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Trade and Global Market

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Contributors

Oguzhan Ozcelebi, Seok-Joon Hwang, Xiaomin Li, Stefan Sumah, Sabina Silajdzic, Eldin Mehic, Er'El Granot, Ana Gama, Raul Navas, Sónia R. Bentes, Maumita Choudhury, Kirill Vaninsky, Alexander Lykov, Alexander Glekin, Vito Bobek

Notice

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Meet the editor

Vito Bobek has a long history in academia, consulting and entrepreneurship. In 2008 he founded a consulting company, Palemid, where he managed 12 big projects, such as Cooperation Programme Interreg V-A Slovenia-Austria (2014–2020) and Capacity Building for the Serbian Chamber of Enforcement Agents. He has also participated in many international projects in Italy, Germany, the UK, the US, Spain, Turkey, France, Romania, Croatia, Montenegro, Malaysia and China. He is also cofounder of the Academy of Regional Management in Slovenia. During the last 17 years, he has also been a member of the supervisory board at KBM Infond Management Company Ltd, which is a part of the Nova KBM, Plc banking group. Nova KBM is the second largest Slovenian bank. Currently, KBM Infond Ltd manages an umbrella fund with 22 subfunds with assets in excess of 300+ million euros. Since 2017 he has been vice-president at Save-Ideas.com. He works as a professor of international management at the University of Applied Sciences FH Joanneum (Graz, Austria) and the University of Maribor (Slovenia). In his academic career he has published 393 units and visited 22 universities worldwide as a visiting professor. He is a member of the editorial boards of five international journals and an open access publishing company. Among his previous functions, he was a columnist at the newspaper *Vecer*, a member of Team Europe Slovenia, a member of the Academic Expert Group in the Commission of the EU (DG Education) for Socrates/Erasmus project evaluation and an adviser to the Minister of Economic Relations and Development of Slovenia for the strategy of International Economic Relations.

Contents

Preface

International capital flows have become significantly important since the increasing trend in globalization of the early 1990s. The diversified global market has become one single market, the investment sector has strengthened itself and countries have started to allow investment inflows for economic growth. Empirical studies have revealed that political instability, political regimes and the quality of existing institutions, in addition to the transition procedure of a nation itself, have a deterministic effect on the linkage of economic growth and corruption. Additionally, exchange rate volatility can determine the amount of exchange rate risk that firms can be opposed to; therefore, exchange rate volatility is a crucial issue that should be monitored by central banks to prevent contagion of negative microeconomic developments to macroeconomic activity and stability. The significant transformation of banking markets raises many questions regarding the motives of financial organisations to finance SMEs, for example what are the factors that have an impact on these organisations' choice and market strategies?

Vito Bobek
University of Applied Sciences FH Joanneum
Graz, Austria

University of Maribor
Maribor, Slovenia

Introduction

Chapter 1

Introductory Chapter

Vito Bobek

Additional information is available at the end of the chapter

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1. Theoretical perspectives on trade and global market

Theoretical Perspectives on Trade and Global Market at the very beginning deals with the relationship between trade openness and economic growth which is ambiguous from both theoretical and empirical point of view. The theoretical propositions reveal that while trade openness leads to greater economic efficiency, market imperfections, differences in technology, and endowments may lead to adverse effect of trade liberalization on individual countries. The empirical evidence pointing to the benefits of trade liberalization and bringing theoretical issues on possible adverse effect of openness to the fore has been reexamined. It has been argued that "passive" trade liberalization may not necessarily lead to positive economic outcomes, particularly in less advanced transition economies. Considering the empirical work on the matter, a lot of controversies are related to measurement issues. We find that openness measured by trade intensity indicators may lead to misleading conclusions about the trade growth nexus. Hence, the discussion of policy implications regarding the positive influence of trade barriers on economic growth goes well beyond the context of transition.

Furthermore, in this section, a generalization of the Ricardian model of international trading is presented. Unlike the original Ricardian analysis, the presented model takes into account the producers' entrepreneurial activities, their specialization factor (the improvement factor in production due to specialization), and the countries' taxes (tariffs). The main result of this model is that for a given entrepreneurial activity culture and a given specialization factor, there exists a critical taxation level above which specialization and all entrepreneurial activities are suppressed and international commerce is ceased.

Sometimes, a change in investment motives, caused by an unexpected shock such as national disasters, can make the location pattern of Foreign Direct Investments (FDIs) hosted in a neighboring country. In this section, the location of new manufacturing FDIs of Japan in Korea from 2008 to 2015 is analyzed. The occurrence of "East Japan earthquake" in 2011 changed the location pattern of Japanese FDIs by industry group. However, general attracting factors, such

as easy accessibility to service establishments, continue to be an important location factor, regardless of the industry group. Therefore, to be an effective strategy, the regional economic development strategy of the host country attracting FDIs should be flexible to the sudden changes in the natural environment of the source country of FDIs, and focus more on the general factors which attract FDIs.

The last part of the section is devoted to corruption which is a constant in the society and occurs in all civilizations; however, it has only been in the last 20 years that this phenomenon has begun being seriously explored. It has many different shapes as well as many various effects, both on the economy and the society at large. Among the most common causes of corruption are the political and economic environment, professional ethics and morality and, of course, habits, customs, tradition, and demography. Its effects on the economy (and also on the wider society) are well-researched, yet still not completely. Corruption thus inhibits economic growth, affects business operations, employment, and investments. It also reduces tax revenue and the effectiveness of various financial assistance programs. The wider society is influenced by a high degree of corruption in terms of lowering of trust in the law and the rule of law, education, and consequently, the quality of life (access to infrastructure, health care). There also does not exist an unambiguous answer as to how to deal with corruption. Something that works in one country or in one region will not necessarily be successful in another. The chapter tries to answer at least a few questions about corruption; the causes for it, its consequences, and how to deal with it successfully.

2. Financial dimensions (exchange rate and bank finance)

Financial Dimensions (Exchange Rate and Bank Finance) starts with the chapter on Panel Vector Autoregression (PVAR) models which are employed to examine the relationships between industrial production growth rate, consumer price inflation, short-term interest rates, stock returns, and exchange rate volatility. More specifically, the consequences of the dynamics detected by the models on monetary policy implementation for 10 OECD countries have been explored. This chapter indicates that factors that may cause a rise in short-term interest rates with respect to the USA can lead to volatility in exchange rates and thus macroeconomic instability. It is also implied that sustaining macroeconomic growth and decreasing inflation can result in increased export performance, which, in turn, provides the amount of US dollars to curb volatility in US dollar quotations. Accordingly, this study reveals that high importance should be given both monetary and nonmonetary factors in open-economy framework to detect the possible impacts on trade and capital flows by Dynamic Stochastic General Equilibrium (DSGE) models. Due to their exchange rate risk of economic agents, it is also suggested that the economic policymakers of these countries had better create a theoretical framework including financial frictions, economic agents' preferences, and different shocks to smooth the variations in exchange rates and minimize the negative outcomes of Brexit.

The second chapter in this section is a continuation of previous topics, namely PVAR models are used to determine the impacts of exchange rate volatility on industrial production growth

rate, consumer price inflation, short-term interest rates, and stock returns for 10 OECD countries. The variance decompositions (VDCs) found that exchange rate volatility can be a secondary factor for the variations in immediate interest rates, implying that Uncovered Interest Rate Parity (UIP) condition should be analyzed by the inclusion of other macroeconomic variables. IRFs expose that volatility in exchange rates can have a positive impact on the liquidity conditions in money market and an increase in real economic activity because investors to move their money away from currency markets to money markets. The relatively lower impact of exchange rate volatility may arise from the zero bound problem, thus it is emphasized that the examination of impacts on exchange rate volatility on macroeconomics variables should be made both considering conventional and unconventional monetary policy. Although impulse response functions (IRFs) did not detect the significant impact of exchange rate volatility on inflation, VDCs obtained supporting results to exchange rate pass through (ERPT). It is suggested that the monetary policy to be developed should clarify alternative channels that exchange rate may affect inflation.

The third chapter in this section deals with micro, small, and medium enterprises (MSMEs), which are particularly important for emerging countries. This is primarily because of MSME's potential in job creation. Yet, lack of access to finance is a major obstacle to their growth. The MSEs are more than just GDP earners; they are instruments of inclusive growth. MSEs also act as ancillary industries for large-scale industries providing them with raw materials, vital components, and backward linkages. This sector seeks to empower people to break the cycle of poverty and deprivation. In addition to limited development of industries in North-East Region (NER) of India, there is limited availability of data on whatever industries exist there. Data showing the credit disbursals toward MSME sector by commercial banks in Assam as a percentage of their total credit disbursements do not show a favorable picture for the MSMEs. Majority of the banks' MSME credit disbursal as a proportion to total credit disbursals ranges between 1 and 6%. Formal lending sector is always preferred over informal sector for the MSMEs because of the credibility of such lending institutions. MSMEs need special credit policy especially at the start-up stages. The chapter aims to find out the characteristics of MSMEs operating under rural villages in Assam and also the various problems encountered by them in obtaining finance from banks.

3. Technical issues of global operations

Technical Issues of Global Operations consists of two chapters. The first chapter in this section is devoted to numerical computer simulation of the market mechanism, the consolidated order book. The chapter consists of two parts. The first part is devoted to empirical analysis of consolidated order book (COB) for the index RTS futures. In the second part, Poissonian multiagent model of the COB has been considered. By varying parameters of different groups of agents submitting orders to the book, it is possible to model various real-life phenomena. In particular, the spread, the profile of the book, and large price changes have been modeled. Two different mechanisms of large price changes have been considered in detail. One such mechanism is due to a dis-balance of liquidity in the COB and another one is arising from the dis-balance of sell and buy orders in the order flow.

The second chapter in this section investigates the relevance of fundamental analysis (FA) for companies listed on the Euronext 100 index. Can FA provide relevant information that increases understanding of the underlying value of a company? This chapter leverages an FA strategy to select shares in a portfolio that can systematically yield significant, positive excess market buy-and-hold returns, 1 and 2 years after the portfolio formation. Using annual financial data available from 2000 to 2016, this analysis calculates three scores applied to construct the portfolios: the L-score, F-score, and PEIS. These insights inform investors' potential uses of fundamental signals (scores) to obtain abnormal returns. The results show that portfolios formed with high versus low scores earned 1- and 2-year abnormal returns between 2000 and 2016. This chapter contributes to scarce accounting research in European capital markets by further understanding of the possibility of mispriced securities.

Finally, I would like to thank Intech publishing company for giving me the opportunity to become the editor of this book. I appreciate that they believed I could provide the necessary knowledge and technical assistance. We together managed to find the other great colleagues that contributed to this book. I would like to thank all the authors for their valuable contributions that resulted in this book; I think that it will be an asset to the professional community. I would also like to thank our technical reviewers and colleagues at Intech. We could not have done it without you.

Author details

Vito Bobek[1,2]*

*Address all correspondence to: vito.bobek@fh-joanneum.at

1 University of Applied Sciences FH Joanneum, Graz, Austria

2 University of Maribor, Maribor, Slovenia

Section 2

Some Theoretical Perspectives on Trade and Global Market

Chapter 2

Trade Openness and Economic Growth: Empirical Evidence from Transition Economies

Sabina Silajdzic and Eldin Mehic

Additional information is available at the end of the chapter

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Abstract

The relationship between trade openness and economic growth is ambiguous from both theoretical and empirical point of view. The theoretical propositions reveal that while trade openness leads to a greater economic efficiency, market imperfections, differences in technology and endowments may lead to adverse effect of trade liberalisation on individual countries. In this chapter, we re-examine the empirical evidence pointing to the benefits of trade liberalisation and bring theoretical issues on possible adverse effect of openness to the fore. It has been argued that 'passive' trade liberalisation may not necessarily lead to positive economic outcomes, particularly in less advanced transition economies. Considering the empirical work on the matter, a lot of controversies are related to measurement issues. We find that openness measured by trade intensity indicators may lead to misleading conclusions about the trade growth nexus. Hence, the discussion of policy implications regarding the positive influence of trade barriers on economic growth goes well beyond the context of transition.

Keywords: trade openness, economic growth, trade liberalisation, transition economies

1. Introduction

The relationship between economic growth and openness remains to be one of the prominent issues in both theoretical and policy context. This issue has gained even more attention in recent years considering the persistent and widespread differences in economic performance among countries, especially among developing countries in the wake of growing international trade integration. Similarly, differences in the catching-up processes among transition economies reflected in the diverse scope, character and the dynamics of their integration into

European and global economic structures have remained largely unexplained and subject to different and even opposing views regarding the relative importance of different economic, policy and institutional factors that might explain the differences. This question becomes even more controversial given that transition economies have followed similar economic liberalisation path and pursued trade liberalisation policies right in the early years of transition. In view of this, it comes as no surprise that the benefits of trade liberalisation remained controversial and increasingly debated in international and academic policy discourse.

While trade is considered an important determinant of income and growth, with theoretically well-substantiated channels of welfare transmission trough trade, the effects of trade policy are theoretically less known or are rather ambiguous. Trade integration allows for more efficient allocation of resources through economies of scale and scope as well as through an increased competition. It facilitates knowledge diffusion and technology transfer, all of which affect costs, and productivity patterns that foster technological progress and lead to a greater efficiency. Notwithstanding this, theoretical propositions relating to market and coordination failures including a need for 'investment coordination', 'infant industry argument', indivisibilities and risks related to investments in (new) technology, technological interdependencies and complementarities, as well as its tacit elements, which hinder its diffusion and knowledge transfer, have all given rise to targeted state intervention predominantly through trade policy and protection of strategic sectors. This is to say that although trade and in particular export-led growth are commonly viewed as important determinant of growth process, trade policy is subject to a lot of controversy. As in line with propositions [1], the effects of trade policy and trade although interrelated are dichotomous and pose conceptually different issues that need to be incorporated in empirical investigation.

The theoretical uncertainty related to the impact of trade policy on trade patterns and changes in technological composition in those patterns led to growing interest in empirical testing of the opposing hypothesis, namely the neoliberal hypothesis which advocates trade liberalisation irrespective of the level of development of an individual country, and an alternative predominantly neo-technological hypothesis which perceives (targeted and temporary) trade protection as response to market imperfections that might be beneficial, depending on the level of technological prowess of an individual country. This theoretical uncertainty is yet associated with mixed and inconclusive empirical evidence on the matter, that is, the impact of trade policy on economic growth.

Given the theoretical basis underpinning the benefits of trade and the mechanism influencing growth performance of individual countries, in this chapter, we highlight the importance of integrating the conceptual framework of trade relations which reflect on the importance of trade policy that is dichotomous from trading as such. This is to say that countries may explore benefits from trading with each other, but that in itself cannot be used as an argument to promote 'passive' trade liberalisation policies per se. Put differently, the concept of trade openness should imply 'neutrality', which cannot be synonymous with the idea that trade or export intensity of individual country is associated with an individual country's 'neutrality' in this sense. Export orientation of individual country may come as a result of export-led growth strategy and the use of various incentive structures for exporting industries including

export subsidies, tax and fiscal privileges. Notwithstanding this, nowadays, 'trade openness' has increasingly been measured by trade intensity variables (in view of the difficulties associated with precise measuring of the type of trade orientation or regime followed by individual country), and its meaning has increasingly been incorrectly associated with the notion of 'free trade'. In light of this discussion, in this chapter, we investigate the effect of distinctive trade measures divided into two broad categories: (1) indicators of trade volumes proxied by the conventional trade intensity variables and (2) indicator of trade policy proxied by trade restrictions on economic growth in the selected transition economies, namely the 10 Central-Eastern European Economies (CEECs-10) including Poland, Czech Republic, Slovakia, Hungary, Slovenia, Bulgaria, Romania, Estonia, Latvia and Lithuania. We find that while higher trade volumes enhanced growth performance of these countries, trade liberalisation policy has not been associated with a positive growth performance under period of investigation 1995–2013. This finding has important policy implications discussed in this chapter.

We postulate that these countries provide an important and isolated experimental framework, advantageous to study the impact of trade integration and trade openness (i.e. trade policy regime) on economic growth. First, we highlight the importance of striking similarities relating to the overall transition policy framework, and in particular, the timing and the character of economic policies pursued by the CEECs countries in the course of transition. The policies of economic liberalisation including far-reaching trade liberalisation, modelled in the context of the integration process into the European Union (EU), were implemented following similar time dynamics and sectoral coverage. The pace and character of trade integration (measured by trade volumes and trade intensity) of these countries has, however, been different. Though trade patterns are related to trade policy, they are not the sole function of liberal trade regime per se. In view of this, it is worth mentioning that the theoretical economic growth literature has predominantly been focused on the relationship between trade openness that is on trade policy regime and economic growth, and not on trade volumes per se.

This is to say that CEECs countries pose almost a perfect basis to analyse the impact of trade liberalisation policy in a cross-country framework and when relying on aggregate macroeconomic data. Second, although these countries followed a similar policy pattern, their economic systems are inherently distinctive giving rise to the importance of understanding the differences in the initial conditions of countries—mostly relating to the differences in the level of industrial and technological development among CEECs-10 countries at the beginning of transition—when studying the impact of trade policy on economic growth. The importance of symmetries between trading partners in acquiring benefits from trade integration is well substantiated in the theoretical literature. Third, EU countries present the major trading partner of the selected transition economies, with similar geographical propositions of trade relations with the most developed EU countries, considered important when examining the impact of trade on economic growth in a cross-country analytical framework. Last but not least, empirical evidence on the impact of trade integration in transition economies is rather weak, and we aim to fill in the gap in the existing literature.

This chapter is structured as follows. The next section gives a brief overview of empirical findings and theoretical propositions relating to the impact of trade on economic growth. We

discuss the relevance of understanding the broader picture of economic system and its development characteristics when discussing the benefits of trade liberalisation. Section 3 explains the methodological framework of empirical investigation, and in Section 4, we discuss the results and policy implications. Conclusion follows.

2. Literature review

Why growth rates differ, and how beneficial is trade liberalisation remains an open and increasingly debated question. Benefits of trade openness to economic growth have been relatively well substantiated in the theoretical growth literature. However, market imperfections and economies of scale have also been considered important in determining those benefits. According to theoretical propositions and endogenous growth theory, asymmetric context of trading partners implies considerable differences in production functions, technology and endowments which may result in the adverse effect of trade openness on countries with inferior technological prowess [2]. Likewise, trade intensity indicators may be misleading proxies of trade openness since they are also determined by the relative importance of external sector of individual country which varies depending on country size, income and geographical propositions.

A large number of studies have dealt with the trade policy issue and attempted to examine the effect of trade policy usually proxied by average tariff rates and indices of non-tariff barriers to trade on economic growth. The problems of inadequate measurement of individual country trade regime and orientation have occupied researchers for many years. The difficulty in measuring trade openness acted as *spiritus movens* underpinning increasing interest of researchers to develop an 'ideal' proxy for trade liberalisation. The increasing interest of researchers has resulted in a number of trade indices that attempt to combine both tariff and non-tariff barriers to trade and measure individual country trade orientation (e.g. see [3]).

All things considered, and especially no simple and clear theoretical explanations on the effect of trade restrictions and economic growth, it comes as no surprise that the empirical evidence on the benefits of trade openness measured using various trade policy indices reveals mixed results and inconclusive evidence. A number of studies have analysed the relationship between trade restrictions and economic growth relaying on the average tariff rates. Yanikkaya's study gives rise to the hypothesis that trade restrictions can promote growth [4]. In his study, he finds evidence that trade restrictions in the form of tariffs, as well as trade-related taxes, are positively associated with economic growth relying on a large sample of both developing and developed countries and concludes that the relationship between trade openness and growth is complex and depends on the level of development and the size of the economy of an individual country as consistent with theoretical propositions. Similarly, contrary to the conventional view that trade barriers are distortive and detrimental to growth, Rodriguez and Rodrik have found that the average tariff growth rates positively affect the total factor productivity growth (TFP) for the sample of 46 countries over the 1980–1990 period [1], while Edwards suggests a rather weak relationship between trade restrictions and economic growth [5]. Contrary to these findings, a study by Harission, for example, found a significant and negative effect of tariff rates on economic growth [6].

Notwithstanding the inconsistency in the results obtained from the empirical investigation of the effect of trade restrictions on economic growth, other studies, which rely on trade intensity measures (e.g. export and import to GDP ratio, export to GDP ratio, etc.), by and large reveal evidence on the positive impact of trade on economic growth [7, 8]. However, in this chapter, we argue at length that papers, which attempt to use conventional measures of trade openness, that is, trade intensity ratios as proxy for trade openness, suffer from serious inconsistencies between theoretical propositions and empirical framework designed to test these hypothesis.

Contemporary trade theories integrated in endogenous growth models imply that trade may be beneficial to economic growth with the underlying mechanism of influence relating to increases in economies of scale, technology transfer and knowledge-related externalities, as well as an increased competition. These mechanisms are all expected to positively affect productivity patterns of local firms and industries, rising value added and income. However, these mechanisms or rather a country ability to rip off the benefits of trade are conditional on endogenous nature of technological change and subsequent growth and diversification of industrial production and export base. Essentially, the theoretical framework (extensions of neoclassical trade and growth theories) presupposes that the differences in the levels of industrial development and technological capabilities across countries may well be associated with possible different outcomes of trade openness (in the sense of 'neutrality' and passive trade liberalisation across all sectors) on economic growth, depending on the size of the economy, technological proficiency and the degree of industrial diversification [9]. Finally, world trade integration may rise global economic growth rate, but adversely affect individual countries.

The presence of underdeveloped or infant industries with latent (defy) comparative advantage, imperfect markets and endogenous pattern of knowledge accumulation in less developed, transition or developing countries, which are well substantiated in the theoretical growth and development literature [10], may call for a strategic trade policy orientation with the combination of import substitution and export industrialisation trade measures, which, if applied 'correctly', may affect comparative advantages of local industries which in turn positively affect economic growth in the long run. As indicated by Rodrik and Rodrigez, higher growth rates seem positively associated with higher tariff rates in the 1990s according to the graphical presentation of data on 66 countries [1]. Moreover, using trade volume and trade intensity indicators as a proxy for trade openness may be entirely misleading. Apart from differences in the size of the economies and the overall level of development proxied by GDP pc (usually incorporated in estimated trade-growth equations), higher export and import shares to GDP may well reflect on a countries' technological prowess and its industries' ability to boost growth via exports and/or imports of technology, production-related factor inputs and intermediary products. Essentially, this is to say that increased trade integration and in particular internationalisation through exports may not necessarily be related to government's exercise of trade-related 'neutrality principle'. In line with this proposition, Busse and Koniger found that the relationship between trade openness and growth predominantly depends on trade specification [8]. Moreover, they postulate the importance of investigating the relationship in a dynamic framework.

On the other side, as shown by Rodriguez and Rodrik study, trade openness may lead to increases in income but does not cause economic growth in the long run [1]. The same hypothesis has been supported by Brunner [11]. He found that trade openness has a significant positive

impact on income but not on economic growth. Hence, a later study by Rigobon and Rodrik after accounting for endogeneity and a country heterogeneity issues on examining the relationship between trade openness and economic growth reveals that trade openness measured as trade share in GDP has a negative effect on economic growth [12].

