financ*e, 12(2), pp. 311–327.

Chang, E., Cheng, J. and Khorana., A. (2000), An Examination of Herd Behavior in Equity Markets: An International Perspective, *Journal of Banking and Finance,* 24, pp. 1651-1679.

Chiang, T. C., and Zheng, D. (2010), An Empirical Analysis of Herd Behavior in Global Stock Markets, *Journal of Banking & Finance*, 34 (8), pp. 1911–1921.

Choijil, E., Méndez, C.E., Wong, W.K., Vieito, J.P., Batmunkh, M.U. (2021), Thirty years of Herd Behavior in Financial Markets: A Bibliometric Analysis, *Research in International Business and Finance*, 59, 101506.

Choi, S. (2016), Herding among local individual investors: Evidence from online and offline trading, *Economics Letters*, 144, pp. 4-6.

Chen, Y.C., Kuo, S.M. and Yang, Y.W. (2020), Is Herding a Safe Haven for Investment?, *Applied Economics Letters*, pp. 1-5.

Christie, W. G., and R. D. Huang. (1995), Following the Pied Piper: Do Individual Returns Herd around the Market?, *Financial Analysts Journal,* 51, pp. 31–37.

Coskun, E.A., Lau, C.K.M., and Kahyaoglu, H. (2020), Uncertainty and Herding Behavior: Evidence from Cryptocurrencies, *Research in International Business and Finance,* 54*,* 101284.

Cuñado, J., Gil-Alana, L.A. and Perez de Gracia, F. (2007), Testing for Stock Market Bubbles Using Nonlinear Models and Fractional Integration, *Applied Financial Economics*, 17, pp.1313-1321.

Demirer, R. and Kutan, A.M. (2006), Does Herding Behavior Exist in Chinese Stock Markets?, *Journal of International Financial Markets, Institutions and Money*, 16(2), pp.123-142.

Devenow, A. and Welch, I. (1996), Rational Herding in Financial Economics, *European Economic Review,* 40, pp. 603-615.

Duygun, M., Tunaru, R. and Vioto, D. (2021), Herding by Corporates in the US and the Eurozone through Different Market Conditions*, Journal of International Money and Finance*, 110, pp. 102311.

Economou, F., Kostakis, A. and Philippas, N. (2018), Cross-country Effects in Herding Behaviour: Evidence from Four European Markets, *Journal of International Financial Markets, Institutions and Money,* 21(3), pp. 443-460.

Fernández, B., Garcia-Merino, T., Mayoral, R. Santos, V. and Vallelado, E. (2011), Herding, Information Uncertainty and Investors' Cognitive Profile, *Qualitative Research in Financial Markets*, 3(1), pp. 7-33.

Filip, A.M., Pece, A.M. and Pochea, M.M. (2015), An Empirical Investigation of Herding Behavior in CEE Stock Markets under the Global Financial Crisis, *Procedia Economics and Finance*, 25, pp. 354-361.

Galariotis, E.C., Krokida, S. and Spyrou, S.I. (2016), Herd behavior and equity market liquidity: Evidence from major markets, *International Review of Financial Analysis*, 48, pp. 140-149.

Galariotis, E.C., Rong, W. And Spyrou, S.I. (2015), Herding on fundamental information: A comparative study, *Journal of Banking and Finance*, 50, pp. 589-598.

Guo, J., Holmes, P. and Altanlar, A. (2020), Is Herding Spurious or Intentional? Evidence from Analyst Recommendation Revisions and Sentiment, *International Review of Financial Analysis*, 71, 101539.

Hirshleifer, D. and Teoh, S.H. (2003), Herd Behavior and Cascading in Capital Markets: a Review and Synthesis, *European Financial Management*, 9, pp. 25-66.

Hwang, S. and Salmon, M. (2004), Market Stress and Herding, *Journal of Empirical Finance*, 11(4), pp. 585-616.

Javed, H., Bagh, T. and Razzaq, S. (2017), Herding Effects, Over Confidence, Availability Bias and Representativeness as Behavioral Determinants of Perceived Investment Performance: An Empirical Evidence from Pakistan Stock Exchange (PSX), *Journal of Global Economics*, 6(1), pp. 1000275.

Kaliva, K. and Koskinen, L. (2008), Stock Market Bubbles, Inflation and Investment Risk, *International Revies of Financial Analysis,* 17(3), pp. 592-603.

Khan, H., Hassairi, S.A. and Viviani, J.L. (2011), Herd Behavior and Market Stress: The Case of Four European Countries, *International Business Research,* 4(3), pp. 53-68.

Kreuser, J., and Sornette, D. (2017), Super-Exponential RE Bubble Model with Efficient Crashes. Working paper, University of Geneva, Switzerland.

Lao, P. and Singh, H. (2011), Herding Behavior in the Chinese and Indian Stock Markets, *Journal of Asian Economics,* 22(6), pp. 495-506.

Maug, E. and Naik, N.Y. (1995), Herding and Delegated Portfolio Management: The Impact of Relative Performance Evaluation on Asset Allocation. Working paper, London Business School.

Pochea, M.M., Filip, A.M. and Pece, A.M. (2017), Herding Behavior in CEE Stock Markets under Asymmetric Conditions: A Quantile Regressions Analysis, *Journal of Behavioral Finance*, pp. 1-17.

Scharfstein, D.S., and Stein, J.C. (1990), Herd Behavior and Investment, *The American Economic Review*, 80, 465–479.

Spyrou, S.I. (2013), Herding in Financial Markets: a Review of the Literature, *Review of Behavioral Finance*, 5(2), pp. 175-194.

Yao, C.Z., Li, H.Y. (2020), Time-varying lead–lag structure between investor sentiment and stock market, *The North American Journal of Economics and Finance*, 52, pp. 101148.

Appendices

Appendix 1. Estimates of Herding Behavior in Frontier Nordic Countries

$CSAD_t = \beta_0 + \beta_1 \cdot \lvert R_{m,t} \rvert + \beta_2 \cdot R_{m,t}^2 + \varepsilon_t$				
	β_0 *t-stat*	β_1 *t-stat*	β_2 *t-stat*	*Adj.* R^2
Latvia				
OLS	0.013***	0.751***	1.466***	0.188
	34.184	21.998	3.971	
$\tau = 10\%$	0.001***	0.869***	0.141	0.254
	4.530	14.773	0.072	
$\tau = 25\%$	0.003***	0.822***	1.241***	0.213
	23.198	54.978	10.514	
$\tau = 50\%$	0.008***	0.771***	1.555***	0.170
	34.314	27.180	3.727	
$\tau = 75\%$	0.017***	0.773***	1.164	0.134
	18.700	3.463	0.169	
$\tau = 90\%$	0.028***	0.649***	2.110***	0.107
	38.104	7.646	2.736	
Lithuania				
OLS	0.010***	0.860***	0.108	0.353
	33.520	15.094	0.096	
$\tau = 10\%$	0.003***	0.789***	-0.596***	0.204
	20.770	40.915	-2.968	
$\tau = 25\%$	0.005***	0.741***	1.220*	0.200
	39.390	29.109	1.828	
$\tau = 50\%$	0.008***	0.787***	1.171	0.204
	45.008	17.247	1.053	
$\tau = 75\%$	0.013***	0.848***	0.885	0.212
	50.348	16.364	1.240	
$\tau = 90\%$	0.028***	0.649***	2.110***	0.107
	37.858	12.122	0.433	
Iceland				
OLS	0.009***	0.667***	0.456***	0.654
	18.973	12.816	10.199	
$\tau = 10\%$	0.001***	0.668***	0.459***	0.273
	13.627	47.313	35.861	
$\tau = 25\%$	0.002***	0.753***	0.381***	0.291
	15.459	49.943	27.916	
$\tau = 50\%$	0.004***	0.761***	0.372***	0.256
	22.133	44.069	23.863	
$\tau = 75\%$	0.010***	0.805***	0.327***	0.194
	22.360	19.172	8.614	
$\tau = 90\%$	0.019***	0.800***	0.324***	0.157
	17.791	5.984	2.681	

Notes: The table reports the OLS and quantile results for the full-period sample for the benchmark model $CSAD_t = \beta_0 + \beta_1 \cdot |R_{m,t}| + \beta_2 \cdot R_{m,t}^2 + \varepsilon_t$, for frontier Nordic countries: Latvia, Lithuania and Iceland. The market portfolios used are OMXRGI, OMXVGI, and OMX Iceland for Latvia, Lithuania, and Iceland, respectively. A negative and statistically significant coefficient β_2 implies the presence of herding behavior in the examined market. Standard errors are estimated by using Newey-West (1987) correction.
***, **, * denote statistical significance at the 1%, 5%, and 10% level.

Appendix 2. Evidence of Herding Behavior in Frontier Nordic Countries Under Up and Down Market

$$CSAD_t = \beta_0 + \beta_1 \cdot D^{up} \cdot |R_{m,t}| + \beta_2 \cdot (1 - D^{up}) \cdot |R_{m,t}| + \beta_3 \cdot D^{up} \cdot R_{m,t}^2 + \beta_4 \cdot (1 - D^{up}) \cdot R_{m,t}^2 + \varepsilon_t$$

	β_0 *t-stat*	β_1 *t-stat*	β_2 *t-stat*	β_3 *t-stat*	β_4 *t-stat*	$Adj.\ R^2$
Latvia						
OLS	0.013***	0.724***	0.770***	2.004***	1.115***	0.187
	33.940	16.495	19.164	3.298	3.172	
$\tau = 10\%$	0.001***	0.860***	0.868***	0.570	0.147	0.253
	4.708	15.270	12.299	0.285	0.058	
$\tau = 25\%$	0.003***	0.815***	0.819***	1.539***	1.255***	0.212
	23.054	44.350	43.322	6.574	9.622	
$\tau = 50\%$	0.008***	0.765***	0.782***	1.606***	1.295***	0.169
	36.231	26.908	28.709	4.702	6.938	
$\tau = 75\%$	0.017***	0.735***	0.804***	1.787	0.845**	0.133
	30.935	4.557	14.300	0.337	2.517	
$\tau = 90\%$	0.028***	0.585**	0.709***	4.126	1.250	0.106
	28.177	2.498	3.697	0.651	0.334	
Lithuania						
OLS	0.010***	0.917***	0.791***	-1.517**	1.763*	0.354
	35.377	15.683	14.731	-2.001	1.741	
$\tau = 10\%$	0.003***	0.784***	0.7159***	-0.559***	1.829***	0.204
	21.064	34.627	23.934	-2.740	4.021	
$\tau = 25\%$	0.005***	0.762***	0.697***	-0.034	2.615***	0.200
	38.881	32.603	18.630	-0.143	2.893	
$\tau = 50\%$	0.008***	0.794***	0.789***	0.624	1.322	0.203
	46.568	15.665	15.173	0.410	1.422	
$\tau = 75\%$	0.013***	0.890***	0.816***	-1.119	2.633***	0.212
	45.407	11.010	10.970	-0.533	4.469	
$\tau = 90\%$	0.018***	1.272***	1.029***	-4.834	0.502	0.220
	36.685	7.840	11.561	-1.301	0.691	
Iceland						
OLS	0.007***	0.810***	0.703***	-3.706***	0.422***	0.656
	19.058	16.755	11.584	-5.765	7.915	
$\tau = 10\%$	0.001***	0.872***	0.664***	-6.415***	0.462***	0.300
	7.630	46.475	27.028	-12.847	20.718	
$\tau = 25\%$	0.001***	0.906***	0.768***	-4.845***	0.366***	0.303
	10.304	26.693	43.964	-3.375	23.184	
$\tau = 50\%$	0.004***	0.888***	0.763***	-3.760***	0.369***	0.258
	20.531	45.363	32.949	-20.095	17.653	
$\tau = 75\%$	0.009***	0.937***	0.820***	-4.463***	0.312***	0.195
	28.256	20.531	41.727	-12.467	17.551	
$\tau = 90\%$	0.019***	0.956***	0.824***	-5.177***	0.301***	0.157
	26.615	10.047	132.292	-7.058	53.530	

Note: The table reports the OLS and quantile results for the full-period sample for the regression model $CSAD_t = \beta_0 + \beta_1 \cdot D^{up} \cdot |R_{m,t}| + \beta_2 \cdot (1 - D^{up}) \cdot |R_{m,t}| + \beta_3 \cdot D^{up} \cdot R_{m,t}^2 + \beta_4 \cdot (1 - D^{up}) \cdot R_{m,t}^2 + \varepsilon_t$, for frontier Nordic countries: Latvia, Lithuania, and Iceland. D^{up} takes value 1, when the market is up and 0, when the market is down. It is assumed that market is up, when the market return in that day is higher than the average market return in previous 30 days. The market portfolios used are OMXRGI, OMXVGI, and OMX Iceland for Latvia, Lithuania, and Iceland, respectively. A negative and statistically significant coefficients β_3, β_4 imply the presence of herding behavior in the examined market in case of up and, respectively, down market. Standard errors are estimated by using Newey-West (1987) correction.
***, **, * denote statistical significance at the 1%, 5%, and 10% level.

Appendix 3. Evidence of Herding Behavior in Frontier Nordic Countries Under High and Low Volatility

$$CSAD_t = \beta_0 + \beta_1 \cdot D^{vol} \cdot |R_{m,t}| + \beta_2 \cdot (1 - D^{vol}) \cdot |R_{m,t}| + \beta_3 \cdot D^{vol} \cdot R_{m,t}^2 + \beta_4 \cdot (1 - D^{vol}) \cdot R_{m,t}^2 + \varepsilon_t$$

	β_0 *t-stat*	β_1 *t-stat*	β_2 *t-stat*	β_3 *t-stat*	β_4 *t-stat*	$Adj.\ R^2$
Latvia						
OLS	0.012***	0.716***	0.834***	1.887***	-0.215	0.188
	33.282	17.768	14.821	4.007	-0.218	
$\tau = 10\%$	0.001***	0.851***	0.871***	1.054	-0.616	0.254
	7.796	22.607	38.498	0.972	-1.269	
$\tau = 25\%$	0.003***	0.826***	0.840***	1.212***	0.491	0.212
	19.772	45.238	19.569	9.325	0.320	
$\tau = 50\%$	0.008***	0.740***	0.819***	1.937***	0.524	0.170
	33.209	22.529	19.081	3.596	0.633	
$\tau = 75\%$	0.016***	0.633***	0.889***	3.063***	-0.767	0.134
	38.308	9.540	15.412	4.498	-1.307	
$\tau = 90\%$	0.027***	0.576***	0.766***	2.739***	0.442	0.107
	38.352	6.726	5.084	3.415	0.186	
Lithuania						
OLS	0.010***	0.815***	0.930***	0.027	1.188	0.356
	35.356	17.615	11.330	0.044	1.089	
$\tau = 10\%$	0.003***	0.783***	0.689***	-0.557***	4.387***	0.205
	23.529	37.687	41.194	-2.781	29.006	
$\tau = 25\%$	0.005***	0.760***	0.675***	-0.022	4.247***	0.200
	42.127	32.902	26.608	-0.092	9.332	
$\tau = 50\%$	0.008***	0.768***	0.774 ***	0.934	2.868	0.203
	28.151	13.845	4.782	0.821	0.394	
$\tau = 75\%$	0.012***	0.817***	0.927***	0.701	1.709***	0.213
	46.730	11.846	11.755	0.378	2.662	
$\tau = 90\%$	0.017***	0.980***	1.403***	0.013	-2.619***	0.226
	36.168	7.538	15.501	0.007	-3.545	
Iceland						
OLS	0.009***	0.644***	0.630***	0.472**	0.826***	0.654
	19.508	9.889	11.994	8.005	6.002	
$\tau = 10\%$	0.001***	0.645***	0.789***	0.479***	-3.860***	0.280
	3.552	21.267	9.901	17.419	-2.125	
$\tau = 25\%$	0.001***	0.735***	0.758***	0.397***	0.599***	0.291
	16.130	38.956	50.226	23.186	14.947	
$\tau = 50\%$	0.004***	0.746***	0.753***	0.384***	0.596***	0.255
	23.417	37.186	44.148	21.161	13.148	
$\tau = 75\%$	0.009***	0.781***	0.751***	0.347***	0.560***	0.194
	21.111	12.036	15.253	5.905	4.349	
$\tau = 90\%$	0.020***	0.754***	0.649***	0.363***	0.759***	0.157
	23.199	59.185	7.129	32.257	3.185	

Note: The table reports the OLS and quantile results for the full-period sample for the regression model $CSAD_t = \beta_0 + \beta_1 \cdot D^{vol} \cdot |R_{m,t}| + \beta_2 \cdot (1 - D^{vol}) \cdot |R_{m,t}| + \beta_3 \cdot D^{vol} \cdot R_{m,t}^2 + \beta_4 \cdot (1 - D^{vol}) \cdot R_{m,t}^2 + \varepsilon_t$, for frontier Nordic countries: Latvia, Lithuania, and Iceland. D^{vol} takes value 1, when the market volatility is high and 0, otherwise. It is assumed that market volatility is high, when the market standard deviation in that day is higher than the average market standard deviation in previous 30 days. The market portfolios used are OMXRGI, OMXVGI, and OMX Iceland for Latvia, Lithuania, and Iceland, respectively. A negative and statistically significant coefficients β_3, β_4 imply the presence of herding behavior in the examined market in case of high and, respectively, low market volatility. Standard errors are estimated by using Newey-West (1987) correction.
***, **, * denote statistical significance at the 1%, 5%, and 10% level.

Appendix 4. The Impact of Global Financial Crisis on Herding Behavior in Frontier Nordic Countries

$CSAD_t = \beta_0 + \beta_1 \cdot D^{GFC} \cdot \lvert R_{m,t}\rvert + \beta_2 \cdot (1 - D^{GFC}) \cdot \lvert R_{m,t}\rvert + \beta_3 \cdot D^{GFC} \cdot R_{m,t}^2 + \beta_4 \cdot (1 - D^{GFC}) \cdot R_{m,t}^2 + \varepsilon_t$						
	β_0 *t-stat*	β_1 *t-stat*	β_2 *t-stat*	β_3 *t-stat*	β_4 *t-stat*	$Adj.\ R^2$
Latvia						
OLS	0.013***	0.744***	0.738***	2.084	1.409***	0.187
	33.919	10.304	18.877	1.643	3.941	
$\tau = 10\%$	0.001***	0.883***	0.873***	0.314	-0.329	0.254
	4.926	18.128	14.877	0.214	-0.147	
$\tau = 25\%$	0.003***	0.869***	0.794***	0.729**	1.405***	0.213
	22.885	35.647	45.557	2.126	11.269	
$\tau = 50\%$	0.008***	0.871***	0.731***	0.224	1.881***	0.170
	34.463	20.372	23.940	0.410	4.315	
$\tau = 75\%$	0.017***	0.806***	0.661***	2.062	1.855***	0.134
	35.499	9.102	8.875	1.064	2.744	
$\tau = 90\%$	0.028***	0.582***	0.620***	4.645***	2.348	0.107
	32.072	7.119	3.491	5.098	1.561	
Lithuania						
OLS	0.010***	1.273***	0.539***	-5.806***	5.098***	0.387
	34.889	13.375	13.192	-4.458	10.148	
$\tau = 10\%$	0.003***	0.861***	0.672***	-1.281***	3.455***	0.207
	21.117	27.910	22.594	-4.670	4.194	
$\tau = 25\%$	0.005***	0.916***	0.605***	-1.465***	4.914***	0.208
	45.299	32.794	32.401	-4.716	28.739	
$\tau = 50\%$	0.008***	1.100***	0.593***	-3.471***	4.782***	0.215
	60.560	19.816	26.273	-6.202	20.273	
$\tau = 75\%$	0.013***	1.572***	0.616***	-8.567***	4.282***	0.241
	60.743	22.656	20.216	-12.490	16.873	
$\tau = 90\%$	0.019***	2.185***	0.507***	-14.555***	4.783***	0.271
	39.690	9.228	7.955	-6.309	9.481	
Iceland						
OLS	0.008***	0.661***	0.775***	0.461***	-2.003	0.654
	16.018	8.982	11.040	7.131	-1.404	
$\tau = 10\%$	0.000	0.512***	0.963***	0.600***	-8.210***	0.317
	1.596	12.841	32.642	16.538	-5.511	
$\tau = 25\%$	0.001***	0.686***	0.906***	0.441***	-3.591***	0.303
	12.221	30.371	70.128	21.529	-20.309	
$\tau = 50\%$	0.003***	0.718***	0.878***	0.410***	-2.751**	0.257
	16.385	22.564	21.372	14.242	-2.056	
$\tau = 75\%$	0.009***	0.718***	0.913***	0.406***	-2.063	0.195
	13.599	14.127	4.782	8.840	-0.245	
$\tau = 90\%$	0.019***	0.822***	0.754***	0.302***	0.402	0.156
	20.960	128.269	4.661	53.242	0.114	

Note: The table reports the OLS and quantile results for the full-period sample for the regression model $CSAD_t = \beta_0 + \beta_1 \cdot D^{GFC} \cdot |R_{m,t}| + \beta_2 \cdot (1 - D^{GFC}) \cdot |R_{m,t}| + \beta_3 \cdot D^{GFC} \cdot R_{m,t}^2 + \beta_4 \cdot (1 - D^{GFC}) \cdot R_{m,t}^2 + \varepsilon_t,$ for frontier Nordic countries: Latvia, Lithuania, and Iceland. D^{GFC} takes value 1, during period of Global Financial Crisis, and 0, otherwise. The considered period of Global Financial Crisis is from January 1, 2007 until December 31, 2009. The market portfolios used are OMXRGI, OMXVGI. and OMX Iceland for Latvia, Lithuania, and Iceland, respectively. A negative and statistically significant coefficient β_3 implies the presence of herding behavior in the examined market during crisis. Standard errors are estimated by using Newey-West (1987) correction.
***, **, * denote statistical significance at the 1%, 5%, and 10% level.