Overall, trade openness in the sense of 'neutrality' or neutral trade orientation of an economy may have a positive impact on economic growth in the short run by an enlarged trade sector, for example, trading-related investments in the economy, boosted imports via increases in income and aggregate demand. However, at the same time, the relationship between trade openness and economic growth in the long run is determined by a host of factors but predominantly by the abilities of local firms and industries to adjust and cope with the international productivity levels and their ability to develop 'imitative' and 'absorptive' capabilities necessary to internalise economies of scale and knowledge externalities-related trade. The scope of possible 'crowding-out' effect on local firms and industries through trade openness is given by the degree of, and the existence of, considerable differences in technologies and endowment of trading partners. If considerable differences are present, trade openness in the form of passive trade liberalisation may lead to ruined potential to build comparative advantage capabilities of local firms/industries. Obviously, although significant in understanding trade openness economic growth nexus, the lost potential of acquiring comparative advantage locally through trade liberalisation is almost impossible to measure or estimate the effect with certainty in a cross-country analysis. Notwithstanding this, the lost potential of trade integration of local industries undermines a sustained economic growth potential in the long run.

All in all, given the theoretical propositions and the empirical evidence, first, we argue that trade openness in the sense of 'neutral' trade regime and passive trade liberalisation may not be an optimal policy choice and may adversely affect individual countries in view of persistent differences in technology and endowments across countries. In case the trading occurs between partners that are at different stages of technological and industrial development, the effect of trade openness on economic growth may not be positive and instantaneous. For this purpose, we rely on the trade of CEECs with developed supposedly technologically superior and innovative EU-15 countries, to test the hypothesis on whether trade restrictions (measured by the average tariff rate) have adversely affected economic growth of the group of transition economies. Having said this, we investigate how homogeneous trade liberalisation regime across CEECs countries (there is no variability in the data, i.e. average effective tariff rate applied across CEECs since 1995) has affected the economic growth of transition economies. Second, we investigate the impact of trade openness measured by trade volumes and various trade intensity ratios (e.g. share of exports and imports to GDP, share of exports to GDP, share of imports to GDP). It is worth noticing that these trade intensity variables may be misleading proxy of trade openness per se, following the discussion on theoretical assumptions relating to trade integration and trade openness. Instead, we assume that both exports and imports may have positively affected growth performance in the period under investigation. Although different mechanisms are at work in comprehending the influence of exports and imports on economic growth, both may reflect on an individual country capability to rip off the benefits of increasing trade integration of these countries that is expected to be revealed by higher trade intensity rations. Importantly, following new trade theories and endogenous growth according to which international trade leads to a more efficient use of

resources at lower costs and apart from early emphasis on exports, imports of intermediary products, resources and technology are likewise important in acquiring a comparative advantage through trade [4]. For this purpose, we include independently imports and export shares into growth regression. Finally, given the similar policy context and similar economic structure of CEEC economies in terms of size (i.e. small open economies), differences in technology and patterns of industrial development and restructuring should be captured by different growth performances of technologically more advanced versus least-developed transition economies as in line with the catching-up hypothesis. For this purpose, we include dummy variable which depicts the group of least-developed CEE economies into growth regression and examine the relevance of expected higher growth performance of least-developed CEE economies. Finally, we estimate growth equation in an integrated and dynamic framework.

3. Empirical analysis

3.1. Methodology

The possible explanation for the observed inconsistency in the empirical results in studies examining the relationship between trade openness and growth reflects on methodological shortcomings and the overall difficulty in developing a proper empirical framework to investigate the impact of trade policy on economic growth. The dynamic and endogenous character of trade and economic growth relationship needs to be integrated in an empirical framework. The importance of incorporating time dynamics in investigating the impact of trade restrictions on economic growth seems worthwhile from a theoretical standpoint. This is to say that trade restrictions may be beneficial to growth if considered (applied) as a temporary phenomenon in relation to building (defy) comparative advantage in specific sector(s). In line with the 'infant industry argument', although trade restrictions or protectionist measures may have ambiguous possible impact on economic growth in the short run, the temporary protection of specific sectors may in fact have a positive effect on the sustained growth in the long run via underlying increases in levels of productivity and technological prowess of protected sectors.

Moreover, in empirical growth modelling, one needs to take into account the problems of endogeneity when examining the impact of trade on economic growth. The problems of endogeneity are related to both (1) the proposition of potential reverse causality between economic growth and trade and (2) common unobserved factors of influence that may give rise to positive-biased estimations. Last but not least, researchers do acknowledge that it is difficult to account for the heterogeneous profile of countries when examining the relationship between economic growth and trade using cross-country data. However, as shown by Rodriguez and Rodrik, a positive correlation between trade indicators and economic growth may be due to methodological deficiencies and factors of influence that researchers do not consider [1]. The specificities relating to remarkable technological differences across countries, the differences in size, and specificities relating to regional patterns as well as geographical factors may be crucial in comprehending the relationship relying on a pooled data. Having this in mind, in this study, we emphasise the importance of the similarities in the context of policy and institutional framework of EU integration of CEE countries, and given the problem of endogeneity through omitted variable and reverse causality, we highlight the importance of analysing the

relationship between trade openness and economic growth, relying on methods of investigation that accounts for the dynamics of the relationship.

3.2. Methods of investigation

In light of this discussion, we estimate the growth regression using two different estimation methods, namely the fixed effect panel applied by estimating Prais-Winsten-correlated panels corrected standard errors (PSCE) method due to the presence of heteroscedasticity and autocorrelation, and the dynamic least squares dummy variable (LSDVC) method. The purpose is to elaborate on an in-depth assessment of implications of results obtained when the impact of trade barriers and trade intensity on economic growth is estimated using dynamic (LSDVC) versus static econometric (PCSE) framework. Essentially, in applying PCSE method to account for, among others, the presence of autocorrelation, we lose important dynamic information, and the impact of trade openness on economic growth is estimated relying on averaging data across within group time dimension. For robustness check, and deeper understanding of the relationship, we then estimate the same models relying on a dynamic LSDVC regression.

Specifically, as indicated earlier, we first estimate growth equation using Prais-Winsten-correlated panels corrected standard errors PSCE method. In this analysis, we deeply consider an appropriate estimation method to obtain robust estimates of individual effects in the presence of heteroscedasticity and serial correlation. We treat the problems of encountered heteroscedasticity and serial correlation, with cautiousness. In an attempt to compute heteroscedasticity-robust standard errors and eliminate serial dependence in time series, we follow Plümper et al.'s recommended technique and use a combination of panel-corrected standard errors with Prais-Winsten transformation (AR1) [13]. Furthermore, we test for the cross-sectional dependence in the data and additionally use corrected standard errors across panels as an estimation strategy to avoid spuriousness in the obtained results. This option is possible with using modified PSCE method of estimation that corrects standard errors correlated across panels. For a detailed discussion of econometric problems and the implications of cross-sectionally correlated residuals, see for instance. Importantly, we test for the presence of reverse causality using Granger causality test. Precisely, the results of Granger causality test using LSDV dynamic regression (AH estimator) indicate that the growth variable shift GDPpc(t-1) does not cause Trade Openness in CEE countries in the observed period. Further the results of the Granger test indicate that the null hypothesis that Trade Openness does Granger cause economic growth can be rejected. In short, the assumption that Trade openness affects economic growth is confirmed, while the inverse causality is rejected. In view of this, we believe that the obtained results of PCSE estimations are robust to endogeneity issues that may be caused by inverse causality. The results of Granger causality test are not reported here due to space limitations.

Notwithstanding this, the results of the PCSE estimations may still be subject to simultaneity problems. In order to properly account for the problems of endogeneity and possible inconsistency in parameters obtained due to omitted variable bias, we carry additional robustness test and estimate the dynamic version of the model using LSDVC dynamic regression. In other words, we integrate lagged-dependant variable into growth equation to remedy for the simultaneity bias. Kiviet proposes a bias-corrected LSDV (least squares dummy variables)

estimate, by estimating the sample bias from an uncorrected LSDV estimate and using this to remove the inconsistency in the parameter estimates [14]. Essentially, we postulate that this method, which attempts to account for the importance of time dynamics in examining the relationship between trade openness and economic growth and accounts for the simultaneity bias in the data, is an important sensitivity analysis. LSDVC is considered an appropriate method for small samples with a small number of cross-section groups and imbalanced panels, which is consistent with the nature of our dataset. The potential biases in the estimators resulting from endogeneity related to both reverse causality and omitted variable bias are lessened (removed) by incorporating lag-dependant variable in the growth equation to be estimated. Thus, the LSDVC model is our preferred model. **Table 3** presents the results of estimated models using both methods of investigation. We compare the results and discuss the robustness of the variables of interest, in the sections to follow.

3.3. The model and the variables

In line with the theoretical propositions and previous empirical analysis discussed, we specify the following growth equation to be estimated:

$$RGDPpc\,G_{it} = \beta_0 + \beta_1\,TRat\,e_{it} + \beta_2 \ln GDPp\,c_{it} + \beta_3\,GFC\,F_{it} + \beta_4\,G\,B_{it} + \beta_5\,Openne\,s_{it} + \beta_6\,CountryDummy + \beta_7\,Time + \varepsilon_{it} \quad (1)$$

where the dependent variable, $RGDPpcG_{it}$, denotes changes of real GDP per capita (GDPpc) of the country *i* in the period *t*; $TRate_{it}$ denotes effectively the applied tariff rate in the country *i* in the period *t*; GDPpc denotes log GDP per capita of the country *i* in the period *t-1*; DI_{it}—domestic investment of the country *i* in the period *t*; GB_{it} denotes government balance (%GDP) of the country *i* in the period *t;* $Openess_{it}$ denotes exports and imports share in GDP of the country *i* in the period *t*; ε_{it}—random error (structure e_{it} depends on whether the model is estimated using OLS, FE or RE model). We also control for individual country effects (CountryDummy) and specific time effect (Time). Importantly, Openness variable in this analysis is measured using three different proxies of trade openness that are integrated individually in growth equations to be estimated due to possible multicollinearity issues indicated by the correlation between trade openness measures (see correlation matrix subsequently). The problem of measurement of trade openness in our analysis is lessened by integrating both trade barrier variable proxied by average tariff rate and using conventional trade intensity indicators X+M/GDP, X/GDP, M/GDP to analyse the relationship between trade and economic growth.

In this research, the independent variable ($RGDPpc_{it}$) and the convergence variable (lnGDPpc) are measured in USD, and the source of data for these variables is IMF. The latter variable is assumed to capture the convergence influence on a country's economic growth rate. Along the lines of catching-up hypothesis, there should be a strong tendency for convergence among industrialising economies including transition economies. Therefore, we anticipated a negative and significant effect of the initial income levels on growth rates in CEE countries. However, given the non-significant coefficient obtained on the convergence variable in all estimations, when including its lagged values, we proceed by estimating growth equations using log values

of GDPpc in period *t*, to account for the differences in human capital and technological advancement of CEE countries. The results presented in **Table 3** relate to logGDPpc measured as the log of income levels in time *t*. The tariff rate data are based on World Bank data and computation of effective tariff rate applied. The source of all other variables is EUROSTAT.

Considering the relatively heterogeneous characteristics of CEE countries related to size, scope and structure of the economies considered on one side, and homogeneous characteristics of trade policy, it is postulated that these specificities of the dataset indicate advantageous framework to analyse the impact of trade policy liberalisation on countries with supposedly different industrial structure and levels of technological proficiency. In particular, we emphasise the vital importance of establishing econometric framework for analysing patterns of catching up through trade integration with the more advanced EU countries, in an attempt to investigate how homogeneous trade policy regime has affected transition economies depending on their level of development and technological prowess captured by the dummy variable in the extended growth model. The dummy variable is set to be 1 for the less-developed transition economies namely Romania, Bulgaria, Latvia and Lithuania, accounting for the differences in the initial conditions and patterns of industrial catching up. Moreover, although trade intensity indicators may fail to accurately capture the effect of trade openness or precisely trade policy regime, in our empirical setting, higher trade intensity ratios are effectively capturing individual country ability to rise economic efficiency and boost technology transfer via increased trade integration with technologically innovative EU countries. Therefore, we expect a positive relationship between trade intensity variables and economic growth. Apart from this, the average tariff rate is incorporated in growth regression to investigate how liberalisation policy has affected growth performance in a general transition and dynamic framework by estimating growth regression relying on LCDVC technique.

Although an ideal measure of trade openness will be an index that takes into account all trade distortion measures as well as all privileged instruments applied to export production to reflect on the concept of 'neutrality', the average tariff rate may generally be considered a viable proxy of trade orientation among transition economies. Not only that these countries have relatively weaker institutional and technical capacity and underdeveloped instruments of trade protection by the means of non-tariff barriers to trade compared to high-income EU industrialised countries, but essentially the integration into EU economic structures implied a homogeneous trade-related regulatory framework including the application of the mutual recognition principle when it comes to non-tariff barriers to trade effective as of 1998. In this study, we rely on the average tariff rate as a proxy for trade policy among CEE countries. Considering the graphical presentation of the tariff data, we conclude that CEECs have followed rapid trade liberalisation policies, and homogeneous trade regime has been applied in the context of EU integration. Last but not least, the EU integration process, which implied universal institutional and policy setting and transitory requirements of the EU enlargement, implies systematic reduction in transaction costs often related to national regulatory regimes and rules of doing business. The impact of different regulation on trade can be examined by assuming minimum or no transaction costs across transition economies. **Tables 1** and **2** present the descriptive statistics of variables and the correlation matrix among variables, respectively.

Variable	Obs	Mean	Std. dev.	Min	Max
rGDPpc growth	203	3.64	4.53	−14.55	13.08
Tariff rate	220	2.46	1.43	1.02	6.27
GDPpc	208	8744.98	6094.11	1102.10	27501.81
Trade to GDP	190	108.18	31.57	43.7	183.4
Exports to GDP	190	52.21	16.93	22.1	93.8
Imports to GDP	190	55.97	15.14	20.7	89.6
GFCF	190	24.51	5.15	5.4	38.4
Government deficit/surplus	188	−3.27	3.07	−15.1	2.9

Table 1. Descriptive statistics.

	rGDPpc growth	Tariff rate	GDPpc	Total trade to GDP	Total exports to GDP	Total imports to GDP	Domestic investment (GFCF)	Government deficit/surplus
rGDPpc growth	1.00							
Tariff rate	−0.01	1.00						
GDPpc	−0.17	−0.59	1.00					
Trade to GDP	−0.02	−0.38	0.60	1.00				
Exports to GDP	−0.10	−0.36	0.63	0.98	1.00			
Imports to GDP	0.06	−0.39	0.55	0.98	0.93	1.00		
GFCF	0.25	−0.11	0.18	0.17	0.08	0.27	1.00	
Gov't balance	0.40	−0.06	−0.11	0.09	0.04	0.14	0.11	1.00

Table 2. Correlation matrix.

4. Results

Table 3 presents the results of the growth equation model estimated using PCSE and LSDVC estimation methods as explained earlier. The three different specifications of the models relate to three distinct measurements of trade openness variables export, import and total trade to GDP indices, as explained. We begin the discussion with Openness and the three distinctive measures of trade intensity. The results of our empirical investigation support the hypothesis that trade volumes are positively associated with growth performance, which is consistent

	Model 1 (trade to GDP)			Model 2 (exports to GDP)		Model 3 (imports to GDP)	
	PCSE	**LSDVC**	**PCSE**	**PCSE**	**LSDVC**	**PCSE**	**LSDVC**
rGDPpc growth (lag)		.095(.083)			.115(.082)		.08(.99)
Tariff rate	−.405(2.75)	1.34**(.073)	−.405(2.75)	.279(2.77)	1.099(.716)	−.72(2.70)	1.42**(0.73)
lnGDPpc	−.77(2.31)	−1.07(2.01)	−.77(.2.31)	−1.49(2.77)	−1.72(1.98)	−.264(2.29)	−.60(−2.04)
Trade to GDP	.079***(.026)	.076***(.022)	.079***(0.026)				
Exports to GDP				.151***(.052)	.138***(.045)		
Imports to GDP						.149***(.047)	.149***(.042)
Domestic investment (GFCF)	.451***(.88)	.378**(.082)	.451***(.88)	.534**(.96)	.432**(.090)	.36***(.089)	.311***(.079)
Government deficit/ surplus	.26**(0.74)	.315***(.095)	.26**(0.74)	.24***(0.75)	.31***(0.096)	.277***(.073)	.326***(.094)
Dummy LD	4.67**(2.12)						
R-squared	*0.75*			*0.74*		*0.75*	
Wald chi2 Prob > F	*0.000*			*0.000*		*0.000*	
No. of observations	*184*			*184*		*184*	

***,**,*denotes significance at 1, 5 and 10%, respectively. Standard errors are in parentheses.

Table 3. Results.

with earlier empirical findings. This is to say that CEE countries, which are more integrated with the EU economies through trade, are likely to grow faster than other supposedly less-integrated countries. Essentially, CEEC seems to have benefited from increasing trade integration in terms of growth rates. All openness variables are significant and positive in all models estimated. The coefficient on openness variable measured as the total trade to GDP (model 1) is 0.079, implying that a 10% increase in trade share will increase GDP pc growth rate by an average of about 8%. The marginal effect of both exports and imports share to GDP is positive and significant and thus estimated at about 0.15 and 0.14, respectively, implying that both export and import positively affect economic growth with a similar magnitude. These results are robust to sensitivity analysis applied using LSDVC econometric framework which accounts for the likelihood of reverse causation between growth and trade volumes emphasised in a number of empirical studies. The obtained coefficients of all trade intensity measures are about the same value in the LSDVC estimations, pointing to the consistent and robust estimate of trade effect on economic growth relying on both estimation techniques.

However, this is not to say that these conventional trade openness measures reflect on trade orientation of CEE countries. These measures have important shortcomings discussed in a number of studies indicated previously in the chapter. Therefore, in this chapter, we do not rely on these measures and do not discuss the impact of these variables in economic growth in the context of trade policy impact.

Instead, the other trade-related variable, namely the Tariff Rate variable, is used to measure the effect of trade restrictions on economic growth in CEE countries. Essentially, the results of our analysis do not support the hypothesis that trade barriers are harmless to economic growth. On the contrary, while the results of PCSE estimations point to the insignificant effect of trade barriers on economic growth, although negatively related to economic growth in Models 1 and 3, the obtained coefficients are highly insignificant with the p-value of over 0.88. The results of the LSDVC estimations are estimated in an attempt to remove simultaneity bias point to, however, a significant and yet positive effect of trade barriers on economic growth. The obtained coefficient is significant at 5% in Models 1 and 3, while it becomes insignificant in Model 2 in which we use export to GDP variable. It is noteworthy to emphasise that the LSDVC estimator has superior properties if compared to static panel estimators when correcting for autocorrelation, and results obtained with respect to dynamic model should implicitly be considered robust to possible simultaneity bias.

Given the inconsistency in the results obtained, it is perhaps safe to conclude that we find no evidence that trade restrictions negatively affected growth performance of transition economies. On the contrary, the results of the dynamic growth model estimations support the hypothesis that trade restrictions may be beneficial to growth performance depending on the symmetries between trading partners. Given the homogeneous trade policy regime among individual countries in our dataset, we conclude that trade liberalisation across CEE countries has not been positively associated with growth performance of CEECs, and we find some evidence that trade restrictions have seemingly had a positive effect on the growth performance of CEEC countries if accounting for the dynamic relationship between economic growth and trade openness.

Finally, the results obtained with respect to dummy variable capturing the growth performance of less-developed CEE countries relative to other CEECs suggest that these countries have been growing faster than other supposedly more developed CEE in the period under investigation. This result is in accordance with the theoretical proposition and the catching-up hypothesis. All other variables enter the growth regression with expected signs and significance, pointing to the importance of macroeconomic stability in the growth process captured by the government balance variable, as well as domestic investments depicted by Gross Fixed Capital Formation.

5. Conclusions

In this chapter, we investigate the impact of trade openness on economic growth in CEE countries over the 1995–2013 periods (the actual dataset considering the missing observations in the data before 1995 for the trade intensity indicators). Essentially, we use a variety of trade openness measures to deepen our understanding on how trade volumes affect growth performance on one side and how effective has been trade liberalisation policy per se in enhancing the growth performance of CEECs. The results of our empirical investigation provide robust evidence that trade intensity measures are positively associated with economic growth, pointing to the benefits of trade integration through not only exports but also increasing imports from

technologically innovative EU countries to less-advanced CEE economies. The results seem not sensitive to simultaneity issues, robustness check and different model specifications applied.

Apart from this, in this chapter, we postulate that trade intensity indicators do not reflect on trade policy regime. Given the particularities of our dataset referring to homogeneous trade policy regime applied among CEE countries in the context of EU integration and the econometric framework used, the effect of trade barriers on economic growth in transition countries proxied by the average tariff rate seems ambiguous. Although the results obtained with respect to the impact of tariff rate on economic growth are not robust to different methods of estimation and sensitivity analysis, we conclude that tariff barriers have not been negatively associated with economic growth in the selected transition countries. Surprisingly, unlike the traditional perception on the negative link between trade barriers and economic growth well substantiated in the empirical literature, we find some evidence that trade barriers may be beneficial to growth performance while relying on a dynamic econometric framework and when removing the possible simultaneity bias. The results of this analysis have important theoretical and policy implications, implying that trade openness and economic growth are not a simple relationship and that its effects depend on differences in the levels of development, size and technological proficiency which seem consistent with the growth and development literature.

Author details

Sabina Silajdzic* and Eldin Mehic

*Address all correspondence to: sabina.silajdzic@efsa.unsa.ba

School of Economics and Business, Sarajevo, Bosnia and Herzegovina

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Chapter 3

The Effect of Taxation, Specialization, and Entrepreneurial Activities on International Trading

Er'el Granot

Additional information is available at the end of the chapter

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Abstract

In this chapter, a generalization of the Ricardian model of international trading is presented. Unlike the original Ricardian analysis, the presented model takes into account the producers entrepreneurial activities, their specialization factor (the improvement factor in production due to specialization) and the countries taxes (tariffs). The main result of this model is that for a given entrepreneurial activity culture and a given specialization factor, there exists a critical taxation level, above which specialization and all entrepreneurial activities are suppressed and international commerce is ceased. The transition from a working international market to a trade-less one is an abrupt one and resembles a phase transition.

Keywords: entrepreneurship, international trading, specialization, unstable markets, entrepreneurial behavior, entrepreneur, iterative economic processes, Austrian school of economic

1. Introduction

One of the successes of the classical economics revolution was to rebut the mercantilist tradition that holds the premises that trading can be harmful for the trading countries. The success was not merely an academic one; as a result of this revolution, Britain, Europe and eventually the whole world experienced a great economic boom.

The revolution was based on three important realizations:

1. The market does not prefer specialization due to the differences in the inborn merits of humans. Specialization itself makes the market much more efficient. Even if initially people have the same general merits, they can still specialize and optimize the market.

2. The market is not a zero sum game. Both sides (countries), in any free transaction, buyers and sellers, benefit from trading.
3. Similarly, trading improves the condition of (international) producers, regardless of the efficiency differences between them.

Despite the fact that these realizations were initial ingredients in the classical revolution, the classical economists themselves did not integrate them in a single theory. While Smith talked only on the first and second realizations [1], Ricardo in the law of comparative advantage disregards the effect of specialization and focused on the third realization [2].

It is a common mistake to assume that Ricardo's law of comparative advantage does take specialization into account; however, it does not. It assumes that the producer's efficiency is independent of his specialization level [2–6].

During the marginalist revolution [7] in the 1870s, the world of economics experienced another split of visions: the majority of the economics community adopted the Marshallian-Walrasian tradition [8, 9], which based their studies on equilibrium analysis. A minority of the economists' community, which was known as the Austrian School [10–12], based their analysis on methodological individualism, that is, they based their approach on the acting entrepreneur [13–15].

This approach was alien to the main stream, where the Marshallian-Walrasian tradition was rooted, especially after the work of Knight [16], which based the market on perfect knowledge. In a perfect knowledge market, there is no room for entrepreneurial activity.

Uncertainty is the playing ground in which the entrepreneur acts. Both schools recognize the fact that the market tend to an equilibrium state, but the realization is different. Perfect knowledge cannot exist in a disequilibrium market. It is much more difficult to explain the equilibria existence in the presence of perpetual entrepreneurial activities. The Austrian economists explained that the entrepreneurs are not a disruptive element, but rather a stabilizing one, since the entrepreneur recognizes any deviation from equilibrium as an entrepreneurial opportunity. Consequently, his entrepreneurial act stabilizes the market and helps in keeping it at a semi-equilibrium state.

The main problem is that from the Austrian's writing, it seems as if the entrepreneur has some special merits [13–15], which helps him recognize the discrepancy in the market, which he can mitigate with his entrepreneurial activity. However, since it was not clear what this merits are, they never demonstrate it.

In [17], it was demonstrated that entrepreneurial activity can be totally random. No insight is required for a successful entrepreneurial act. In fact, the profit and loss mechanism along with some memory of past transaction is sufficient to navigate the entrepreneurial activity in the right direction to mitigate the deviations from equilibrium.

International trade requires specialization, and specialization is an entrepreneurial activity. The producer risks himself in specializing. While specializing, the producer compromises, for he has to change his production point, at least temporarily, to a worse one. His analysis teaches him that there is a good chance that eventually, after trading, his condition will be better; however, by no means, it is a simple decision to specialize. It is an entrepreneurial decision.

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Taxes and regulations suppress entrepreneurial activity, but they operate in a different manner. Regulations prohibit some activities, while taxes reduce the motivation to make them. Therefore, trade, international and domestic, requires entrepreneurial activity and specialization, while taxes suppress the three.

There is a delicate connection between these components. For example, when entrepreneurial activities increase (either by educational activities or regulations' reductions), specialization and trading are encouraged despite the suppressive effect of some taxes.

Any theory of international trading that does not include entrepreneurial and specialization ([3]) along with taxes cannot be regarded as a complete theory. In this chapter, we propose a model, which integrate these components into a single model, which yields simple relations.

2. The effect of taxation

When two traders interact and exchange a certain good, their status is presented initially as a point in the commodities space. The exchange itself is presented by arrows, which oriented toward the final states (final points in the commodities space—see **Figure 1**). When there are no taxes, then the two arrows are identical in terms of length and slope.

However, when taxes are applied, then the head of the arrows is drawn toward the origin. It does not matter whether the taxes are collected in terms of commodity A or commodity B. The buyer 'sees' a higher price, while the seller 'sees' a lower one.

In **Figure 1**, the collected taxes are 20% of the exchanging commodities. In the figure, it is assumed that both buyers and sellers pay the same tax level.

In the Marshallian-Walrasian tradition, the price of commodities is determined by the intersection of the demand and supply curves [18]. This is a stationary equilibrium scenario.

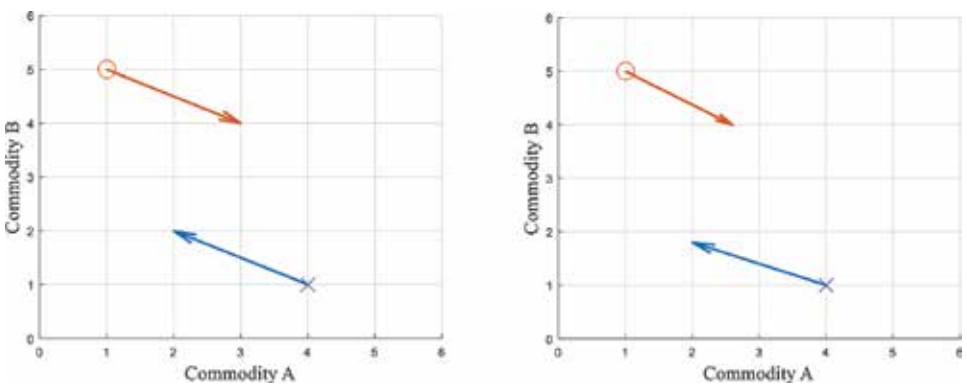

Figure 1. The 'x' and 'o' represent the two traders' possession before the trading transaction. The arrows represent the transaction itself. On the left, there are no taxes, and therefore the arrows are parallel, while on the right, due to taxes, the arrows are tilted toward the origin.

In general, the curves are unknown and can have an arbitrary shape (see, e.g. [19]); however, at the vicinity of the intersection, they can be approximated by a linear curve, that is, the demand curve (at the vicinity of the intersection) can be written as

$$D(p) = D - pd \tag{1}$$

while the supply curve can be written as

$$S(p) = S - ps, \tag{2}$$

where D, S, d and s are independent of the price p.

When taxes are applied, the price increases by a factor, which for convenience matters will be written as an exponent, e^t (which is equivalent to a tax of $100t\%$), that is, the demand curve decreases faster

$$D(p) = D - pe^t d. \tag{3}$$

Similarly, in the supply curve, the price decreases by e^{-t} (again, it is assumed that the taxes are equal for buying and selling), that is

$$S(p) = S - pe^{-t}s. \tag{4}$$

The intersection occurs when

$$D(p^*) = S(p^*) = \sqrt{DS}\frac{\sqrt{\frac{Ds}{Sd}}e^{-t} + \sqrt{\frac{Sd}{Ds}}e^t}{\sqrt{\frac{s}{d}}e^{-t} + \sqrt{\frac{d}{s}}e^t} = \sqrt{DS}\frac{\cosh(\alpha + t - \theta)}{\cosh(\alpha + t)} \tag{5}$$

where $\sqrt{\frac{D}{S}} \equiv \exp(\theta)$, $\sqrt{\frac{d}{s}} \equiv \exp(\alpha)$, at the price level

$$p^* = \sqrt{\frac{DS}{ds}}\frac{\sinh(\theta)}{\cosh(\alpha + t)}. \tag{6}$$

Therefore, the market price decreases, because taxes reduce the attractiveness of the commodity, while the consumer price increases to

$$p^* e^\tau = \sqrt{\frac{DS}{ds}}\frac{\sinh(\theta)\exp(t)}{\cosh(\alpha + t)}. \tag{7}$$

Clearly, trading is suppressed since cosh is a convex function, the denominator of Eq. (5) increases faster than the numerator. That is, Eq. (5) decreases when taxation increases.

However, even analyses, which consider taxation, still lack two important ingredients: specializations and entrepreneurship.

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Following [6, 17], assume that the *production possibility frontier*s (PPFs) of two producers are

$$\frac{a_1}{A_1}+\frac{b_1}{B_1}\le 1 \tag{8}$$

and

$$\frac{a_2}{A_2}+\frac{b_2}{B_2}\le 1 \tag{9}$$

respectively. That is, the maximum numbers of units of commodities A and B that the first producer can produce are A_1 and $B_{1,}$ respectively, and the production of the second one is bounded by A_2 and B_2, respectively, while a_1 and b_1 are the number of units the first producer chooses to produce, and similarly, a_2 and b_2 are the number of units the second one produces.

In this case, trading occurs provided the price $p \equiv \Delta A/\Delta B$, which is the ratio between exchanged commodities ΔA units of A for ΔB units of B, obeys

$$\frac{A_2}{B_2} < p < \frac{A_1}{B_1}. \tag{10}$$

However, if taxes are introduced, the condition for trading is less flexible

$$\begin{aligned} &\frac{A_2}{B_2} < p\exp(-t) < p\exp(t) < \frac{A_1}{B_1} \text{ or} \\ &\frac{A_2}{B_2}\exp(t) < p < \frac{A_1}{B_1}\exp(-t). \end{aligned} \tag{11}$$

Therefore, trading is possible provided the tax level is lower than

$$t < \ln\left(\sqrt{\frac{A_1}{B_1}\frac{B_2}{A_2}}\right) \tag{12}$$

However, this analysis ignores, again, specialization.

3. The effect of specialization

In case the producers can specialize, the PPF becomes a convex curve. Therefore, if a manufacture specializes by doubling the time he invests in the production of a certain product, the resultant production increases by a factor, which is *larger* than 2.

Following [6, 17], we choose the following PPF, which takes specialization into account

$$\left(\frac{a}{A}\right)^{\alpha} + \left(\frac{b}{B}\right)^{\beta} = 1 \tag{13}$$

The smaller the exponents α, β the higher is the level of specialization.

Hereinafter, to simplify the analysis, we take that the specialization level in both commodities is the same, that is, $\alpha = \beta$. Therefore, we focus on a PPF of the form

$$\left(\frac{a}{A}\right)^{\beta} + \left(\frac{b}{B}\right)^{\beta} = 1, \tag{14}$$

in which case the relation between the specialization factor F and the exponent $\alpha = \beta$ is simply [6].

$$F = 2^{1/\beta - 1}, \tag{15}$$

which means that the ratio between the production productivities in the case of full specialization (free trading) and no specialization (no trading) is $F = 2^{1/\beta - 1}$ [6].

Since the units, by which the commodities are measured, are arbitrary, then without the loss of generality, we can replace the parameters to the dimensionless coordinates $\xi \equiv a/A$ and $\eta \equiv b/B$. Therefore, Eq. (14) reads

$$\xi^{\beta} + \eta^{\beta} = 1. \tag{16}$$

Furthermore, it is convenient to change the coordinates into radial ones, that is

$$\xi^2 + \eta^2 = r^2, \tag{17}$$

$$\xi = r\cos\varphi, \text{and} \tag{18}$$

$$\eta = r\sin\varphi. \tag{19}$$

Then, instead of the Cartesian relation $\eta = \left(1 - \xi^{\beta}\right)^{1/\beta}$, a radial one emerges

$$r(\varphi) = \frac{1}{\left(\sin^{\beta}\varphi + \cos^{\beta}\varphi\right)^{1/\beta}}, \tag{20}$$

and due to the symmetry of the problem, it is more convenient to use the deviation from the 45° angle, that is, we take the angle $\delta = \varphi - \pi/4$, in which case

$$r(\delta) = \frac{1}{\left(\sin^{\beta}(\pi/4 + \delta) + \cos^{\beta}(\pi/4 + \delta)\right)^{1/\beta}} = \frac{\sqrt{2}}{\left((\cos\delta + \sin\delta)^{\beta} + (\cos\delta - \sin\delta)^{\beta}\right)^{1/\beta}} \tag{21}$$

For small angles, Eq. (21) can be approximated by

$$r(\delta) \cong r_0 + \left(1 - \frac{\beta}{2}\right) r_0 \delta^2 \tag{22}$$

where

$$r_0 \equiv r(\delta = 0) = 2^{1/2 - 1/\beta} \tag{23}$$

is the distance to the origin.

Equations (21) and (22) allow one to evaluate the specialization r as a function of the entrepreneurial activity δ, because δ is the deviation from the (pre-trade) optimal point.

Therefore, if any single producer/entrepreneur can decide in changing his working point from $(r_0, \delta = 0)$ to $(r(\pm\delta), \pm\delta)$, then the producers' population splits into two sub-groups: one at $(r(\delta), +\delta)$ and the other at $(r(\delta), -\delta)$.

These two populations start trading with a price, which in the $\xi - \eta$ space is equal to 1 (which is B/A in the $a - b$ space). Therefore, after trading they both converge to the point $(r(\delta)\cos(\delta), 0)$, which is more favorable point in the preference ranking of the producers (since this point is perpendicular to the PPF) (**Figure 2**).

When taxes are applied, the final point (after trading, AF) is closer to the origin (0,0), that is, $r_{AF}(\delta) < r(\delta)\cos(\delta) \cong r_0\left[1 + \left(\frac{1-\beta}{2}\right)\delta^2\right]$. Clearly, when the taxes are high so that $r_{AF}(\delta) \leq r_0$, then the motivation for entrepreneurship, specialization, and trading vanishes.

This event occurs when the change in the arrows slope, which is the normalized change in the price Δp, is equal to

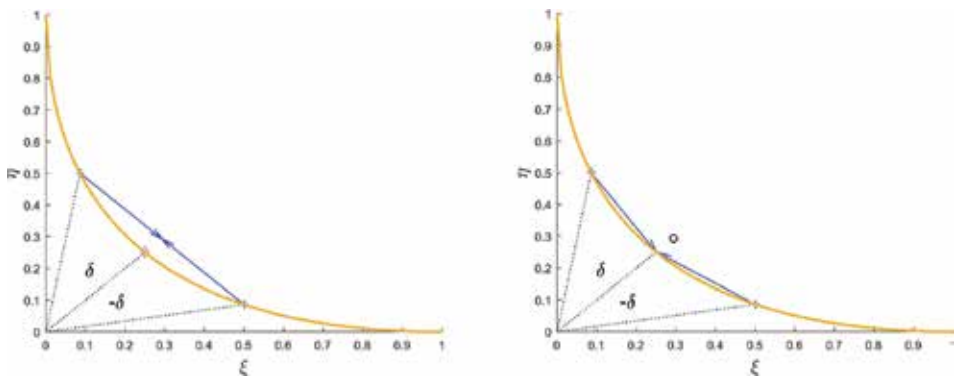

Figure 2. Trading in the presence of specialization and taxation. Without specialization, the production point is $\xi = \eta = 1/4$ (the diamond in the left figure). The curved line is the PPF. With specialization, the producers' production point splits into the two '+', while trading (represented by arrows) improves the status of both producers to the point represented by 'o' (in the right figure). Taxation tilts the arrows to a worse position, which can even eliminate the specialization beneficial effect (the right figure).

$$\Delta p = 2\frac{r(\delta)\cos\delta - r_0}{r(\delta)\sin\delta} \cong (1-\beta)\delta, \tag{24}$$

However, the normalized change in the price is exactly the tax level, that is, the tax level beyond which no trading is possible (t_c) is equal to

$$t_c \cong (1-\beta)\delta. \tag{25}$$

Eq. (25) is the main result of this chapter, for it integrates taxation (t) specialization (β) and entrepreneurship (δ) in a simple relation.

Now since (Eq. (15)) $\beta = \frac{1}{1+\log_2 F}$, then we can formulate an expression which relates the entrepreneurial parameter δ and the specialization factor F to the critical taxation level t_c:

$$t_c \cong \frac{\delta}{1 + 1/\log_2 F} \tag{26}$$

This equation can be rewritten to evaluate the critical specialization factor, which is required to initiate trading for a given level of entrepreneurship and taxation, namely

$$F_c = 2^{(\delta/t-1)^{-1}}. \tag{27}$$

This is the specialization factor required to overcome the suppression effect of the countries' tariffs, the graph of which is presented in **Figure 3**.

Since without specialization, the production frontier is $a/F + b/B = 1/F$, then δ can be easily replaced with a corresponding variation in the real commodity units Δa and Δb, namely

$$\delta = -\sqrt{8}F\frac{\Delta a}{A} = \sqrt{8}F\frac{\Delta b}{A} \tag{28}$$

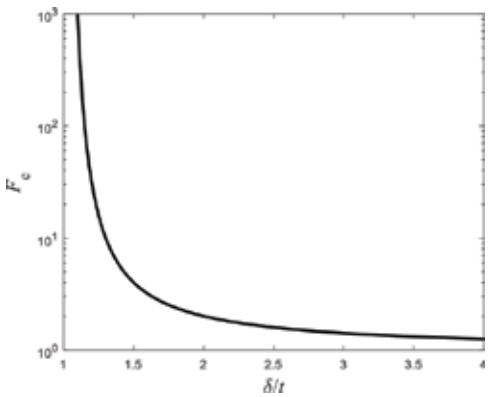

Figure 3. The dependence of the critical specialization factor as a function of the ratio between δ and the tax level t.

and therefore, the critical taxation can be written as a function of the real change in production, caused by the entrepreneurial decision, that is,

$$t_c \cong \frac{\sqrt{8}F|\Delta a/A|}{1+1/\log_2 F} = \frac{\sqrt{8}F|\Delta b/B|}{1+1/\log_2 F}. \tag{29}$$

4. Perpetual entrepreneurial activities

In real markets (international and domestic) where the traders are also producers, as was explained above and in [17], the producers take much risk when they decide on the amount of good to produce. In this case, a producer may find himself in a worse condition. Any change in his production habits is a temporary deterioration in his preference ranking.

Clearly, the only information he has on the other producers' preferences is the market price, which in our units is approximately $p = 1$.

Let us assume that all producers are identical; therefore, they all have the same production frontier, then the nth producers can be characterized by the Cartesian pair (ξ_n, η_n) or the radial pair (δ_n, r_n). Similarly, they all have the same preference ranking matrix $R(\xi, \eta)$. This two-parameter function (matrix in the discrete case) can be regarded as the utility function of the state (ξ, η); however, when the parameters (ξ, η) are discrete, then a ranking function is consistent with the Austrian school as well ([6, 20]). Therefore, we prefer to use the term 'preference ranking' matrix instead of 'utility' function.

Initially therefore, the point with the highest preference ranking is $\xi_n = \eta_n = r_0/\sqrt{2}$, that is,

$$R_n^{(0)} = R\left(r_0/\sqrt{2}, r_0/\sqrt{2}\right) = \max_{\eta<\eta[\xi_n]} R(\xi, \eta), \tag{30}$$

which is equivalent in radial coordinates to $r = r_0$ and $\delta = 0$ (for all n).

When trading begins, each one of the producers uses the current market price to evaluate future profits from possible production alternatives. This is a perpetual process [21], which consists of multiple iterations.

Let m represents the iteration number. Initially, $m = 0$.

In any iteration, the market price is first determined. Let the market price of the mth iteration be $p^{(m)}$.

Furthermore, it is assumed that the state of the nth producer at the mth iteration is characterized by the two parameters $\left(\delta_n^{(m)}, r_n^{(m)}\right)$, and therefore their state in the $(m + 1)$th iteration can be written

$$\delta_n^{(m+1)} = \delta_n^{(m)} + \Delta\delta_n^{(m)} \tag{31}$$

$$r_n^{(m+1)} = r\left(\delta_n^{(m+1)}\right) \tag{32}$$

where $r(x)$ is function (21), and $\Delta\delta_n^{(m)}$ are random variations that are subject to the constrains

$$-\frac{\pi}{4} \le \delta_n^{(m)} \le \frac{\pi}{4}. \tag{33}$$

These states can easily be transformed back to Cartesian coordinate by

$$\xi_n^{(m)} = r_n^{(m)} \cos\left[\delta_n^{(m)}\right]. \tag{34}$$

$$\eta_n^{(m)} = r_n^{(m)} \sin\left[\delta_n^{(m)}\right] \tag{35}$$

Now, all the possible states that are reachable by trading $\{\xi, \eta\}$ must obey

$$\eta - \eta_n^{(m+1)} \le -\tau p^{(m)} \left(\xi - \xi_n^{(m+1)}\right), \tag{36}$$

where $\tau = \exp(\mathrm{sgn}(\delta)t) = \begin{cases} \exp(t) & \delta > 0 \\ \exp(-t) & \delta < 0 \end{cases}$ is the taxation effect on the price level (note that it has the opposite effect on buyers and sellers).

If among all these points (which are reachable by trading), there is at least one point, whose preference ranking is larger than the previous iteration ranking $R\left(\xi_n^{(m)}, \eta_n^{(m)}\right)$, that is,

$$R\left(\xi_n^{(m)}, \eta_n^{(m)}\right) < \max_{\eta - \eta_n^{(m+1)} \le -\tau p^{(m)} \left(\xi - \xi_n^{(m+1)}\right)} R(\xi, \eta) \tag{37}$$

Then, $\left\{\xi_n^{(m+1)}, \eta_n^{(m+1)}\right\}$ (or equivalently $\left(\delta_n^{(m+1)}, r_n^{(m+1)}\right)$) is chosen as the next iteration production point, otherwise (if the ranking is lower than the previous one) then this trial point is rejected and the previous production point is kept.

Clearly, this process determines the production decisions, and it does not include the trading results. In principle, nothing assures the entrepreneurial producer that he will reach a higher ranking point. This is a risk that he takes.

5. Simulations

We simulate the market with N entrepreneurs, which their entrepreneurial activities in every iteration $\Delta\delta$ are randomly selected with a uniform distribution, namely their probability density satisfies

$$P(\Delta\delta = x) = \begin{cases} 1/\Phi & |x| < \Phi/2 \\ 0 & else \end{cases}. \tag{38}$$

All entrepreneurs have the same PPF with a specialization exponent of $\beta = 1/2$ (which is equivalent to a specialization factor of $F = 2$).

We begin with zero taxes and $N = 40{,}000$ entrepreneurs. These entrepreneurs can be distributed among different countries provided there are no tariffs.

In this case, the initial market is totally unstable, and in the very first trading iterations, the market splits into two distinct population sub-groups: one group produces more units of commodity B than units of commodity A (for which $\delta > 0$) and vice versa for the second group (for which $\delta < 0$). The problem is totally symmetric, and there are no drifts (unlike [17], where the drifts seem to be a simulation artefact).

In **Figure 4**, two histograms of the population as a function of the iterations number (the time) are presented. As can be seen, the population indeed splits into two population sub-groups.

Therefore, half of the iterations, on average, do not improve specialization, because they work in the wrong direction. The average improvement, among those that do contribute, is $\Phi/4$ (the average between zero and $\Phi/2$); therefore, the specialization angles increase linearly with the iteration number m:

$$\delta(m) = \begin{cases} \pm\Phi m/8 & \Phi m/8 < \pi/4 \\ \pm\pi/4 & else \end{cases} \tag{39}$$

where m stands for the iteration number and the upper/lower signs of '$\pm$' stand for the buyers/sellers population group, respectively. These equations are presented in the left plot of **Figure 4** by the dashed lines for the simulation parameter $\Phi = 0.015 Rad$.

Similarly, we can clearly see the 'parabolic' rise in the specialization factor r (the right figure). The dashed curve corresponds to the function

$$r(m) = \begin{cases} \dfrac{1/\sqrt{2}}{\cos(\Phi m/8) + \sqrt{\cos(\Phi m/4)}} & \Phi m/8 < \pi/4 \\ 1 & else \end{cases} \tag{40}$$

which is a derivation of Eq. (21) for $\beta = 1/2$.