Appendix 5. The Impact of European Sovereign Debt Crisis on Herding Behavior in Frontier Nordic Countries

$CSAD_t = \beta_0 + \beta_1 \cdot D^{ESD} \cdot \lvert R_{m,t}\rvert + \beta_2 \cdot (1 - D^{ESD}) \cdot \lvert R_{m,t}\rvert + \beta_3 \cdot D^{ESD} \cdot R_{m,t}^2 + \beta_4 \cdot (1 - D^{ESD}) \cdot R_{m,t}^2 + \varepsilon_t$						
	β_0 *t-stat*	β_1 *t-stat*	β_2 *t-stat*	β_3 *t-stat*	β_4 *t-stat*	$Adj.\ R^2$
Latvia						
OLS	0.012***	0.889***	0.749***	-3.404	1.515***	0.187
	33.311	7.165	21.245	-0.936	3.957	
$\tau = 10\%$	0.001***	0.969***	0.851***	-3.730	0.730	0.254
	5.110	14.287	16.608	-1.077	0.456	
$\tau = 25\%$	0.003***	1.043***	0.820***	-5.439	1.253***	0.213
	21.623	8.286	51.712	-0.739	10.295	
$\tau = 50\%$	0.008***	1.011***	0.762***	-6.312	1.639	0.170
	33.501	9.166	26.202	-1.286	3.872	
$\tau = 75\%$	0.016***	1.073***	0.752***	-8.305***	1.563	0.133
	19.418	6.546	3.302	-2.768	0.219	
$\tau = 90\%$	0.028***	0.736**	0.636***	1.390	2.292***	0.106
	37.607	2.502	7.655	0.216	2.907	
Lithuania						
OLS	0.010***	0.814***	0.891***	2.323***	-0.897	0.354
	35.594	11.772	16.958	2.917	-1.321	
$\tau = 10\%$	0.002***	0.722***	0.775***	3.207	-0.481**	0.204
	18.821	4.384	34.801	0.435	-2.261	
$\tau = 25\%$	0.005***	0.751***	0.713***	2.872*	1.541***	0.200
	39.049	10.865	28.989	1.700	2.628	
$\tau = 50\%$	0.008***	0.876***	0.776***	-0.080	0.873	0.203
	45.044	9.143	17.931	-0.035	0.871	
$\tau = 75\%$	0.012***	0.875***	0.866***	2.142***	-0.016	0.212
	47.778	8.868	13.327	2.627	-0.010	
$\tau = 90\%$	0.017***	0.961***	1.211***	1.068	-3.718***	0.220
	38.935	4.378	17.229	0.589	-4.265	
Iceland						
OLS	0.009***	0.582***	0.659***	11.536***	0.462***	0.654
	18.517	3.047	12.447	1.207	10.184	
$\tau = 10\%$	0.001***	0.637***	0.646***	5.779***	0.478***	0.274
	14.340	31.748	41.427	7.166	33.789	
$\tau = 25\%$	0.001***	0.641***	0.745***	6.306**	0.387***	0.292
	15.276	16.001	46.157	2.330	26.492	
$\tau = 50\%$	0.004***	0.216***	0.752***	27.011***	0.378***	0.262
	23.806	3.514	41.100	6.421	22.900	
$\tau = 75\%$	0.009***	-0.326	0.814***	45.453***	0.317***	0.200
	30.739	-1.588	35.810	3.153	15.445	
$\tau = 90\%$	0.018***	1.861***	0.802***	-32.040**	0.321**	0.159
	17.129	3.407	5.678	-2.430	2.509	

Note: The table reports the OLS and quantile results for the full-period sample for the regression model $CSAD_t = \beta_0 + \beta_1 \cdot D^{ESD} \cdot |R_{m,t}| + \beta_2 \cdot (1 - D^{ESD}) \cdot |R_{m,t}| + \beta_3 \cdot D^{ESD} \cdot R_{m,t}^2 + \beta_4 \cdot (1 - D^{ESD}) \cdot R_{m,t}^2 + \varepsilon_t$, for frontier Nordic countries: Latvia, Lithuania, and Iceland. D^{ESD} takes value 1, during period of European Sovereign Debt Crisis, and 0, otherwise. The considered period of European Sovereign Debt Crisis is from May 2, 2010 until December 31, 2012. The market portfolios used are OMXRGI, OMXVGI, and OMX Iceland for Latvia, Lithuania, and Iceland, respectively. A negative and statistically significant coefficient β_3 implies the presence of herding behavior in the examined market during crisis. Standard errors are estimated by using Newey-West (1987) correction.
***, **, * denote statistical significance at the 1%, 5%, and 10% level.

Appendix 6. The Impact of Covid-19 Pandemic on Herding Behavior in Frontier Nordic Countries

$$CSAD_t = \beta_0 + \beta_1 \cdot D^{CoWHO} \cdot |R_{m,t}| + \beta_2 \cdot (1 - D^{CoWHO}) \cdot |R_{m,t}| + \beta_3 \cdot D^{CoWHO} \cdot R^2_{m,t} + + \beta_4 \cdot (1 - D^{CoWHO}) \cdot R^2_{m,t} + \varepsilon_t$$

	β_0 *t-stat*	β_1 *t-stat*	β_2 *t-stat*	β_3 *t-stat*	β_4 *t-stat*	$Adj.\ R^2$
Latvia						
OLS	0.012***	1.027***	0.750***	-8.432	1.492***	0.187
	33.777	2.781	21.938	-0.763	4.043	
$\tau = 10\%$	0.001***	0.892***	0.864***	0.505	0.320	0.253
	4.753	8.922	15.541	0.085	0.177	
$\tau = 25\%$	0.003***	0.886***	0.821***	-1.997	1.244***	0.212
	22.743	5.640	53.934	-0.199	10.424	
$\tau = 50\%$	0.008***	0.983***	0.770***	-5.278	1.567***	0.170
	33.931	6.919	27.033	-1.200	3.746	
$\tau = 75\%$	0.016***	0.708**	0.773***	3.465	1.163	0.133
	18.950	2.102	3.467	0.374	0.167	
$\tau = 90\%$	0.028***	0.511	0.653***	0.284	2.069	0.106
	37.281	0.642	7.598	0.013	2.655	
Lithuania						
OLS	0.010***	0.620***	0.872***	-4.976	-0.040	0.354
	33.658	3.723	15.092	-0.711	-0.035	
$\tau = 10\%$	0.002***	1.008***	0.795***	-21.208	-0.654***	0.204
	20.115	4.066	40.125	-1.052	-3.209	
$\tau = 25\%$	0.005***	0.808***	0.746***	-10.416	1.166*	0.200
	37.711	3.476	28.411	-0.479	1.730	
$\tau = 50\%$	0.008***	0.583***	0.807***	-0.416	0.722	0.205
	37.402	7.754	12.272	-0.185	0.370	
$\tau = 75\%$	0.012***	0.425***	0.853***	0.692	0.806	0.213
	48.990	3.107	15.910	0.185	1.119	
$\tau = 90\%$	0.018***	0.317***	1.126***	-0.096	-1.722	0.223
	27.311	1.892	6.120	-0.021	-0.327	
Iceland						
OLS	0.009***	0.844***	0.667***	-3.018**	0.454***	0.654
	18.578	8.434	12.207	-2.342	9.663	
$\tau = 10\%$	0.001***	0.910***	0.656***	-3.622***	0.469***	0.281
	14.488	43.493	48.082	-17.444	37.936	
$\tau = 25\%$	0.001***	0.984***	0.737***	-4.404***	0.394***	0.296
	15.887	39.358	48.266	-16.970	28.527	
$\tau = 50\%$	0.003***	1.086***	0.753***	-5.611***	0.378***	0.258
	20.997	16.450	40.282	-8.860	22.439	
$\tau = 75\%$	0.009***	0.967***	0.784***	-1.434	0.345***	0.194
	18.323	8.537	13.392	-0.705	6.513	
$\tau = 90\%$	0.019***	0.884***	0.817***	-2.501	0.307**	0.156
	18.275	4.588	5.886	-0.795	2.445	

Note: The table reports the OLS and quantile results for the full-period sample for the regression model $CSAD_t = \beta_0 + \beta_1 \cdot D^{CoWHO} \cdot |R_{m,t}| + \beta_2 \cdot (1 - D^{CoWHO}) \cdot |R_{m,t}| + \beta_3 \cdot D^{CoWHO} \cdot R^2_{m,t} + \beta_4 \cdot (1 - D^{CoWHO}) \cdot R^2_{m,t} + \varepsilon_t$, for frontier Nordic countries: Latvia, Lithuania, and Iceland. D^{CoWHO} takes value 1, during period of Covid-19 pandemic announced by the World Health Organization, and 0, otherwise. The considered period of Covid-19 pandemic is from March 11, 2020 until the end of the sample. The market portfolios used are OMXRGI, OMXVGI, and OMX Iceland for Latvia, Lithuania and Iceland, respectively. A negative and statistically significant coefficient β_3 implies the presence of herding behavior in the examined market during crisis. Standard errors are estimated by using Newey-West (1987) correction.
***, **, * denote statistical significance at the 1%, 5%, and 10% level.

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THE PRICE IMPACT OF S&P 500 AFFILIATION

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Abstract: We examine how abnormal returns and abnormal return determinants change when a company is added to S&P 500. Newly added companies experience a significant increase in abnormal returns around the announcement and addition dates. This increase is accompanied by an improvement in liquidity and a decrease in associated shadow cost. While before their addition, firm-specific abnormal returns can be explained by price impact, they are explained by changes in trading activity during the addition event. Additionally, companies with higher leverage ratios benefit more from index affiliation.

JEL Classification: G10, G12, G14,

Keywords: Index addition, index restructuring, stock addition, liquidity, abnormal returns

1. Introduction

The index anomaly gained academic attention over half a century ago. The first articles to analyze the impact of index reconstruction date back to the '80s, when authors were curious to capture and explain the effects affiliation with the S&P 500 Index might have on the added (or removed) stocks.

Most existing literature suggests that including a stock in the S&P 500 index can positively impact its price and increase synchronicity. Nonetheless, there is no consensus regarding the drivers of these effects.

We aim to see whether the *price pressure hypothesis* (Scholes, 1972) and the *investor awareness hypothesis* (market segmentation hypothesis (Merton, 1987)) can explain the increase in abnormal returns around the addition date as well as to capture whether the abnormal return determinants change once a company is included in the index.

We employ a combination of event study, multiple regression analysis, and difference in difference analysis over two estimation and one event window to: (1) confirm there is a change in the behavior of the analyzed stocks, (2) understand whether return creation during the event window can be explained through the price pressure or investor awareness lenses.

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2. Literature review

Schleifer (1986) was one of the pioneering studies in this area. The author analyzed the companies included in S&P 500 and noticed that, upon the announcement that a company *would become* an S&P 500 member, its abnormal returns went up (on average) by 2.8%. The author points out that the effect did not reverse for 60 days window.

Harris and Gurel (1986) examine prices and volumes surrounding the S&P 500 reconstruction events and find evidence supporting the price-pressure hypothesis. However, the authors mention that the prices reverse about two weeks after the event.

Jain (1987) extended Shleifer's (1986) study by including a sample of deletions from the S&P 500. The author confirms the presence of a price effect associated with the S&P 500 restructuring. He mentions that included companies registered an average 3.1% return on the first trading day after inclusion, with no price reversal over the next 60 trading days.

The S&P Committee began pre-announcing S&P 500 changes in October 1989. To see if this change in the information environment might have an impact on stock prices directly affected by the restructuring effect, Beneish & Whaley (1996) focus solely on the period post-1990. Their results suggest an even higher impact on abnormal returns – up to 7.2% between the announcement and the addition date. Unlike previous studies, Baneish & Whaley (1996) mention a price reversal around two weeks into the restructuring. They offer two possible arguments: (1) a higher return premium associated with affiliation to the S&P 500 and (2) speculative activity caused by the influx of new information to the market.

Brealey (2000) analyzes and compares the index effects using the FTSE All-Shares and the FTSE 100 indices. The author does not report any significant price impact after index addition. However, he mentions that index deletions were subject to negative abnormal returns.

Barberis et al. (2005) studied the co-movement between S&P 500 and the new additions. They report that the correlation between the stock and the index increases after the inclusion event, while the results are stronger for the post-2000s data. Unlike previous studies, authors find evidence suggesting that the co-movement captured is an effect of investor sentiment and market friction and has nothing to do with the company's fundamentals.

Becker-Blease & Paul (2008) study the impact external shocks might have on stock liquidity to highlight potential investment opportunities. Authors conclude that in the event of a stock restructuring (which they consider an external event to the company and a liquidity shock), there is a significant positive relationship between the liquidity of a stock and the investment decisions, which is consistent with the liquidity premium.

Petajisto (2011) analyzes the indexing premium from 1990 to 2005. The author compares a large cap index effect (S&P 500) and a small cap index effect (Russell 2000). He reports abnormal returns for companies from both indices; however, the impact was significantly higher for the large-cap index affiliates.

Kasch & Sarkar (2014) use a control sample. The authors report higher profits, positive momentum, and increased market value. In terms of co-movement, the authors conclude a short-term reversal. Additionally, they mention that the control and actual samples manifest similar behaviors regarding the market value and co-movement with the index.

3. Data and Methodology

a. The curious case of the S&P 500 addition rules

Unlike many benchmark indices (Russel 2000, Nikkei, or Topix), the S&P 500 Index does not follow a calendar reconstitution approach. Changes to the index are made on an as-needed basis (Liu, 2019), while the level of transparency associated with the restructuring decision is relatively low (Afego, 2017).

The addition and deletion decisions are taken by the S&P Index Committee and are somewhat subjective. The Committee should announce the change five days prior to the restructuring. However, sometime the Committee will only name the company to be added without disclosing the actual date. In such cases, the actual addition date can be as far as one month into the future. All the announcements are publicly available on the S&P Website[1] at the same time to the clients and affected companies alike.

Index additions are announced as a supplement to index deletions. According to Chen et al. (2004), nearly ¾ of all S&P 500 deletions are caused by mergers, acquisitions, and bankruptcy events. To maintain the number of constituent stocks at 500, the S&P Committee will select new constituents based on criteria such as the company's market value, liquidity, domicile, percentage of free-float shares, sector representation and financial viability. It is worth noting that the company is not required to meet all criteria to be included, as the final decision is left at the discretion of the Committee.

In theory, all the information pertinent to the selection criteria is publicly available and should be incorporated in prices if the stock market is efficient. As such, the restructuring event should not bear any new information. (Liu, 2019).

b. Sample

Using media sources (Google, S&P Web site), we gathered our sample of additions and deletions from 1994-2019. We identified 622 restructuring events, during which 1178 companies were either added or deleted from the S&P 500 index. We use Chen et al. (2004) sample for the pre-2000s data, which is available on the Journal of Finance webpage. We exclude companies involved in corporate actions, companies delisted in the year following the event day, and companies that were subject to both an addition and a deletion event in the same year[2]. Our final sample is comprised of 522 additions and 117 clean deletions.

We experiment with the addition and the actual event date but notice no material difference in results; to ensure consistency across data, we use the effective day as our event.[3]

Similar to Liu (2011) & Daya et al. (2012), we use a two-year sample period, with one year in each direction from the event, to minimize the possibility of unknowingly including another extrinsic event in our data sample.

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[1] More details available from: https://www.spglobal.com/spdji/en/indices/equity/sp-500/#news-research

[2] Additional screens (such as availability of return and volume data during the year prior and after the event) were employed.

[3] We do this because the announcement date is not always 5 days before the effective date, which could lead to distortions in data.

Given a small sample size for our deletions,[4] the remainder of this paper will focus on the additions.

c. Data

We collect daily data (price, volume, number of shares outstanding, number of shareholders, ROA, leverage etc.) for the sample firms using Datastream and Eikon platforms provided by Refinitiv. The S&P 500 index is used as the market, while S&P 500 sector indices are used as industry proxies. The Fama-French MKT, SMB & HML factors are retrieved from Prof. French's website.

d. Hypothesis

There are several hypotheses that aim to explain the price impact around an index reconstruction event.

While variate in terms of instruments used to describe the abnormal return generation around the addition event, they can be traced to one of the two underlying theories that state that the abnormal return around the event day is either: (1) demand based, or (2) information based.

In this study we focus on two hypothesis that aim to explain the short-term abnormal return creation. Namely, the price pressure and the investor awareness hypothesis.

According to Scholes (1972) the long-term demand is perfectly elastic, yet the short-term demand can have a downward sloping curve due to the excessive buy-sell pressures. We believe that after addition the S&P 500 Index companies will experience a significant positive abnormal return, that will reverse over longer time horizons.

Investor awareness hypothesis (Merton, 1987), states that investors will only trade in a sample of companies of which they are aware. As such, he/she will require an additional premium for not being fully diversified. We believe that, affiliation with the S&P 500 Index will improve company's visibility, which in turn will increase investors' awareness.

e. Methodology

To capture the dynamic of the S&P 500 restructuring event, two estimation windows were used to account for potential changes in risk exposure that might happen during our event[5]. Our pre-event estimation window is (-260, -31), and the post-event window is (+31, +260). We allow 30 trading days around the event to limit any potential speculative impact. As a robustness check, we use a second set of estimation windows (-260, -101), (+101, +260) consistent with Liu (2011).

The individual-level analysis is then followed by a multiple regression analysis in which we identify the pre-event and the post-event behaviors and study to which extent the abnormal returns during the two estimation windows can be explained through (i)liquidity and investor awareness.

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[4] Which is further reduced by some independent and control variables used (our final sample consists of 90 deletions)

[5] Using the ex-post event window (Liu, 2011) or combining the two windows (Sheleifer, 1986) does not significantly impact the results.

We conclude the study with a difference in difference analysis to estimate whether liquidity and investor awareness changes are responsible for the abnormal return during the event window.

4. Results

a. Changes in abnormal returns

We compute abnormal returns to see whether the index re-constructure event causes a price impact.

The abnormal returns are computed as Jensen's alpha from the market model (1). To address some of the critiques in Afego (2017), we also compute the abnormal returns from the extended market and industry[6] model and the Fama-French 3 factor model.

$$AR_i = R_i - \beta_i * R_m \quad (1)$$

We begin this section by documenting the price effects around the addition day. Results based on abnormal and cumulative abnormal returns for the addition event are presented in Table 1.

Results for the Market & Market-Industry Model are very similar. As such, we will only keep the Market model results going forward. The Fama-French 3 Factor model results are quite different, and we will keep them as a robustness check.

We notice that the cumulative abnormal returns are positive even 15 days pre-event, suggesting there was some market anticipation before the reconstruction event. Furthermore, abnormal returns for the -5 day (usually associated with the announcement day) are positive and significant, with a coefficient of 0.2%. However, we can see that the abnormal returns are even higher one day before the announcement proxy, which can signify speculative pressures pre-announcement.

The gradual increase in abnormal returns captured by all three abnormal return (AR) measures until the re-constructure event can indicate external price pressures. Chen et al. (2004) explain this behavior. They suggest that the pre-announcement can trigger speculative practices among arbitragers willing to profit from the indexer's restructuring moves.

About 72% of our sample scored positive abnormal returns the day after the announcement that cannot be explained by the market or the Fama-French 3-factor models. This can be a sign of an increasing demand from both indexers and arbitragers, reflecting in a short-term increase in price pressure. (Scholes, 1972; Harris & Gurel, 1986).

[6] Because until 2008 the Real Estate companies from S&P were reported as a part of the Financial sector, they are regresses against the S&P 500 Financials index.

Table 1.

MAR is the mean abnormal return computed as Jensen's alpha from the specified model. %AR is the percentage of companies that have non-negative abnormal returns during the analyzed day.

		MAR(%)			%AR>=0		
	Day	Market Model	Market & Industry Model	Fama-French 3-Factor Model	Market Model	Market & Industry Model	Fama-French 3-Factor Model
	-10	0.00%	-0.05%	0.26%	50%**	51%	55%***
	-9	0.05%	0.07%	-0.08%	51%**	52%	49%**
	-8	0.12%	0.13%	0.08%	54%***	55%	50%**
	-7	0.07%	0.05%	0.26%	51%**	51%	57%***
	-6	0.37%***	0.32%***	0.33%**	55%***	57%***	55%***
	-5	0.22%*	0.23%*	0.21%	50%**	55%	51%**
	-4	0.30%***	0.30%***	0.34%***	72%***	72%	51%**
	-3	0.27%**	0.26%**	0.58%***	52%**	53%	56%***
	-2	0.41%***	0.45%***	0.24%	56%***	58%	48%**
	-1	0.47%***	0.43%***	0.49%***	52%**	53%	54%**
Event Day		*0.25%***	*0.28%***	*-0.22%****	*53%**	*53%***	*45%****
	1	-0.05%**	-0.03%**	-0.15%	48%	51%	45%***
	2	0.02%**	-0.11%**	0.08%	50%	48%*	50%**
	3	0.13%**	0.10%***	-0.18%*	53%	54%	41%***
	4	0.01%**	0.04%**	-0.15%	53%	52%	50%**
	5	0.14%**	0.16%**	-0.07%	52%	52%	47%***
CAR							
(-15, -6)					0.71%***	0.69%*	1.68%***
(-5, +10)					2.29% •	2.29% •	1.90%***
(-3, +10)					0.81%***	1.89%***	0.37%***
(+1, +10)					0.74%***	0.74%***	-0.70%

t-test (sign test) was used to test the significance of the mean, and the binomial distribution was used to test the significance for %AR>0 (as in Schleifer (1986), Chen et al. (2004).
***, **, * represents significance at 1%, 5% and 10% respectively.

Following Chakrabarti et al. (2005) we analyze the cumulative abnormal returns over a collection of windows ten days before the announcement and going ten days past the effective day. The values for the post-addition and pre-announcement windows are comparable, suggesting that the returns will likely reverse over a longer timeframe, which is consistent with the price pressure hypothesis.

b. Information quality & liquidity

The previous section confirms that index affiliation can impact abnormal returns, leading to a permanent (yet marginal) increase in abnormal returns while also causing a consistent (yet marginally significant) increase over the shorter event window. Nevertheless, the question regarding possible explanations of this effect remains unanswered.

To address this issue, we compute several proxies, as suggested by the academic literature[7], to test for the impact of liquidity and investor awareness on abnormal return generation around index restructuring.

The liquidity hypothesis

An increase in stock illiquidity should lead to an increase in prices, as explained in Amihud & Mendelson (1986), due to the illiquidity premium demanded by investors for trading in less liquid stocks.

We expect that liquidity will increase during the event window due to the lower transparency levels regarding the selection criteria. This will happen due to rising indexer demand (Chen et al. 2004) and speculative pressures.

To capture liquidity, we use four proxies to capture different liquidity characteristics. This approach will serve two purposes: (1) to be a robustness test and (2) to help us capture the dynamics of the re-constructure event.

Amihud's illiquidity measure (2002), which captures the price impact, is computed using the formula in eq. (2), $R_{t,d}^{i}$ is the return of the stock i on the day d, over the t window, while $V_{t,d}^{i}$ is the dollar volume.

$$ILLIQ_t^i = \frac{1}{Days_t^i} \sum_{d=1}^{Days_t^i} \frac{\left|R_{t,d}^i\right|}{V_{t,d}^i} \tag{2}$$

Zeros is the ratio of zero trading days over the total trading days, as suggested by Lesmond et al. (1999). It is a proxy for trading costs.

We computed the implicit Bid-Ask spread (Roll, 1984) using Goyenko et al. (2009) updated formula:

$$BidAsk_t = \begin{cases} 2\sqrt[2]{-cov(r_t, r_{t-1})} & \text{when } cov(r_t, r_{t-1}) < 0 \\ 0 & \text{when } cov(r_t, r_{t-1}) \geq 0 \end{cases} \tag{3}$$

All those three measures are proxies for illiquidity; as such, their increase should be a sign of liquidity worsening.