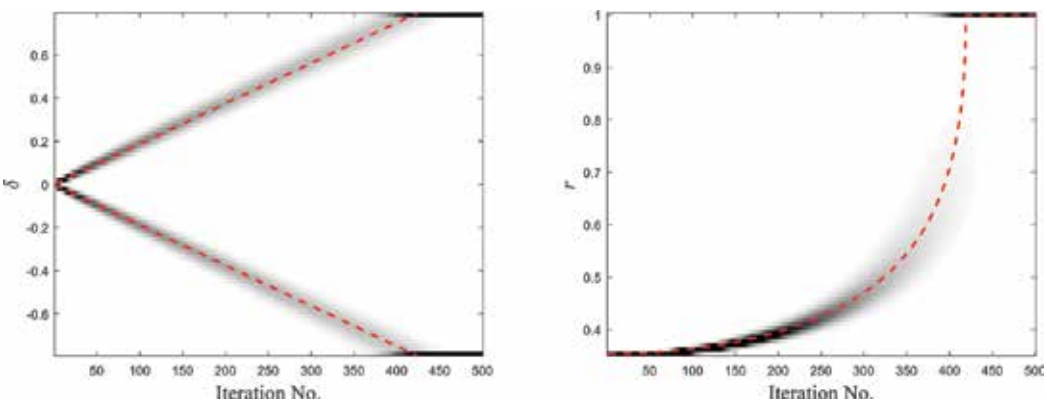

Figure 4. The population distribution as a function of the iteration number (temporal histogram). The darker the color, the higher is the number of producers. The instability is clearly shown as the population splits into two sub-groups of specialized producers-buyers and sellers. The dashed curves correspond to functions (39) and (40).

When transaction taxes are applied (i.e. tariffs in international trading), then the system can be quasi stable.

In the next simulation, the tax levels are varied. For every tax level, 500 iterations were applied on a market of $N = 400$ participants (which can represent 400 countries). The results are presented in **Figures 5** and **6**. The transition between the specialization domain (high r) and non-specialization domain (low r) is clearly seen. Below the critical taxation level, the market experiences a split, and full specialization is reached when the standard deviation of δ converges to $\sigma(\delta) \to \pi/4$, while the mean specialization parameter r converges to $\langle r \rangle \to 1$. However, when the taxes are higher than the critical level $t_c \cong \Phi/4$ (note that $\beta = 1/2$), specialization and trading are totally suppressed. The transition is extremely sharp and it resembles a phase transition.

When the simulation runs over many entrepreneurial parameter's value (Φ), a phase diagram appears (**Figure 7**). The gray levels represent the mean value $\langle r \rangle$ after 500 iterations. However,

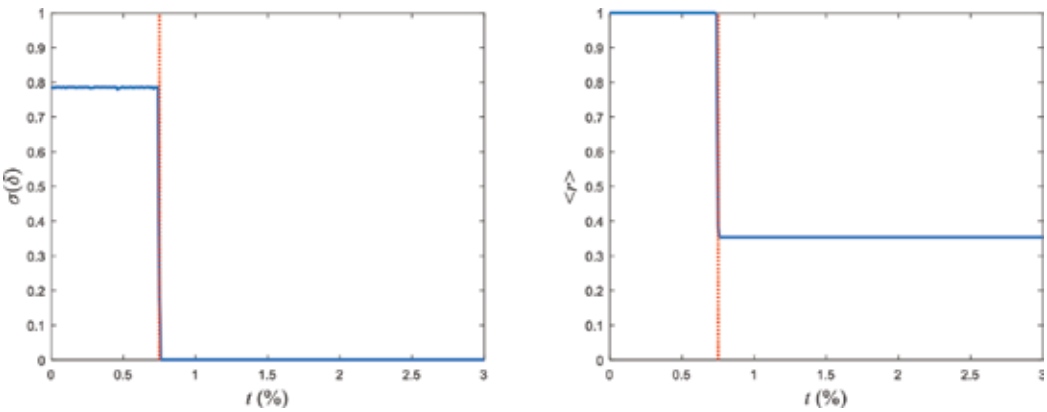

Figure 5. The impact of taxation on the standard deviation of δ, left figure, and the mean value of r, right figure (both are a measure of specialization) for the entrepreneurial parameter $\Phi = 0.03 Rad$ after 500 iterations and $N = 400$ participants (entrepreneurs/countries/producers). The critical taxation level $t_c \cong (1-\beta)\Phi/2$ is presented by the horizontal dashed line.

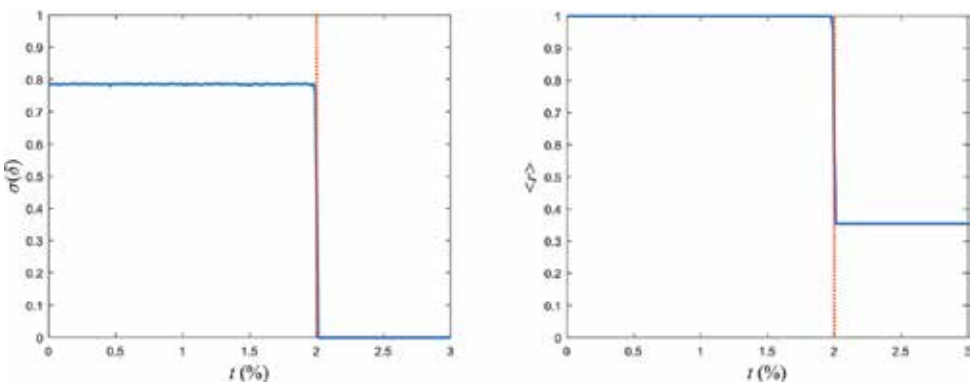

Figure 6. Same as **Figure 5** but for $\Phi = 0.08 Rad$.

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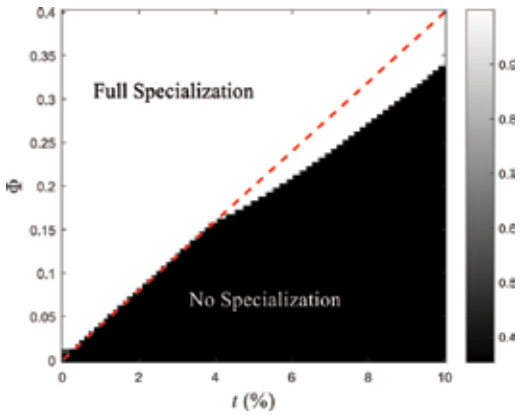

Figure 7. A two-dimensional phase diagram. The diagram represents $\langle r \rangle$, which is a measure of market specialization, as a function of the entrepreneurial activity parameter Φ and the taxation level t. The darker the color, the lower is the value of $\langle r \rangle$. The phase transition is clearly seen. The dashed line corresponds to $t_c \cong (1-\beta)\Phi/2$.

there are no gray levels, there are only black (no specialization and no trading) and white (full specialization and full trading). For low taxation level, the transition between the two 'phases' agrees with the theoretical line $t_c \cong (1-\beta)\Phi/2$.

It should be stressed that in this chapter, it was assumed that the entrepreneurial activity is bounded by regulations. These regulations were manifested by the uniform distribution. In case the regulations are less binding, and the entrepreneurial activity is unbounded and is affected only by human merits, then the distribution may be replaced by a normal, that is, Gaussian, distribution, in which case the transition between phases depends on the measurement time and is clearly less sharp.

6. Summary

In this chapter, a generalization of the Ricardian model was presented. Unlike the original model, the presented one takes into account:

1. Entrepreneurial activities. The model regards the market as a perpetual process of entrepreneurial actions. The producers check random variations and choose the ones with the highest prospect of being profitable.
2. Specialization. The model takes into account the fact that specialization is not a linear process.
3. Taxes and tariffs. In the presence of taxes, the effective price that the buyer 'sees' is different from the one the seller 'sees'. This fact is also taken into account.

The main result of this model is that when the entrepreneurial activity is bounded by regulations (and can be approximated by random variables with a uniform distribution), a critical

taxation level appears, below which the market propagates toward full specialization, and the market clears by trading, while above this level, specialization is fully suppressed and no trading is possible. The transition between these two domains is extremely sharp and resembles a phase transition.

Author details

Er'el Granot

Address all correspondence to: erel@ariel.ac.il

Department of Electrical and Electronics Engineering, Ariel University, Ariel, Israel

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Chapter 4

Location Choice of Inward FDIs in Korea: The Case of Japanese FDIs with Unexpected Shock in Home

Seok-Joon Hwang and Xiaomin Li

Additional information is available at the end of the chapter

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Abstract

Sometimes, a change in investment motives, caused by an unexpected shock such as national disasters, can make the location pattern of foreign direct investments (FDIs) hosted in a neighboring country. In this paper, the location of new manufacturing FDIs of Japan in Korea from 2008 to 2015 is analyzed. The occurrence of "East Japan earthquake" in 2011 changed the location pattern of Japanese FDIs by industry group. However, general attracting factors, such as easy accessibility to service establishments, continues to be an important location factor, regardless of the industry group. Therefore, to be an effective strategy, the regional economic development strategy of the host country attracting FDIs, should be flexible to the sudden changes in the natural environment of the source country of FDIs, and focus more on the general factors which attract FDIs.

Keywords: inward foreign direct investments, location choice, East Japan earthquake, colocation

1. Introduction

The Korean government has attempted to attract foreign direct investments (FDIs) in the free economic zone (FEZ) of each region for regional economic development from the early of 2000s. The popular strategy of regional governments to attract FDIs is making their FEZs centers for a specific industry which they expect to accommodate in their respective region. The benefits of localization can reduce production cost and the chosen location can provide maximum profits for firms in the industry. The spiral accumulation process of benefits between regional concentration of firms in the industry and benefits from localization can raise the probability of FDIs' choosing a specific region as a final destination.

In view of individual FDIs, the potential profits accruing to alternative locations in the host country are the main decision factors for the location choice. In other words, industrial and regional attributes of alternative locations are the major components of the potential profits. However, the weights of these attributes on the decision on location choice can depend on the investment motives of individual FDIs. It can change the potential profits of the alternative location in the host country. Unfortunately, in the estimation process of location choice of FDI, this linkage is not directly observed and mixed together in the data. The one way to identify this linkage explicitly is using a natural experiment. For example, a natural disaster, such as an earthquake, can motivate companies in the region to change their location owing to high uncertainty in their business environments. In this case, the behavior of location choice can be different in comparison to one without the occurrence of a natural disaster.

Recently, both the frequency and magnitude of earthquakes in Japan increased[1]. Even though it is not possible to forecast the exact date of an earthquake, it can be expected that the frequencies and magnitudes of future earthquakes will be often and big, respectively. This unexpected shock raises the uncertainty of business environments in Japan and a temporal increase of Japanese FDIs in Korea can be observed whenever there is a natural disaster. This means that it is highly probable that there is a change of investment motives of Japanese FDIs around that time of a natural disaster. In the future, it will also be highly probable that a similar situation will be repeated frequently. This natural experiment can help us observe the effects of the profits on the location choice.

In lieu of the above, the location choice of Japanese FDIs in Korea considering the "East Japan Earthquake" of 2012 is analyzed as follows. First, this paper analyzes how the weights of important location factors of individual new Japanese FDIs changed from the estimation of location choice equation. Second, the concentration of both the industry groups and regions is analyzed, and the consistent interpretations between the first and second analyses are suggested. This provides an important policy implication for the regional governments in Korea intending to attract FDIs in their regions for their economic growth.

In Section 2, we explain the trend and current situation of the location of new Japanese FDIs in the manufacturing industry in Korea. In Section 3, literature surveys of location choice analyses are introduced shortly. The results of location choice by periods and industry groups are explained in Sections 4 and 5. Co-location index analyses are provided in Section 6 and the conclusions are presented in Section 7.

2. The location pattern of new Japanese FDIs in Korea

The Ministry of Trade, Industry and Energy of Korea releases data which includes the names of firms, industry classification, starting date of investment, and the location of FDIs[2]. For this

[1]The frequency of earthquake in Japan which is greater than or equal to a magnitude of 6, is two times from 1990 to 1999, 63 from 2000 to 2009 and 88 from 2010 to 2015 [1].

[2]This data reveals only the information on the nationality of major investors. There is no method to identify the type and size of investments, such as whether it is green field or merger.

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research, data released in August 2016 is used. This data provides the number of new Japanese FDIs in the manufacturing sector in Korea from 1962 to 2015. **Figure 1** shows the time trend of the number of new Japanese FDIs in the manufacturing sector for the previously mentioned periods.

Some periods which show increasing trends are indexed with a number in **Figure 1**. The first period ranges from 1969 to 1974. This period is represented as the first boom time of economic planning in Korea. In this period, the Korean economy attempted to increase exports, particularly in the manufacturing sector. The second period ranges from 1985 to 1988. This period was known for increasing demand due to the 88 Seoul Olympics. Furthermore, in this period, there was an intentional appreciation of Japanese Yen known as the "Plaza Accord" in 1985. The third period was the year 1995, the "Great Hanshin Earthquake." The fourth period ranges from 1998 to 2004. This was the recovery period from the "foreign currency crisis" in Korea. The last period ranges from 2012 to 2014, the time of "East Japan Earthquake." The duration of FDIs increase in the third and fifth periods is very short in comparison to the other periods. These are candidates for the temporal FDIs increase. Increase in uncertainty on account of the unexpected disaster can draw temporal FDIs, which can drive decision makers to choose their location instantly.

When we focus on the regional distribution of new Japanese FDIs in Korea after the 1990's, another observation can be made on the temporal location choice pattern on earthquakes. **Figure 2** shows the trend of the number of new Japanese FDIs in the capital metropolitan area (that is, Seoul, Incheon and Gyunggi-do) and other areas.

Figure 2 shows that from 2011 to 2015, the trend of new Japanese FDIs in the capital metropolitan area and other areas are similar. This pattern is also similar to that from 1994 to 1996. However, there is rather different observation for the other periods (such as from 1999 to 2009). In this case, their movements are contrary. Therefore, this co-movement pattern from 2011 to 2015 can be related to the effects of the unexpected shock on location choice.

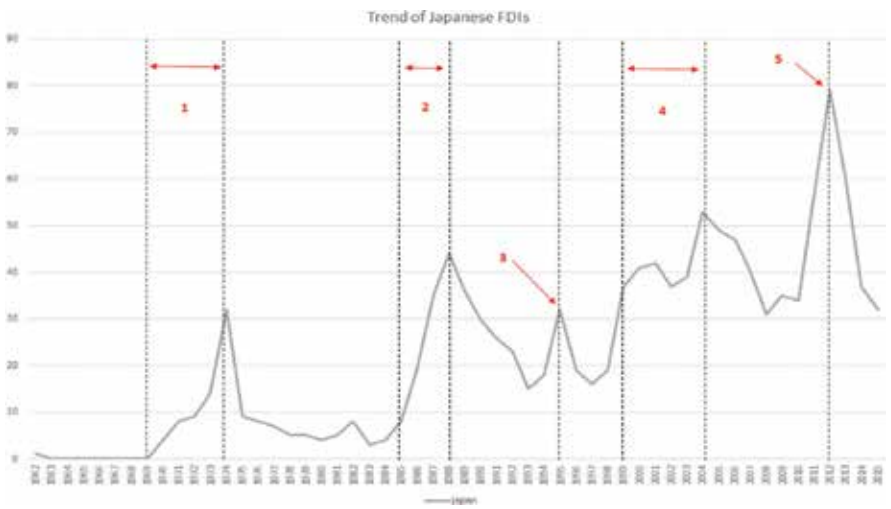


Figure 1. Trend of new Japanese FDIs in the manufacturing sector in Korea.

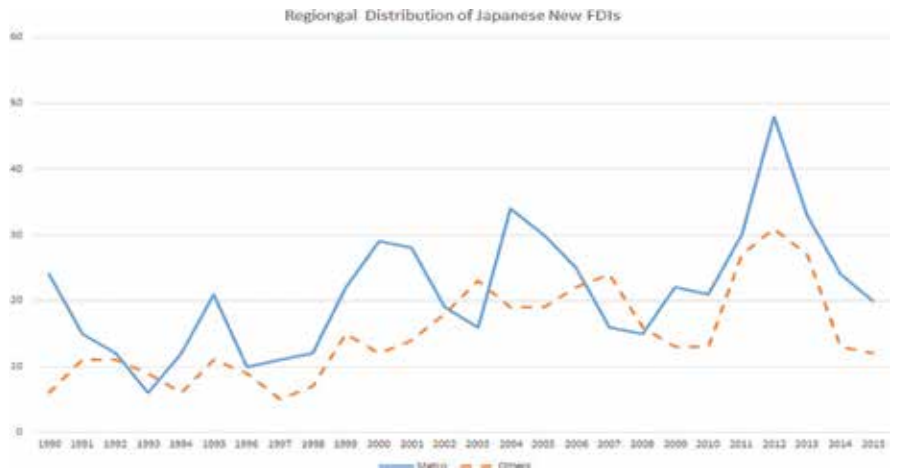


Figure 2. Regional distribution of new Japanese FDIs.

Year	Number of new Japanese FDIs
2008	31
2009	35
2010	34
2011	57
2012	79
2013	60
2014	37
2015	32

Table 1. Number of new Japanese FDIs in manufacturing sectors.

The number of new Japanese FDIs in manufacturing sector from 2008 to 2014 is reported in **Table 1**[3].

3. Short literature surveys in FDI location choice study

One of the main factors in a decision on the location of FDIs is the agglomeration of same nationality and industry group in a region. Head et al. [2] show the importance of "geographical proximity and same origin country" in the location choice of FDIs. They regard these factors as the scope of externality, and they empirically find their importance from the estimation

[3]Fifty-seven firms invested in 2011 are omitted when the location choice equation is estimated. Because there are many missing data in explanatory variables at 2010, there is no way to estimate the choice equation at that year.

of Japanese FDIs location choice in United States of America (the U.S.) with conditional logit model suggested by McFadden [3].

He [4], Crozet et al. [5], Hilber and Voicu [6] and Spies [7] specify the attributes of regional and industrial characteristics in more detail. In contrast to Head et al. [2], they specify the attributes of alternatives, which reflect the production factor supply and demand in the region. Those variables are represented indirectly in the cumulative mass of domestic firms in the case of Head et al. [2]. Some of the above studies used nested logit as their estimation method. The adoption of this method is more reasonable in comparison to conditional logit because the nested logit considers the axiom of IIA (irrelevant independent alternatives) condition explicitly in the estimation process. In their estimation, they find the importance of agglomeration variables in the location choice estimation.

Hwang [8] and Lee and Hwang [9] undertook studies on the location choice of Japanese FDIs in Korea. They both adopted the nested logit estimation technique. Hwang [8] uses data from 1999 to 2005. He suggests that as Japanese firms have a historically long relationship with Korean firms, their location choice behavior is rather different to those from the U.S. and European Union (the EU). One of the main differences is that there is no statistically significant preference for a capital metropolitan area in Japanese FDIs' location choice. Lee and Hwang [9] extended the analysis of Japanese FDIs' location choice from 1998 to 2006 and empirically find the existence of industrially heterogeneous location choice behavior. However, the overall estimation shows results similar to Hwang [8].

4. Estimation of location choice by periods

As literature on FDIs' location choice suggests, agglomeration variables are chosen to analyze the location choice behavior of Japanese FDIs in Korea. There are three agglomerations; agglomeration of Japanese FDIs, agglomeration of other source countries except Japan, agglomeration of Korean (host country) firms. Each agglomeration term is calculated based on the number of firms located in the same region and classified as the same industry group. It is defined as follows:

$$\mathrm{AGJPN}_{ijt} = \sum_{k=t-10}^{t} FDI_{ijk}^{JPN} \quad (1)$$

Here, i means industry group, j represents region, FDI_{ijk}^{JPN}: Number of new Japanese FDIs in *i* industry and *j* region at k year.

The above represents the stock level of FDIs of *i* industry in *j* region. As the exit information of FDIs in Korea is not available, 10-year span is chosen as an average life-span of FDIs.[4]

[4]Buckley et al. [10] found that the average lifespan of Japanese FDIs in the United Kingdom (the U.K.) was 13.9 years around the 1990s. As the distance between Japan and Korea is shorter than that between Japan and the U.K., the entry and exit of Japanese FDIs in Korea can be more frequent in comparison to that of the U.K. Thus, as a rule of thumb, we select 10 years as the average lifespan of Japanese FDIs in Korea.

The agglomeration of other source country FDIs are calculated similar to the calculation of AGJPN.

$$\mathrm{AGOTH}_{\mathrm{ijt}} = \sum_{k=t-10}^{t} FDI_{ijk}^{OTH} \tag{2}$$

Here, i means industry group, j represents region, $\mathrm{FDI}_{\mathrm{ijk}}^{\mathrm{OTH}}$: Number of new FDIs from other country except Japan in *i* industry and *j* region at k year.

The regional accumulation of Korean firm in the specific year t, represented as EST_{ijt}, can be captured more accurately from the publicly released data in Korea.[5] It is the total number of firms located in the same region and classified in the same industry group in a specific year.

When the location decision equation is estimated with the three variables, as Head et al. [2] suggests, EST_{ijt} is expected to capture the regional distribution of resources which affect the supply of the host country's production factors, regardless of their observability. As long as EST_{ijt} is included, the observed and unobserved effects of resource distribution and market environment in the host country can be controlled. Thus, the remaining FDI agglomeration variables can allow us to identify the pure agglomeration effects on the location choice.

Other researchers have suggested more specifications of host country's resource distribution. The typical suggestion is the unit labor cost per production by both region and industry group. This is specified to represent the level of production efficiency and is defined as follows:

$$ULABOR_{ijt} = \frac{Salary_{ijt}}{(Production_{ijt}) * (Employment_{ijt})} \tag{3}$$

Here, $Salary_{ijt}$ represents total payments to employments of *i* industry in *j* region at time *t*, $Production_{ijt}$ represents total production of *i* industry in *j* region at time *t*, and $Employment_{ijt}$ represents total number of employed of *i* industry in *j* region at time *t*.

A higher value of $ULABOR_{ijt}$ signifies that the production of the industry i in region j at time t is relatively more inefficient in view of labor productivity. In addition, the rent information to control land cost and the share of college or higher degree holder in the economically active population in region j at time t are included. The share of degree holders is used to capture the quality of labor in the region. Occasionally, the market size information is included. Regional gross domestic product discounted with the distances of each region is at times used to capture the market size in the estimation. All these variables control the regional and industry specific attributes that can be observed. Finally, regional dummies can be included in the location choice equation to capture the effect of unobserved regional attributes on the location choice. When these variables are added to the three agglomeration variables in the location equation, the estimated coefficient of EST_{ijt} can be expected to be unbiased in capturing the agglomeration effect of the host country's firms on the location choice.

[5]All publicly released Korean data are extracted from [11].

Variables[2]	Cond. logit I with fixed effects	Cond. logit II with fixed effects	Nested logit I with fixed effects	Nested logit II with fixed effects
LAGJPN	−0.012	−0.015	0.046	0.047
	0.175	0.175	0.185	0.186
LAGOTH	0.363**	0.358**	0.420**	0.417**
	0.146	0.147	0.162	0.164
LEST	0.391**	0.400**	0.405**	0.419**
	0.069	0.073	0.072	0.076
LULABOR		−0.005		−0.008
		0.031		0.032
LRENT		−0.453		−0.160
		1.024		1.100
LUNIV		−2.134		−2.375
		1.705		1.682
CAP			0.773	0.747
(H_0: IV = 1)			(t-value: 1.293)	(t-value: 1.526)
Likelihood	−640.237	−639.308	−639.545	−638.354
	χ^2 (3) = 56.25**	χ^2 (6) = 58.11**	χ^2(18) = 171.21**	χ^2(21) = 173.59**
	N = 308	N = 308	N = 308	N = 308

** is significant at 5% significance level.

[1]2011 data is omitted as certain explanatory data of 2011 from the public released data is missing.