We also compute Turnover, the ratio between trading volume and number of outstanding shares. This is a direct measure of liquidity, the only one we use that can capture liquidity without information production (Chen et al. 2004).

We calculate each measure for pre- and post-estimation windows and test the difference between the means for the two windows using the t-test and the non-parametric Mann-Whitney[8] test.

Results from Table 2 suggest a significant positive change in Turnover post-addition and a significant negative change in illiquidity as captured by the Amihud measure. Results for Zeros and the implicit bid-ask spread are inconclusive.

[7] To name a few: Chen et al. (2004) use Amihud's illiquidity to explain abnormal returns, Daya et al. (2012) use Bid-Ask spread to capture changes in trading activity, Baran & King (2012) use Turnover to explain the cost of capital.

[8] Armitage et al. (2002) offer a detailed description of the two tests.

Investor awareness hypothesis

Measuring the impact of investor awareness has proven to be a complex task, primarily due to the lack of a good proxy that properly captures this dimension.

We will use three different measures to try and capture investor awareness.

First, analyst coverage (COVERAGE), calculated as the average number of analysts covering the stock over the analyzed window. The idea is that the more analysts cover a stock, the faster the information flow.

A second measure we employ is forecast dispersion (DISPERSION), the standard deviation of yearly analyst forecasts divided by the average forecast.

We expect a decline in dispersion once the stock is added to S&P 500.

The results presented in Table 2 partially confirm our expectations, as the t and z values are not significant.

The third proxy for investor awareness is the Shadow cost, as suggested by Merton (1987). It represents the difference between the returns expected by a fully diversified investor and an "under-diversified" investor. This measure builds upon the idea that an investor only trades in a finite set of securities he/she is aware of and will be subject to under-diversification.

We believe that, once affiliated with the index, a larger number of investors will become aware of the company, leading to lower shadow costs. Lower shadow costs will minimize the premium expected by the under-diversified investor, thus leading to a higher price for the added security.

We compute shadow cost as suggested by Kadlec & McConnell (1994). Excess return is the return of security *i* in excess of the stock market, and MV is the market value.

$$SC_i = \frac{\sigma(ExcessReturn)_i}{S\&P\ 500\ MV} * \frac{MV_i}{Number\ of\ Shareholders} \tag{4}$$

We notice a small significant decrease in shadow cost for our sample, suggesting that more investors become "aware" of the added companies.

Other variables

We use a set of additional control variables:

(1) Exchange dummy – companies listed on NYSE are more familiar to investors (Chen et al. 2004);
(2) ROA[9] – an increase in ROA should lead to higher abnormal returns;
(3) Book to Market Value – an increase in book to market value should represent an investment opportunity (an undervalued stock);
(4) Leverage as Debt to capital and Debt to equity. Investors have less faith in highly indebted companies and will require a higher risk premium to trade them.

[9] Several studies (i.e., Denis et al. (2003), Chan et al. (2013a)) suggest that affiliation to an index can be a stimuli for company's management, that should improve it's overall performance.

***

Results in Table 2 suggest an increase in analyst coverage following the addition event. According to Chan et al. (2013) it is a sign of an improvement in price efficiency as more information will reach the market. However, the difference between the two estimation windows is not statistically significant. We also notice that the increased coverage is accompanied by an increased EPS forecast, suggesting higher optimism levels. Baran & King (2014) explain this optimism through the additional event optimism, while Denis et al. (2003) believe it might result from an improvement in the company's performance. A decline in ROA leads us to believe that Baran & King's (2014) hypothesis regarding optimism is more likely.

There is no significant change in company sizes following the addition event, while the number of shareholders increases by about 50%. We believe that this increase is caused by an increase in institutional holdings[10]. Chan et al. (2003) report a 40% increase in institutional holdings in their sample.

Table 2.
t-stat and Mann-Whitney z-stat for the difference between windows.

	(-260, -31)	(31, 260)		
	mean	mean	t-stat	Mann–Whitney
ILLIQ (x10^4)	0.479	0.211	*-0.78*	*-3.97*
BID-ASK	0.2762	0.3154	*2.02*	*2.13*
TURNOVER	0.0105	0.0157	*0.76*	*2.04*
ZEROS	0.0888	0.0806	*-0.51*	*-1.87*
EPS	1.6638	2.033	*2.47*	*2.5*
COVERAGE	11.8415	12.1336	*0.38*	*0.47*
DISPERSION	0.2503	0.2005	*-1.25*	*-1.37*
SIZE	8.7253	8.9291	*3.43*	*4.41*
ROA	8.1881	7.3482	*-1.12*	*-0.7*
DEBT/EQ	1.2014	0.8404	*-1.08*	*-0.23*
DEBT/CAP	0.2964	0.3368	*1.76*	*3.19*
SHAREHOLDERS	19773	29649	*1.65*	*2.14*
SHADOW COST(10^6)	0.0352	0.0287	*-0.51*	*-2.24*

c. Main results

To see the extent to which (i)liquidity and investor awareness are responsible for abnormal return generation in the case of S&P 500 index affiliation and to capture the dynamics of this relationship, we estimate multiple multivariate regressions on the pre-event and post-event windows.

The purpose is to isolate any changes in return behavior consistent with changes in the informational environment.

[10] Coffee (1991) and Agarwal(2009) provide evidence in support of insitutional ownership impact on stock liquidity.

The dependent variable is abnormal return, while the independent variables are a collection of liquidity and investor awareness proxies accompanied by control variables.

As such, we estimate the following regression:

$$AR_i = LIQ_i + IA_i + \sum_{i=1}^{k} C_{i,k} + \epsilon \quad (5)$$

where, LIQ is the liquidity proxy, IA is the investor awareness proxy, and C are control variables.

Although all regressions were estimated on abnormal returns using all three abnormal return proxies, we will report only the results for the abnormal return computed from the market model unless new evidence is available.

Pre-event window

Tables 3-5 aggregate results for different (i)liquidity measures' impact on abnormal returns during the pre-event window. ILLIQ & ZEROS are statistically significant, whereas BID-ASK & TURNOVER are not.

Table 3.
Pre-event window (-260, -31) regression results

	-1	-2		-3	-4
ILLIQ	-0.58464**	-0.53537**	ZEROS	-0.006165***	-0.00562***
	(-2.67)	(-2.40)		(-6.02)	(-5.10)
DISPERSION	0.00006	-0.00001	DISPERSION	0.000086	0.00003
	(0.75)	(-0.12)		(1.03)	(0.42)
DUMMY_NASDAQ	0.00042***	0.0003**	DUMMY_NASDAQ	0.000216	0.00014
	(3.02)	(2.16)		(1.57)	(1.02)
BTMV	-0.00008***	-0.00008***	BTMV	-0.000074***	-0.00008***
	(-3.41)	(-4.41)		(-4.65)	(-5.55)
ROA	0.00001*	0.00001	ROA	0.000014**	0.00001***
	(1.88)	(1.54)		(2.1)	(1.81)
DEBT_CAP	-0.00042**	-0.00028	DEBT_CAP	-0.000415**	-0.0003*
	(-2.27)	(-1.58)		(-2.17)	(-1.66)
constant	0.0004***	0.00077***	Constant	0.000947***	0.00124***
	(3.64)	(3.16)		(6.37)	(4.71)
Industry Dummy	NO	YES	*Industry Dummy*	NO	YES
F-stat	4.5	4.69	***F-stat***	11.12	6.65
R-squared	0.0577	0.1224	***R-squared***	0.1466	0.1776

Values in brackets are the t-statistics calculated based on errors corrected by the cluster option for companies. ***, **, and * represent significance at 1%, 5%, and 10%.

These results are consistent with the efficient market hypothesis and confirm the low informational content of stock prices before their addition to S&P 500. Less informed traders will lead to more friction regarding price informativeness (Holden & Subrahmanyam, 1992). Moreover, investors will demand an illiquidity premium for trading illiquid stocks, leading to lower abnormal returns (Amihud & Mendelson, 1980).

Changing the proxy for abnormal returns and controlling for industries does not affect the results.

Table 4.
Pre-event window (-260, -31) regression results (2)

	-1	-2		-3	-4
ILLIQ	-0.54045**	-0.53789**	ZEROS	-0.006439***	-0.00623***
	(-1.96)	(-2.04)		(-6.01)	(-5.43)
COVERAGE	0.00002*	0.00001	DISPERSION	0.000004	-0.00001
	(1.84)	(0.53)		(0.41)	(-0.84)
DUMMY_NASDAQ	0.00052***	0.00038**	DUMMY_NASDAQ	0.000346**	0.00022
	(3.25)	(2.42)		(2.25)	(1.46)
BTMV	-0.00008***	-0.00008***	BTMV	-0.000075***	-0.00009***
	(-3.49)	(-4.83)		(-4.88)	(-6.35)
ROA	0.0000116	9.43E-06	ROA	0.0000115*	9.83E-06
	(1.59)	(1.19)		(1.67)	(1.32)
DEBT_TO_EQ	-0.00001**	-0.00001***	DEBT_CAP	-0.000008**	-0.00001***
	(-2.20)	(-2.96)		(-2.23)	(-2.82)
constant	0.00007	0.00059**	constant	0.000827***	0.00137***
	(0.54)	(2.16)		(4.6)	(4.61)
Industry Dummy	NO	YES	*Industry Dummy*	NO	YES
			F-stat		
F-stat	5.83	4.94	***R-squared***	11.69	7.33
R-squared	0.073	0.12222		0.1422	0.1791

Values in brackets are the t-statistics calculated based on errors corrected firm cluster option.
***, **, and * represent significance at 1%, 5%, and 10%.

The lack of significance for implicit BID-ASK and TURNOVER measures can be explained by the fact that they capture different liquidity characteristics. For example, TURNOVER measures trading activity and does not account for price impact, so we can consider it a measure of liquidity without information production (Chen et al. 2004). As such, the lack of significance for this measure, together with strongly significant ILLIQ and ZEROS, could be a sign that price changes pre-addition are influenced by the information flow and the market's ability to incorporate that information rather than a simple change in trading volumes (Chan et al. 2013)

Table 5.
Pre-event window (-260, -31) regression results (3)

	(1)		(2)
BID-ASK Spread	0.000228	TURNOVER	0.00045
	(1.25)		(0.39)
COVERAGE	0	COVERAGE	0
	(0.79)		(0.81)
DUMMY_NASDAQ	0.00036**	DUMMY_NASDAQ	0.00035**
	(2.25)		(2.21)
BTMV	-0.00008***	BTMV	-0.00008***
	(-4.97)		(-4.72)
ROA	9.52E-06	ROA	9.86E-06
	(1.23)		(1.26)
DEBT_TO_EQ	0.00001***	DEBT_TO_EQ	-0.00001**
	(-3.04)		(-2.97)
constant	0.00048*	constant	0.00053*
	(1.75)		(1.93)

	(1)		(2)
Industry Dummy	YES	*Industry Dummy*	YES
F-stat	4.94	***F-stat***	4.69
R-squared	0.1154	***R-squared***	0.1127

Values in brackets are the t-statistics calculated based on errors corrected by the cluster option for companies. ***, **, and * represent significance at 1%, 5%, and 10%.

Results in Table 6 account for the impact of shadow cost. Shadow cost is not significant pre-addition, although its negative coefficients suggest that it could negatively affect abnormal returns. Including this variable does not change the statistical significance of ILLIQ & Zeros coefficients.

Contrary to our expectations, companies listed on NASDAQ have higher abnormal returns than those traded on NYSE. Blume & Edelen (2004) argue that the different exchange mechanics could explain this phenomenon. The authors show that bilateral agreements frequently employed on NASDAQ can lead to higher return generation.

Table 6.
Pre-event window (-260, -31)

AR from	Market Model		Market & Industry Model		Fama-French 3-Factor Model	
	(1)	(2)	(3)	(4)	(5)	(6)
ILLIQ	-0.159351**		-0.1773**		0.06182	
	(-2.22)		(-2.57)		(0.71)	
ZEROS		-0.0036498**		-0.0032637*		-0.0013659
		(-2.23)		(-2.03)		(-0.82)
SHADOW_COST	-559	-628.63	-320.81	-383.17	-536.51	-562.58
	(-0.81)	(-0.86)	(-0.61)	(-0.69)	(-0.77)	(-0.79)
DUMMY_NASDAQ	0.00042**	0.00035*	0.000325*	0.00026	0.00037*	0.00034
	(2.25)	(1.85)	(1.83)	(1.46)	(1.71)	-1.58
BTMV	-0.00008***	-0.00008***	-0.000072***	-0.00007***	-0.00015***	-0.00015***
	(-6.11)	(-6.72)	(-5.15)	(-5.63)	(-11.44)	(-11.80)
ROA	-0.000013	-9.35E-06	-0.00001	-0.00001	-7.37E-06	-6.00E-06
	(-1.40)	(-1.03)	(-1.13)	(-0.78)	(-0.66)	(-0.53)
DEBT_TO_EQ	-0.000005	0	-0.000005	0	-0.00001	-0.00001
	(-1.49)	(-1.26)	(-1.48)	(-1.26)	(-1.58)	(-1.53)
constant	0.001233***	0.00146***	0.000718**	0.00092***	0.00139***	0.00148
	(4.05)	(4.63)	(2.6)	(3.14)	(3.85)	(3.91)***
Industry Dummy	YES	YES	YES	YES	YES	YES
F-stat	6.35	4.92	6.98	3.63	14.48	13.71
R-squared	0.0831	0.0997	0.0702	0.0853	0.12	0.1217

Values in brackets are the t-statistics calculated based on errors corrected by the cluster option for companies. ***, **, and * represent significance at 1%, 5%, and 10%.

Post-event window

In line with our expectations, the coefficients for (i)liquidity measures are not significant for the post-event window. Interestingly, after their addition to S&P 500, companies with higher leverage register higher abnormal returns. We can explain this by the "market leader" branding that comes together with an S&P 500 affiliation, which is associated with higher trust[11] levels. (Merton, 1987)

[11] For details, please refer to Guiso, Sapienza and Zingales (2008).

Table 7.
Post-event window (31,260)

AR from	Market Model		Market & Industry Model		Fama-French 3-Factor Model	
	(1)	(2)	(3)	(4)	(5)	(6)
ILLIQ	-0.279542		-0.27584		-0.33965	
	(-0.34)		(-0.33)		(-0.36)	
ZEROS		-0.00052		-0.00033		0.00118
		(-0.55)		(-0.37)		(1.15)
COVERAGE	0.00000	0.00	0.00000	0.00000	0.00000	0.00000
	(-0.31)	(-0.35)	(-0.57)	(-0.55)	(-0.40)	(0.04)
DUMMY_NASDAQ	-0.00032**	-0.00034	-0.00022	-0.00024	-0.00032**	-0.00031*
	(-2.00)	(-2.15)	(-1.51)	(-1.63)	(-2.00)	(-1.92)
BTMV	0.00013	0.00013	0.00011	0.00011	-0.00002	-0.00003
	(0.79)	(0.79)	(0.69)	(0.68)	(-0.13)	(-0.16)
ROA	-8.1E-07	-7.72e-07	0.00000	0.00000	0.00	1.09e-08
	(-0.27)	(-0.26)	(-0.41)	(-0.41)	(0.04)	(0.00)
DEBT_TO_EQ	-0.00001	-0.00001*	-0.00001	-0.00001	-0.00001	-0.00001
	(-1.87)	(-1.81)	(-0.85)	(-0.76)	(-1.14)	(-1.04)
constant	0.00006	0.00011	0.00002	0.00005	-0.00012	-0.00029
	(0.21)	(0.04)	(0.09)	(0.20)	(-0.41)	(0.381)
Industry Dummy	YES	YES	YES	YES	YES	YES
F-stat	1.68000	1.70000	0.98000	0.99000	1.18000	1.25000
R-squared	0.04130	0.04060	0.02280	0.02160	0.03250	0.22840

Values in brackets are the t-statistics calculated based on errors corrected by the cluster option for companies. ***, **, and * represent significance at 1%, 5%, and 10%.

Unfortunately, our model is not a good descriptor for abnormal returns post-index addition, suggesting there could be other variables, such as stock price co-movement or company-specific risk, that might better describe abnormal return creation post-index addition (Chan et al. 2013b) One other explanation would lay with full price reversal after the addition event, suggesting no significant abnormal return generation after stocks affiliation to the index.

The positive statistically significant coefficient for debt to capital is a sign that investors are more familiar with the companies they believe to be sector leaders (Merton, 1987) and are more likely to entrust their money despite higher leverage ratios, albeit requiring a risk premium to do so.

Table 8.
Post-event window (31,260)

AR from	Market Model		Market & Industry Model		Fama-French 3-Factor Model	
	(1)	(2)	(3)	(4)	(5)	(6)
BID-ASK Spread	0.000269		0.000256		0.000516	
	(1.33)		(1.39)		(1.55)	
TURNOVER		-0.00028		-0.00023		-0.00029*
		(-1.91)		(-1.47)		(-1.69)
COVERAGE	0.00000	0.00	0.00	0.00	0.00	0.00
	(-0.11)	(-0.25)	(-0.34)	(-0.48)	(-0.14)	(-0.32)
DUMMY_NASDAQ	-0.00034**	-0.00033**	-0.000244*	-0.00023	-0.00032**	-0.00033**
	(-2.19)	(-2.08)	(-1.70)	(-1.59)	(-2.00)	(-2.08)
BTMV	0.00012	0.00013	0.000091	0.00011	0.00000	-0.00002
	(0.70)	(0.80)	(0.59)	(0.69)	(-0.06)	(-0.13)

	(1)	(2)	(3)	(4)	(5)	(6)
ROA	-8.61e-07	-8.51e-07	-0.000001	0.00000	-2.78e-07	9.49e-08
	(-0.30)	(-0.29)	(-0.46)	(-0.44)	(-0.09)	(0.03)
DEBT_TO_EQ	-0.00001	-0.00001	-0.000002	-0.00001	-0.00001	-0.00001
	(-1.30)	(-1.88)	(-0.27)	(-0.86)	(-0.98)	(-1.14)
constanta	-0.00004	0.00005	-0.000076	0.00001	-0.00042	-0.00013
	(-0.15)	(0.19)	(-0.34)	(0.07)	(-1.40)	(-0.42)
Industry Dummy	YES	YES	YES	YES	YES	YES
F-stat	1.85000	1.70000	1.10000	1.03000	1.47000	1.27000
R-squared	0.04400	0.04110	0.02570	0.02220	0.03780	0.03190

Values in brackets are the t-statistics calculated based on errors corrected by the cluster option for companies. ***, **, and * represent significance at 1%, 5%, and 10%.

Upon including shadow cost in our regression, we notice it has a strong statistically significant impact on abnormal returns. Moreover, coefficients for ILLIQ, BID-ASK, and TURNOVER in models that include SHADOW COST appear significant at a 10% confidence level.

We follow up and re-run these models over the more isolated estimation window (+101, +260). All above-mentioned variables lose their statistical significance.

As such, the results presented in Table 9.A confirm it is best to use two sets of estimation windows to allow more time for the reconstruction changes to take effect.

Table 9.A.
Post event estimation window (31, 260)

	(1)	(2)	(3)	(4)
ILLIQ	7.31653***			
	(37.81)			
ZEROS		-0.00081		
		(-0.46)		
BID-ASK			0.00052*	
			(1.83)	
TURNOVER				-0.00022 *
				(-1.67)
SHADOW_COST	549.985**	533.817**	588.100**	544.384**
	(2.60)	(2.44)	(2.73)	(2.53)
DUMMY_NASDAQ	-0.00017	-0.00023	-0.00022	-0.00021
	(-0.92)	(-1.24)	(-1.22)	(-1.14)
BTMV	0.00015	0.00010	0.00006	0.00010
	(0.72)	(0.47)	(0.31)	(0.50)
ROA	0.00000	0.00000	0.00000	0.00000
	(-0.93)	(-0.36)	(-0.48)	(-0.42)
DEBT_TO_CAP	0.00008**	0.00009**	0.00009**	0.00008**
	(2.25)	(2.65)	(2.82)	(2.50)
constant	-0.00025	-0.00018	-0.00033	-0.00023
	(-0.65)	(-0.44)	(-0.87)	(-0.60)
Industry Dummy	YES	YES	YES	YES
F-stat	235.88000	1.93000	2.45000	1.98000
R-squared	0.10330	0.02920	0.04040	0.02920

Table 9.B.
Post event estimation window (101, 260)

	(1)	(2)	(3)	(4)
ILLIQ	2.45179			
	(0.30)			
ZEROS		0.00086		
		(0.64)		
BID-ASK			0.00049	
			(1.44)	
TURNOVER				-0.00050
				(-1.55)
SHADOW_COST	200.236	162.146	113.841	198.731
	(1.21)	(1.03)	(0.62)	(1.20)
DUMMY_NASDAQ	0.00026	0.00026	0.00026	0.00025
	(1.21)	(1.25)	(1.22)	(1.19)
BTMV	0.00015	0.00017	0.00012	0.00016
	(0.38)	(0.42)	(0.31)	(0.41)
ROA	0.00001	0.00001	0.00001	0.00001
	(0.75)	(0.72)	(0.58)	(0.76)
DEBT_TO_CAP	0.00005	0.00003	0.00007	0.00004
	(0.14)	(-0.91)	(0.20)	(0.11)
constant	-0.00045	-0.00050	-0.00063	-0.00044
				(-0.82)
Industry Dummy	YES	YES	YES	YES
F-stat	0.90000	0.91000	1.15000	1.06000
R-squared	0.01310	0.01400	0.02110	0.01490

Values in brackets are the t-statistics calculated based on errors corrected by the cluter option for companies. ***, **, and * represent significance at 1%, 5%, and 10%.

d. The difference in difference analysis

We conclude our study by performing a difference in difference analysis for the event window, similar to Chen et al. (2004), Liu (2011) and Chan et al. (2013a). We consider that the event window[12] starts 30 days prior to the event and lasts through 30 days after. We use this event window to capture any speculative behaviors that might happen weeks before S&P Committee's announcement.

Unlike Chan et al. (2013a), who only use ILLIQ for their difference in difference study, we compute differences for all our variables, as each (i)liquidity measure captures a different side of stock liquidity.

Our dependent variable is the mean abnormal return over the event window, and the regression we estimate is as follows:

$$AR_i = \Delta LICH_i + \Delta IA_i + \sum_{i=1}^{k} \Delta C_{i,k} + \epsilon \quad (6)$$

We notice that abnormal returns during the event window can be explained through ΔTURNOVER, a proxy for changes in trading activity. As expected, companies with higher trading volumes register higher abnormal returns during the event window. This is a stock market anomaly, and it is in line with the price pressure hypothesis (Kim & Kim, 2023; Amihud et al., 2015). Indexers want to buy stocks to re-adjust their portfolios to replicate the new index structure as close to the event date as possible to minimize their tracking error. The price they are willing to pay for the shares is just below the cost they would have to pay for an earlier adjustment. Nevertheless, the information regarding a future index restructuring is already public, causing price pressure from arbitragers willing to profit from indexers' rebalancing.