[2]"L" means the variables are taken with the logarithm.

Table 2. Estimation results: 2008–2015[1].

Table 2 shows the estimation result of the location choice equation considering data from 2008 to 2015.[6] In the table, conditional logit I includes only agglomeration variables to estimate the choice model with regional dummies. Conditional logit II includes other regional and industrial attributes with agglomeration variables in the estimation. Nested logit estimation is adopted to estimate the location choice with Seoul, Incheon and Gyunggi-do considered as an alternative group of capital-metro area. Model I includes only agglomeration variables with fixed effects and model II includes fixed effects with other regional or industrial attributes to the agglomeration ones in the explanatory variables. Note that when market size variable is used in the estimation with regional dummies together, the likelihood-function is not converged, which may be related to the multicollinearity problem. Thus, whenever regional dummies are included in the estimation, market size variable is omitted.

One of base estimations for the total period provides the following results:

[6]Summary statistics for the variables are provided at **Table A1** in Appendix A.

1. The method of nesting, which is the grouping of Seoul, Incheon and Gyunggi-do as an alternative, that is, capital-metro area, is not statistically meaningful. Inclusive variables (CAP) in the nested models I and II show no significance in the estimation results. Therefore, the null hypothesis which insists that Seoul, Incheon and Gyunnggi-do are independent alternatives is accepted. In this case the conditional logit model itself is sufficient to use as the location choice estimation method.
2. The Japanese agglomeration variable is not statistically significant, regardless of the grouping of alternatives. This means that when new Japanese FDIs make a location decision in Korea, there is no tendency of following the pre-existing Japanese and same industrial companies' location choice. Further, it indicates that the new FDIs are not probable to have any connection with pre-existing companies in Korea. This is an exception when the location choice of other source countries is considered. Generally, new FDIs in the same industry group from the U.S. and EU in Korea tend to agglomerate ([9]; and [8]).
3. There are no explanatory powers of industrial and regional attributes in the location choice behavior. Only agglomeration variables of other source countries and domestic companies are statistically significant at 1% significance level. This means that there is an unobserved relationship between new Japanese FDIs and other source country's FDI stock, or domestic country's firm which can significantly affect the location decision of Japanese FDIs. In addition, the magnitude of these effects is similar.

These estimation results are not sufficient to explain the short-run location choice behavior of new Japanese FDIs. The time periods are decomposed into the prior periods of unexpected

Variables	Cond. logit I with fixed effects	Cond. logit II with fixed effects	Nested logit I with fixed effects	Nested logit II with fixed effects
LAGJPN	−0.169	−0.172	−0.056	−0.054
	0.295	0.296	0.185	0.317
LAGOTH	0.606**	0.583**	0.896**	0.868**
	0.246	0.252	0.302	0.311
LEST	0.217**	0.237**	0.266**	0.290**
	0.107	0.117	0.119	0.134
LULABOR		−0.023		−0.023
		0.057		0.060
CAP			0.364**	0.360**
(H_0: IV = 1)			(t-value: 3.011)	(t-value: 3.011)
Likelihood	−207.175	−207.092	−204.616	−204.544
	χ^2 (3)=16.67**	χ^2 (4)=16.83**	χ^2(18) = 65.57**	χ^2(19) = 65.71**
	N = 100	N = 100	N = 100	N = 100

**is significant at 5% significance level.

Table 3. Estimation results: 2008–2010.

shock and the post period: periods of 2008–2010 and 2012–2015. In the estimation of 2008 and 2010, the likelihood function is not converged with regional attribute variables, except the unit labor cost. Thus, unit labor cost and other agglomeration variables with regional dummies are used in the estimation of location choice.

From the above two period estimations, distinct changes are founded. Prior to the East-Japan earthquake, location choice behavior of new Japanese FDIs is more affected by the other source country FDI agglomeration. When we group Seoul, Incheon and Gyunggi-do regions into one alternative, this effect is clearly dominant (both inclusive variables in nested logit I and II in **Table 3** are statistically significant at 1% significance level). However, the estimation after the catastrophic disaster shows the effect of the other source country FDI agglomeration is gone. On the contrary, the effect of domestic company agglomeration is a statistically dominant effect on the location choice of new Japanese FDIs. Furthermore, location choices are independently made over all regions. That is, inclusive variables in **Table 4** show statistically insignificant. So this explains there is a change in location decision factor after the unexpected shock in Japan. One of possible explanations is that, because uncertain situation of Japanese firm according to the shock in the home country is raised, new Japanese FDIs may make location decision in quick. This decision in hurry can make them to follow the distribution of the

Variables	Cond. logit I with fixed effects	Cond. logit II with fixed effects	Nested logit I with fixed effects	Nested logit II with fixed effects
LAGJPN	0.067	0.076	0.047	0.047
	0.219	0.220	0.224	0.225
LAGOTH	0.021	0.210	0.199	0.197
	0.180	0.182	0.179	0.179
LEST	0.569**	0.559**	0.565**	0.550**
	0.097	0.101	0.098	0.102
LULABOR		0.007		0.009
		0.038		0.038
LRENT		1.668		1.437
		2.600		2.535
LUNIV		−6.252**		−6.354**
		2.694		2.718
CAP			1.075	1.103
(H_0: IV = 1)			(t-value: 0.340)	(t-value: 0.447)
Likelihood	−420.291	−417.287	−420.230	−417.180
	χ^2 (3) = 48.49**	χ^2 (6) = 54.49**	χ^2(18) = 135.04**	χ^2(21) = 141.14**
	N = 208	N = 208	N = 208	N = 208

**is significant at 5% significance level.

Table 4. Estimation results: 2012–2015.

host country's firm in investment destination country. This is so strong that the agglomeration of the host country firm can have a dominant effect on the location choice of them.

In the case of cost variables such as unit labor cost and rent, they show a positive effect on the location choice. However, as the table shows, they are not statistically significant. So the role of cost variable on the location choice is negligible in this period. The effect of labor quality measured with the proportion of college or more degree holder shows a negative effect on the location choice. It is exceptional result because traditional literature shows that there exists a positive relationship between labor quality and location choice. One possibility is that there can be some correlated relationship between regional dummies and that variable. But it cannot be a clear explanation. So the robustness of those estimations is required to be checked. In next section, the estimation results by industry are introduced and the robustness of the estimation is explained.

5. Estimation by industry group

The criterion of industry classification can be determined by the characteristics of industries. However, if the criterion depends on those of classification objects, that is determined endogenously. It is not appropriate to be criterion. Otherwise, it is determined exogenously, because it is not influenced by the characteristics of the classification objects, it is suitable as a criterion to classify industry consistently. In this respect, when classifying new Japanese foreign direct investments into industries, it is possible to provide relatively more consistent criterion depending on the characteristics of Korean industries than applying them according to the characteristics of Japanese companies.

This industry classification is grouped based on the shipments information. According to US census bureau, the manufacturers' shipments measure the dollar value of products sold by manufacturing establishments.[7] The manufacturers' shipments give information about the economic condition in the domestic manufacturing sector and also indicate future business trends. Industries are classified into "above average shipments industry" and "below average shipments industry" based on the information of Korean industries. The above average shipments industry in Korea means the industry which shows high shipments value than the average shipment over the whole industry and tends to be main export industries of Korea. While those below average shipments tend to target domestic markets. Also, since Korean companies are well aware of the distribution of production factor and the market, the difference in their location may make a geographical difference. This may provide a clue for the change of Japanese FDIs' location choice pattern. Therefore, we classify new Japanese FDIs in Korea according to the average shipments of Korean industries (**Table 5**).

The same location choice model is estimated by period and industry. However, in this estimation, the number of samples in each period is decreased. It restricts the number of explanatory variables in the estimation. To reduce the number of explanatory variables, the fixed effects,

[7] [12].

Above average shipment	Below average shipment
11 Food and beverage products	13 Textiles, except apparel
12 Tobacco products	14 Wearing apparel, clothing accessories and fur articles
19 Coke, hard-coal and lignite fuel briquettes and refined petroleum products	15 Tanning and dressing of leather, luggage and footwear
	16 Products of wood and cork except furniture
20 Chemical products	17 Pulp, paper and paper products
21 Pharmaceuticals, medicinal chemicals and botanical products	18 Printing and reproduction of recorded media
24 Basic metal products	22 Rubber and plastic products
26 Electronic components, computer, radio, television and communication equipment and apparatus	23 Other non-metallic mineral products
	25 Fabricated metal products
30 Motor vehicles, trailers and semitrailers	27 Medical, precision and optical instruments, watches and clocks
31 Other transport equipment	28 Electrical equipment
	29 Other machinery and equipment
	32 Furniture
	33 Other manufacturing

Table 5. Industry classification (Korea Standard Industry Classification 2-digit).

that is, regional dummies are dropped. And only the conditional logit technique is adopted. The estimation results are show in **Tables 6** and **7**.[8]

In the estimation of below average shipment industry, domestic firm agglomeration and market size are statistically significant location choice factors before the disaster. This explains the location of companies in the below average shipment industry follows the domestic resource distribution and market potential of regions in the host country. They regard Korea as one of final consumption markets. However, after the earthquake, the new Japan FDI' location choice has changed as follows. First, the motivation to keep Korea as a source of their production factors became stronger. It is possible that the accumulation of Korean firms is highly related to the distribution of production factors.[9] The above suggestion can be backed up by the fact that Japanese firms are more affected by the accumulation of Korean firms in the decision of location choice after the earthquake. Second, since land price is the price of production factor, it should show a negative relationship in the traditional location theory. However, the estimation results show that Japanese FDIs location choice have a statistically significant positive relationship with the land price after the earthquake. It suggests that Japanese companies may

[8]Refer to **Tables A2** and **A3** in Appendix A for summary statistics of variables. And the geographic distributions of new Japanese FDIs by periods and by industry groups are provided at Appendix C.
[9]This is explained more in detail in the section of colocation analysis.

Variables	2008–2010	2012–2015
LAGJPN	−0.077	−0.231
	0.398	0.316
LAGOTH	0.356	0.060
	0.392	0.255
LEST	0.400**	0.657**
	0.143	0.119
LULABOR	−0.080	−0.020
	0.070	0.048
LRENT	0.099	0.305**
	0.171	0.137
LMSIZE	0.464*	0.195
	0.285	0.202
N	53	120
Log likelihood	−116.896	−263.947

*is at 10%.
**is significant at 5% significance level

Table 6. Conditional Logit (w/o fixed effects) estimation results of the below average shipment industry.

perceive location as the nature of investment. In other words, since Japanese companies much worry about the maintaining the value of their assets in Japan after the earthquake, they can regard the real estate in neighboring country as an investment object that can preserve the value of assets in a stable region. Particularly, as land prices are higher, real estate value would be maintained. Therefore, it can be an alternative investment destination that maintains the value of its assets and this investment tendency can be reflected in the location decision.

In the case of the above average shipment industry, the firms in this group are affected more by the location of other source country agglomeration, that is the location where FDIs from other country origin are gathered, before the shock. Even though the effect of domestic resource distribution is statistically significant location factor, the magnitude of the estimated coefficient of this variable is much smaller than that of other country agglomeration. However, after the shock, the magnitude of effects of two variables are reversed each other. This will be explained in more detail in the next section. However, it is clear that the unexpected shock raises the importance of domestic firms' agglomeration on their FDIs location choice. And investment motive for the real estate is similar to that of the firms in the below average shipment industry.

Generally, these group estimation results confirm the robustness of overall estimation shown in **Tables 3** and **4**. The unexpected earthquake in Japan clearly changes the Japanese FDIs' the weight of location factors in their decision process temporarily. The effect of domestic resource distribution on the location choice plays a strong role of the location decision as shown in the overall estimation after the unexpected shock. However, still we do not know exactly the role of agglomeration in detail. So the co-location behavior is required to be more investigated. And this will be done in the next section.

Variables	2008–2010	2012–2015
LAGJPN	−0.148	0.403
	0.434	0.312
LAGOTH	0.827**	0.439**
	0.354	0.266
LEST	0.361**	0.571**
	0.191	0.150
LULABOR	0.008	−0.001
	0.092	0.061
LRENT	0.080	0.328**
	0.198	0.168
LMSIZE	0.309	0.394
	0.312	0.250
N	47	88
Log likelihood	−99.279	−163.705

**is significant at 5% significance level.

Table 7. Conditional logit (w/o fixed effects) estimation results of the above average shipment industry.

6. Estimation of co-location index

While the estimation result shows the importance of domestic agglomeration after the unexpected shock, the effect of that on the location choice is not clear. To clarify the effect, we calculate co-location index of industry and region, then use these indices to find out why the new FDIs gather together with domestic firms. Both co-location indices are defined as follows:

Co-location index of *i* industry at t:

$$CL\,I_{it} = \frac{\sum_{j=1}^{15}\left(TFD\,I_{ijt} \times TDF\,M_{ijt}\right)}{\sum_{j=1}^{15} TFD\,I_{ijt} \times \sum_{j=1}^{15} TDF\,M_{ijt}} \tag{4}$$

Co-location index of *j* region at t:

$$CL\,R_{jt} = \frac{\sum_{i=1}^{n}\left(TFD\,I_{ijt} \times TDF\,M_{ijt}\right)}{\sum_{i=1}^{n} TFD\,I_{ijt} \times \sum_{i=1}^{n} TDF\,M_{ijt}} \tag{5}$$

Here, $TFDI_{ijt}$: Total number of new FDI in *i* industry in *j* region at t and $TDF\,M_{ijt}$: Total number of domestic firms in *i* industry *j* region at t.

To calculate the industrial co-location index, two-digit level industry classification (KSIC) is used. In this case the number of industries is 33 and the number of region is 15 administrative local government regions. $CL\,I_{it}$ index measures the degree of regional concentration of a specific industry. The denominator in Eq. (4) is the potentially possible number of match between new

Japanese FDIs and all nationally distributed domestic firms in the same industry. The numerator is the realized number of match, that is, the number of realized pairs between new FDIs and domestic firms in the same region and industry. Therefore, the ratio such as CLI_{it} represents the degree of regional co-location in a specific industry. The calculation of CLR_{jt} is similar to that of CLI_{it} but the meaning of regional concentration of a specific industry is changed by the industrial concentration in a specific region. So while the variations of CLI_{it} come from the differences in industrial characteristics, those of CLR_{jt} come from the differences in regional characteristics.

Each co-location index is regressed on the characteristics of industry or those of region. To explain regional concentration of industries, such variables as follows are used:

1. L500 above: the number of domestic firms which hire more than 500 employees. This variable captures the distribution of firm size in the same industry in a specific region. We expect that the higher the value is the less likely new FDIs gather together to avoid high competition with large firm in the market.
2. R&D: this is the size of R&D investment. This variable can capture the possibility of technological interaction or spillover benefits between new FDI and pre-existing domestic firms. The higher the size of R&D investment is, the more likely new FDIs gather together when they want to closely each other because of the easiness of technology transfer.
3. The power of dispersion index: this is one of indices in the induced production coefficient in input-output table. This index means that when there is one unit increase in final demand in an industry, how many increases in output of the entire system of industry are required. This is the measure of backward linkages. If an industry is close to manufacture type, the index is high. If an industry is close to primary industry type, then the index is low.
4. The sensitivity of dispersion index: this is also one of indices in the induced production coefficient in input–output table. This captures the output increase in an industry to produce one unit increase in final demand of every industry. This measures the forward linkages. If the index is high, then the industry is close to intermediate good production. If the index is low, then the industry is close to final good production.

In the case of industrial concentration in region estimation, following variables are used:

1. Regional exports: the export amount of a specific region.
2. Service establishments: the number of companies in service industry in the region.

We regress each co-location index of industry and that of region on those variables. One-way fixed panel estimation method with lag variable is adopted. The estimation equation is as follows:

$$\left(\mathrm{y}_{\mathrm{t}}-\bar{y}\right)_{t}=\beta_{0}+\beta_{1}\left(x_{t-1}-\bar{x}\right)_{t-1}+\beta_{2}\left(y_{t-1}-\bar{y}\right)_{t-1}+\mathrm{u}_{\mathrm{t}} \tag{6}$$

y_{t}: CLI or CLR at t., $\bar{y}=\frac{\sum_{t=1}^{n} y_{t}}{n}$, $\mathrm{x}_{\mathrm{t-1}}$: explanatory variables at t-1, $\bar{x}=\frac{\sum_{t=1}^{n} x_{t}}{n}$, u_{t} time error.

The estimation period is short from 2013 to 2015. However, we can explain the co-location behavior of Japanese new manufacture FDI with domestic, that is, the host country firm agglomeration

Variables	Total industry	Above average shipments	Below average shipments
Constant	0.0048	−0.0059	0.0087
	0.013	0.013	0.019
L500 above	−0.0182*	−0.0153*	−0.0212
	0.011	0.008	0.019
R&D	0.0172	0.0838	0.0239
	0.123	0.119	0.187
Power	0.9407**	0.4192	1.5919*
	0.474	0.361	0.917
Sensitivity	−0.3398*	−0.3544**	−0.4710
	0.190	0.125	0.478
Lag(−1)	−0.1993	−0.4377*	−0.1744
	0.124	0.221	0.169
R^2	0.1789	0.4779	0.1589
N	92	32	60

*is at 10%.

**is significant at 5% significance level.

Table 8. Regional concentration of industries 2013–2015: colocation index.

after the unexpected shock. The estimation is done by total, above average shipment industry and the below average shipment industry. The estimation results are shown as below tables.[10]

Table 8 shows the regional concentration of industry estimation result. The interest thing is R&D does not have any statistically significant factor in the estimation. This explains technological relationship is not the main factor of co-location of Japanese FDIs with domestic firm agglomeration. Maybe this estimation result explains why the share of college degree or above holder in a region cannot be an effective location decision factor for new Japanese FDIs or it affects negatively in the location decision of them.

Overall estimation explains the competitiveness in market, represented by firm size distribution, and each index of backward and forward linkages are important factors which make domestic firm agglomeration attractive to new Japanese FDIs after the shock. When we decompose industry group in to the above average shipment and the below one, the co-location factor is more clearly identified. In the case of the above average shipment industry, Japanese FDIs prefer not to gather together with large size domestic firms. And there is a negative relationship between the sensitivity of dispersion index and the tendency of Japanese FDIs' gathering together with domestic firms. That is, the lower the value of the index, the higher the tendency of Japanese FDIs' gathering with domestic firms. The fact that the index value is low means that the production quantity of this industry to be required to increase the one unit production of final good in every other industry is low. If this type of companies gather together, it is highly probable that they are looking for the location which is close to the market. Besides the effect of the power of dispersion index is not statistically significant. It means that it is not certain whether the Korean

[10]Summary statistics for the variables are shown in **Table B1** in Appendix B.

Variables	
Regional exports	−0.5479
	1.014
Service est.	1.8624*
	1.004
Lag(−1)	−0.3931**
	0.1544
R^2	0.7597
N	60

*is at 10%.
**is significant at 5% significance level

Table 9. Industrial concentration of region 2013–2015: colocation index.

industry is manufacture or primary industry type, that is, whether they are input chasers or providers. Therefore, it is likely that new Japanese FDIs prefer the place the Korean industry gathers together looking for their market. In summary, the new Japanese FDIs in the above average shipment industry group try to find the stable final good demander in Korea after the earthquake.

However, the new Japanese FDIs in the below averaged shipment industry group shows a different co-location pattern. To them, the power of dispersion index is the only statistically significant factor for co-location. The higher the index, the highly possible the new Japanese FDIs in this industry group gather together with domestic firms. When the Korean industry is manufacture type, that is, input chasers, the new Japanese FDIs gather together with Korean firms. In this case, it is not proven statistically whether the type of Korean industry is intermediate good producer or final good producers. This explains that it is highly possible that the Japanese FDIs in this group want to secure the intermediate good producers of Korea. Furthermore, this interpretation can be backed by the fact that, even though new Japanese FDIs are confronted with the high competition with Korean companies of same industry in the market, they do not afraid of this competition in the region.

Table 9 shows the results of industrial concentration of region. This explains the importance of the existence of service providers in regional co-location.[11]

Finally, we can summarize the location behavior of new Japanese FDIs with unexpected shock as follows. First, the unexpected earthquake raises the uncertainty of business environment in Japan temporarily. This definitely increases the number of Japanese FDIs in Korea sharply from 2012 to 2015. Because of the unexpected shock, the location decision is quickly made. This explains why they just try to follow the location of domestic agglomeration more strongly than ever. And we can observe the investment motivation for keeping their asset in the relatively safe region. Second, however, the co-location patterns are different between industry groups. In the case of the above average shipment industry, they try to secure Korean final demander. In contrast with them, the new Japanese FDIs in the below average shipment industry group try to secure Korean intermediate good producers. So while Japanese FDIs in the above average

[11]Summary statistics for the variables are shown in **Table B2** in Appendix B.

shipment industry group try to avoid competition with large size domestic firm agglomeration, those in the below average shipment industry group do not care about the large size domestic firm distribution. But the interest thing is that Japanese FDIs in both groups seem not to have interests with the R&D investments of Korean firms. The fact that this is the temporary decision making may be one explanation for this. Third, one of the main factors for industrial concentration in a region is whether new Japanese FDIs can get an easy access to business services.

7. Conclusions

The role of FDIs on regional economic development is not trivial because FDIs help economically depressed region increase income, production and employment. FDIs also choose their location where they can get the greatest benefits. The location choice is not an unilateral decision making process but interactive one with time consuming interaction between the regional key players (for example, regional government or local business owners) and decision makers. This can generate endogenous relationships among location choice factors. This explains why it is not easy to get unbiased estimators in the location choice estimation. However, if location decision must be made in quick without time consuming interactions, it can be expected that some biases in the estimation can be corrected.

A natural disaster which affects a restricted area such as an earthquake raises the uncertainty of business environment in the area. Furthermore, if the probability of the recurrence of earthquake is high then the uncertainty is piled up. In Japan, there are two large scale earthquakes after the 90's. First one is the "Great Hanshin earthquake" in 1994, and the second one is the recently occurred "East Japan earthquake" in 2012. These two unexpected earthquake increases the uncertainty of business environment in Japan. Besides, the frequencies and magnitude of earthquakes in Japan are sharply increased after the 2000s. That increases the temporal increase of Japanese FDIs into the neighboring country such as Korea. So it is highly probable that such temporal increase of FDIs drives the decision makers in hurry. The analysis of location choice under such a natural experiment as an earthquake may provide us with less biased estimators of regional or industrial attributes on the location choice. And it can give us a chance of our identifying why new Japanese FDIs are heading for Korea, too.