None of the investor awareness proxies are significant during the event window, although the coefficient sign for shadow cost is positive. It could imply that companies less known to investors will profit more from their affiliation with S&P 500.

As such, we can conclude that companies that were less traded before the event will benefit more from the addition to S&P 500.

Table 10.
Event window (-30, +30)

	(1)	(2)	(3)	(4)
ΔILLIQ	0.00891			
	(0.25)			
ΔZEROS		-0.00080		
		(-0.17)		
ΔBID-ASK			0.00003	
			(0.07)	
ΔTURNOVER				0.00029*
				(1.65)
ΔSHADOW_COST	175.210	192.867	155.206	172.362
	(0.14)	(0.15)	(0.12)	(0.13)

[12] We use a second event window (-15, +65) as a robustness test, which does not affect our findings.

	(1)	(2)	(3)	(4)
DUMMY_NASDAQ	-0.00004	-0.00004	-0.00004	-0.00004
	(-0.09)	(-0.09)	(-0.10)	(-0.09)
ΔBTMV	-0.00010	-0.00010	-0.00010	-0.00010
	(-1.29)	(-1.30)	(-1.28)	(-1.29)
ΔROA	0.00000	0.00000	0.00000	0.00000
	(0.06)	(0.07)	(0.06)	(0.07)
ΔDEBT_TO_CAP	-0.00059	-0.00060	-0.00059	-0.00059
	(-0.69)	(-0.71)	(-0.69)	(-0.69)
constanta	0.00045	0.00045	0.00044	0.00045
	(0.51)	(0.50)	(0.51)	(0.51)
Industry Dummy	YES	YES	YES	YES
F-stat	0.79000	0.73000	0.75000	1.47000
R-squared	0.02790	0.02800	0.02790	0.02810

Values in brackets are the t-statistics calculated based on errors corrected by the cluster option for companies. ***, **, and * represent significance at 1%, 5%, and 10%.

5. Conclusions

We examine the dynamics of abnormal return determinants around the event of S&P 500 reconstruction on a sample of 522 additions. Our results suggest that affiliation with S&P 500 can affect a stock's abnormal return determinants.

First, over the pre-event window, where there is less information available about the companies analyzed, abnormal returns are explained through the liquidity hypothesis, consistent with the efficient market hypothesis (Fama, 1970). As such, investors will require higher illiquidity premia for trading less-liquid stocks.

During the event window, abnormal returns are explained through the price pressure hypothesis, as higher demand from institutional investors and arbitragers leads to higher prices and abnormal returns. Increased trading activity positively affects the returns of newly added companies.

The post-event window is characterized by the least informational content. Neither liquidity, investor awareness, nor fundamental factors appear to be responsible for abnormal returns during that window. This phenomenon can be explained through full price reversal over the longer time-frame, suggesting no significant abnormal returns being generated after inclusion in the S&P 500 Index.

Our results are consistent with existing literature. Additionally, we show that during the event window, price impact, as measured by illiquidity, and trading costs, as captured by the implicit bid-ask spread, do not influence the abnormal return creation, while increased demand for newly added stocks does.

References

Agarwal, P. (2009). *Institutional ownership, liquidity and liquidity risk.* Cornell University.

Armitage, P., Berry, G., & Matthews, J. (2002). *Statistical Methods in Medical Research.* Malden: Blackwell Science.

Baran , L., & King, T. (2014). S&P 500 Index reconstitutions and information asymmetry. *Applied Financial Economics*, 777-971.

Barberis, N., Shleifer, A., & Wurgler, J. (2005). Comovement. *Journal of Financial Economics*, 283-317.
Bechmann, K. L. (2004). Price and Volume Effects Associated with Changes in the Danish Blue-Chip Index: The KFX Index. *Multinational Finance Journal*, 3-34.
Becker-Blease, J. R., & Paul, D. L. (2008). Stock Liquidity and Investment Opportunities: Evidence from Index Additions. *Financial Management*, 35-51.
Beneish, M. D., & Whaley, R. E. (1996). An Anatomy of the "S&P Game": The Effects of Changing the Rules. *The Journal of FINANCE*, 1909-1930.
Blume, M. E., & Edelen, R. M. (2004). S&P 500 Indexers, Tracking Error, and Liquidity. *The Journal of Portfolio Management*, 37-46.
Brealey, R. A. (200). Stock prices, stock indexes and index funds. *Bank of England Qarterly Bulletin*, 61-68.
Brealey, R. A. (2000). Stock Prices, Stock Indexes and Index Funds. *Bank of England Quarterly Bulletin*, 61-68.
Chakrabarti, R., Huang, W., Jayaraman, N., & Lee, J. (2005). Price and volume effects of changes in MSCI indices - nature and causes. *Journal of Banking & Finance*, 1237-1264.
Chan, K., Kot, H. W., & Tang, G. Y. (2013). A comprehensive long-term analysis of S&P 500 index additions and deletions. *Journal of Banking & Finance*, 4920-4930.
Chan, K., Hameed, A., & Kang, W. (2013). Stock price synchronicity and liquidity. *Journal of Financial Markets*, 414-438.
Chen, H., Noroha, G., & Singal, V. (2004). The Price Response to S&P 500 Index Additions and Deletions: Evidence of Asymmetry and a New Explanation. *The Journal of FINANCE*, 1901-1929.
Denis, D. K., McConnell, J. J., Ovtchinnikov, A. V., & Yu, Y. (2003). S&P 500 Index Additions and Earnings Expectations. *The Journal of FINANCE*, 1821-1840.
Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of FInance*, 383-417.
Jain, P. C. (1987). The Effect on Stock Price of Inclusion in or Exclusion from the S&P. *Financial Analyst Journal*, 58-65.
Lin, C., Sanger, G. C., & Booth, G. G. (1998). External information costs and the adverse selection problem: A comparison of NASDAQ and NYSE stocks. *International Review of Financial Analysis*, 113-136.
Liu, S. (2011). The Price Effects of Index Additions: A new explanation. *Journal of Economics and Business*, 152-165.
Liu, S. (2019). S&P 500 Affiliation and Stock Price Informativeness. *Journal of Behavioral Finance*.
Merton, R. C. (1987). A Simple Model of Capital Market Equilibrium with Incomplete Information. *The Journal of Finance*, 483-510.
Petajisto, A. (2008). Selection of an Optimal Index Rule for an Index Fund. *SSRN Research Papper*.
Scholes, M. (1972). The Market for Securities: Substitution versus Price Pressure and the Effects of Information on Share Prices. *The Journal of Business*, 179-211.
Shleifer, A. (1986). Do Demand Curves for Stocks Slope Down? *The Journal of Finance*, 579-590.

Appendix 1

A. Additions	Industry									
Year	Energy	Materials	Industrials	Consumer Discretionary	Consumer Staples	Health Care	Financial	IT Services	Utilities	Real Estate
1994	12	15	42	35	19	14	18	18	14	2
1995	0	0	0	2	0	2	6	2	1	0
1996	0	0	3	1	1	1	4	0	0	0
1997	1	0	2	1	1	1	6	3	2	0
1998	0	0	3	3	1	1	5	0	4	0
1999	2	1	2	4	1	0	2	4	2	0
2000	3	0	1	2	0	1	1	4	1	0
2001	0	0	2	0	1	0	1	3	0	1
2002	0	0	3	2	0	1	3	1	0	1
2003	0	0	0	1	1	1	0	0	1	2
2004	1	0	0	1	0	2	1	0	0	0
2005	2	0	0	4	2	1	1	0	0	2
2006	1	0	2	1	0	0	1	5	0	3
2007	1	0	4	5	1	0	3	2	0	4
2008	3	2	2	1	1	3	1	2	3	0
2009	1	2	3	4	1	0	0	4	1	3
2010	2	0	1	3	0	0	2	1	1	0
2011	0	1	1	3	0	2	1	1	0	1
2012	1	1	1	3	1	0	0	2	0	1
2013	1	0	2	4	0	2	0	0	0	1
2014	0	0	2	3	0	1	1	1	0	1
2015	0	0	3	7	1	3	0	2	0	3
2016	0	1	4	5	0	3	2	1	2	5
2017	0	0	2	3	0	5	3	7	0	3
2018	1	1	4	3	1	1	2	3	1	0
2019	0	0	0	0	0	1	1	0	0	0
TOTAL	32	24	89	101	33	46	65	65	34	33

The final sample of additions for 1994-2019. Breakdown by industry is done based on the GICS classification. To be included in the final sample, companies must have at least 2 years of continuos returns around the event day.

Appendix 2

B. Deletions	Industry									
Year	Energy	Materials	Industrials	Consumer Discretionary	Consumer Staples	Health Care	Financial	IT Services	Utilities	Real Estate
1994	0	0	0	0	0	0	0	0	0	0
1995	0	0	1	2	0	0	1	0	0	0
1996	0	0	1	2	0	0	0	0	0	0
1997	0	0	0	0	0	1	1	0	0	0
1998	0	0	2	0	0	0	2	0	0	0
1999	1	1	4	2	0	0	0	0	0	0
2000	1	0	2	1	1	0	0	0	0	1
2001	1	1	0	0	0	0	0	0	0	1
2002	0	2	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	1	0
2004	0	1	1	1	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	1	0	0
2006	0	0	1	1	0	0	0	0	0	0
2007	0	0	1	0	0	0	0	3	0	0
2008	1	1	3	3	1	0	3	2	1	0
2009	0	0	2	1	0	0	1	2	0	1
2010	0	0	0	2	0	0	1	0	0	0
2011	0	0	1	0	0	0	0	0	0	1
2012	1	0	0	1	0	0	0	0	0	0
2013	0	0	0	2	0	0	1	5	0	0
2014	0	2	0	1	0	0	1	1	0	0
2015	1	0	1	0	0	0	1	1	0	0
2016	1	0	2	2	1	1	1	0	0	0
2017	4	0	2	4	0	0	0	1	0	0
2018	2	0	1	1	1	1	1	0	1	0
2019	0	0	0	0	0	0	0	0	1	0
TOTAL	13	9	25	26	4	3	14	16	4	4

The final sample of deletions for 1994-2019. Breakdown by industry is done based on the GICS classification. To be included in the final sample, companies must have at least 2 years of continuous returns around the event day.

Appendix 3. Regression results for the event window

Event window (-30, +30). AR as computed from the market model.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔILLIQ	-0.22928	-0.24022						
	(-0.52)	(-0.41)						
ΔZEROS			-0.0009	-0.0006				
			(-0.27)	(-0.18)				
ΔBID-ASK					-0.0003	-0.0003		
					(-0.86)	(-0.89)		
ΔTURNOVER							0.0004 ***	0.0005 **
							(3.80)	(2.37)
ΔDISPERSION	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003*	0.0003	0.0003*
	(1.48)	(1.63)	(1.48)	(1.63)	(1.53)	(1.71)	(1.49)	(1.66)
DUMMY_NASDAQ	0.0003	0.0002	0.0003	0.0002	0.0003	0.0002	0.0003	0.0002
	(0.83)	(0.60)	(0.84)	(0.60)	(0.83)	(0.61)	(0.85)	(0.60)
ΔBTMV	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
	(-1.60)	(-1.38)	(-1.60)	(-1.37)	(-1.62)	(-1.40)	(-1.60)	(-1.37)
$\Delta ROA(10^4)$	-0.1100**	-0.1040**	-0.1090**	-0.1030**	-0.1100**	-0.1030**	-0.1100**	-0.1030**
	(-2.47)	(-2.15)	(-2.44)	(-2.13)	(-2.34)	(-2.03)	(-2.44)	(-2.13)
ΔDEBT_CAP	0.0006	0.0007	0.0006	0.0007	0.0006	0.0006	0.0007	0.0007
	(1.37)	(1.31)	(1.36)	(1.30)	(1.29)	(1.230	(1.38)	(1.34)
constanta	-0.0002	-0.0003	-0.0002	-0.0003	-0.0002	-0.0003	-0.0002	-0.0003
	(-0.75)	(-0.58)	(-0.75)	(-0.58)	(-0.65)	(-0.44)	(-0.77)	
Industry Dummy	NO	YES	NO	YES	NO	YES	NO	YES
F-stat	2.15000	1.71000	2.13000	1.70000	2.07000	1.70000	5.33000	3.27000
R-squared	0.01790	0.03730	0.01800	0.03730	0.01970	0.03930	0.0181	0.0376

Values in brackets are the t-statistics calculated based on errors corrected by the cluster option for companies. ***, **, and * represent significance at 1%, 5%, and 10%.

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THE EUROPEAN BANKS UNDER THE SHOCK OF THE RUSSIAN INVASION OF 2022: AN EVENT STUDY APPROACH

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Abstract: This paper evaluates the reaction of systemically important banks in Europe to the shock of the Russian invasion of Ukraine in 2022. Using the event study methodology and three of the most commonly used models for estimating theoretical returns (CAPM, Fama-French with 3 factors, Fama-French with 5 factors), we show that banks react differently relative to the event date (February 24, 2022) depending on the country. Overall, systemically important banks recorded massive cumulative abnormal returns in the event window. The results differ at the country level depending on the exposure of the respective banks to Russia, the dependence of countries on Russian gas and oil, and the level of informational efficiency of the markets on which they are traded.

JEL classification: G12, G14, G15, H56.

Keywords: Event study, G-SIB's, war, Russia, Fama-French models.

1. Introduction

Both war and terrorism have been repeatedly proven to create uncertainty in economies and financial markets, making them collateral victims. A few months after the deployment of military bases near the border with Ukraine, Russia officially attacked Ukraine on February 24, 2022, marking an abrupt escalation of the Russo-Ukrainian war, which began in 2014. In academic literature, war is one of the most significant events, along with financial crises, health crises, natural disasters, political elections, and terrorist attacks, that influence global capital markets. Military conflicts increase investor uncertainty about the future profitability of companies, which leads to fluctuations in stock prices (Rigobon and Sack, 2005).

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With the escalation of this conflict, companies and administrations have imposed sanctions on the Russian Federation in an effort to boycott the invasion. The most notable are those in the finance and payment systems sector: Paysera, Apple Pay, and Google Pay were the first companies to take actions to restrict services in the Russian Federation, starting on February 24 and 26, respectively. The Prime Minister of Norway, Jonas Gahr Stoere, declared that he had chosen to freeze the fund's investments and liquidate assets related to the Russian Federation, namely shares in 47 companies and government bonds worth approximately $3 billion.

The most prominent effect of this conflict is felt in the energy market, given that 41% of Russia's natural gas exports are directed towards the European Union (EU). In order to impose financial sanctions on the Russian Federation, the EU wants to become independent of Russian imports through the REPowerEU project, which aims to achieve this independence by 2030.

The Russian banking sector was directly targeted in terms of the Russian Federation's sanction effort. So far, seven Russian banks and their subsidiaries have been excluded from the SWIFT system, according to the organization's announcement dated March 20, 2022. European banks, according to calculations made by the Financial Times, have a cumulative exposure to the Russian Federation of $96 billion. The sanctions that private banks in the EU have taken are minimal, but banks such as Société Générale, Deutsche Bank, and BNP Paribas want to end their activity in Russia or minimize future investments, in an effort to reduce their exposure in the event of a deterioration in the Russian economy.

European banks entered 2022 on an unprecedented wave of optimism, due to the prospect of rising interest rates, the end of the COVID-19 pandemic, and growing profits. However, the crisis in Ukraine quickly dampened this optimism. The Russian invasion triggered an exodus of Western companies from the country, led to a rise in commodity prices, hit the euro currency, and even threatened a global recession. Assessing the potential damage to individual banks is complicated due to the variety of ways they are exposed. Some hold Russian bonds and stocks, others have stakes in Russian banks, while others are sensitive to the secondary effects on the European economy.

In Europe, French, Italian, and Austrian banks have the highest exposure to Russia, according to data from the Bank for International Settlements (Table 1).

Table 1. Banks' exposure to Russia (September 2021)

Country	$ Million
Italy	25,300
France	25,156
Austria	17,500
US	14,673
Germany	8,076
Switzerland	3,725
UK	3,042
Spain	812
Other	764

Source: Bank for International Settlements

Western banks have significantly reduced their exposure to Russia since the Crimea invasion in 2014. But that doesn't mean they are not exposed to substantial losses due to its isolation from the global financial system.

The purpose of this paper is to investigate if and to what extent systemic important banks in Europe have experienced significant changes in abnormal returns due to the invasion of February 24, 2022. We applied the event study methodology on a sample of 32 listed systemic important banks from 12 developed European countries to evaluate changes in market capitalization of these banks. The banks were grouped by country and their reaction to the event was observed on intervals, 5 days before the event, on the day of the event, and 5 days after the event. We also extend the evaluation to a series of political statements and major events during the Ukrainian crisis (February-March 2022). We also look at a particular case, that of neighboring countries to Ukraine, to try to observe if a small geographic distance from the conflict has an amplified impact.

In this paper, we focus on the reaction of financial markets to the Russia's invasion of Ukraine, particularly on the response of European systemically important banks.

This paper contributes to the literature by analyzing a particular sector, that of European systemically important banks, grouped by country, in an attempt to understand how investors incorporate the new information related to Russia's invasion of Ukraine. The main results of this paper suggest that the war affects systemically important banks in Europe differently depending on the country.

2. Literature Review

2.1. Historic

The event study methodology introduced by Fama et al. (1969) has gained popularity over time as an econometric technique and has become the standard method for measuring the reaction of financial asset prices to certain announcements or events. These unexpected announcements and events subject financial markets to a high level of stress, and market participants may lose their ability to rationally evaluate the implications of these events.

There is a large amount of research in the financial and economic literature that seeks to measure abnormal stock returns. Most of the articles that study abnormal returns are based on the efficient market theory developed by Fama et al. (1969) and Fama (1970), which argues that stock prices reflect all available information and that superior returns can only be obtained by chance. Considering the two characteristics of efficient markets: 1) how quickly and completely any new information is incorporated into asset prices; 2) which information is considered relevant and which is not, informational efficiency can be weak, semi-strong, or strong.

Informational efficiency in weak form is present when asset prices traded on a market reflect instantaneously and completely the entire history of their prices. Specifically, this translates into the impossibility of consistently earning excess profits from transactions inspired by studying the history of asset prices.

Informational efficiency in semi-strong form is manifested when the relevant information, in addition to price history, is formed from all publicly available information such as financial situations and details of these financial situations, statements made

by the company's representatives regarding profit on smaller periods of one year, announcements made by the company about its activities, other public information related to the general economic outlook and the national economy. To the extent that this information becomes public, it is instantaneously and completely integrated into the current price of assets, and consistent excess profits cannot be obtained from transactions based on this type of information.

Informational efficiency in strong form represents the most advanced level of efficiency, whose existence is considered only theoretical. The relevant information incorporated by the present course of assets is, in this case, both public and private privileged information, which means that even managers, financial analysts, traders, and all those who have access to such inside information cannot consistently earn excess profits by trading based on it.

Event studies are largely based on the analysis of so-called "normal" and "abnormal" returns, which are calculated using an estimation model.

2.2. Estimation models used in practice

Over time, a variety of models have been proposed, analyzed, and/or used in practice to measure theoretical profitability, which is then used to calculate abnormal returns.

1. Market Model: assumes that returns follow a market model with a single factor of form:

$$R_{it} = \alpha_i + \beta_i * R_{mt} + \varepsilon_{it} \quad (1)$$

where Rit is the return of company i's stock on day t; R_{mt} is the market return on day t; εit represents the error term (a series of independent and identically distributed random variables with mean 0 and independent of the market return). The regression coefficient βi is a measure of Rit's sensitivity to the reference market. Abnormal returns are then calculated using the formula:

$$AR_{it} = R_{it} - (\alpha_i + \beta_i * R_{mt}) \quad (2)$$

Although this model is generally accepted as the standard model, there are also criticisms of it.

2. Adjusted Market Model: in this model, the observed market return on day t, R_{mt}, is subtracted from the observed return Rit on day t. The abnormal return is then obtained by the formula:

$$AR_{it} = R_{it} - R_{mt} \quad (3)$$

3. Empirical Mean Method: in this case, the abnormal return during the event window is the return of observation i on day t minus the average return of observation i in the estimation window:

$$AR_{it} = R_{it} - \bar{R}_i \quad (4)$$

4. CAPM Model includes the risk-free rate in the estimation and thus represents a more detailed approach than the market model:

$$R_{it} = R_{ft} + \alpha_i + \beta_i * \left(R_{mt} - R_{ft}\right) + \varepsilon_{it} \quad (5)$$

5. Multifactor Models: in an attempt to improve the variance explained by the single-factor model (thereby favoring the detection of AR), sometimes the theoretical return is estimated using multiple factors, using a multifactor model (MFM) such as the three or five-factor model introduced by Fama and French in 1992 and 2014, respectively. The Fama-French three-factor model is an asset pricing model developed in 1992 that extends the capital asset pricing model (CAPM) by adding size (SMB) and value (HML) risk factors in addition to the market risk factor from CAPM. The equation for this model is:

$$R_{it} - R_{ft} = \alpha_{it} + \beta_{mkt} * \left(R_{t,mkt} - R_{ft}\right) + \beta_{SMB} SMB + \beta_{HML} HML + \varepsilon_{it} \quad (6)$$

In 2014, Fama and French formulated a five-factor model, adding profitability (RMW) and investment behavior (CMA) as risk factors.

$$R_{it} - R_{ft} = \alpha_{it} + \beta_{mkt} * \left(R_{t,mkt} - R_{ft}\right) + \beta_{SMB} SMB + \beta_{HML} HML + \beta_{RMW} RMW + \beta_{CMA} CMA + \varepsilon_{it} \quad (7)$$

2.3. Review of specialized literature

The academic interest in evaluating the financial effects of unforeseen events has increased recently due to the health crisis triggered by the COVID-19 pandemic. The literature on the causes and economic consequences of wars has stimulated a large number of studies in economics. Research findings (Murdoch and Sandler, 2002) show that wars reduce economic growth across regions formed by neighboring countries.

An event whose impact has been extensively studied is the September 11, 2001 attacks. Carter and Simkins (2004) examined the reaction of investors to the stock prices of aviation companies on American markets. They concluded that their results suggest that the market perceived the long-term consequences of the attacks, and the effect of the attack on US airlines was more pronounced than on the stock of cargo airlines or foreign airlines outside the US.

Rigobon and Sack (2005) found that the risk of war in Iraq has a negative effect on the US stock market, so the war risk factor is useful in estimating stock price variations during war.

Panagiotis and Spyridon (2010) studied the reaction of the stock prices of Greek banks during three major terrorist attacks (the September 11, 2001 attack, the Madrid bombing of March 11, 2004, and the London bombing of July 7, 2005). They showed that during the September 11 attack, the market overreacted to the set of information that the attack conveyed, which caused an excessive decrease in the stock prices of Greek banks.

Martins et al. (2023) looked at the immediate impact of the military conflict between Russia and Ukraine on the stock market performance of the largest European banks. According to their findings, banks with a high exposure to Russia and those that are listed in Russia experienced a more significant negative reaction in the stock market.

Kumari et al. (2023) examined the market reaction as well to the Russian invasion of Ukraine, employing the event study method, cross-sectional and network analysis. The results show a negative impact on the leading European Union stock market indices. Further, Poland, Denmark, and Poland exhibit positive cumulative abnormal returns post-event, showing that the developed markets and NATO nations are insignificant to the war event.

Moreover, Izzeldin et al. (2023) showed that, in broad terms, stock markets and commodities responded most rapidly to the Russian invation, but the post-invasion crisis intensity is noticeably smaller compared to both the Covid-19 and the 2008 global financial crisis.

In other studies, Boungou and a Yatié (2022) have employed a research on the daily data on stock returns for a sample of 94 countries over the period from 22 January to 24 March and the results show significant negative effects of the Ukraine-Russia war on global stock indices.

In most of the studies, the 2022 Russian invasion of Ukraine was found to have a significant impact on global stock market indices, resulting in negative cumulative abnormal returns. However, the effects were found to be heterogeneous, as reported by Boubaker et al. (2022) in their recent empirical study.

3. Data & Methology

The event study methodology according to Fama (1970) is based on the efficient market hypothesis, which states that when new information appears in the market, investors immediately evaluate its current and future impact. This evaluation results in price changes so that they reflect the effect of this new information on the future performance of the evaluated asset. Thus, significant changes in financial asset prices can be attributed to specific events that led to the appearance of this new information. This is where the power of the event study methodology is observed, namely its ability to identify these significant changes based on the general evaluation of investors.

3.1. Description of the methodology

According to MacKinlay (1997), conducting an event study typically involves following a procedure divided into the following steps:

1. Defining the event window.
2. Calculating theoretical returns:
    a. Defining the estimation window.
    b. Choosing the estimation model.
3. Estimating abnormal returns.
4. Testing the statistical significance of abnormal returns.

The procedure begins by defining the period during which the event should influence the returns of the analyzed companies. Generally, an event window spans over several days before and after the event date. To define abnormal returns, the analysis proceeds to the second step and calculates theoretical or expected returns.

This step requires defining the estimation window, which represents a sample before the event window. Equation (8) defines abnormal returns (AR) in a generic way:

$$AR_{it} = R_{it} - E(R_{i,t|X_t}) \quad (8)$$

where Ri,t is the realized actual return, and E(Ri,t|Xt) is the theoretical return conditioned on information X in period t, without any relation to the event.

We have seen that abnormal returns estimation can be carried out by different models. The most commonly used is the single-index model (SIM) (MacKinlay 1997; Sorokina et al., 2013):

$$AR_{it} = R_{it} - (\alpha_i + \beta_i R_{mt}) \quad (9)$$

According to this SIM model, theoretical returns depend on the parameters αi and βi (calculated in the estimation window) and the market return $R_{m,t}$.

In this study, we calculated theoretical returns both with the single-factor model (market factor) and with more complex models with multiple factors (the Fama-French three-factor model and the Fama-French five-factor model). After theoretical returns are calculated, abnormal returns can be obtained. For the period around the event, we are interested in calculating the difference between the observed stock return and the stock return as it should have been according to the estimation model.

To observe the impact on a certain number of companies (banks in our case) over intervals around the event date, abnormal returns are aggregated. The cumulative average abnormal return (CAAR) is calculated using the average abnormal return (AAR).

$$AAR_t = \frac{1}{N} \sum_{i=1}^{N} AR_{i,t} \quad (10)$$

where $AR_{i,t}$ represents the estimated abnormal return for bank i.

To observe the average effect over an interval of several days, it is necessary to calculate the cumulative average abnormal returns (CAAR) by adding the average abnormal returns (AAR) over the interval.

$$CAAR(t_1, t_2) = \sum_{t=t_1}^{t_2} AAR_t \quad (11)$$

Thus, for each day t, the abnormal returns (AARt) are calculated for all banks, which provide information on the evolution of the sample on each day of the analyzed period. Then, for each analyzed interval, the cumulative average abnormal returns (CAAR) are calculated by adding AAR over the analyzed interval. These provide information on the overall performance of banks around the event date.

Once abnormal returns (AR) are calculated, regardless of the chosen calculation method, it is necessary to study their statistical significance. In order for the analysis to have economic relevance, it is necessary to analyze the statistical significance of these abnormal returns; that is, their difference from zero must be verified. In this paper, we performed the implicit test implemented in the Stata

software by the estudy command (explained in Chapter 2.3), which assumes that stock returns and hence AR are normally and homoscedastically distributed in the estimation window and event window.

3.2. Data

The data are represented by daily closing prices for 32 systemically important banks in 12 developed European countries, for the period from May 19, 2021, to March 30, 2022, and were extracted from the yahoofinance.com website. The values of the factors used in the Fama-French models with 3 and 5 factors for developed markets were extracted from the database of Prof. Kenneth French. We chose an estimation window of approximately 180 trading days prior to the event (February 24, 2022) in accordance with Afik et al. (2021), with a buffer window of 30 days between the event day and the estimation window. We used 4 intervals for observing cumulative average abnormal returns (5 days before the event, the event day, 5 days after the event, and the entire -5..0..+5 interval).
Data processing was performed in Stata software using the "estudy" command as explained by Pacicco et al. (2018).

4. Results

In this section, the results of the analysis regarding the impact of the invasion in Ukraine on the systemically important banks in Europe are presented.

4.1. Results for the invasion date of 24.02.2022

For the invasion date of 24.02.2022, the results obtained are displayed in Table 3 for the Fama-French model with 3 factors in the form of cumulative average abnormal returns (CAAR) grouped by country for the 4 intervals of interest (5 days before the event, the event day, 5 days after the event, and the entire -5..0..+5 interval). Evaluating these results is complicated due to the variety of ways in which banks and countries are presented.

Table 2. Dependence on Russian gas (percentage of total)

Country	Percentage
Finland	94%
Austria	64%
Germany	49%
Italy	46%
Poland	40%
France	24%
Netherlands	11%

Source: Statista 2020

The abnormal returns obtained in the three tables do not differ significantly, confirming the results of Brown and Warner (1980, 1985) that the use of more sophisticated models does not greatly reduce the variance of abnormal returns. The

results show massive abnormal returns achieved overall by systemic banks in Europe caused by the Russian invasion of Ukraine on 24.02.2024. However, these abnormal returns are manifested differently in the event window depending on the country.

Sweden, Spain, and the United Kingdom show statistically significant CAARs only on the event day, specific to markets with a high level of informational efficiency that develop a high speed in incorporating this new information. Thus, after the information about the Russian invasion reaches the market, prices react on that day, realizing significant abnormal returns, thus incorporating this new information into the price, and in the following days, returns return to normal values on a new level of equilibrium.

Table 3. Cumulative average abnormal returns (CAAR) relative to the Fama-French 3-factor model; event date: 24.02.2022, with 4 specified intervals

Country	Bank	CAAR (-5,-1)	CAAR (0,0)	CAAR (1,5)	CAAR (-5,5)
Austria	EBS	**-11.55%*** **	**-10.67%*** **	-5.72%	**-27.95%*** **
	RBI	**-21.03%*** **	**-24.24%*** **	**-20.38%*** **	**-65.65%*** **
	CAAR group	**-16.25%*** **	**-17.23%*** **	**-12.93%*** **	**-46.40%*** **
Denmark	DANSKE	**-9.47%*** **	**-7.40%*** **	-4.02%	**-20.90%*** **
	JYSK	-7.30%*	-4.57%**	-8.11%**	**-19.98%*** **
	SPNO	-5.51%	-4.27%**	-1.50%	-11.28%**
	SYDB	**-11.46%*** **	3.54%**	-9.43%**	**-17.35%*** **
	CAAR group	**-8.39%*** **	**-3.09%*** **	**-5.61%*** **	**-17.09%*** **
Finland	NDA	1.01%	-0.21%	-2.43%	-1.63%
France	BNP	-5.49%	**-8.03%*** **	-9.08%**	**-22.60%*** **
	ACA	-7.07%**	-0.81%	-8.37%**	**-16.25%*** **
	GLE	-9.01%**	**-13.30%*** **	**-17.95%*** **	**-40.26%*** **
	CAAR group	**-7.16%*** **	**-7.25%*** **	**-11.55%*** **	**-25.96%*** **
Germany	CBK	-0.01%	**-13.59%*** **	-11.74%**	**-25.34%*** **
	DB	-10.12%**	**-10.91%*** **	**-12.67%*** **	**-33.70%*** **
	CAAR group	-5.00%	**-12.24%*** **	**-12.18%*** **	**-29.42%*** **
Italy	BAMI	-7.19%	**-9.26%*** **	**-14.99%*** **	**-31.44%*** **
	ITS	-7.01%**	**-8.46%*** **	**-14.71%*** **	**-30.19%*** **
	UNI	-9.25%**	**-15.33%*** **	**-15.06%*** **	**-39.65%*** **
	CAAR group	**-7.80%*** **	**-10.97%*** **	**-14.83%*** **	**-33.60%*** **
Netherlands	ING	-7.20%**	**-8.06%*** **	**-14.64%*** **	**-29.90%*** **
Poland	BHW	-2.56%	**-16.40%*** **	3.01%	-15.95%**
	PEO	**-14.49%*** **	**-15.89%*** **	1.76%	**-28.62%*** **
	MBK	**-18.64%*** **	**-15.72%*** **	3.63%	**-30.73%*** **
	SPL	**-10.50%** **	**-14.92%*** **	5.74%	**-19.68%*** **
	CAAR group	**-11.46%*** **	**-15.73%*** **	3.79%	**-23.40%*** **
Spain	SAN	-5.03%	**-8.51%*** **	-3.98%	**-17.52%*** **
	BBVA	-3.79%	**-6.36%*** **	-3.78%	-13.93%**
	SAB	-8.94%*	**-8.20%*** **	-10.84%**	**-27.98%*** **
	CAAR group	-5.89%**	**-7.69%*** **	-6.16%**	**-19.74%*** **
Sweden	SWED	-3.03%	**-3.05%*** **	-3.39%	**-9.46%*** **
	SEB	-3.37%	**-3.23%*** **	-1.25%	-7.84%**
	SHB	-2.38%	-2.31%**	2.66%	-2.04%
	CAAR group	-2.92%**	**-2.86%*** **	-0.65%	-6.43%***

Country	Bank	CAAR (-5,-1)	CAAR (0,0)	CAAR (1,5)	CAAR (-5,5)
	CS	-6.53%*	-2.24%	-4.31%	-13.08%**
Switzerland	UBS	**-7.81%*** **	**-6.07%*** **	-5.45%*	**-19.34%*** **
	CAAR group	**-7.17%*** **	**-4.14%*** **	-4.86%**	**-16.17%*** **
	BARC	2.45%	**-5.80%*** **	-4.52%	-7.88%
	HSBA	0.97%	**-3.98%*** **	-1.71%	-4.73%
UK	LLOY	3.24%	**-8.20%*** **	-1.12%	-6.08%
	STAN	7.83%**	**-7.14%*** **	-0.38%	0.31%
	CAAR group	3.66%**	**-6.27%*** **	-1.91%	-4.52%*

*** p-value < .01, ** p-value <.05, * p-value <.1

According to the banks' exposure to Russia, Austria stands out with the highest CAAR among all observed countries, manifested in all analyzed intervals (Raiffeissen Bank with -65% cumulatively in the event window). Although in Table 1 Austria appears after Italy and France in total exposure, this exposure is much larger relative to the size of the Austrian economy.

Nordea, the domestic systemic importance bank in Finland, has absolutely no reaction in all analyzed intervals, surprising at first glance given that Finland has a significant border with Russia and imports 94% of its gas from Russia (Table 2). But this gas accounts for only about 5% of total energy consumption. The most plausible explanation for the Finnish bank's lack of reaction is that its exposure to Russia is very small after it decided to close its operations in Russia in 2019.

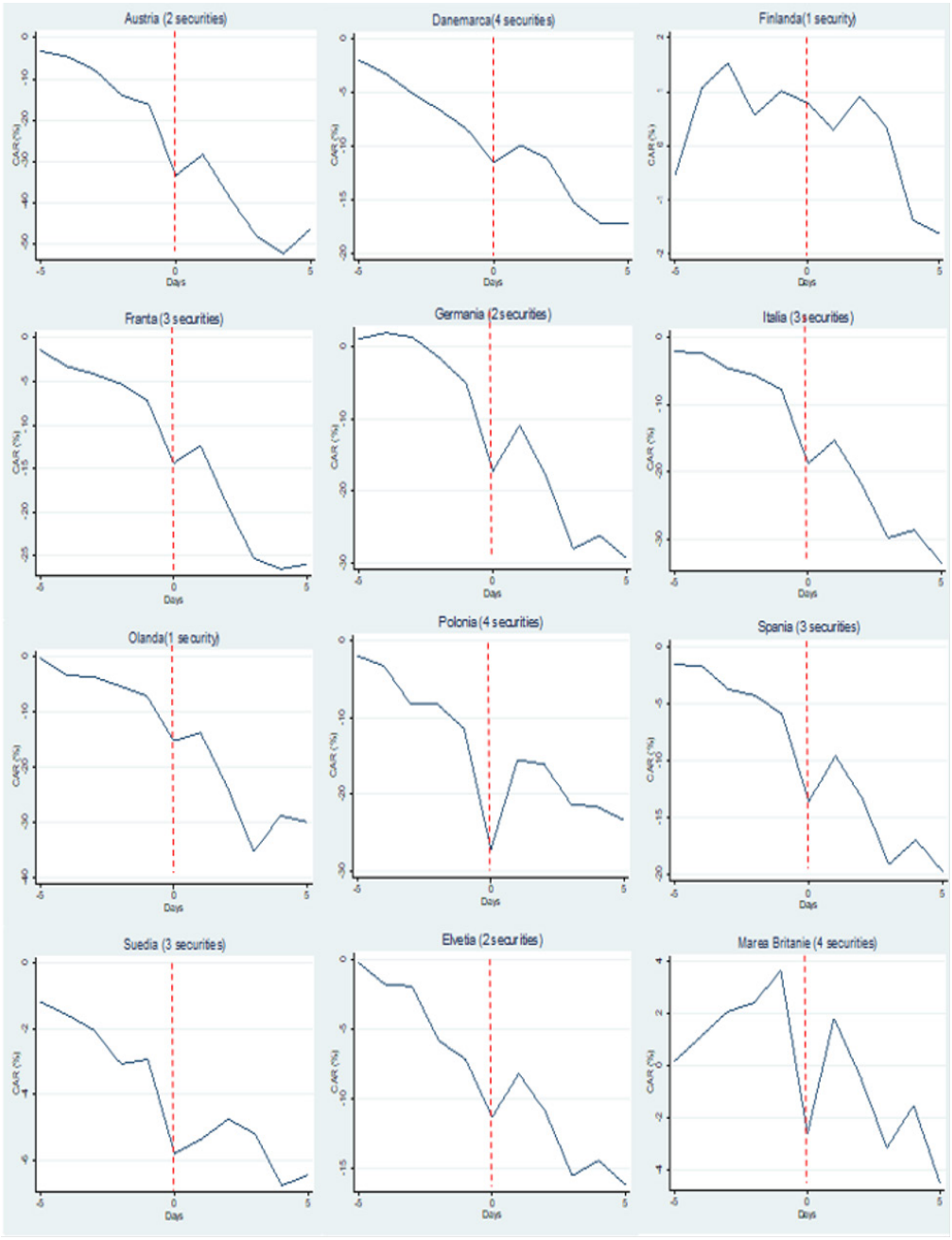
Netherlands and Germany have significant CAARs on the event day and in the post-event interval, suggesting an underreaction on the event day. Both Germany's dependence on Russian gas and oil, as well as the significant exposure of the German banking system, result in a cumulated reaction of approximately -30% in abnormal returns manifested in the event window.

Italy and France, as a group, show significant reactions on all intervals with certain exceptions at the level of individual banks (Credit Agricole and BNP Paribas in France, and Banco BPM in Italy). And in this case, the magnitude of these CAARs corresponds to the exposure of these banks to Russia. Italy and France are the countries with the highest bank exposure to Russia (Table 1).

Poland records statistically significant CAARs before the event and on the event day, suggesting that the event was anticipated to some extent. Additionally, after the event day, in this case, we have positive returns suggesting the phenomenon of overreaction.

For all these results, in Figure 1, we have the graphical representation over time of the average abnormal returns at the country level.

Figure 1. Graph of cumulative average abnormal returns (CAAR) grouped by country



4.2. Expansion of analysis - events and political statements around the date of the invasion

We present an extension of observing the reaction of banks to a series of political statements and major events during the Ukrainian crisis (February - March 2022): 1. Bilateral meeting between French President Emmanuel Macron and Putin, followed by controversial press statements: while Emmanuel Macron declares that Russia will not escalate the crisis, the Kremlin spokesperson states that no agreement can be reached (08.02.2022); 2. The first warning sign: Biden's national security adviser warns that a potential Russian invasion is underway before the end of the Beijing Olympics on February 20 (11.02.2022); 3. The second warning sign: Biden and Blinken stated that Russia is failing to withdraw its troops from its side of the border, while also accusing a possible false flag operation in eastern Ukraine. American officials warn that Russia is about to invade Ukraine (17.02.2022); 4. The first round of economic sanctions from NATO (22.02.2022); 5. Strengthened sanctions (28.02.2022); 6. The EU details the exclusion of Russian SWIFT banks, an action that will take effect from March 12. The exclusion of banks is a coordinated international action that includes the US and the UK (02.03.2022); 7. Russian forces bomb the Zaporizhzhia nuclear power plant (04.03.2022); 8. The US and the UK ban Russian oil (08.03.2022); 9. The EU extends sanctions, the UK targets oligarchs, and Canada and Australia ban certain energy imports from Russia (10.03.2022); 10. Russia targets Western Ukraine (14.03.2022).

Due to the large number of announcements and important events that occurred in a relatively short period of time, we narrowed the event window to two days before and after the respective event. Thus, the new observed intervals of interest are two days before the event date, the event day itself, two days after the event date, and the entire interval -2..0..+2. Of course, due to this large number of announcements and important events, the relevance of the obtained results may suffer, greatly increasing the risk of contamination of one event window with the effect of other events.

Among the announcements and events listed above, after running the estudy command for each of them separately, a few results stand out. The announcement of the tightening of sanctions against Russia on 28.02.2022 triggered a new wave of abnormal returns (Table 4), but this time only for the countries whose banks have a high exposure to Russia (Austria, France, Germany, Italy, Netherlands).

Another interesting event in terms of the obtained results is the bombing of the Zaporizhia nuclear power plant on 04.03.2022, which caused a reaction among the European systemically important banks by showing significant abnormal returns on that day. Looking at the results of the announcement on 08.03.2022 regarding the ban on Russian oil by the UK and US, they appear rather irrational at first glance (significant negative abnormal returns are observed in the period before the announcement, and significant positive abnormal returns are observed on the day of the announcement and the following days). The explanation is that the results of this announcement are contaminated by the event on 04.03.2022, which occurred very close in time (March 5 and 6, 2022 were weekend days). Thus, the significant negative abnormal returns obtained in the two days preceding the announcement on 08.03.2022 are rather a continuation of investors' concerns about the risk of a

possible major nuclear accident due to the Russian bombings on 04.03.2022. And the significant positive abnormal returns on 08.03.2022 and the following two days are more likely due to positive news about the decreased risk of a nuclear accident at the Zaporizhia plant.

Table 4. Cumulative Average Abnormal Returns (CAAR) relative to the Fama-French 3-factor model; event date: 02/28/2022; with 4 specified intervals

Country	Bank	CAAR (-2,-1)	CAAR (0,0)	CAAR (1,2)	CAAR (-2,2)
Austria	EBS	-3.85%*	**-8.11%*** **	**-14.26%*** **	**-26.21%*** **
	RBI	**-20.96%*** **	**-13.07%*** **	**-12.82%*** **	**-46.85%*** **
	CAAR group	**-12.15%*** **	**-10.56%*** **	**-13.54%*** **	**-36.25%*** **
Denmark	DANSKE	-4.16%*	-1.08%	**-5.90%*** **	**-11.14%*** **
	JYSK	-3.41%	-0.97%	**-10.84%*** **	**-15.22%*** **
	SPNO	-0.47%	-0.08%	-8.25%	-8.80%**
	SYDB	1.50%	-3.26%**	0.38%	-1.37%
	CAAR group	-1.53%	-1.34%	**-6.07%*** **	**-8.94%*** **
Finland	NDA	-0.80%	0.54%	-2.29%	-2.55%
France	BNP	-5.12%**	-8.42%***	-5.12%**	**-18.65%*** **
	ACA	-1.71%	-0.96%	**-7.53%*** **	**-10.20%*** **
	GLE	**-9.30%*** **	**-11.32%*** **	**-9.81%*** **	**-30.43%*** **
	CAAR group	**-5.22%*** **	**-6.80%*** **	**-7.36%*** **	**-19.38%*** **
Germany	CBK	-5.83%**	**-7.18%*** **	**-9.75%*** **	**-22.76%*** **
	DB	-6.08%**	**-7.25%*** **	-6.51%**	**-19.84%*** **
	CAAR group	**-5.94%*** **	**-7.21%*** **	**-8.12%*** **	**-21.27%*** **
Italy	BAMI	-6.42%**	-1.97%	**-7.69%*** **	**-16.09%*** **
	ITS	**-5.56%*** **	**-7.43%*** **	**-6.95%*** **	**-19.93%*** **
	UNI	**-10.87%*** **	**-10.09%*** **	-5.98%**	**-26.94%*** **
	CAAR group	-7.57%	-6.44%	-6.87%	-20.87%
Netherlands	ING	**-6.49%*** **	**-9.75%*** **	-5.21%**	**-21.45%*** **
Poland	BHW	-6.94%**	-4.63%**	0.46%	-11.11%**
	PEO	-0.30%	-2.83%	**-8.30%*** **	**-11.43%*** **
	MBK	-4.34%	4.91%*	**-12.26%*** **	-11.70%*
	SPL	-4.81%*	-0.29%	-2.77%	-7.88%*
	CAAR group	**-4.07%*** **	-0.65%	**-5.56%*** **	**-10.28%*** **
Spain	SAN	-3.92%	-4.09%**	-2.33%	**-10.34%*** **
	BBVA	-4.20%	-1.86%	-2.23%	-8.29%*
	SAB	-2.83%	-5.13%**	-6.44%*	**-14.41%*** **
	CAAR group	-3.64%**	**-3.69%** **	-3.65%**	**-10.97%*** **
Sweden	SWED	-3.46%**	-0.30%	-2.19%	**-5.96%*** **
	SEB	-2.96%*	0.59%	-3.28%**	-5.64%**
	SHB	-1.02%	1.37%	-0.58%	-0.23%
	CAAR group	**-2.48%*** **	0.56%	-2.01%**	**-3.93%*** **
Switzerland	CS	-0.26%	-1.77%	-3.63%	-5.66%
	UBS	-1.79%	**-3.58%*** **	-3.41%*	**-8.79%*** **
	CAAR group	-1.00%	-2.67%**	-3.51%**	**-7.19%*** **

Country	Bank	CAAR (-2,-1)	CAAR (0,0)	CAAR (1,2)	CAAR (-2,2)
UK	BARC	-2.29%	-2.36%	-1.59%	-6.24%*
	HSBA	-0.62%	-2.60%**	-0.28%	-3.49%
	LLOY	-3.62%*	-1.26%	-3.16%	-8.04%**
	STAN	-0.88%	-2.83%*	0.72%	-2.99%
	CAAR group	-1.83%*	**-2.26%****	-1.07%	**-5.16%****

*** p-value < .01, ** p-value <.05, * p-value <.1

4.3. Analysis of neighboring countries with Ukraine

We conducted a specific analysis on the neighboring countries of Ukraine (Romania, Poland, and Hungary) in an attempt to see if a small geographic distance to the conflict has a significant impact on the systemic importance banks in these countries. The results obtained (Table 5) do not offer clear evidence in this regard. The reaction differs in the three neighboring countries with Ukraine.