In this research, the location choices of new manufacturing Japanese FDIs into Korea from 2008 to 2015 are analyzed. The location of 308 Japanese new FDIs is investigated. In the location choice estimation results, two common things and different things between two industry groups are found. First common thing is that the propensity to follow domestic firm agglomeration in location choice of new Japanese FDIs in two industry groups is strengthened after the "East Japan Earthquake." Second is that, even though high rent affects the production cost, the propensity to choose a high rent area as their location is increased after the shock. The first different thing is that new Japanese FDIs in the industry group of the below average shipments is not affected by the potential market size of the region after the shock in the location choice. And a second, in the case of new Japanese FDIs in the industry group of the above average shipments, the effect of other source country FDIs in Korea on the location choice of them is smaller after the shock.

In the analysis of co-location index, the above average shipment industry, they try to secure Korean final demander. In contrast with them, the new Japanese FDIs in the below average

shipment industry group try to secure Korean intermediate good producers. So while Japanese FDIs in the above average shipment industry group try to avoid competition with large size domestic firm agglomeration, those in the below average shipment industry group do not care about the large size domestic firm distribution. However, Japanese FDIs in both industry groups prefer the place where they can easily access to the service industry.

Based on this estimation results, we suggest consistent interpretations as follows. AFTER the earthquake, the new Japanese FDIs in the above average shipment industry group regard the Korean market as final consumption place. This is backed by the fact that, after the shock, they do not prefer to choose the place as their location where there are large size domestic firms. It looks like that they try to avoid high competition in the place with large size domestic firms. So they start to look for the non-metro-capital area which has relatively smaller scale domestic firms agglomeration after the shock. Being contrasted with the above case, the new Japanese FDIs in the below average industry group, before the shock, regard the Korean market as final consumers. However, after the shock, they try to choose the location as their final destination where they can secure their intermediates goods supply like Korea firms do. After all, these all show that there are changes of various investment motives when there is an unexpected shock.

This analysis implies that regional governments in Korea need to reconsider the strategy of industrial specialization in the region or their free economic zones. That is, they must consider the neighboring FDI source country's change of natural environments. Since the frequency of disaster is higher and the magnitude of disaster is bigger, investment motives of firms in the country can change a lot. An inflexible industry-tailored policy cannot be appropriate for the region to attract FDIs from the country with frequent and big disasters in this case. Instead of specialization, the industry diversification strategy can be more suited for the region to attract FDIs from the country. In view of that, the regional governments need to focus on the general strategy for attraction, for example, the increasing the availability of service in the region. As a result, to be effective strategy, the strategy of regional economic development through the attraction of FDIs must be flexible with the sudden change of natural environments in the source countries of FDIs.

A. Summary statistics for location choice estimation

	2008–2015	**2008–2010**	**2012–2015**
JPN FDIs stock	5.5 (1.6)	6.0 (2.3)	5.1 (0.9)
Other FDIs stock	10.2 (3.6)	10.4 (5.7)	10.1 (2.2)
Domestic establishments	312.0 (89.0)	309.8 (150.8)	313.7 (25.8)
Unit labor cost	398.5 (53.6)	409.5 (50.9)	390.2 (61.8)
Rent	539.2 (24.6)	515.8 (17.8)	556.7 (6.3)
Number of college grad.	611.5 (67.6)	547.3 (26.9)	659.6 (38.0)
Market size	224,791.9 (18,407.8)	206,258.3 (3215.1)	236,691.8 (8348.4)
Number of observation	308	100	208

Note: (·) is standard deviation.

Table A1. Summary statistics of location choice estimation data.

	2008–2015	2008–2010	2012–2015
JPN FDIs stock	8.4 (3.8)	9.2 (6.0)	7.7 (1.8)
Other FDIs stock	16.9 (8.0)	17.1 (12.5)	16.8 (4.7)
Domestic establishments	300.5 (54.2)	265.5 (37.8)	326.7 (52.8)
Unit labor cost	282.7 (78.7)	289.3 (73.6)	277.7 (93.3)
Number of observation	135	47	88

Note: (·) is standard deviation.

Table A2. Industry group with above average shipments.

	2008–2015	2008–2010	2012–2015
JPN FDIs stock	3.0 (0.7)	2.8 (1.1)	3.1 (0.4)
Other FDIs stock	4.6 (0.9)	4.0 (0.5)	5.0 (0.9)
Domestic establishments	314.7 (140.0)	337.7 (232.1)	297.5 (48.9)
Unit labor cost	493.4 (58.1)	522.5 (82.6)	471.5 (26.7)
Number of observation	173	53	120

Note: (·) is standard deviation.

Table A3. Industry group with below average shipments.

B. Summary statistics for colocation index estimation

	Total	Above average shipments	Below average shipments
CLI	0.12 (0.14)	0.12 (0.13)	0.12 (0.15)
R&D	2472 (8128)	6205 (13,501)	482 (689)
I500	13.50 (18.72)	14.50 (15.48)	13.00 (20.74)
Power of disp. index	1.90 (1.51)	2.81 (2.24)	1.42 (0.60)
Sensitivity of disp. index	1.89 (1.39)	2.61 (2.09)	1.51 (0.64)
observations	92	32	60

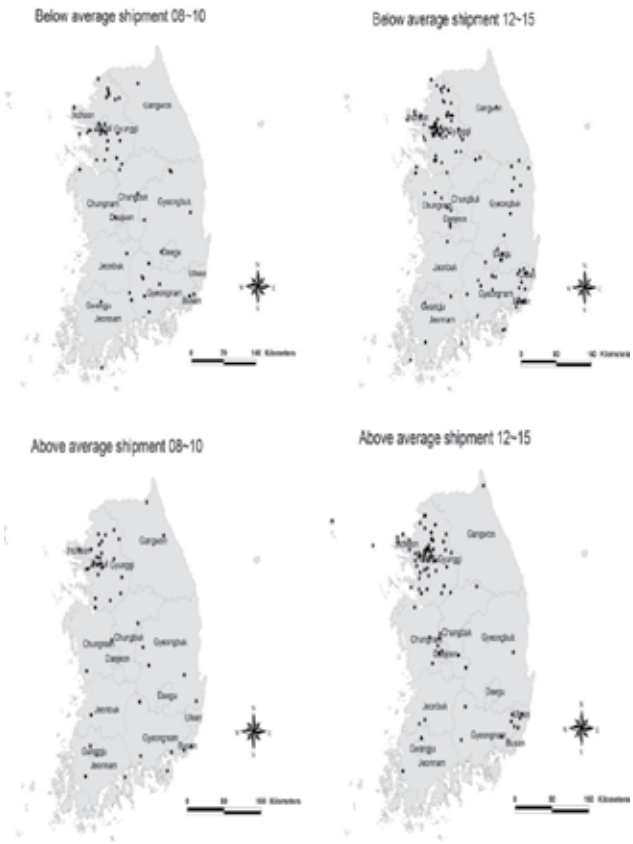
Note: (·) is standard deviation.

Table B1. Estimation of regional colocation of industries.

Variables	Average (Standard deviation)
CLR	0.063 (0.006)
Regional exports	37,270 (696)
Service establishments	22,695 (1514)
Observation	60

Table B2. Estimation of industrial colocation of region.

C. Regional distribution of new Japanese FDIs in manufacture



Before (2008–2010) and after (2012–2015) the East Japanese Earthquake

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Author details

Seok-Joon Hwang[1]* and Xiaomin Li[2]

*Address all correspondence to: sxh219@knu.ac.kr

1 School of Economics and Trade, Kyungpook National University, Daegu, Republic of Korea

2 Department of International Trade, Graduate School, Kyungpook National University, Daegu, Republic of Korea

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Chapter 5

Corruption, Causes and Consequences

Štefan Šumah

Additional information is available at the end of the chapter

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Abstract

Corruption is a constant in the society and occurs in all civilizations; however, it has only been in the past 20 years that this phenomenon has begun being seriously explored. It has many different shapes as well as many various effects, both on the economy and the society at large. Among the most common causes of corruption are the political and economic environment, professional ethics and morality and, of course, habits, customs, tradition and demography. Its effects on the economy (and also on the wider society) are well researched, yet still not completely. Corruption thus inhibits economic growth and affects business operations, employment and investments. It also reduces tax revenue and the effectiveness of various financial assistance programs. The wider society is influenced by a high degree of corruption in terms of lowering of trust in the law and the rule of law, education and consequently the quality of life (access to infrastructure, health care). There also does not exist an unambiguous answer as to how to deal with corruption. Something that works in one country or in one region will not necessarily be successful in another. This chapter tries to answer at least a few questions about corruption and the causes for it, its consequences and how to deal with it successfully.

Keywords: corruption, influence, economy, economic growth, rule of law

1. Introduction

The word corruption is derived from the Latin word "corruptus," which means "corrupted" and, in legal terms, the abuse of a trusted position in one of the branches of power (executive, legislative and judicial) or in political or other organizations with the intention of obtaining material benefit which is not legally justified for itself or for others.

Corruption was referred to as a great sin already in the Bible: "Do not accept a bribe, for a bribe blinds those who see and twist the words of the innocent." However, the history of corruption is in fact related to the beginning of the creation of law and the state and was already

in the antiquity considered an evil, which negatively affects the public administration and the functioning of the political system. The earliest records of corruption date back to the thirteenth century BC, to the time of the Assyrian civilization. From the found plates, written in cuneiform, the archeologists managed to discern how and who accepted bribes. Under the Roman law, the criminal offense of corruption was defined as giving, receiving or claiming benefits in order to influence an official in connection with his work. Due to the prevalence of corruption in the country, this law was supplemented by a new law, which predicted compensation for damage in double value of the damage, and the loss of political rights for the perpetrator of the corruptive act. However, this did not help alleviate corruption, especially due to the fact that corruption was most practiced by the members of the Senate and senior state officials, both in Rome itself and in the remote Roman provinces. The early Christian faith condemned corruption, yet corruption later also developed greatly in ecclesiastical structures, and achieved its peak with the selling of indulgences in the Middle Ages, all until the condemnation of the latter (as well as of other immoral acts of the clergy, with the Pope at the head) by Martin Luther. Apart from the condemnation of corruption, the Reformation also led to a break with until then dominant Catholic culture and the emergence of Protestant ethics.

As a child (he was a hostage at the Ravenna court), Attila[1] noticed a high level of corruption among the state officials of the Western Roman Empire and how they appropriated the state money (as a consequence, there was less money in the Treasury and therefore the taxes increased). He thus decided that if he would ever to rule, he would do so fairly and by oppressing the corruption in his own country. The early feudalism was familiar with various laws that punished the bribing of courts also with death. Later, when the developed feudalism again turned to the Roman law, a number of laws (Dušan's Code, Mirror of the Swabians) discussed the abuse of position. Then, in late Feudalism, countries became virtually helpless in the fight against corruption, as illustrated by the case of France, which in 1716 established a special court in which should rule in cases of abuse of royal finances; however, these abuses (embezzlement, extortion, bribery, scams, etc.) were so extensive that the court was abolished and a general amnesty introduced in 1717 made some forms of corruption quite a tradition. The corruption was also widespread during the time of the Spanish Inquisition, where the victim of the accusation could make amends with money, which made the corruption, especially among the inquisitors, extensive.

Throughout the history, many intellectuals dealt with corruption or theorized about it one way or another. Machiavelli[2] had a low opinion on republics, considering them even more corrupt than other regimes, and according to him, corruption leads to moral degradation, bad education and bad faith. On the other hand, however, the great philosopher, diplomat and lawyer Sir Francis Bacon[3] was known both for receiving bribes and taking them. When he reached the highest judicial position in England, he was caught in as many as 28 cases of accepting a bribe and defended himself before the parliament by saying that he usually

[1] Attila (406–453) was the great ruler of the Huns, who, as the first, united all the Huns and conquered a considerable part of Europe and Asia. He is also known as the Whip of God.

[2] The Renaissance political theorist (1469–1527) who was for more than a decade engaged in diplomatic and state affairs in Florence. Modern political philosophy and political science consider him the founder of the realistic approach to the theory of politics.

[3] An English philosopher, writer, judge and politician (1561–1626). He rejected Aristotle's view and philosophy and sought to gain the reputation of the experimental science.

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accepted a bribe from both parties involved and that the dirty money therefore did not affect his decisions. The parliament did not accept these arguments and sent him to the jail where he spent only a few days as he was able to bribe the judge.

Thus, although the corruption has been occurring in society ever since, it has only been given more attention in the recent period—the researches on the phenomenon and its negative impacts have become more common after 1995, when countries and international institutions began to be aware of this problem. The attitude of the public toward corruption was, until then, neutral. In 1998, Kaufmann and Gray [1] found that:

- Bribery is widespread, especially in the developing and transition countries; there are, however, significant differences between and within regions.
- Bribery increases transaction costs and creates insecurity in the economy.
- Bribery usually leads to ineffective economic results, in the long term impedes foreign and domestic investments, reallocates talents due to income and distorts sectorial priorities and technology choices (for example, it creates incentives for contracting major defense projects or unnecessary infrastructure projects, but does not encourage investments in rural specialist health clinics or in preventive health care). This pushes companies into the "underground" (outside the formal sector), weakens the state's ability to increase revenue and leads to ever-increasing tax rates (as too little tax is taken), which is levied on less and less taxpayers, consequently diminishing the state's ability to provide enough public goods, including the rule of law.
- Bribery is unfair, as it imposes a regressive tax, which heavily burdens in particular commercial and service activities performed by small businesses.
- Corruption destroys the legitimacy of the state.

Many other researchers and institutions (the World Bank Institute—WBI, the European Commission, the United Nations, the EBRD) have investigated corruption and its impact on macroeconomic and microeconomic indicators through various forms of corruption, as well as its connection with local customs and habits, and how it affects the everyday lives of people. Most studies are therefore mainly the analyses of the effects of corruption on various economic indicators, such as GDP growth, investments, employment, tax revenues and foreign investments [2–5], or the study of various forms of corruption in relation to politics and the economic environment [6], the research of its social condition and various manifestations [7, 8]. Dobovšek [9] agrees with the negative effects, i.e. high economic, political and social costs, and adds that corruption is not a weakness of people but of institutions (supervisory and other), as they should be the ones to obstruct the greed and temptation of individuals within them.

2. Causes of corruption

Although corruption differs from country to country, it is possible to identify some of the key common driving forces that generate it. What is common to all countries, which are among

the most corrupt, has been identified by Svensson [10]; all of them are developing countries or countries in transition,

- with rare exceptions, low-income countries,
- most countries have a closed economy,
- the influence of religion is visible (Protestant countries have far the lowest level of corruption),
- low media freedom and
- a relatively low level of education.

Regardless of the above, corruption cannot be assessed unambiguously, since there is never only one phenomenon that is responsible for the occurrence and the development of it; corruption always arises from an array of several, interrelated factors, which can differ considerably from one another. Among the most commonly mentioned factors that influence the development of corruption are: political and economic environment, professional ethics and legislation, as well as purely ethnological factors, such as customs, habits and traditions.

2.1. Political and economic environment

The phenomenon of corruption is strongly influenced by the political and economic environment. The more is the economic activity in the country regulated and limited, the higher the authority and the power of officials in decision making and the greater the possibility of corruption, since individuals are willing to pay or offer payment in order to avoid restrictions. A great potential for corruption is especially there where the officials are under the regulation given the opportunity to decide on the basis of discretion.

The level of corruption is also affected by the monetary policy. Goel and Nelson [11] in their research found a strong link between monetary policy and corruptive activity in the States. The States that have a well-regulated financial sector, not a lot of informal economy or black market are also less corrupt than those where the opposite is true. They also find that there is less corruption in the countries with higher economic and political freedom.

Dimant [12] puts it well in his claim that the level of efficiency of public administration determines the extent to which corruption can find fertile soil and sprout. Such efficiency is determined by the quality of the regulations and permits, since ineffective and unclear regulations help to increase the level of corruption in at least two different ways:

1. The artificially created monopoly of power that enables civil servants to obtain bribes is based on their superior position and embedded in the system.
2. On the other hand, however, ineffective and unclear regulations cause inhibition and therefore encourage natural persons to pay bribes in order to speed up the bureaucratic procedure.

Corruption is also strongly influenced by the low salaries of public administration employees (state officials), who are therefore trying to improve their financial position by receiving bribes, and consequently, the socio-economic situation of the government officials also affects the phenomenon of corruption. This is demonstrated also by Allen et al. [13] in their study where they find that corruption arises because agencies, institutions and the government can no longer control corruption effectively due to underpaid officials, which is a problem especially in the developing countries, where they do not have the sufficient tax revenue to properly reward the local officials. However, low wages are not the only cause of corruption; the poor state of the public administration, which is a consequence of political "overcrowding"[4] of officials, due to which loyalty usually prevails over professional standards, also strongly affects the corruption. As an important factor influencing corruption, some authors also indicate satisfaction with the work done by officials—the more they are dissatisfied with their work or place of work, the higher the degree of corruption, which is confirmed by Sardžoska and Tang [14] in their studies. The mentioned authors find that the private sector has higher ethical values, in particular those that affect satisfaction with work, than the public sector and is therefore less unethical (especially regarding thefts and corruption). Indirectly, Svenson [10] also affirms this and states that in principle, the salary level of civil servants affects the receipt of a bribe (the higher it is, the smaller the chance that the person will act corruptly). However, he continues on that a higher salary also strengthens the negotiating power of the official, which leads to higher bribes and he also states that, on the basis of existing research, it is very difficult to determine whether a higher salary causes less corruption, which means that the level of salary is not a decisive factor, but merely one of many.

The economy is unfortunately largely dependent on politics and often reflects the rule of law; various options for eliminating competition are exploited, and bribery is just one of the possible weapons in the struggle to gain a job. At the same time is the mentality of the economy sometimes: "The cost of a bribe is only a substantial business cost, an integral part of the contract," or "Even if we stop the bribery, our rivals will not, so we must bribe in order to remain competitive, "or" bribery and misleading behaviour are not really crimes, they are just part of the old business practice. They are part of the game and everyone does it." On the other hand is the point sometimes simply the "lubricating" of the bureaucratic wheel by the private sector to do certain things faster or easier.

The political influence of corruption is also manifested through the proverb: examples are attractive! If the top of the politics (government, parties and leading politicians) is corrupt, then corruption shows at all levels, and this evil at the same time spreads among the ordinary population, as nobody trusts the institutions or the rule of law. Johnston [15] thus points out useful thinking in terms of two types of equilibrium—the balance between the openness and the autonomy of the institutions and elites it leads and the balance between political and economic power and opportunities for cooperation. Ideally, the institutions should be open to influences and feedback from different sources, yet at the same time sufficiently independent to effectively carry out their work. Where the openness and independence of the institutions are in balance, the officials are accessible, but not excessively exposed to private influences;

[4]Overcrowding in this context implies replenishment of posts in public administration with members of one party.

if they can make authoritative decisions, while not using their power to arbitrate, the corruption is relatively low. But where the official power is poorly institutionalized, too exposed to private influence, and the officials' independence is reflected in excessive exploitation of their power—they can do as they please—the possibility for extreme corruption is again high.

2.2. Professional ethics and legislation

Lack of professional ethics and deficient laws regulating corruption as a criminal offense, and the prosecution and sanctioning of it are also an important cause for the emergence and spread of corruption. A great influence comes also from the ineffective sanctioning of corruption, which only increases the possibility of continuing the corruptive actions of those involved, creating at the same time a strong likelihood that others will join in the corruption due to this inefficient sanctioning.

The sole lack of professional ethics is a particular issue, as the administration requires different amounts of time to develop or change its ethics and professional standards, which is well known in transition countries (in some, ethics and professional standards changed overnight and approached the equivalents in the developed democracies, and in some, they remained the same as in socialism). It is precisely in the transition countries that the "softer" acts of corruption are often considered to be acceptable and justifiable. Therefore, due to lack of professional ethics in some countries that otherwise manage illegal corruption well, there is nevertheless a widespread form of legal corruption.

Corruption also generates a lack of transparency and a lack of control by supervisory institutions. Therefore, where there is insufficient legal basis or sufficient political will to control, which enables a non-transparent functioning of both politics and the economy, corruption flourishes. Corruption is also affected by the extensive, non-transparent or incomplete legislation, where laws can be interpreted in different ways (for the benefit of the one who pays).

2.3. Habits, customs, tradition and demography

Different countries have different attitudes to corruption. In Europe alone, we can find two extremes; from completely corruption intolerant North to the warm South, where corruption is an almost normal, socially acceptable phenomenon. Or the difference between countries with a democratic past, which traditionally prosecute corruption, and former socialist countries, where the corruption in the state apparatus was a part of folklore tradition. Then, there are also different customs; in some cases, a "thank you" in the form of a gift for a service (for which this person has already been paid with a salary) is an expression of courtesy, and elsewhere it is considered corruption. Everything is only a matter of ethics and morality; however, they can be very different in different areas and different countries.

Some forms of corruption also relate to an informal form of social security, where the family or the immediate community takes care of its members. Such forms of informal social security prevail in less developed countries, where there is no legal regulation of formal social security and in the countries of Southern Europe where the influence of the broader family

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(patriarchate[5]) is still very strong, like for example in Italy, Greece, Albania, Bosnia, etc. These countries are known for nepotism, cronyism and patronage, since the family as well as the wider community provide social security. The family or community takes care of their members, who, in return, must be loyal and in a way also repay the benefits they receive from it. The same is true of faith. While the southern, predominantly Catholic, very hierarchically organized part of Europe, encourages the cult of the family (also joint and several community) and several liability, the northern, mainly Protestant part, emphasizes individualism and individual responsibility (which means less forms of corruption). The corruption also prospers better in countries where Islam and Orthodoxy are the main religion. The influence of the dominant religion in the country is thus important.

The influence of majority Protestantism has been tested several times and has proven to be an important factor for the low level of corruption in a country. However, the relationship between Protestantism and good governance is probably rooted more in history than in today's practice. Today, there are many nominally Protestant countries that are de facto secular, while also many non-Protestant countries fight effectively against corruption. Thus, the influence of Protestantism appears to emerge from its egalitarian ethos, which could indirectly function as a support to the general orientation toward ethical universalism, literacy and the promotion of individualism. Its role is therefore important, as it at certain stages of the development explains why the first countries that were well managed were predominantly Protestant. This does not mean that other religious traditions are incompatible with good governance, but only that they have not succeeded in compiling this particular array of factors at the right moment [16].

Similarly, the research by North et al. [17] showed that, according to the authors, the least corrupt countries or those countries where the rule of law is the strongest were predominantly Protestant in 1900 and those who are most corrupt were predominantly Orthodox in the same year. The results of their research have shown that there is a link between religion and corruption on one hand, and respect for the rule of law on the other, but not that the link is causative. The questions therefore arise: Why do some religions respect the rule of law more than others and control corruption? Do the characteristics of a particular religion themselves lead to the results? Are there any differences in religious doctrines, practices or cultures that lead to such results? Are there other links that are not rooted in the religious culture, but are related to religious affiliation?