In the case of Romania, we have a statistically insignificant reaction on the analyzed intervals. According to the National Bank of Romania (BNR), Romanian banks do not have loans and advances granted, and the deposits attracted have a total value of only 17.9 million lei for Russia and 40.7 million lei for Ukraine (Dec. 2021). No bank in Romania has direct equity holdings originating in Ukraine or the Russian Federation. Thus, the cumulative exposure of Romanian banks is very low.

OTP Bank in Hungary has previous experience of involuntary exit from regional markets following the conflict between Russia and Ukraine. The bank had to leave Crimea after the territory's annexation by Russia in 2014 and parts of eastern Ukraine due to the outbreak of a military conflict between Russian-backed separatists and Ukrainian forces in the same year. Russia and Ukraine accounted for 11.6% of the OTP group's total risk-weighted assets at the end of December 2021. In this case, we have a lack of reaction on the day of the event followed in the next days by obtaining significant negative abnormal returns.

Table 5. Cumulative average abnormal returns (CAAR) relative to the CAPM model; Event date: 24.02.2022; with 4 specified intervals

Country	Bank	CAAR (-5,-1)	CAAR (0,0)	CAAR (1,5)	CAAR (-5,5)
Romania	BRD	-0.30%	1.53%*	-3.76%*	-2.53%
	TLV	-0.50%	1.50%	-1.18%	-0.17%
	CAAR group	-0.39%	1.52%**	-2.47%	-1.34%
Poland	BHW	-2.69%	-15.53%***	4.23%	-14.00%**
	PEO	**-14.55%*****	**-15.99%*****	1.67%	**-28.87%*****
	MBK	**-19.13%*****	**-15.65%*****	4.06%	**-30.72%*****
	SPL	**-11.11%*****	**-14.48%*****	6.74%	**-18.86%*****
	CAAR group	**-11.78%*****	**-15.41%*****	4.43%*	**-22.76%*****
Hungary	OTP	-1.05%	-0.16%	**-11.29%*****	**-12.50%*****

5. Conclusion

In this paper, we have shown the significant impact that the war in Ukraine has on systemically important banks in Europe, manifested by significant cumulative abnormal returns during the analyzed period. The country-level analysis shows a different reaction of these banks depending on their exposure to Russia, the dependence of their respective countries on Russian gas and oil, and the level of informational efficiency of the markets in which they are traded.

The results indicate that investors have penalized banks with very high exposure to Russia, followed by those whose countries depend to a significant extent on Russian gas and oil. However, the study does not suggest that geographic distance has a significant impact on the abnormal returns observed.

The variety of ways in which banks are exposed, both at the individual and country levels, represents a vulnerability related to the interpretation of the results obtained in this study. European banks exposed to Russia will continue to be subject to strong pressures to drastically reduce these exposures and exit the Russian market, which will affect their profitability in the short and medium term. Additionally, the European Union's plan to accelerate the abandonment of imports of oil and gas from Russia will have a short-term impact on the economies of countries dependent on these resources and indirectly on the profitability of banks in these countries.

The impact of wars on stock markets is an important topic for investors, portfolio managers, and regulatory authorities. Therefore, this study, with its empirical evidence of the financial effects of the Russo-Ukrainian armed conflict on European banks, can be used in making portfolio rebalancing decisions or developing effective hedging strategies.

In conclusion, as a direction for future research, given that the market volatility on that particular day was extremely high, we suggest an analysis on intraday data collected on the day of the invasion.

References

Afik, Z., Tehila R.C. & Yaron, L. (2021). Getting High On Cannabis Stock Returns an Event Study. Finance Research Letters, 46, 102226.

Barett, W., Heuson, A., Kolb, R. & Schropp, G. (1987). The adjustment of stock prices to completely unanticipated events. The Financial Review, 22 (2), p. 345-354.

Binder, J. (1998). The event study methodology since 1969. Review of Quantitative Finance and Accounting, 11, p. 111–137.

Boehmer, E., Masumeci, J. & Poulsen, A.B. (1991). Event-study methodology under conditions of event-induced variance. Journal of Financial Economics, 30, p. 253–272.

Boubaker, S., Goodell, J. W., Pandey, D. K. & Kuma, V. (2022). Heterogeneous impacts of wars on global equity markets: Evidence from the invasion of Ukraine. Finance Research Letters, 48, 102934.

Boungou, W. and Yatié, A. (2022). The impact of the Ukraine–Russia war on world stock market returns. Economics Letters, 215, 110516.

Brown, S. & Jerold, B.W. (1980). Measuring Security Price Performance". Journal of Financial Economics, 8 (3), p. 205-258.
Brown, S. & Warner, J. (1985). Using daily stock returns: The case of event studies. Journal of Financial Economics, 14, p. 3-31.
Carter, D. & Simkins, B. (2004). The market's reaction to unexpected, catastrophic events: the case of airline stock returns and the September 11th attacks. The Quarterly Review of Economics and Finance, 44, p. 539-558.
Chen, A., & Siems, T. (2004). The effects of terrorism on global capital markets. European Journal of Political Economy, 20, p. 349-366.
Fama, E., Fisher, L., Jensen, M. & Roll, R. (1969). The adjustment of stock prices to new information. International Economic Review, 10, p. 1-21.
Fama, E. (1970). Efficient capital markets: a review of theory and empirical work. Journal of Finance, 25 (2), p. 383-417.
Izzeldin, M., Muradoglu, Y. G., Pappas, V., Petropoulou, A & Sivaprasad, S. (2023). The impact of the Russian-Ukrainian war on global financial markets. International Review of Financial Analysis, 87, 102598.
Kavussanos, M. & Dockery, E. (2001). A Multivariate Test for Stock Market Efficiency: The Case of ASE. Applied Financial Economics, 11, p. 573-79.
Kumari, V., Kumar, G. & Pandey, D. K. (2023). Are the European Union stock markets vulnerable to the Russia–Ukraine war?. Journal of Behavioral and Experimental Finance, 37, 100793.
Mackinlay, A. C. (1997). Event Studies in Economics and Finance. Journal of Economic Literature, 35 (1), p. 13-39.
Martins, A. M., Correia, P. & Gouveia R. (2023). Russia-Ukraine conflict: The effect on European banks' stock market returns Antonio. Journal of Multinational Financial Management, 67, 100786.
Pacicco, F., Vena, L. & Venegoni, A. (2018). Event study estimations using Stata: The estudy command. The Stata Journal, 18 (2), p. 461–476.
Panagiotis, L. & Spyridon, R. (2010). The Impact of Terrorism on Greek Banks Stocks: An Event Study. International Research Journal of Finance and Economics, 51, p. 88-96.
Rigobon, R. & Sack, B. (2005). The effects of war risk on US financial markets. Journal of Banking & Finance, 29 (7), p. 1769-1789.
Sorokina, N., Booth, D. E. & Thornton, J. H. Jr. (2013). Robust methods in event studies: Empirical evidence and theoretical implications. Journal of Data Science, 11, p. 575–606.
*** https://finance.yahoo.com
*** https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library

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THE IMPACT OF SOCIAL NORMS ON STOCK LIQUIDITY

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Abstract: There is a growing body of research that shows the impact of culture on individual's financial decisions. We aim to investigate how the strength of social norms and the tolerance for deviant behavior influence stock liquidity. Using a panel of 26 developed and 19 emerging countries we show that there is an inverted U-shaped relationship between the measure of cultural tightness-looseness, developed by Gelfand et al. (2011) and stock liquidity. Additionally, our results suggest that financial literacy has a moderating effect on the relationship between social norms and liquidity.

JEL Classification codes: G12, G15, G41

Keywords: social norms, liquidity, trust, information asymmetry, financial literacy.

1. Introduction

The fact that stock market liquidity plays a crucial role in the global economy is a lesson we had to learn the hard way during the 2008 financial crisis. It was then that we realized that a significant shock to the stock market liquidity level could shake even the strongest of economies. Nowadays, due to the ever-reaching globalization and digitalization of capital markets, such a shock can spread in a matter of seconds without regard for borders or territorial limits.

As such, policymakers, practitioners, and academia have been trying to understand and explain the mechanics of liquidity creation and liquidity shock propagation for over a decade. Nonetheless, liquidity is a complex and elusive concept, whereas measuring it and identifying its determinants is a real challenge.

Academic literature that investigates liquidity determinants, highlights many factors that relate to the company and its performance, the mechanics of the stock market, and the macroeconomic conditions. However, it has not been able to explain its anomalies. The issue is that most of those studies chose the premise of a rational investor trading on an efficient market as their starting point and try to explain his/her behavior by maximizing a utility function.

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Citing Nobel laureates Akerlof and Shiller:

"The real problem... is the conventional wisdom that underlies so much of current economic theory. So many members of the macroeconomics and finance profession have gone so far in the direction of 'rational expectations' and 'efficient markets' that they fail to consider the most important dynamics underlying economic crises. Failing to incorporate animal spirits into the model can blind us to the real sources of trouble."

Recently, a new branch of empirical finance has emerged, shifting the focus away from the market and its principles and towards the investor and the factors that motivate his/her decisions. One such factor being analyzed is the role culture plays in investment decisions. Studies by Chui et al. (2010), Eun et al. (2015), and Karolyi (2016) show that the constraints imposed by culture on an individual's behavior, albeit informal, have a significant impact on the trading behavior of institutional and retail investors alike. According to Aggarwal and Goodell (2014), national culture (identity) defines how entities influence social trust and the cost/price of financial transactions. Moreover, it can shape the institutional environment. Consequently, it defines how individuals perceive institutions and contribute to their formation.

In the same paper, authors urge finance researchers to explore the benefits of incorporating culture and its dimensions in empirical models, arguing that the impact culture can have on financial decisions has been shown in multiple management and business administration studies.

Existing literature focuses on investigating the role culture plays in the decision-making process at the individual level (Grinblatt and Keloharju, 2001; Guiso et al., 2008; Chui et al., 2010; Siegel et al., 2011; Eun et al., 2015), company level (Giannetti and Yafeh, 2012; Li et al., 2013; Ahern et al., 2015), or country level (Stulz and Williamson, 2003; Kwok and Tadesse, 2006; Gorodnichenko and Roland, 2011) while focusing on individual values, estimated through cultural dimensions.

We aim to expand the existing theoretical framework by accounting for the constraints imposed by social norms on human behavior, using a novel cultural dimension proposed by Triandis (1989) and operationalized by Gelfand et al. (2011).

2. Literature review

Grinblat and Keloharju (2001) is one of the pioneering studies in financial literature to analyze the impact of culture on investment decisions. Authors show that in the case of the Finnish stock market, investors prefer to own, buy, and sell shares of Finnish companies that are located closer to them and whose CEO is closer in terms of cultural background.

A study by Stulz and Williamson (2003) investigates the role of cultural differences (measured through religion and language) on international investor protection. Their results suggest that a country's dominant religion is better at explaining the cross-country differences in creditor rights protection, as opposed to the commercial openness, language, per capita income or the origins of the legal system. Generally speaking, authors show that Catholic countries have lower levels of creditor rights protection than Protestant countries.

Guiso, Sapienza and Zingales (2008) analyze the "trust" managers from different European countries put in each other. Authors show that the more trust an investor has in the people of the target country, the higher the trading volume,

portfolio investments, and foreign direct investments are in that country. After controlling for different origin and/or country-specific characteristics, their results remain robust. Pari passu, the authors point out that trust levels between two countries are explained to an extent through similarities in terms of religion, genetic or somatic distance, as shown by DeBruine(2002)[1].

Chui et al. (2010) is one of the pioneering studies to have used Hofstede's cultural dimensions to explain trading activity. Authors show that cultural differences (as captured by the individualism index) significantly impact trading volume and securities' volatility. Authors associate individualism with higher levels of overconfidence and self-attribution bias while showing that there are two types of overconfidence: overconfidence in general knowledge and peer-comparison overconfidence. According to them, peer-comparison overconfidence is responsible for the trading activity, leading to the investor overestimating his/her knowledge while underestimating the publicly available information. Furthermore, the authors explain the self-attribution bias using Zuckerman (1979). As such, Zuckerman (1979) defines the self-attribution bias as "people attempt(ing) to enhance or protect their self-esteem by taking credit for success and denying responsibility for failure." The bottom line is Chui et al. (2010) believe that higher trading volumes registered in individualist countries are caused by individual traders betting against the market because they are convinced that the information they posses is superior to that of others.

The cultural dimensions defined by Geert Hofstede (2001) are likely one of the most important contributions toward understanding and measuring cultural differences. The theoretical framework he proposed became the foundation of a vast area of studies in fields such as Management, Marketing, International Business, and Behavioral Finance. Notwithstanding, over the last two decades, more and more studies (Shenkar, 2001; McSweeney, 2002; Ailon, 2008) have criticized the use of these cultural dimensions and that of cultural distance. The authors emphasize that culture is too complex of a concept to be captured by four dimensions. As such, they urge academia to continue and deepen the research in this area.

Those critiques gave rise to new alternative cultural dimensions, developed by researchers such as Shalom Schwartz (1994), Robert House (2002), and Ronald Inglehart (1997). Nonetheless, Hofstede's original dimensions remain to be the most used.

Chui et al. (2002) analyzed the impact of culture through the alternative dimensions proposed by Schwartz (1994), showing that companies from countries with a higher score of conservatism and mastery are associated with a lower level of indebtedness, while Shao et al. (2010) show that these dimensions have a significant impact on the dividend policy. Ahern et al. (2012) exploit World Value Survey (a different measure of cultural values based on Inglehart's dimensions) to explain cross-border mergers.

This idea is latter on picked up by Eun et al. (2015). The authors study the impact of culture on stock price synchronicity. They expand the model proposed by Chui et al. (2002) by including a new cultural dimension operationalized by Gelfand et al. (2011). This dimension captures the cultural differences through the concept of

[1] The author suggests that people tend to put more trust in people who "look-like them".

cultural tightness-looseness (CTL[2]). According to Eun et al. (2012) the convergence of the investor behavior in tight cultures can cause positive correlations when it comes to investment decisions and choices. This convergence can in turn lead to higher co-movements in stock returns. Whilst individualism refers to the approach an individual takes when evaluating his/her own actions. The authors believe that individualist investors have more conviction in their own ability to gather and analyze information and are less concerned by the divergent opinions that might arise in the market. Based on this, authors suggest that the herding behavior is less prominent on stock markets from the more individualist countries, and that individualist investors contribute to a better stock price informativeness.

Notwithstanding, just a few studies focus on the impact of culture and investors' characteristics on stock market liquidity. For example, Blau (2017). The author builds upon the results obtained by Guiso, Sapienza and Zingales (2008) and analyses the impact of "social trust" on liquidity of cross-listed securities. Using a sample of 391 American Depositary Receipts, he evaluates how the levels of social trust in the origin country impact the liquidity of the stock listed in the USA. His results align with Guiso et al.'s (2004) hypothesis. Lower trust levels lead to lesser participation; as such, the lower the trust level, the lower the liquidity.

Zadeh (2022) is another example of a study aiming to investigate the effects of social trust of stock liquidity. The author uses the "Social Capital" index, computed and reported by the Northeast Regional Center for Rural Development (NRCRD) to proxy social trust. According to Woolcock (2001) the "Social Capital" index captures "the norms and networks that facilitate collective action." Moreover, Li et al. (2018) highlight that the norms promoted in these regions/states motivate the members of the communities to make their decisions and to act in a decent way in accordance with them. Zadeh's (2022) results show that ethical norms and social networks in regions characterized by a high level of social trust increase the level of transparency and loyalty towards the company, which in turn reduces the concern of shareholders regarding the agency problem. He suggests that trust levels impact the informational environment of the company, increase the credibility, and as such, lead to higher stock liquidity. He also argues that the relationship is stronger for poorly managed companies with low levels of transparency.

Thus, a new direction of research is gradually emerging. It aims to expand the analysis of investor's cultural background beyond the dimensions of traditional values. Until now, most financial studies have focused on individual values (internal constraints), ignoring how social norms (external constraints), and their strength at societal level can affect the behavior of its members.

Recent psychology and anthropology studies have shown that individual behavior is not only influenced by cultural values, but also by social norms and their enforcement. Triandis (1989) suggests that the clarity of social norms and the severity

[2] According to Gelfland (2011): „Tightness-looseness is part of a complex, loosely integrated multilevel system that comprises distal ecological and historical threats (e.g., high population density, resource scarcity, a history of territorial conflict, and disease and environmental threats), broad versus narrow socialization in societal institutions (e.g., autocracy, media regulations), the strength of everyday recurring situations, and micro-level psychological affordances (e.g., prevention self-guides, high regulatory strength, need for structure)".

of the sanctions applied for deviant behavior represent a new dimension of culture. It has a significant impact on the behavior of the individual. This new dimension has been associated with a multitude of economic phenomena, such as entrepreneurial activity (Harms and Groen, 2016), the performance of international mergers and acquisitions (Li and Gelfand, 2022), or the accuracy of financial reporting (Noh and Cho, 2022).

The motivation for our study lies, on the one hand, in the results obtained by Eun et al. (2015) regarding the impact of the tightness-looseness dimension on price synchronicity, and on the other hand in the results obtained by Zadeh (2022) regarding how social capital and trust in institutions influence market liquidity. As such, we decided to investigate whether this new dimension has an impact on the liquidity of the market.

Gelfand et al. (2011) describes tight societies as more inflexible, where social norms play an essential role in social life. The behavior of the members of a tight society is shaped by a multitude of social norms, the obedience to which is carefully monitored by the social institutions and by the other members of the society. In such societies, the rules are clear, while any deviation from them is sanctioned. In general, tight societies are characterized by discipline and order. At the same time, loose societies do not emphasize so much on social norms. Most of the time they are not clearly defined and are transmitted through various unofficial channels. The behavior of members of those societies is much more liberal, not limited by norms and public opinion.

In an earlier study Gelfand et al. (2006) show that the "shaping" of a member's behavior within a society starts from an early age. Parents in tight societies emphasize respecting the rules and conforming to the opinion of the majority in their children's education, monitoring children's behavior and applying stricter socialization tactics, while parents in loose societies encourage their children to explore and make independent decisions. They do not apply severe sanctions, considering mistakes and deviations a part of the learning process. The authors explain these differences through the concepts of "narrow socialization" and "broad socialization". In addition, they argue that the members of tight societies, as characterized by higher sense of responsibility are focused on failure prevention (prevention focus), while members of loose societies focus on achieving desired results (promotion focus). Authors refer to "kiasu" as an example of the prevention focus.[3]

In other words, the fear of failure is higher in tight societies, because members of such societies always feel monitored, whilst their every action is being evaluated and/or criticized, by the family, community or society's institutions from an early age. This fear of failure and of negative public opinion often leads to the underestimation of one's own abilities and leads to a greater risk aversion. We believe that tighter cultures will be associated with lower trading activity due to higher resilience to enter the market as compared to loose societies.

Thus, the first channel through which we consider that the dimension of tightness-loosens affects the liquidity of the capital market is the trading activity, reduced by the risk aversion of members of tight societies and amplified by the over-confidence of members of loose societies.

[3] According to Wu and Dai (2001) in Kiasu "the emphasis is on not losing rather than winning or on reducing risk of failure, rather than striving for success".This is a phenomenon characteristic to Singaporean society.

The second channel through which tightness-loosens can influence liquidity is informational asymmetry. Eun et al. (2015) suggest that, overall, tight societies are characterized by a more opaque informational environment, arguing that the members of a tight society have a more holistic way of thinking, and are less inclined to collect and analyze information independently.

Furthermore, in tight societies, there is a much lower probability that a member will use information that contradicts the general opinion, due to their tendency to "conform" to the public opinion. An important premise in this sense is highlighted by Gelfand et al. (2006) who claim that tightness-looseness has an important impact on the preferred way of collecting, processing and evaluating information. The authors suggest that tightness and looseness can also be associated with the decision-making style, which can be "adaptive" or "innovative". The first one refers to adapting an idea or finding a solution through existing procedures and is characteristic of tighter societies, while the second one implied challenging existing paradigms and thinking outside the box, to identify new solutions to existing problems and is more often found in loose societies.

Thus, informational asymmetry in tight societies can be determined by the way in which information is obtained (through official and verified channels only) and by the probability that contradictory information is likely to be made public. Besides these, informational asymmetry in tight countries can be fueled by "narrow socialization"[4].

The third channel through which we believe that tightness-looseness could impact the stock market liquidity is trust. Investments in the capital market essentially represent the entrusting by the investor of a sum of money, to a certain entity (company or institution), with the aim of increasing his/her capital. As such, investor's confidence in the fact that he/she is able to recover his/her money and the associated gains is imperative. This confidence is based on interpersonal trust (i.e., trust in company's management) or trust in institutions (i.e, the conviction that the institutions will enforce the law). Guiso et al. (2004), Guiso et al. (2008), Blau (2017), Zadeh (2022) confirm this relationship, showing that higher levels of trust lead to a higher investor participation and a higher stock liquidity.

A challenge arises from the fact that loose societies are characterized by a higher degree of interpersonal trust, and lower levels of institutional trust, while tight societies have a higher level of institutional trust and lower degrees of interpersonal trust. As such, while for the first two channels the relationship between tightness-looseness appears to be linear (the looser the society, the higher the liquidity), when it comes to the third channel, a higher level of liquidity seems to be associated with more of a moderate level of looseness, which is characterized by a higher level of both, interpersonal and institutional trust.

If we were to look at the extreme tight and loose societies more closely, we can see that none of them are representative of a 'healthy' society. A tighter society, governed by unbendable rules and severe sanctions for any deviant behavior will have high levels of discipline and order (better/stronger institutions, lower crime rates), but will fail to evolve due to its preference to maintain a status quo and the

[4] According to Gelfand et al. (2006) media institutions in tight societies employ "narrow socialization", which assumes that in tight societies the probability that the media will be censored is higher than in loose societies.

societal homogeneity (higher likelihood of autocracy and repressions). A looser society is heterogenous and disorganized (weaker institutions, higher crime rates), does not have a set of clear norms, whilst deviant behavior is accepted and tolerated. Nonetheless, the members of looser societies are more creative and flexible (i.e. can better adapt to innovations and technological advancements) and the free speech is encouraged (civil rights).

As such when it comes to tightness-looseness, the societies that are somewhere in the middle are the ones that benefit the most, as they can reap the advantages of the both types of societies. Harrington, Boski and Gelfand (2014) show that when compared to moderate societies, the tighter and the looser societies tend to have lower happiness and health levels, whilst being characterized by a less developed economy. To conclude, our principal hypothesis is the following:

H_1: There is a curvilinear relationship (inverted U-shape) between tightness-looseness and liquidity, according to which the higher level of liquidity corresponds to an average level of CTL;

At the same time, we consider that the nature of this relationship can be shaped by the investor's financial education, due to the correction effect it has on the investor's perception. In other words, understanding the functioning and mechanics of the stock market gives the investor a better perspective on the existing opportunities, diminishing the effect values or social norms have on his/her decision-making process.

H_2: The level of financial education shapes the way in which the strength of social norms and tolerance of deviant behavior influences stock liquidity.

3. Research design

a. Data

To capture the nature of the relationship between CTL and stock liquidity, we constructed a panel of 26 developed (Australia, Austria, Belgium, Canada, Cyprus, South Korea, Denmark, Switzerland, Finland, France, Germany, Greece, Hong Kong, Israel, Italy, Japan, Great Britain, New Zealand, Norway, Holland, Portugal, Singapore, Spain, Sweden, USA, Taiwan) and 19 emerging (Argentina, South Africa, Bangladesh, Brazil, Chile, China, Egypt, India, Indonesia, Philippines, Malaysia, Mexico, Pakistan, Peru, Poland, Romania, Sri Lanka, Thailand, Turkey) countries.

For each of those countries we've obtained a list of primary major stocks that are traded[5] on the main exchange, with a few exceptions, where two main exchanges were considered (China (Shanghai Stock Exchange and Shenzhen Stock Exchange), South Korea (Korea Exchange and KOSDAQ) and Japan (Japan Stock Exchange and Osaka Stock Exchange) using the Datastream platform. For the USA, only the NYSE exchange was considered, due to specific trading mechanism and a different reporting of trading volumes employed by NASDAQ.

We then filter the data to exclude: closed-end fund, preference shares, depository receipts, Mexican ordinary participation certificates, Peruvian investor shares, cumulative preference shares, stapled securities, rights, units and other

[5] Delisted stocks were not excluded from our sample, to avoid survivorship bias.

securities with special features. Next, following Griffin et al. (2010) a set of additional specific filters were applied for each country (such as removing securities that contain in their names "PNA", "PNB", "RCSA" in the case of Brazil, "1PF", "PFD" in the case of South Korea, or "GENUSSCHEINE", "GSH" for Germany).

For our final sample consisting of 26,512 securities, we gathered daily data regarding total return index, price, volume etc. covering a 23 years span (2000-2022).

As in Karolyi et al (2012), days for which over 90% of the securities listed on an exchange had zero returns were removed. Additionally, based on the warning by Ince and Porter (2006) regarding the frequency of errors in the data provided by Datastream, returns exceeding 200% or returns that were reversed the next day were eliminated.

b. Liquidity

We use Amihud's (2002) illiquidity measure to capture stock liquidity, because it is considered to be one of the best proxies of high frequency measures (Lesmond, 2005; Hasbrouck, 2009; Goyenko, Holden and Trzcinka, 2009). Nevertheless, given the specifics of our data sample and those of Amihud's illiquidity measure, we decided to follow Karolyi et al. (2012) in transforming Amihud's illiquidity to reduce the impact of outliers and facilitate result interpretation. Thus, we compute liquidity (Liq) as follows:

$$Liq_{i,t} = \frac{1}{n}\sum_{i=1}^{n} -log\left(1 + \frac{|R_{i,d}|}{P_{i,d}VO_{i,d}}\right)$$

where $R_{i,d}$ is the return, $P_{i,d}$ is the price in USD, and $VO_{i,d}$ is the trading volume for stock *i* on day *d*.

We discard stock-day observations with a daily liquidity in the top and the bottom 0.5% of the cross-sectional distribution within a country.

c. Cultural Tightness-Looseness

The strength of social norms and tolerance towards deviant behavior, or cultural tightness-loosenes (CTL) was estimated using the measure proposed by Gelfand (2011).[6]

The measure was built on the basis of a questionnaire applied between 2000-2003 on a sample of 6,960 respondents from 5 continents. Each of the participants answered a set of 6 questions:

1. There are many social norms that people are supposed to abide by in this country.
2. In this country, there are very clear expectations for how people should act in most situations.
3. People agree upon what behaviors are appropriate versus inappropriate in most situations this country.

[6] Originally computed for 33 nations, and later expanded by Erikson, Gelfand et al. (2021) to cover a sample of 57 nations.

4. People in this country have a great deal of freedom in deciding how they want to behave in most situations.
5. In this country, if someone acts in an inappropriate way, others will strongly disapprove.
6. People in this country almost always comply with social norms.

For each of the six questions, the participants were asked to choose one of the following options: strongly disagree, moderately disagree, slightly disagree, slightly agree, moderately agree, strongly agree.

d. Control Variables

In order to isolate the impact of CTL on stock liquidity, we use the following control variables: macroeconomic indicators such as GDP per capita, GDP growth level, inflation, broad money, stock market development indicators such as the number of listed companies or the ratio between the capitalization of the capital market and the country's GDP, as well as company level indicator (according to various studies such as Chung et al. 2010; Prommin et al. ,2014, Ng et al.2016, Dang et al.2018) we use share price, ROA, Book to Market, financial leverage and market value. The size of the company, estimated by the natural logarithm of the market value, allows us to control for the risk of adverse selection, generated by the increased attention that large companies attract and the significantly larger volume of available information (Diamond and Verrecchia (1991)). To capture possible variation across industries we include 5 separate dummies for Industrial, Utility, Transportation, Bank/Savings&Loan and Insurance companies.

The main source for company-level information is the Datastream (Refinitiv) platform, the macroeconomic variables were downloaded from the World Bank Database.

e. Theoretical model

The main hypothesis tested in this study refers to the impact of the strength of social norms (estimated with the help of the CTL measure) on stock liquidity. We expect an inverted U-shaped relationship between the two. The maximum values of liquidity being associated with an average level of CTL.

To test this hypothesis, a battery of panel regressions was estimated, using the following model:

$$Liq_{i,j,t} = \alpha_0 + \alpha_1 CTL_j + \alpha_2 CTL_j^2 + \beta_1 X_{j,t} + \beta_2 Y_{i,t} + \varepsilon_{i,j,t}$$

Where $Liq_{i,j,t}$ is stock's liquidity, CTL_j is cultural tightness-looseness measure of country j, $X_{j,t}$ is a vector of control variables at the country level, $Y_{i,t}$ is a vector of control variables at the firm level.

The existence of an inverted U-shape relationship would imply that the two coefficients related to the variables CTL and CTL^2 have opposite signs, i.e. $\alpha_1>0$, while $\alpha_2<0$. Our assumption regarding the non-linear relationship between the two variables is rooted in the results of the Harrington, Boski and Gelfand (2015) study.

Harrington et al. (2015) analyze how CTL affects a series of indicators of the nation's well-being. They show that moderate societies as compared to very permissive or very strict societies are characterized by a better general psychological

state (a higher degree of happiness, a lower level of dysthymia and a lower suicide rate), a higher level of life expectancy, better economic and political conditions (low risk of political instability and a higher level of GDP). The authors show that both a high level of CTL, i.e. a social environment with multiple limitations and severe sanctions for any violation thereof, and a low level of it, i.e. a relaxed social environment with a high tolerance for violations, can be harmful to the society, negatively influencing its level of development.

4. Empirical results

f. Main results

To establish a reference point, were run models (1) and (2) from Table 1, using only the control variables. The pooled OLS regressions (model 1-4) and Tobit regressions (5-6) with time fixed effects and errors corrected by the clustering option at the company level were employed. Additionally, we added the industry dummies in models (2), (4) and (6) to control for specific effects.

The results for control variables are consistent with previous studies and confirm our expectations. We can see that bigger companies, companies with higher ROA, Book-to-Market, leverage, and lower stock prices have higher liquidity. Although the positive relationship between financial leverage and stock liquidity may seem counterintuitive, since it suggests that higher indebtedness of the company would lead to higher stock liquidity, Ng et al. (2016) report similar results.

At the same time, the coefficients related to the number of listed companies, GDP per capita, and the level of GDP growth are also significant and positive, suggesting that the liquidity of stocks traded on larger stock exchanges in developed countries with a positive economic evolution is significantly higher.

We add *CTL* and CTL^2 in models (3) and (4) to investigate the nature of the relationship between tightness-loosens and stock liquidity[7]. The signs for CTL and CTL^2 coefficients confirm our first hypothesis (H1), i.e. the existence of an inverted U-shaped relationship.

Table 1. Main results

	(1)	(2)	(3)	(4)	(5)	(6)
CTL			0.0110***	0.0108***	0.0109***	0.0108***
			(26.29)	(25.94)	(26.27)	(25.92)
CTL^2			-0.00069***	-0.00069***	-0.00069***	-0.00069***
			(-24.44)	(-24.12)	(-24.42)	(-24.10)
Market value	0.0045***	0.0046***	0.0038***	0.0039***	0.0038***	0.0039***
	(39.84)	(39.73)	(34.92)	(34.44)	(34.90)	(34.42)
ROA	0.0000***	0.00001***	0.0001***	0.0001***	0.0001***	0.0001***
	(13.28)	(12.89)	(12.29)	(12.06)	(12.21)	(11.98)

[7] Before running the two models, the test proposed by Lind and Mehlum (2010), available in STATA through the utest command, was performed, which confirmed the existence of an inverted U-shaped relationship.

	(1)	(2)	(3)	(4)	(5)	(6)
Book to Market	0.0005*** (3.50)	0.0005*** (3.68)	0.0003*** (2.40)	0.0004** (2.51)	0.004** (2.44)	0.0004** (2.55)
Leverage	2.19e-06 *** (4.59)	2.16e-06 **** (4.53)	0.00001 *** (19.25)	0.00001 *** (19.28)	0.00001 *** (19.20)	0.00001 *** (19.23)
Price	-9.48e-07 *** (-2.73)	-8.83e-07 ** (-2.52)	-6.19e-07* (-1.78)	-6.00e-07* (-1.72)	-6.23e-07* (-1.80)	-6.03e-07* (-1.74)
# listed companies	0.0033*** (17.60)	0.0032*** (17.08)	0.0014*** (7.23)	0.0014*** (7.12)	0.0014*** (7.24)	0.0014*** (7.13)
GDP per capita	0.0040*** (19.37)	0.0039*** (19.11)	0.0024*** (7.92)	0.0024*** (7.85)	0.0024*** (7.93)	0.0024*** (7.85)
GDP growth	0.0008*** (15.00)	0.0008*** (14.68)	0.0005*** (8.03)	0.0005*** (7.92)	0.0006*** (8.05)	0.0005*** (7.93)
Const	-0.1292*** (-33.60)	-0.1320*** (-32.95)	-0.1313*** (-23.49)	-0.1329*** (-23.59)	-0.1313*** (-23.48)	-0.1328*** (-23.58)
Industry effects	NO	YES	NO	YES	NO	YES
Year effects	YES	YES	YES	YES	YES	YES
Adj-R^2	0.1199	0.1209	0.1290	0.1293		
F-stat	97.47	83.13	86.25	74.48	86.17	74.41
N	282,593	282,593	245,488	245,488	245,345	245,345
Log likelihood					523577.4	523633.43
VIF-mean	2.28	2.33	2.34	2.39		

Note: This table presents panel regressions between stock liquidity and cultural tightness-looseness CTL. t-statistics, based on standard errors clustered at the firm level, are reported in parentheses. Statistical significance is denoted by *, **, and *** at the 10%, 5%, and 1% levels, respectively.

However, taking into account the fact that the maximum value that the liquidity measure can take is 0 and that we may be dealing with a certain number of censored observations, in models (5) and (6) we use Tobit regressions.[8] The results suggest that the number of censored observations is quite small, and does not significantly affect the relationship between the dependent variable and the explanatory variables.

Table 2. Sub-sample results

	(1) Developed countries	(2) Emerging countries	(3) Big companies	(4) Small companies
CTL	0.0112*** (12.20)	0.0083*** (8.94)	0.0005*** (6.17)	0.0092*** (12.73)
CTL^2	-0.0007*** (-11.55)	-0.0004*** (-9.06)	-0.00003*** (-6.25)	-0.0006*** (-12.72)
Market Value	0.0033*** (26.43)	0.0067*** (25.04)	0.0001*** (12.02)	0.0156*** (34.98)

[8] In cases where the dependent variables are limited/truncated, the use of the Tobit model is recommended.

	(1) Developed countries	(2) Emerging countries	(3) Big companies	(4) Small companies
ROA	0.0001*** (10.94)	0.0001*** (5.93)	0.00001*** (4.33)	0.00008*** (7.19)
Book to Market	0.0004** (2.59)	-0.00004 (-0.12)	0.00004*** (2.74)	0.0009*** (5.36)
Leverage	0.00001*** (11.25)	-0.00008 (-1.20)	9.95e-07*** (4.58)	0.00002*** (15.29)
Price	5.77e-07** (2.12)	1.22e-06 (0.55)	1.65e-07*** (5.19)	3.74e-06*** (4.44)
# listed companies	0.0029*** (13.40)	-0.0019*** (5.52)	0.0002*** (9.06)	0.0042*** (9.53)
GDP per capita	-0.0034** (-2.42)	-0.0004 (-0.43)	0.0001** (2.28)	0.0035*** (7.76)
GDP growth	0.0011*** (9.56)	0.0004*** (5.21)	0.00006*** (4.52)	0.0009*** (7.83)
Const	-0.0735*** (-4.08)	-0.1133*** (-9.62)	-0.0088*** (-7.14)	-0.2827*** (-27.59)
Industry effects	YES	YES	YES	YES
Year effects	YES	YES	YES	YES
Adj-R^2	0.1222	0.1674	0.0169	0.2012
F-stat	59.63	36.54	18.44	81.46
N	171,484	74,004	130,697	114,791

Note: This table presents the results of the panel regressions of stock liquidity and CTL using pooled OLS; t-statistics, based on standard errors clustered at the firm level, are reported in parentheses. Statistical significance is denoted by *, **, and *** at the 10%, 5%, and 1% levels, respectively.

An important aspect when analyzing a relationship described by a quadratic function is the maximum/minimum point, which can be easily calculated using the first derivative, that resumes to -b/2a, or in our case $-\alpha_1/2\alpha_2$. Computing the maximum point helps us understand where the relationship between CTL and liquidity reverse.

Applying this formula to the coefficients from model (4) we get a 7.82 value for CTL, that corresponds to a maximum liquidity level. As CTL values vary between 3.1 (Israel) and 12.3 (Pakistan) we can see that the maximum level for liquidity corresponds to a moderate level of tightness.

Overall, our findings suggest that CTL plays an important role in explaining cross-country differences in stock market liquidity, and that our first hypothesis is valid. However, it would be interesting to see to what extent our results are remain significant if we consider only companies from developed countries or emerging countries. It is possible that the effect of CTL on liquidity is different depending on the level of development of the economy. In this sense, following the classification proposed by Amihud (2015), our sample was divided into developed countries and emerging countries. We re-ran the basic models on the two sub-samples.

The results, presented in Table 2, show us that the nature of the relationship between CTL and liquidity is the same, i.e. inverted U-shaped. The coefficients remain significant for both developed and emerging countries.

Models (3) and (4) reported in Table 2, analyze if the effect of CTL on small companies is different from its effect on large companies. We divided the sample according to the market value in two sub-samples (below and above the sample mean). We note that for both small and large cap companies the results obtained in the basic models are preserved, with small differences in control variables.

g. Robustness check

In this section we present the results for the robustness tests. To ensure that previously obtained results are not biased, we re-run the basic models using random effects[9] regressions. We also look for additional control variables to reduce the likelihood of omitted variable bias.

Financial literature suggests including in the model variables such as inflation, broad money, the ratio between market capitalization and the country's GDP or the quality of institutions. In addition, two company-level control variables were included: return and the tangibility of the company's assets.

The regressions results are presented in Table 3. CTL remains a significant determinant of liquidity regardless of the added control variable. All five added control variables have significant coefficients, confirming their importance to liquidity providers.

Coefficient signs for most of the control variables used are in accordance with our expectations. Higher stock liquidity is characteristic to countries with higher institutional quality, more developed stock markets and broader money supply.

Nevertheless, the sign for tangibility ratio suggests that companies with less tangible assets are more liquid, although, in theory, tangible assets are more easily tracked which should offer investors additional safety with regards to the company's future evolution. Results could vary across industries (i.e. companies from the IT & financials sectors having, generally less tangible assets, than for example, Industrials).

Table 3. Results of random effects regressions

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
CTL	0.0087*** (15.78)	0.0081*** (15.16)	0.0082*** (13.48)	0.0093*** (13.97)	0.0084*** (16.54)	0.0098*** (17.96)
CTL²	-0.0005*** (-12.92)	-0.0004*** (-12.20)	-0.0004*** (-10.63)	-0.0005*** (-13.16)	-0.0004*** (-13.41)	-0.0005*** (-15.52)
Return	0.0013*** (8.60)					
Tangibility		-0.0051*** (-5.37)				
MV/GDP			2.70e-06*** (6.00)			
Broad money				0.00001*** (5.50)		

[9] The results of the Breusch-Pagan test confirm the existence of significant random effects.

	(1)	(2)	(3)	(4)	(5)	(6)
Inflation					0.00007** (1.99)	
Institutional quality						0.0086*** (13.55)
Market value	0.0061*** (29.05)	0.0062*** (29.94)	0.0064*** (29.78)	0.0054*** (33.78)	0.0063*** (29.95)	0.0064*** (29.66)
ROA	0.00007** (7.02)	0.00007** (7.66)	0.00007*** (7.49)	0.00008** (8.08)	0.0007** (7.86)	0.0007*** (7.72)
Book to Market	0.0005** (2.45)	0.0005*** (2.62)	0.0005** (2.62)	0.00005 (0.34)	0.0005*** (2.62)	0.0006*** (3.01)
Leverage	0.00001*** (16.04)	0.00001*** (14.10)	0.00001*** (13.09)	0.00001*** (13.91)	0.00001*** (13.79)	0.00001*** (14.90)
Price	-3.25e-06*** (-6.45)	-3.05e-06*** (-6.62)	-3.23e-06*** (-6.84)	-2.70-06*** (--5.08)	-3.08e-06*** (-6.73)	-3.12e-06*** (-6.56)
# listed companies	0.0009*** (3.79)	0.0008*** (3.48)	0.0010*** (4.12)	-0.0011 (-4.36)	0.0008*** (3.39)	0.0006*** (2.67)
GDP per capita	0.0037*** (12.09)	0.0037*** (12.36)	0.0042*** (12.41)	0.0017*** (8.09)	0.0039*** (12.12)	-0.0014*** (-5.00)
GDP growth	0.0008*** (13.62)	0.0008*** (13.96)	0.0009*** (13.98)	0.0004*** (10.78)	0.0008*** (13.79)	0.0009*** (14.39)
Const	-0.1640*** (-26.55)	-0.1617*** (-27.09)	-0.1742*** (-25.50)	-0.1210*** (-29.39)	-0.1659*** (-26.02)	-0.1256*** (-29.92)
Industry effects	YES	YES	YES	YES	YES	YES
Year effects	YES	YES	YES	YES	YES	YES
Overall-R^2	0.1253	0.1226	0.1199	0.1227	0.1221	0.1219
χ^2	2566.21	2582.10	2547.19	2471.59	2593.53	2723.64
N	234,793	244,688	242,084	221,426	245,488	237,817

Note: This table presents the results of the panel regressions of stock liquidity and CTL using random effects; t-statistics, based on standard errors clustered at the firm level, are reported in parentheses. Statistical significance is denoted by *, **, and *** at the 10%, 5%, and 1% levels, respectively.

h. The moderator effect of financial literacy

Financial education is yet another important factor that could have a significant effect both directly, on stock market liquidity and indirectly, on the way social norms influence investment decisions.

Defined by Servon and Kaestner (2008) as "the person's ability to understand and apply financial concepts". Financial literacy plays an important role both at the individual level and at the macroeconomic level.

In financial literature, there are numerous studies that analyzed the effect of financial literacy on various financial decisions (Bayer et al. 1996; Hilgert et al. 2003; Lusardi and Mitchell, 2007; Guiso and Jappelli, 2008; Muller and Weber, 2010; Dvorak and Hanley, 2010; Van Rooij et al. 2011; Smith et al., 2011; Ludlum et al.,

2012)[10], showing that most people have a low level of financial education, which can be associated with under-diversification of portfolios, a low level of stock market investments, and a lack of savings for retirement, frequent changes regarding the allocation of accumulated capital, questionable financial decisions and irresponsible financial behavior (exaggerated use of credit cards, over-indebtedness and others).

The importance of financial education is highlighted by Akerlof and Schiller (2010) in their book "Spiritus Animalis", suggesting that it could diminish the role of culture on financial decisions. Mainly, however, the authors focus on the problem of savings, showing that most people do not save enough.

Aren and Aydemir (2015) show that financial literacy has a moderating effect on the relationship between risk aversion and the intention to invest in risky assets. Furthermore, the authors investigate the effect that financial literacy has on the "locus of control". The concept of "locus of control" taken from psychology refers to the extent to which people believe they have control over the situations and experiences that affect their lives. According to this concept, people who consider that everything that happens in their life (good or bad) is the result of their own actions, have what the psychologic literature calls "internal locus of control", while people who consider that everything that happens to them is determined by "external forces" such as the chance, luck or destiny, have what the literature calls "external locus of control".