A study titled *Perception of corruption* by authors Melgar et al. [18] tried to find out which groups of people are more likely to pay for corruption. They found that those who think that there is a lot of corruption also perceive it so and are consequently more willing to pay for it (as they think or expect the society to function that way). By using a wide and very heterogeneous set of data and econometrics, it has been shown that the social status and personal characteristics also play an important role in the shaping of corruption perception at the micro level. While divorced women, unemployed persons, persons working in the private

[5]Patriarchate is a social arrangement in which all authority is held by male representatives of the families that make up the community. The right to name, social and political status, as well as the possession and authority over family members is automatically transferred from the father to the firstborn or to the nearest male relative.

sector or the self-employed are considered to be in positive correlation with the perception of corruption (corruption is perceived more and they are more willing to pay bribes), the opposite applies to married persons, full-time employees, people who frequently attend religious ceremonies and people with at least secondary education (they perceive less corruption and are also unwilling to pay). According to the classification of countries, they find that it can be proved that all African and Asian countries are in the upper half of the table, and the same applies to the former socialist countries and most of the East Asian countries. People living in these countries perceive more corruption than others. On the contrary, most European countries and some of the former English colonies show lower perceptions than the average (there are also exceptions) and rank in the lower half, the same as half of the richest countries. They also added that the geographical classification of countries has been strongly correlated with the corruption perception index (CPI), which shows that individual characteristics and social conditions are specific factors that influence the perception of corruption. However, they have also found that better economic results reduce the perception of corruption, while the macroeconomic instability and income inequalities have precisely the opposite effect. With Mahič [19], we also found a similar influence on the perception of corruption; in the economic crisis (high unemployment and low purchasing power), the perception of corruption is rising.

A very important factor that affects corruption is also demographics. A number of studies have shown that patriarchal society is more prone to corruption. This is confirmed by several researches that actually explore to what extent are men women corrupt. Several earlier, especially econometric contributions to the debate on who is more corrupt, men or women, argued that there is a link between a higher representation of women in government and lower levels of corruption. An influential study of 150 countries in Europe, Africa and Asia by the World Bank [20] confirmed this and concluded that women are more reliable and less prone to corruption. The subsequent findings were later reinforced by further research. Rivas [21] also affirms this in his research and notes that, according to the results of the survey, the conclusion could be that women are less corrupt than men and that the increase in the number of women on the labor market and in politics would help fight corruption. Lee and Guven [22] in the survey: *Engaging in corruption—the influence of cultural values and the contagion effects at the micro-level* also raised the question of whether men are more corrupt than women. The findings of the research support the thesis that women are less susceptible to corruption than men, especially in cultures that require men to be ambitious, competitive and materially successful, as these factors significantly contribute to unethical behavior. This was surprisingly well shown also in practice [23] when, due to gender equality, the Peruvian government a decade ago decided to involve more women in the police units. When the 2,500 female police officers were joined as traffic police officers, something unexpected happened; bribery was drastically reduced, and people welcomed the female police officers on the streets.

3. The impact of corruption on the economy

In 1997, Tanzi and Davoodi [2] conducted a systematic study of the impact of corruption on public finances. Several important findings came to light:

a. Corruption increases the volume of public investments (at the expense of private investments), as there are many options that allow for public expenditure manipulation and are carried out by high-level officials so as to get bribes (which means that more general government expenditures or a large budget offer more opportunities for corruption).

b. Corruption redirects the composition of public expenditure from the expenditure necessary for basic functioning and maintenance to expenditure on new equipment.

c. Corruption tends to pull away the composition of public expenditure from the necessary fixed assets for health and education, as there is less chance of getting commissions than from other, perhaps unnecessary projects.

d. Corruption reduces the effectiveness of public investments and the infrastructure of a country.

e. Corruption can reduce tax revenues by compromising the ability of the state administration to collect taxes and fees, although the net effect depends on how the nominal tax and other regulatory burdens were selected by the officials, exposed to corruption.

The influence of corruption on the economy was studied by the same authors [3] through several factors:

1. *Through the impact of corruption on businesses*: The impact of corruption on a business is largely depend on the size of the company. Large companies are better protected in an environment that is prone to corruption, they avoid taxes more easily and their size protects them from petty corruption, while they are often also politically protected, which is why the survival of small (especially start-up companies) and middle-sized companies, regardless of their importance for the growth of the economy and the development, is much more difficult than the survival of large companies.

2. *Through the impact of corruption on investments*: Corruption affects (a) total investments, (b) the size and form of investments by foreign direct investors, (c) the size of public investments and (d) the quality of investment decisions and investment projects.

3. *Through the influence of corruption on the allocation of talents*: Indirectly, corruption has a negative impact on economic growth through the allocation of talents, since gifted and prospective students are driven, due to the influence of the environment and the situation in the country, for example, to study law rather than engineering, which would add value to the country.

4. *Through the impact of corruption on public spending*: Corruption has a negative impact on public spending and has an especially strong impact on education and health. There are also indications of the correlation between corruption and military expenditure, which means that high level of corruption reduces economic growth due to high military expenditure.

5. *Through the impact of corruption on taxes*: Because of corruption, less taxes are levied than would otherwise be, as some of the taxes end up in the pockets of corrupt tax officials. There are also frequent tax relieves in the corrupt countries, selective taxes and various

progressive taxes; in short, there is much less money than the country could have, and so corruption, through the country's financial deficit, also affects the economic growth; and conclude the findings on the negative impact (both indirect and direct) of corruption on economic growth.

Smarzynska and Wei [5] came to similar conclusions regarding the effects of corruption on the size and composition of investments. Corrupt countries are less attractive for investors, and if they do opt for an investment, due to non-transparent bureaucracy, they often enter the market with a joint venture, as they usually understand or control matters of the home country better. The local partner can also help foreign companies with the acquisition of local licenses and permits or can otherwise negotiate with the bureaucratic labyrinths at lower costs. Generally inclined (as investors) to the joint venture in the corrupt countries are especially the US investors; however, even investors from those European countries, which are among the highest ranked on the CPI, quickly adapt to local conditions.

Corruption for various reasons also affects the following:

1. Employment, because the job does not go to the most suitable or qualified person, but the one who is ready to pay for it or in any other way return the favor.
2. Also affects total investments [24].
3. The size and composition of foreign investments and the size of public investments.
4. The effectiveness of investment decisions and projects. In the presence of corruption, the investments are smaller, as entrepreneurs are aware that they will have to bribe the officials or even give them a profit share for a successful implementation of a business. Due to these increased costs, the entrepreneurs are not interested in investing.

Wei [25] even made a projection which predicted that in the case of reduction in corruption in Bangladesh to the level of corruption in Singapore, the growth rate of GDP per capita would increase by 1.8% per year between 1960 and 1985 (assuming that the actual average annual growth rate was 4% per year), and the average per capita income could have been more than 50% higher, whereas the Philippines could, if its level of corruption was reduced to that of Singapore (if everything remained unchanged), have raised their investments in relation to GDP by as much as 6.6%, which means a significant increase in the investments. At the same time, he notes that in order to reduce the corruption to the level of Singapore in the countries that he compared (India, Kenya, Sri Lanka, Turkey, Colombia, Mexico and Ghana), the State should raise the salaries of officials by 400—900%. He therefore asks himself whether this would even be possible. However, he notes that in the event of a large increase in salaries, a new form of corruption would likely arise when everyone would be prepared to pay a bribe for a well-paid official job.

Corruption often reduces the effectiveness of various financial assistance programs (both state and international), as money is "lost somewhere along the way" and does not reach those that need it or for whom it is intended, as the financial benefits, deriving from corruption, are not

taxable because they are hidden. The state is thus also losing part of the income from the taxes due to corruption, while the public spending, resulting from corruption (or narrow private interests) leads to negative effects on the budget.

The European Commission in its report found that corruption is costing the European economy about 120 billion a year, and according to the European Commissioner for Home Affairs, Cecilia Malstoström, the corruption in Europe is most present in public procurement, financing of political parties and health care [26].

The United Nations estimate that the cost of corruption in Afghanistan amounted to about $ 3.9 billion in 2012. According to Transparency International, the former leader of Indonesia, Suharto, embezzled between $ 15 and $ 35 billion, whereas the embezzlements of Mobutu in Zaire, Ferdinand Marcos in the Philippines and Abacha in Nigeria are estimated to amount to $ 5 billion [27]. However, the World Bank survey shows that $ 1 billion in bribes, both in rich and developing countries, is paid annually [28], which means that even the developed countries are not immune to corruption (but in a different form) and that the political corruption is especially present in large infrastructure projects. Bađun [29] on the example of Croatia gives conclusions, which are valid for all post-communist countries.

Impact on enterprises: A survey conducted by the EBRD and the World Bank shows that bribes paid in smaller companies account for 5% of their annual profits and in medium-sized companies 4% of their annual profits. However, both are, compared to large companies, where bribes comprise less than 3%, in a much worse position, which shows how bribes are causing problems or are putting these smaller companies into a subordinate position compared to the large ones, which in turn leads to the collapse of these.

Also interesting is the study of the *Shadow Economy in Highly Developed OECD Countries* where Schneider and Buehn [30] also find the link between the low quality of institutions that are the holders of the rule of law (or degree of corruption) and the shadow economy, and therefore, the weaker the "law" is, the higher the degree of corruption and of shadow economy. In the study *Corruption and the Shadow Economy* [31], the same authors explore the relationship between the degree of corruption and the emergence of the shadow economy, and their findings are that the high level of shadow economy and the high degree of corruption are strongly linked to one another. One of the hypotheses in this survey (which has been confirmed) is also: the higher the degree of corruption, the lower the economic development measured by GDP per capita. The authors detected a positive correlation; corruption thus affects the economic development.

However, the extended practice of finding annuity outside the logic of the market and competition can therefore lead to a (neo) liberal conclusion that the root of the existence of corruption is in the very existence of the state—especially in excessive, selective and deforming state interventions and subsidies that create fertile soil for the development of corruption. The truth is that the devastating combination consists of widespread state intervention and subsidies in the simultaneous absence of a strong institutional framework and detailed rules of the game, including the control of public finances and effective anti-trust legislation and legal practices. On the other hand, however, there is no clear evidence that private monopolies are

more effective and less corrupt than the public ones and that privatization, especially long-lasting, gradual and non-transparent one (so-called gradualism), reduces positive developmental and social effects, including the reduction of corruption [32]. Yet market deregulation, legal and judicial reform and transparent management of public procurement would significantly reduce corruption in many developing countries (as well as in transition countries), at which point the government should play an important role in the shaping of the anti-corruption policy. There should be a strong strengthening of the public procurement institution. The law is admittedly strict about the public procurement, but one of the main reasons for public procurement problems is the lack of a skilled workforce, and public procurement is thus still the breeding ground of corruption. There also exists a proverb "poverty is a curse," which applies largely to all developing countries, as these are the countries that are most affected by poverty. Poverty destroys all ethical and moral values.

One of the important aspects of the damage to the global economy is also the failure to respect copyright and intellectual property. The more corrupt countries are also inclined to lower respect for the aforementioned, and the economic damage amounts to billions of dollars. Cavazos-Cepeda et al. [33] found that reforms, legal, fiscal and intellectual incentives to respect copyright and intellectual property patents encourage the society to make itself more innovative and economically more effective; however, they underline the importance of human capital and investment in people as one of the most important factors for reducing the level of corruption in the country.

There are also theories that corruption can act as the lubricant of the economic wheel and at least in some cases has a positive impact on the economic growth. The empirical analysis done by Dreher and Gassebner [34] on a sample of 43 countries between 2003 and 2005 shows that corruption is even useful, but with some reservations. In particular, they investigated the short-term effects of corruption and found, for example, that in countries where corruption is widespread, more new entrepreneurs enter the market (corruption in the public sector is expected to promote private entrepreneurial activity). They are, however, not necessarily to succeed, as there is a high likelihood that they will go bankrupt due to the rigid regulations that block the activity and because of which bribes are needed. They do acknowledge, on the other hand, that most authors who have been doing research for a longer period of time admit the harmfulness of corruption both for society and the economy. Something similar show the data for some Asian countries, where, unlike their findings (short-term benefit), the high degree of corruption coincides with the long-term economic growth.

Svendson [10] also notes that, in light of the theoretical literature and various research studies, notwithstanding that these show the negative impact of corruption on the economic growth, but this cannot be said for sure, since there are difficulties in measuring corruption, and at the same time, the question arises whether the econometric models that were made are good enough to capture all the important variables. He also states that corruption appears in many forms and that there is no reason to assume that all types of corruption are equally harmful to the economic growth.

Recent empirical researches also attest to that; while many countries have suffered, as a characteristic consequence of corruption, the decline in economic growth, other countries have had economic growth (in some cases a very positive one) despite corruption. The latter is also to

be expected, since corruption has many manifestations and it would be surprising if all types of corrupt practices had the same effect on economic performance. Analyses show that one of the reasons for this is the extent to which the perpetrators of corrupt practices—in this case the bureaucrats—coordinate their behavior. In the absence of an organized corruption network, each bureaucrat collects bribes for himself, while ignoring the negative impact of others' demands for them. In the presence of such a network, the collective bureaucracy reduces the total value of the bribe, which results in lower bribe payments and higher innovation, and the economic growth is consequently higher in the latter case than in the former case. The interesting question is not so much why is the degree of corruption in poor countries higher than in the rich ones, but rather why the nature of corruption differs between countries. The extent to which corruption is organized is just one aspect of this, but there are other aspects. For example, it is common practice in some countries to pay ex post (as a share of profit, for example) instead of ex ante (in advance, as a bribe) to officials or politicians, so it is assumed that the effects on the economy will be different. The precise reason why corruption should take on one form and not the other is an important issue which has been largely ignored and which could have to do with cultural, social and political reasons, as well as economic circumstances [35].

In the fight against corruption, a remarkable role was also played by the debt crisis. The die Welt newspaper [36] mentions the study of the Hertie School of Governance, which shows that Italy, Spain and Portugal have made great strides in the fight against bribery and corruption of their civil servants due to lack of money, which enabled a significantly more transparent and "pure" practice for the award of public procurement. The crisis is supposed to dry up monetary resources and thus reduce the chances of corruption. Also, the crisis has changed the perception of the society, and bad business practices, which were acceptable before the crisis, are acceptable no longer. However, the fight against corruption is often similar to the fight against windmills. The case of India shows how corruption is changing, getting new dimensions, not only in scope, but also in methods. Just as the population in India is growing, so is corruption, and there are always new ways how to cheat both the state and the society. The perception of corruption is increasing year after year. Despite all the anti-corruption moves and anti-corruption initiatives, people do not hesitate to offer or accept a bribe. The bribers are becoming innovative, they adapt to the situation and the innovation of companies in paying bribes and hiding them is also visible. However, just as elsewhere in the world, the negative effects of corruption are the same; it reduces foreign direct and domestic investments, increases inequality and poverty, raises the number of freeloaders (renters, free-riders) in the economy, distorts and exploits public investments and reduces public revenues.

4. Discussion

Corruption is, in fact, a multidirectional process. On one hand, the provider benefits, on the other the recipient, and both are aware of the deed that remains hidden. The third link in the chain is everyone else, the victims. Although not every act of corruption is yet a criminal offense, it is, however, unethical and detrimental to the economic and political development of a society. Usually, there are persons involved with political, economic and decision-making power, and as the philosopher Karl Popper wrote in his book, *The Open Society and its Enemies*,

that the greatest problem is not the question of who should give orders, but how to control the one who gives them. How to organize the political and social institutions in order to prevent the weak and incompetent rulers from doing too much harm? However, as there is no general and unmistakable way of preventing the tyranny or corruptions of the heavyweights, the price of freedom is eternal alertness [37]. Greediness, ambition, rapacity and immorality have been known to the human society ever since the emergence of civilization and use every tool available to them: kinship, common past, school contacts, common interests, friendship and, of course, political as well as religious ties.

In a study by Šumah et al. [38], we did an analysis of countries, taking into account their ranking on the Corruption Perception Index published every year by Transparency International, and identified the main factors affecting the level of corruption in a particular group of countries, or rather, we tried to find similarities and differences between individual groups of countries in terms of what affects the level of corruption in these groups. We have established a basic model of three factors (risk, benefit and consciousness) that was created on the basis of the merger of several known, scientifically proven factors that cause or reduce corruption or affect its level in the individual country. According to this degree of corruption, we have identified five groups, classified the countries and analyzed their common characteristics. The findings were as follows:

- Corruption is linked to the level of GDP (the higher the GDP, the lower the rate of corruption).
- Corruption is related to the level of education (the higher the average level of education, the lower the level of corruption).
- Corruption is strongly linked to the geographical location. The highest level is in Asia (mainly in Central Asia), Africa (North and Central Africa) and South America (according to the Transparency International map).
- Corruption is strongly linked to the country's prevailing religion.
- Corruption is linked to freedom in the country (personal freedom, freedom of speech, economic freedom, etc.), with respect to the rule of law in a country and inefficiency of public administration, which is often also locally limited or is inherently corrupt.
- The lower the country is ranked, the more dominant is the patriarchal society.

Many researchers are still involved in corruption. The findings show that there is a link between corruption and its negative effects, but from most of the studies it is not possible to determine what the cause is and what the consequence. Whether is the level of corruption lower due to high GDP, or is it vice versa, cannot be directly identified, since the corruption depends on economic indicators, while at the same time affecting them [39]. It is also very difficult to claim that the average low level of education is due to corruption or, conversely, that corruption is a result of low education. Similarly goes for the rule of law and (in)efficiency of public administration. This interdependence will surely continue to be the subject of numerous researches in the future, for the only way to be successful in the fight against corruption is if we know the causes and begin to eliminate them.

Nevertheless, there remains something that needs to be emphasized. Almost all of the studies ignore the fact that the top of the most corrupt countries consists of countries with one of the various forms of armed conflict (civil war, intertribal conflicts, inter-religious wars or some other form of aggression), which means that peace in the country is a prerequisite for a successful fight against corruption. The least corrupt countries are countries that have a lasting peace on their territory (most since the Second World War or even longer), which is confirmed by the above fact. Peace is therefore one of the prerequisites for a successful fight against corruption.

The answer to the question of how to deal with corruption is not unambiguous; some countries have achieved great success in dealing with it in a relatively short time (Singapore, Estonia and Georgia) and some have been struggling for a long time (the most famous example is Italy). The first condition is in any case to ensure freedom (personal freedom, economic freedom, freedom of speech, freedom of the press, etc.) and democracy, and then education and awareness of people. However, at this point, it is not about introducing the Western type democracy, as our culture knows it, for it has often proven that, especially with the help of the army, more harm than benefit was caused. It is necessary to start using good practices of countries that are similar to each other (religion, habits, tradition, ethics and morality) and that have common history.

Author details

Štefan Šumah

Address all correspondence to: stefan.sumah@gmail.com

FKPV Celje, Slovenia

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Section 3

Some Financial Dimensions: Exchange Rate and Bank Finance

Chapter 6

Analysis of the Role of Exchange Rate Volatility in Monetary Policy Conduction in OECD Countries: Empirical Evidence from Panel-VAR Models

Oguzhan Ozcelebi

Additional information is available at the end of the chapter

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Abstract

In this study, panel vector autoregression (PVAR) models are employed to examine the relationships between industrial production growth rate, consumer price inflation, short-term interest rates, stock returns and exchange rate volatility. More specifically, I explored the consequences of the dynamics detected by the models on monetary policy implementation for 10 OECD countries. This study indicates that factors that may cause a rise in short-term interest rates with respect to the USA can lead to volatility in exchange rates and thus macroeconomic instability. It is also implied that sustaining macroeconomic growth and decreasing inflation can result in increased export performance, which in turn provides the amount of US dollars to curb volatility in US dollar quotations. Accordingly, this study reveals that high importance should be given to both monetary and non-monetary factors in the open-economy framework to detect the possible impacts on trade and capital flows by dynamic stochastic general equilibrium (DSGE) models. Due to their exchange rate risk of economic agents, I also suggest that the economic policy makers of these countries had better create a theoretical framework including financial frictions, economic agents' preferences and different shocks to smooth the variations in exchange rates and minimise the negative outcomes of Brexit.

Keywords: panel vector autoregression, exchange rate volatility, monetary policy, macroeconomic and financial stability, OECD countries

1. Introduction

After the collapse of the Gold standard system in 1971, the vast majority of countries have abandoned fixed exchange rates for floating systems, which in turn lead to an increased

volatility in exchange rates. The transmission of various endogenous and exogenous economic shocks to macroeconomic variables has increased. In the era of financial globalisation process, monetary policy authorities have given a high weight to reduce the negative consequences of exchange rate variations on inflation dynamics because exchange rate volatility among the major currencies has continued in the 2000s. In order to curb exchange rate volatility, policy makers and researchers employ quantitative models to determine which macroeconomic and financial factors can be important. According to [1], it can be asserted that exchange rate volatility can both be explained by monetary and non-monetary factors. Financial openness can be regarded as another crucial factor influencing the relationship between exchange rate volatility and macroeconomic variables. Herein, it should be noted that macroeconomic and financial variables may have different impacts on nominal and real exchange rate volatility.

It has generally been acknowledged that real exchange rate is under the influence of macroeconomic variables more than nominal exchange rate. The study conducted by [2] has been recognised as a pioneering approach, exposing that unexpected nominal shocks would lead to an overshooting of nominal and real exchange rates in the short-run under perfect capital mobility. Those implications were also supported by [3], who showed that increases in real exchange rate volatility are more attributable to shocks of exchange rates and interest rates compared to the stickiness of goods prices because the latter took more time to adjust. In line with dynamic stochastic general equilibrium (DSGE) models, it can be assumed that there may be imperfect capital mobility across international borders causing differentiation in the response of exchange rate volatility in macroeconomic and financial shocks according to the perfect capital mobility. For instance, [4] adopted a DSGE model with endogenous portfolio choice to understand whether gross foreign asset holdings and asset trading help to curb real exchange rate volatility. Coeurdacier and Gourinchas [4] suggested the application of various hedging strategies to reduce exchange rate volatility. On the hand, the impact on real exchange rate volatility can change according to the computation methods of [5] and thus it can be put forward that monetary policy authorities may take wrong policy measures to maintain macroeconomic stability. Although [5] found little evidence of significant differences in the responses of macroeconomic and financial variables to the overall volatility vis-à-vis volatility attributed to the high-frequency components, I transformed the exchange rate volatility series into its frequency components, generated filtered series with inverse discrete Fourier transform (IDFT) and included them in my empirical model. Accordingly, it is assumed that fixed exchange rates are not supposed to change, and thus, exchange rates have no volatility, whereas exchange rates are expected to be more volatile in floating exchange rates. Parallel to the Taylor-rule framework, this paper focuses on the interactions between the industrial production growth rate, consumer price inflation, short-term interest rates, stock returns and exchange rate volatility by employing panel VAR (PVAR) methodology for 10 OECD countries outside the Euro area (Canada, Czech Republic, Iceland, Israel, Korea, Mexico, Norway, Poland, Sweden and the United Kingdom). More specifically, the impacts of industrial production growth rate, consumer price inflation, short-term interest rates and stock returns on exchange rate volatility are examined for those countries. Countries included in the panel

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data set have both floating currency regimes and the capital control regimes that are not classified as "Wall" according to the IMF, because it is intended to make interpretations for the cases that exchange rate and capital control policies cannot be implemented to curb exchange rate volatility. In line with [6], the roles of dynamic interdependencies (DI), static interdependencies (SI) and cross-section heterogeneities (CSH) are considered by imposing the plausible restrictions into the estimation process of PVAR modelling. This type of modelling allows us to explore the effects of volatility in exchange rates of the United Kingdom on the variations in the exchange rates of other countries under investigation since Brexit has been recognised as a global risk factor for currency markets. The aims of this study are: (i) to determine the proportion of changes in dependent variables that are due to their own shocks, versus shocks from the other variables by estimating variance decompositions (VDCs) of PVAR models and (ii) to trace the responsiveness of the dependent variables in PVARs to shocks for each of the variables by computing impulse response functions (IRFs). The main hypothesis of this paper tests whether industrial production growth, consumer price inflation, short-term interest rates, share prices have the considerable amount of impact on volatility in exchange rates. Therefore, the research question of this study is formulated as follows: whether changes in the variables under investigation and the interactions between them lead to changes in the monetary policy stance of countries under investigation. The policy implications and suggestions derived from this study may shed light on the optimal approach for monetary policymakers to use in these countries.