This characteristic of "locus of control" is considered by numerous studies in psychology and management to be an underlying factor in financial decisions. Our assumption is that one of the alternative channels through which social norms could affect investment decisions is the "locus of control". Members of a tight society, theoretically, are more likely to have an "external locus of control" because their whole life is "directed" by social norms and institutions. Thus, we could speculate that the greater aversion to risk in tight societies is caused by the perception of the lack of control that the members of such a society have over their own lives.

Van Roij et al. (2011) using the data obtained by De Nederlandsche Bank's Household Survey regarding the demographic and economic characteristics of a sample of 2,000 households in the Netherlands, construct a measure of the level of financial literacy, with the help of which they show that the lack of basic economic and financial knowledge represents one of the main reasons why most households do not invest in the capital market.

As such, in the second part of our empirical study, we decided to investigate to what extent financial education can moderate the effect of CTL on market liquidity. A better level of knowledge of financial concepts and the way capital markets work, could reduce the reluctance that investors have towards trading activity. Although, in addition to the actual level of financial knowledge, preconditions such as personal experience, trust in the financial system or the extent to which investments in the capital market are practiced by the family, friends or acquaintances or any other subjective reasons, have an important role. However, a person who really understands the mechanics of the market, will get over them more easily.

The level of financial literacy in this study was estimated through the answers to 5 questions related to risk diversification, inflation, interest and compound interest, obtained by the Standard & Poor's Ratings Services Global Financial Literacy Survey.

[10] See Aren and Aydemir (2014) for an extended literature review.

The survey was applied to a sample of 150,000 adults from 140 countries. According to the results obtained, only 1 out of 3 adults at the global level answered correctly on 3 out of the 4 subjects, the fewest correct answers being recorded for the question regarding portfolio diversification.

In order to capture the moderating effect of financial education on the relationship between CTL and stock liquidity, the following model was used:

$$Liq_{i,j,t} = \alpha_0 + \alpha_1 CTL_j + \alpha_2 CTL_j^2 + \alpha_3 Fin\_Lit + \alpha_4 CTL_j \times Fin\_Lit_j + \alpha_5 CTL_j^2 \times Fin\_Lit_j + \beta_1 X_{j,t} + \beta_2 Y_{i,t} + \varepsilon_{i,j,t}$$

where $Liq_{i,j,t}$ is liquidity of stock *i* from country *j* in year *t*, CTL_j is measure of cultural tightness-looseness of *j* country, Fin_Lit_j is level of financial literacy in country *j* , $X_{j,t}$ is a vector of control variables at the country level, and $Y_{i,t}$ is a vector of control variables at the company level, $CTL_j \times Fin\_Lit_j$ and $CTL_j^2 \times Fin\_Lit_j$ represents interaction terms between CTL and financial literacy.

In the new model we are looking at two aspects: (1) the significance of the interaction terms coefficients α_4 and α_5, that show us whether the analyzed variable has any moderating effect, and (2) the signs of the coefficients which suggests the nature of the effect. In theory, the moderation effect is possible only when $Fin\_Lit \neq 0$. A U-shaped relationship between CTL and liquidity exists when $\alpha_1+\alpha_4 Fin\_Lit<0$ and $\alpha_2+ \alpha_5 Fin\_Lit>0$, and an inverted U-shaped relationship exists when $\alpha_1+\alpha_4 Fin\_Lit>0$ and $\alpha_2+\alpha_5 Fin\_Lit<0$.

Table 4. Moderating effect of financial literacy

	(1) All countries	(2) Developed countries	(3) Emerging countries	(4) All countries	(5) Developed countries	(6) Emerging countries
CTL	0.0318*** (14.59)	0.0713*** (11.48)	0.3115*** (10.79)	0.0310*** (11.58)	0.0722*** (12.65)	0.2927*** (8.66)
CTL²	-0.0017*** (-12.55)	-0.0039*** (-11.16)	-0.0172*** (-10.56)	-0.0016*** (-9.22)	-0.0040*** (-12.48)	-0.0162*** (-8.58)
Fin_Lit	0.0015** (10.69)	0.0039*** (10.99)	0.0388*** (10.70)	0.0015*** (8.98)	0.0040*** (11.72)	0.0362*** (8.40)
CTL*Fin_Lit	-0.0038*** (-9.90)	-0.0009** (-10.46)	-0.0091*** (-10.65)	-0.0004*** (-7.92)	-0.0010*** (-11.76)	-0.0085*** (-8.44)
CTL²*Fin_Lit	0.0001*** (6.31)	0.0004*** (9.48)	0.0005*** (10.41)	0.0002*** (5.43)	0.00005*** (11.13)	0.0004*** (8.33)
Market value	0.0036*** (31.25)	0.0033*** (28.08)	0.0063*** (18.62)	0.0057*** (26.46)	0.0055*** (23.94)	0.0072*** (17.29)
ROA	0.0001*** (12.41)	0.0001*** (12.01)	0.0001*** (4.48)	0.00007*** (7.57)	0.00007*** (6.95)	0.00008*** (3.83)
Book to Market	0.0004*** (2.95)	0.0005*** (2.95)	0.0003 (0.88)	0.0007*** (3.81)	0.0007*** (6.95)	0.0005* (1.69)
Leverage	7.96e-06*** (8.14)	5.25e-06*** (7.85)	-0.00003 (-0.88)	7.53e-06 *** (10.54)	4.36e-06 *** (6.75)	-6.24e-06 (-0.10)

	(1) All countries	(2) Developed countries	(3) Emerging countries	(4) All countries	(5) Developed countries	(6) Emerging countries
Price	6.44e-08*** (0.20)	6.44e-07* (1.74)	-1.42e-06 (-0.55)	-2.48e-06*** (-6.54)	-2.11e-06*** (-5.68)	-5.58e-06*** (-2.45)
# listed companies	0.0004*** (2.62)	0.0006** (2.57)	-0.0014*** (-3.11)	0.0001 (0.78)	0.0012*** (4.65)	-0.0027*** (-3.77)
GDP per capita	0.0064*** (14.15)	0.0036** (2.13)	-0.0037** (-2.96)	0.0069*** (14.67)	0.0091*** (3.29)	0.0004 (0.32)
GDP growth	0.0006*** (7.63)	0.0011*** (9.99)	0.0009*** (8.48)	0.0010*** (13.62)	0.0014*** (13.35)	0.0008*** (8.29)
Const	-0.2435*** (-18.58)	-0.3842*** (-9.46)	-1.3914*** (-11.54)	0.2712*** (-19.12)	-0.4647*** (-9.95)	-1.3455*** (-9.30)
Industry effects	YES	YES	YES	YES	YES	YES
Year effects	YES	YES	YES	YES	YES	YES
Adj-R^2/Overall-R^2	0.1413	0.1482	0.1960	0.1337	0.1387	0.1940
F-stat/ χ^2	67.75	60.35	26.74	2697.47	2407.46	974.55
N	228,458	171,484	56,974	228,458	171,484	56,974

Note: This table presents the results of the panel regressions of stock liquidity and CTL using pooled OLS (model 1-3),and random effects (model 4-6); t-statistics, based on standard errors clustered at the firm level, are reported in parentheses. Statistical significance is denoted by *, **, and *** at the 10%, 5%, and 1% levels, respectively.

If $\alpha_1 + \alpha_4 Fin\_Lit$ is equal to $\alpha_2 + \alpha_5 Fin\_Lit$ we obtain the *Fin_Lit* threshold that transforms an inverted U-shaped relationship into a U-shaped relationship. The turning point of the function can be estimated using the following formula:

$$CTL = -(\alpha_1 + \alpha_4 Fin\_Lit)/2 \times (\alpha_2 + \alpha_5 Fin\_Lit)$$

The results of the regressions run both on the whole sample (models 1 and 4) and separately on developed and emerging countries, presented in Table 4, show us that all the coefficients of the interaction terms are significant at 1%. The sign of the coefficients suggests the existence of an inverted U-shaped relationship between CTL and liquidity in countries with a low level of financial education and a U-shaped relationship in countries with a high level of financial education.

Thus, the calculated turning point for model (1) is 9.29, and the Fin_Lit threshold at which the inversion of the function occurs is equal to 84.27. That is, theoretically countries with a level of financial education above 84.27 manage to reverse the form of the relationship between CTL and the liquidity of the securities, but we emphasize that this is a theoretical threshold, because none of the countries in our sample have such a high level of financial literacy. However, we consider that the results are in line with our expectations, validating the second hypothesis, according to which the way in which social norms influence the stock liquidity is shaped by the level of financial literacy.

One of the main practical implications of these results comes from the fact that culture, or in our case the strength of social norms, is not a variable decision-makers or regulatory authorities could influence. Even if they were to succeed in influencing it, this would have taken several generations. It is quite difficult to change an adult's perspective. The level of financial literacy, on the other hand, can be improved over a relatively short timeframe, the results being visible after a few years. Thus, we consider that one of the most effective ways in which decision-makers could positively impact the liquidity of the capital markets in the long term is through measures aimed at increasing the level of financial literacy.

5. Conclusions

Liquidity, analyzed through the lens of classical theories, is a relatively simple concept, behind which are the basic mechanisms of the market influenced by supply and demand. However, as the last financial crisis showed us, liquidity is a much more complex phenomenon, which captures, in addition to demand and supply, the interactions between the investor, the market and the global economy. Although these interactions do not always lead to a transaction, they shape the state of tomorrow's economy. Hence the importance of the phenomenon of liquidity and the factors that influence it.

Most financial empirical studies that analyzed the phenomenon of stock liquidity focused on factors related to the company, the capital market, or the economy in general. Among the few examples of studies that tried to capture the impact of subjective factors, such as social trust are Blau (2017) and Zadeh (2022). Both show there is a strong connection between the investor's level of trust and his/her willingness to trade on the stock market.

In this study, we tried to analyze the stock market liquidity through the lens of cognitive biases, determined by the strictness/permissiveness of social norms. The role and impact of social norms on an individual's behavior have been increasingly highlighted in psychology and anthropology studies. In addition, rather recently Gelfand et al. (2010) and Uz (2014) proposed some measures to capture the strength of social norms and tolerance towards deviant behavior.

As such, we propose to extend the analyses performed by Chui et al. (2010), Eun et al. (2015), and Tang et al. (2019) in which authors studied the impact of culture on trading activity, by incorporating into the model a new cultural dimension called tightness-looseness (CTL). Our results confirm the existence of a significant relationship between CTL and liquidity regardless the estimation method used or the control variables included in the model. This relationship follows an inverted U-shape. As such, a high/low level of CTL corresponds to low levels of liquidity, while a moderate level of CTL corresponds to a high level of liquidity.

We believe that CTL influences liquidity through several main channels: risk aversion, information asymmetry, and (interpersonal & institutional) trust. Members of tight societies have greater levels of risk aversion, because, since childhood, they were taught to answer for their own actions, and got used to the idea that any violation of the rules will be strictly punished. This is why members of tight societies are more focused on preventing negative events (prevention focus). In regards to the stock markets, this prevention focus manifests through the hesitation to carry out a transaction, unless the probability of a gain is very high.

In loose societies, the focus is on results (promotion focus). Members of such societies are more inclined to assume a much greater risk, even if the probability of profit is relatively small. Children in such societies are encouraged to explore and express their opinions freely. Both approaches taken to the extreme can be harmful. The overestimation of risks (tight societies) leads to a reluctance towards everything new, which implies stagnation and missed opportunities, such as those existing on the stock market. Underestimating risks (loose societies) and overconfidence in one's own abilities implies unjustified exposure to risks and a higher probability of failure.

At the same time, the hierarchical structure of tight societies (a greater distance from power) determines higher levels of informational asymmetry, due to the way and the means through which information is transmitted (limited access to information, censored media institutions and the practice of narrow socialization),while loose societies are characterized by a greater degree of freedom, easier access to information, but also greater volumes of false information, fraud and mass manipulation.

Generally, our results confirm the assumption regarding the fact that very tight societies, are too dependent on "social approval" not independent enough to take initiative and go against the trend, for example by purchasing a stock whose price is decreasing due to mass selling.

One of the factors that could counterbalance the effect of culture and social norms on investor behavior is financial literacy. The results from the second part our empirical study confirm that financial literacy can shape the nature of the relationship between CTL and liquidity, reversing its direction. The higher the level of financial education of the investor, the easier will he/she overcome the cognitive bias, making the correct (rational) financial decision.

The moderating effect of financial literacy on the relationship between CTL and liquidity has some important implications for decision-makers and financial market regulatory authorities. First of all, our results show that increasing the level of financial literacy can reduce the effect of culture on market liquidity. As such authorities from countries with lower levels of stock market liquidity, should take measures aimed at increasing the level of financial literacy in order to improve the stock market liquidity. Secondly, our results confirm the assumption regarding the fact that the level of development of a stock market is influenced by the extent to which the society managed to find a balance between free will and obedience. A "healthy" stock market cannot be built in a conservative and over-regulated environment, because innovation is one of the main engines of development, but at the same time, the lack of clear rules and adequate control mechanisms leads to chaos and lack of confidence in stock markets.

References

Aggarwal, R., Kearney, C., & Lucey, B. (2012). Gravity and culture in foreign portfolio investment. Journal of Banking & Finance, 36(2), 525–538. doi:10.1016/j.jbankfin.2011.08.0007

Aggarwal, R., & Goodell, J. W. (2014). Cross-national differences in access to finance: Influence of culture and institutional environments. Research in International Business and Finance, 31, 193–211. doi:10.1016/j.ribaf.2013.09.004

Ahern, K. R., Daminelli, D., & Fracassi, C. (2015). Lost in translation? The effect of cultural values on mergers around the world. Journal of Financial Economics, 117(1), 165–189. doi:10.1016/j.jfineco.2012.08.006

Ailon, G. (2008). Mirror, Mirror on the Wall: Culture's Consequences in A Value Test of its Own Design. Academy of Management Review, 33(4), 885–904. doi:10.5465/amr.2008.34421995

Akerlof, G. A., & Shiller, R. J. (2009). Animal spirits: How human psychology drives the economy, and why it matters for global capitalism. Princeton University Press.

Amihud, Y. (2002). Illiquidity and stock returns: cross-section and time-series effects. Journal of Financial Markets, 5(1), 31–56. doi:10.1016/s1386-4181(01)00024-6

Blau, B. M. (2017). Social trust and the liquidity of cross-listed securities. Journal of Business Research, 78, 155–171. doi:10.1016/j.jbusres.2017.05.009

Chui, A. C. W., Titman, S., & Wei, K. C. J. (2010). Individualism and Momentum around the World. The Journal of Finance, 65(1), 361–392. doi:10.1111/j.1540-6261.2009.01532.x

Chui, Andy C.W., Alison Lloyd, and Chuck C. Y. Kwok, 2002, "The Determination of Capital Structure:Is National Culture a Missing Piece to the Puzzle?" Journal of International Business Studies 33,99-127.

Chung K., Elder J., and Kim J. (2010) Corporate governance and liquidity. Journal of Financial and Quantitative Analysis, 45:265–291.

Dang, T. L., Moshirian, F., & Zhang, B. (2019). Liquidity shocks and institutional investors. North American Journal of Economics and Finance, 47, 184–209.

DeBruine, L., M., (2002) "Facial Resemblance Enhances Trust," Proceedings of the RoyalSociety of London B, 269, 1307-1312.

Diamond, D. W., Verrecchia, R. E., 1991. Disclosure, liquidity, and the cost of capital. The Journal of Finance, 46, 1325-1359.

Eun, C.S., Wang, L., Xiao, S.C., 2015. Culture and R 2. J. Financ. Econ. 115 (2), 283–303.

Eriksson, K., Strimling, P., Gelfand, M., Wu, J., Abernathy, J., Akotia, C. S., … Anum, A. (2021). Perceptions of the appropriate response to norm violation in 57 societies. Nature Communications, 12(1). doi:10.1038/s41467-021-21602-9

Gelfand, M. J., Nishii, L. H., & Raver, J. L. (2006). On the nature and importance of cultural tightness-looseness. Journal of Applied Psychology, 91(6), 1225–1244. https://doi.org/10.1037/0021-9010.91.6.1225

Gelfand, M. J., Raver, J. L., Nishii, L., Leslie, L. M., Lun, J., Lim, B. C., … Yamaguchi, S. (2011). Differences Between Tight and Loose Cultures: A 33-Nation Study. Science, 332(6033), 1100–1104. doi:10.1126/science.1197754

Giannetti, M., & Yafeh, Y. (2012). Do Cultural Differences Between Contracting Parties Matter? Evidence from Syndicated Bank Loans. Management Science, 58(2), 365–383. doi:10.1287/mnsc.1110.1378
Goyenko, R. Y., Holden, C. W., & Trzcinka, C. A. (2009). Do liquidity measures measure liquidity?. Journal of financial Economics, 92(2), 153-181.
Gorodnichenko Y. and Roland G. (2017) „Culture, Institutions and the Wealth of Nations" Review of Economics and Statistics 99, 402-416.
Griffin, J. M., Kelly, P. J., & Nardari, F. (2010). Do Market Efficiency Measures Yield Correct Inferences? A Comparison of Developed and Emerging Markets. Review of Financial Studies.
Grinblatt, M., Keloharju, M., 2001. What makes investors trade? J. Finance 56 (2), 589–616.
Guiso, L., Sapienza, P., & Zingales, L. (2004). The Role of Social Capital in Financial Development. American Economic Review, 94(3), 526–556. doi:10.1257/0002828041464498
Guiso, L., Sapienza, P., Zingales, L., 2008. Does culture affect economic outcomes? Res.Instit. Econ. 20 (2), 23–48.
Han,M. Li,Y. , Wang N. & Zhang H., (2020). Cultural diversity in ownership and stock liquidity, Applied Economics Letters.
Harrington JR, Boski P, Gelfand MJ (2015). Culture and National Well-Being: Should Societies Emphasize Freedom or Constraint? PLoS ONE 10(6).
Harms, R., Groen, A., (2016) Loosen up? Cultural tightness and national entrepreneurial activity, Technol. Forecast. Soc. Change.
Hasbrouck, J., 2009. Trading costs and returns for US equities: estimating effective costs from daily data. J. Financ. 64 (3), 1445–1477.
Hofstede, G. (2001), Culture's Consequences: Comparing Values, Behaviors, Institutions, and Organizations Across Nations, 2nd ed. Sage, Thousand Oaks, CA.
House, R., Javidan, M., Hanges, P., & Dorfman, P. (2002). Understanding cultures and implicit leadership theories across the globe: an introduction to project GLOBE. Journal of World Business, 37(1), 3–10. doi:10.1016/s1090-9516(01)00069-4
Ince, O. S., & Porter, R. B. (2006). Individual Equity Return Data from Thomson Datastream: Handle with Care! Journal of Financial Research, 29(4), 463–479. doi:10.1111/j.1475-6803.2006.00189.x
Inglehart, R. (1997). Modernization and Postmodernization: Cultural, Economic, and Political Change in 43 Societies. Princeton, NJ: Princeton University Press.
Karolyi, G. A. (2016). The gravity of culture for finance. Journal of Corporate Finance, 41, 610–625. doi:10.1016/j.jcorpfin.2016.07.00
Karolyi, G. A., Lee, K.-H., & van Dijk, M. A. (2012). Understanding commonality in liquidity around the world. Journal of Financial Economics, 105(1), 82–112. doi:10.1016/j.jfineco.2011.12.008
Kwok, C. C. Y., & Tadesse, S. (2006). National culture and financial systems. Journal of International Business Studies, 37(2), 227–247. doi:10.1057/palgrave.jibs.8400188
LESMOND, D. (2005). Liquidity of emerging markets. Journal of Financial Economics, 77(2), 411–452. doi:10.1016/j.jfineco.2004.01.005

Li, R., Gordon, S., & Gelfand, M. J. (2017). Tightness–looseness: A new framework to understand consumer behavior. Journal of Consumer Psychology, 27(3), 377–391. https://doi.org/10.1016/j.jcps.2017.04.001

Li, K., Griffin, D., Yue, H., & Zhao, L. (2013). How does culture influence corporate risk-taking? Journal of Corporate Finance, 23, 1–22. doi:10.1016/j.jcorpfin.2013.07.008

Li C., Li D., Chiu C.-Y., Peng S. (2018). Strong brand from consumers' perspective: a cross-cultural study. J. Cross Cult. Psychol. 50 116–129.

McSweeney, B. (2002) Hofstede's Model of National Cultural Differences and their Consequences: A Triumph of Faith—A Failure of Analysis. Human Relations, 55, 89-118.

Noh, M & Cho, M K, 2022. "Cultural tightness and accounting conservatism," Journal of Contemporary Accounting and Economics, Elsevier, vol. 18(1).

Ng, L., Wu, F., Yu, J., Zhang, B., 2016, Foreign investor heterogeneity and stock liquidity around the world, Review of Finance 20, 1867-1910.

Prommin, P., Jumreornvong, S., & Jiraporn, P. (2014). The effect of corporate governance on stock liquidity: The case of Thailand. International Review of Economics Finance, 32, 132–142.

Schwartz, S. H. (1994). Are there universal aspects in the content and structure of values? Journal of Social Issues, 50, 19-45.

Shao, Liang, Chuck C.Y. Kwok, and Omrane Guedhami, 2010, "National Culture and Dividend Policy," Journal of International Business Studies, 41, 1391-1414.

Shenkar, O. (2001) Cultural distance revisited: Towards a more rigorous conceptualization and measurement of cultural differences. Journal of International Business Studies, 32(3), 519–536.

Siegel, J. I., Licht, A. N., & Schwartz, S. H. (2011). Egalitarianism and international investment. Journal of Financial Economics, 102(3), 621–642. doi:10.1016/j.jfineco.2011.05.010

Stulz, R. M., & Williamson, R. (2003). Culture, openness, and finance. Journal of Financial Economics, 70(3), 313–349. doi:10.1016/s0304-405x(03)00173-9

Triandis, H. C. (1989). The self and social behavior in differing cultural contexts. Psychological Review, 96(3), 506–520. https://doi.org/10.1037/0033-295X.96.3.506

Woolcock, M. (2001). The Place of Social Capital in Understanding Social and Economic Outcomes. Paper Presented at the Contribution of Human and Social

Wu, W., & Dai, S. (2001). A comparative study of crisis management planning in Singapore and Hong Kong. National University of Singapore. Singapore.

Zadeh, Mohammad Hendijani, 2023. "Stock liquidity and societal trust," Journal of Behavioral and Experimental Finance, Elsevier, vol. 37(C).

Zuckerman, M. (1979). Attribution of success and failure revisited: or the motivational bias is alive and well in attribution theory. Journal of Personality, 47(2), 245–287. https://doi.org/10.1111/j.1467-6494.1979.tb00202.x