2. Literature review

The unprecedented momentum and the changes in global financial integration in the last two decades have led to an ever-increasing interest among researchers to understand the linkages between exchange rate volatility and monetary policy. Thus, there have been a variety of contributions to the literature using different quantitative techniques. In this respect, the previous approaches analysing the consistency of the theoretical framework for interactions between exchange rates and interest rates can be useful for discerning precise implications for monetary policy. Additionally, monetary policy authorities can employ different policy tools in terms of liquidity management in financial markets. Herein, after the 2008–2009 Global Financial Crisis, short-term interest rates in many developed countries approached the zero bound and thus the effectiveness of monetary policy is reduced. In this process, quantitative easing policies have been adopted by the FED, the ECB, Bank of Japan and Bank of England which may significantly influence the volatility in major currencies. For this purpose, [7] investigated the possible effects of monetary aggregates in the determination of exchange rates. The results of [7] indicated that accounting for major structural break points in monetary variables leads to empirical results that are statistically consistent with predictions from theoretical monetary models of exchange rate determination. Thus, the usage of modes including monetary factors to analyse exchange rate volatility was supported. When the scientific literature is examined, it has been recognised that VAR-type of models can be adopted to examine the impacts of

monetary policy shocks on exchange rates. For instance, [8] found that the effect of a positive innovation in monetary policy is associated with an exchange rate appreciation in developed economies; it leads to significant depreciation in currencies of developing economies.

Factors affecting foreign exchange rates may depend on the level of development of countries, as well as on monetary and non-monetary factors. In other words, nominal and real factors can have considerable amount of impact on exchange rate volatility; the study by [9] can be regarded as a pioneering approach in that extent. [9] extended the traditional parity condition model by including non-parity factors, namely, trade, productivity and foreign reserves using panel techniques for quarterly data series over 55 years. [9] obtained outcomes supporting both purchasing power parity (PPP) and International Fisher Effect (IFE) theorems. Moreover, the non-parity factors significantly influenced the exchange rates of Canada, Japan, the United Kingdom and the United States. In a similar approach to [1, 9] analysed the factors which may affect the real exchange rate volatility. [1] also considered the role of both trade and financial openness to formulate the optimal combination of international trade and financial measures for lowering exchange rate volatility. [1] investigated the variations in the real exchange rates for 82 countries from 1974 to 2013 with OLS and IV methods and concluded that the composition of trade and financial openness matters for the stabilisation of reel exchange rates. More specifically, [1] suggested that policies that aim to reduce real exchange volatility should focus on: (i) the composition of financial openness as measured by the type of capital flows (i.e. equity vs. loan-related) and (ii) the role of the structure of trade (i.e. manufacturing vs. non-manufacturing) in the transmission process of shocks to real exchange rate. Herein, it can be asserted that the type of capital control regime is a crucial factor which may vary the impacts on exchange rate volatility. Additionally, the deregulation of financial markets in the era of financial globalisation process has led to an increase in cross-border capital flows, which are widely believed to be an important role on exchange rates. Similarly, it can be inferred that consequences of macroeconomic and financial factors on exchange rate volatility may differ according to the exchange rate regime. Moreover, [10] stressed that exchange rate volatility differed between countries with a floating regime, even if their macroeconomic fundamentals were similar.

In terms of the effects of financial variables and exchange rate volatility, the role of international portfolio flows has become indispensable. There studies in the literature analysing the relationship between exchange rates and flows focus on developed economies [11–13], the minority of the contributions to the literature in the relevant topic for developing countries are conducted by [14–16]. Most recently, [17] studied the effects of equity and bond portfolio inflows on exchange rate volatility using monthly bilateral data for the US vis-a-vis seven Asian developing and emerging countries. Using GARCH models and Markov switching specifications with time-varying transition probabilities in addition to a linear regression model, [17] found that high (low) exchange rate volatility is associated with equity (bond) inflows from the Asian countries towards the US except for the Philippines. Thus, it was suggested by [17] that capital controls could be an effective tool to stabilise the volatility in exchange rates. Along with macroeconomic factors, exchange rates can be highly influenced by variations in different financial markets during periods of prevalent financial integration processes. Herein, it can be asserted that exchange rate volatility can be affected by the volatility in stock returns and vice versa. [18] investigated the possible impacts of the volatility of stock returns in the US, the United

Kingdom and Japan on the volatility of exchange rate changes using EGARCH modelling. [18] found that volatility of home stock returns had a considerable impact on the volatility of exchange rate changes, implying the validity of the asset approach models for exchange rates and the integration of financial markets among these countries. [19] revealed that bilateral exchange rate volatility (relative to creditor countries) was negatively influenced by the stock of external debt, while optimal currency area variables were relatively important for explaining bilateral exchange rate volatility for industrial countries. Similarly, [20] investigated the cross-country differences in the long-run volatility of the real exchange rate both for developing and industrial countries by including trade shocks, output shocks, country characteristics and currency crisis in ARCH estimations. The long-run real exchange rate of developing countries was between 2 and 2.5 times larger than that of industrial countries due to the fact that developing countries had larger shocks (both real and nominal) or to differences in the sensitivity of the real exchange rate to these shocks. Moreover, [20] stressed that after controlling for shocks and sensitivities, differences in residual volatility were strongly correlated with the level of development and to the degree of diversification in the economy. Based on the theoretical and empirical framework of [20, 21] used an enhanced specification by including nominal shocks (categorised as: domestic monetary variables, budget and trade balances and financial market variables) and inflation shocks to model real exchange rate, nominal exchange rate and relative price volatility for developing and industrialised countries. [21] also showed that nominal and real exchange rates had similar (and high) volatility in industrialised countries, whereas nominal exchange rate volatility was considerably higher than real exchange rate volatility in developing countries. Furthermore, [21] found that inclusion of nominal factors led to a sizable reduction in real exchange rate volatility spread between developing and industrialised countries, assuming that all explanatory factors affect real exchange rate volatility through the changes in nominal exchange rate and price level. Using MGARCH and TVCC-MGARCH models to determine the role of monetary, real, and financial variables on nominal exchange rate volatility, [22] investigated the case of selected EMU members and candidate countries. Volatility in the Polish zloty/euro and the Hungarian forint/euro forex markets were affected by the monetary-side of the economy according to the ex-ante analysis. Ex-post analysis of [22] indicated that forex markets in France, Italy and Spain were influenced by monetary and real shocks.

Transmission of import prices to inflation is an important factor identified by monetary policy authorities for price stability, thus variations in exchange rates have been recognised as the major determinant of the degree of pass-through. For the case of emerging countries, [23] stated that implementation of a 'flexible inflation targeting' regime entailed a de facto managed-floating exchange rate with foreign exchange interventions and moderate exchange rate volatility, while 'strict inflation targeting' implied a fully flexible exchange rate regime. In their study, a panel data set for 37 countries was analysed with pooled OLS with time dummies. [23] showed that inflation targeting caused higher exchange rate instability than alternative regimes. Foreign exchange interventions in some inflation targeting countries were more effective in lowering volatility than in non-inflation targeting countries. More specifically, [23] found that foreign exchange interventions in inflation targeting countries played a useful role in containing the exchange rate volatility, especially negative interventions (sales of foreign reserves). However, [24] suggested that optimal monetary policy and the Taylor rule did not prevent exchange rate volatility, whereas pegged exchange rate was better at

stabilising exchange rate volatility. Additionally, [25] stated that volatility of some macroeconomic variables should change in order to reduce real exchange rate volatility. By using a VAR model for New Zealand, [25] found that output and inflation volatility should be increased by approximately 10–15% and 0–15%, respectively to reduce real exchange rate volatility by approximately 25%. [26] developed a type of DSGE model and introduced trend inflation, policy credibility, policy uncertainty and the competitive structure of goods markets for attaining the inflation target. [26] found that stabilising the exchange rate involved a trade-off between real stability and inflation stability and the best monetary policy rule was to stabilise prices of non-traded goods. Similarly, [27] constructed a DSGE model with sticky-prices to analyse the influences of monetary policy on real exchange rate dynamics. [27] emphasised that if a monetary policy rule had a strong interest rate smoothing component, these kinds of models failed to generate high real exchange rate persistence in response to monetary shocks. Increasing policy inertia might decrease real exchange rate persistence, in the presence of persistent monetary shocks.

Even though studies in the literature have analysed the interactions between exchange rate volatility financial and macroeconomic variables, only one study in the literature conducted by [5] examined the interactions between these variables using a PVAR model. They investigated the joint dynamics of exchange rate volatility, real GDP growth, foreign reserves, interest rates and equity index return for a panel set of 29 countries. [5] also analysed the interactions between variables for developing and developed countries separately using PVAR models; however, these countries may have different exchange rates, monetary policies and capital control regimes. Thus, this approach has a weakness since any common pattern cannot exist in the selected country groups. [5] assumed that the correlations between variables might differ in high volatile periods and economic shocks might influence high-frequency and low-frequency components of volatility differently. In this respect, both annual standard deviations of exchange rates and annual exchange rate volatility attributable to high-frequency components were incorporated into their PVAR models. Within this theoretical framework, [5] found weak empirical evidence for a significant difference in the responses of macroeconomic and financial variables to the overall volatility vis-à-vis the high-frequency components. Ref. [5] also found that the effects of exchange rate volatility on macroeconomic and financial variables were stronger for developing countries relative to developed economies. Furthermore, the exchange rate volatility in both measures was significantly related to real GDP, foreign reserves, interest rates and equity index. In this study, I considered the interactions between exchange rate volatility and macroeconomic and financial variables with PVAR modelling for a sample of 10 OECD countries outside the Euro area with floating currency regimes and capital control regimes not classified as "Wall" class according to the IMF. Even though these countries can be classified as developing and industrialised countries, I applied a panel procedure, since [21] implied that the inclusion of other nominal factors caused a sizable reduction in exchange rate volatility spread between developing and industrialised countries. However, dynamic cross-sectional differences were considered in this study, similar to [6], since the panel data set used contains countries with different macroeconomic characteristics. In this study, I took into account SIs and CSHs, occurring when the correlations between the errors of two countries' VARs are not zero and two countries have VARs with different coefficients. By selecting OECD countries implementing floating currency regimes and relatively liberal

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capital control regimes, I eliminate the weaknesses in estimation results which different currency and capital control regimes can cause and thus focus on making policy implications for countries with similar conditions.

3. Research methodology

The relationship between exchange rate volatility and macroeconomic and financial variables was examined using PVAR models estimated over the period 1999:M1 to 2017:M6[1], considering the availability of data for all countries. This paper contributes to the literature by incorporating the differences between interest rate policies of monetary authorities reflected in the short-term interest rates. As reflected in the ordering of variables in PVAR models, the critical importance is given to the exchange rate volatility in the models since exchange rate volatility can be harmful to the economy by raising the risk factor for domestic firms trading internationally and increased prices to hedge against the additional risk premium. I also considered the fact that volatility in exchange rates may have negative consequences on real economic activity via changes in international competiveness. Within Cholesky decomposition, I assumed that variations in exchange rates influence economic activity, referring to the change in industrial production and inflation, particularly through the trade channel. Accordingly, I assumed that changes in economic activity affect the monetary policy stance, which in turn influences the share market. Within this context, I sought to show the effects of exchange rate volatility on GDP, consumer prices, short-term inflation, and share prices, and discuss the possible impacts of exchange rate volatility on economic and financial conditions for the following periods by estimating IRFs and VDCs. Since the study used month data, I particularly considered the role of SI in the estimation process of PVAR modelling. The main motivation of this paper was to test whether changes in the variables under investigation and the interactions between them led to changes in the monetary policy stances of Canada, Czech Republic, Iceland, Israel, Korea, Mexico, Norway, Poland, Sweden and the United Kingdom. Due to the United Kingdom's high vulnerability to financial shocks, the possible impacts of Brexit are also taken into account in this study by analysing the consequences of the shocks in the volatility of exchange rates in the United Kingdom on currency markets and global economy. The motivation to analyse the possible impacts of Brexit through the exchange rates is that there has been a high amount of variation in the British pound/US dollar following the Brexit vote.

To carry out my empirical exercise, daily exchange rate data (exchange rate of a currency against the US dollar) were employed to compute quarterly standard deviations, which measured the overall volatility ($volex_t$). I constructed the filtered series ($filvolex_t$) with IDFT, using a subset of the frequency spectrum of the original exchange rate volatility series.[2] PVAR model specifications took into account the role of DI, SI and CSH by searching for the plausible restrictions in the model and thus the second PVAR model used the filtered series

[1]Although panel models generally use annual data for empirical analysis, there are also studies in the literature that use panel-type models with monthly and quarterly data [28, 30].

[2]I selected the number of steps as 20 for the magnitude and the phase. Alternative frequency component indexes revealed little difference in terms of the results and thus the robustness of the results was verified.

in order to examine the interactions among variables. Industrial production growth rate ($indg_t$) was expressed as the percentage of changes in the related index (base year 2010 = 100) over the previous period. I also incorporated consumer price inflation ($cpri_t$), referring to the change in CPIs (base year 2010 = 100) over the previous period of the current year. The difference between short-term interest rates ($dirt_t$) was computed by subtracting immediate central bank interest rates in the US (irt_t^{usa}) from the immediate central bank interest rates of each country (irt_t^c). I computed the stock returns (sto_t) as the percentage of change in the stock market index (base year 2010 = 100) from the previous month. On the other hand, the consequences of the financial crisis of 2007–2009 for the relations between the variables were incorporated with dummy variables taking the value of 1 for the period from 2008:M1 to 2017:M6. I used the database from the OECD and databases from the relevant central banks. All series were in levels and they were derived using plausible techniques. The ordering of variables in PVAR models was:$filvolex_t$, $indg_t$, $cpri_t$, $dirt_t$, sto_t, respectively. Although theoretical assumptions can lead to changes in the identification of VAR-type of models, alternative ordering of PVAR models' variables showed no significant differences, supporting the robustness of estimation results in this study. Panel root tests with different assumptions showed that the variables were stationary at levels, even at the 1% significance level.[3] Thus, I employed PVAR modelling due to the theoretically accepted interactions among the variables.

4. Results and discussion

PVAR models are a useful tool for macroeconomic policy analysis since there is no need to impose a prior constant on the relationship between the variables. Within this framework, it is necessary to impose the same underlying structure for each cross-sectional unit (country), while a constraint may be violated in practice. Because fixed effects could be correlated with the regressors due to lags in the dependent variable, I employed the Helmert procedure to eliminate the fixed effects similar to [28]. Thus, the lagged regressors were incorporated as instruments to estimate the coefficients of the PVAR model with the GMM procedure. Estimation of PVAR 1 was implemented by choosing the optimal lag order in the PVAR specification and the moment condition. More specifically, I employed the moment and model selection criteria (MMSC), which is analogous to the Akaike Information criterion (AIC), the Bayesian Information Criterion (BIC), and the Hannan-Quinn Information Criterion (HQIC). Hereby, I performed VDCs analyses and computed IRFs and based on a PVAR (1) model. Following [6], I considered the role restrictions involving DIs, SIs and CSHs in PVAR 2. There is DIs if one country's lagged variables affect another country's variables. SIs mean that the correlations between the errors in two countries' VARs are not equal to zero, while there are CSHs if two countries have VARs with different coefficients. In other words, there exists homogeneity when the coefficients on the own lagged variables for the two countries are equal.

[3]Panel unit root test results can be provided upon request.

Based on a PVAR (1) model, I do not ignore any restrictions since the model with all DI, SI and CSH restrictions performed better than any other alternatives, similar to [6]. The dimension of the panel data set used in this study was near the panel data set of [6], while I employed the same prior hyperparameters to produce priors since the performance of this type of PVAR model was verified by [6]. In this respect, Stochastic Search Specification Selection S4, which allows updating priors from the data, was used in PVAR 2.[4]

4.1. Variance decomposition analysis results

I used the variance decomposition analysis based on PVAR 1 model to determine the degree of importance of each variable included in the model. **Table 1** shows that exchange rate volatility in PVAR 1 was of great importance for understanding the variations over the 36-month period, parallel to [9, 21], implying that the PPP theory may be consistent. FEVDs revealed that changes in economic activity play an important role in the variations in exchange rate volatility in contrast to [5]. Up to the following 36th month, industrial production growth accounted for nearly 10% of the variation in exchange rate volatility, while inflation dynamics explained a minimum of 15%. These findings revealed that the mechanism, through which supply and demand dynamics influence exchange rate volatility, is critically important for monetary policy authorities aiming at financial and economic stability in line with [22]. By implementing variance decomposition analysis, I highlighted the role of economic agents' preferences under alternative constraints in an open-economy framework in each country. The variance decomposition exercise also showed strong interactions among economic activity and currency markets in these countries, whereby the structure of foreign trade and competiveness level of firms are critical factors in terms of lowering exchange rate volatility in each country parallel to [20]. On the other hand, VDCs of PVAR 1 provided weak evidence for the effects of shocks in financial markets on exchange rate volatility in these countries in contrast to [17]. Increases in short-term interest rates and stock prices accounted for nearly 10% of the variation in exchange rate volatility in PVAR 1. The related findings implied that volatility in money markets and stock markets may not cause a high amount of volatility in currency markets in contrast to [18]. However, UIP can be consistent in these countries and changes in monetary policy stances may influence the value of both nominal and real exchange rates in line with [22], which in turn affects foreign competiveness. More precisely, the central banks of these countries may induce only a small degree of capital inflows and outflows that can affect currency markets by changing their monetary policy. Similarly, changes in firm values can have an impact on the variability of the current account balance and the need for foreign funds through the changes in the exchange rate values.

4.2. Impulse response analysis results

In **Figure 1**, the responses of exchange rate volatility to positive shocks in short-term interest rates are shown depending on the PVAR 1's impulse responses. Following an increase in the short-term interest rates relative to the US interest rate, the exchange rate volatility (filtered

[4]For the details of the identification of PVAR model with restrictions, see [6, 31].

Forecast horizon	VDCs				
	$filvolex_t$	$indg_t$	$cpri_t$	$dirt_t$	sto_t
1	.9477392	.0359672	.0001868	.0070239	.009083
12	.6723151	.1172815	.1621161	.0282486	.0200389
24	.6475916	.1191467	.1621421	.0516856	.0194341
36	.6314912	.1239062	.1588667	.0662796	.0194562

Table 1. VDCs of exchange rate volatility (filtered series) from PVAR 1.

series) may increase due to a flow of funds into the exchange rate market. This finding was consistent with the Mundell–Fleming (M–F) model and in line with [2, 5, 8, 17]. The IRFs implied that contractionary monetary policy implementations in these countries may lead to a deterioration in stability in currency markets and also other financial markets, which, in turn, may negatively affect the foreign competiveness of these countries and deteriorate real economic activity. IRFs based on PVAR 1 also revealed that increases in inflation rates in these countries can be recognised as a factor negatively influencing economic stability and thus causing an increase in exchange rate volatility parallel to [5, 25]. Increases in inflation and contractionary monetary policy were crucial in terms of the determination of exchange rate volatility. Even though differences between positive and negative shocks may exist in VAR-type models, the actual difference between these two responses seems small and thus I am hard pressed to make the case for using the asymmetric model on economic grounds [29]. Thus, decreases in inflation and expansionary monetary policy stances in these countries may become factors causing stability in the currency market and other financial markets. On the other hand, it is important to determine the role of fluctuations in real economies on exchange

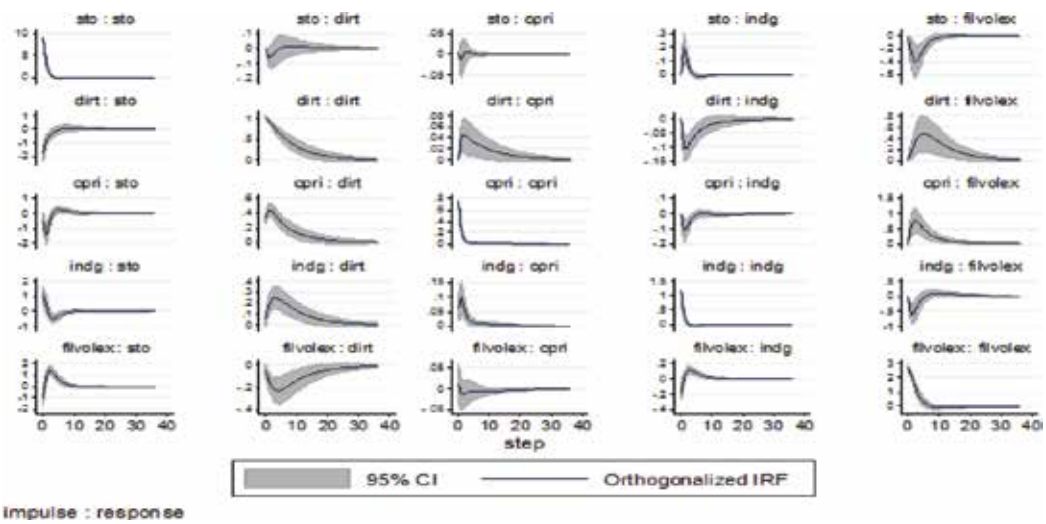

Figure 1. IRFs for the PVAR 1 with filtered exchange rate volatility.

rate volatility. Impulse response exercise revealed that increases in economic growth can positively affect financial and economic stability in line with [25], leading to a fall in exchange rate volatility. Economic growth in these countries may provide foreign currency related to the improvement of current account balance as predicted by the export-led growth hypothesis. Herein, the value of real exchange rates may influence the competiveness of these countries along with the need for foreign technology acquisition. The export-led growth hypothesis requires the liberalisation of foreign trade and capital flows, while IRFs of PVAR 1 indicated that increases in stock prices in these countries may make the financial markets attractive and thus increase the flow of funds into the domestic economy. Therefore, the development of financial markets and maintaining financial economic stability are important targets for economic policy makers to eliminate the negative consequences of exchange rate volatility. Additionally, IRFs exposed that both monetary and non-monetary factors may have a significant amount of impact to examine the volatility in exchange rates in OECD countries parallel to [1]. Herein, the monetary policy-makers in those countries should give a high importance to possible consequences of financial development and openness.

4.3. Search for restrictions in PVAR 2 model and impulse response analysis results

The implications of the Brexit vote have broad and direct economic and political fallout for the United Kingdom and Europe, while the vote is a factor triggering the anti-globalisation movements more generally. Additionally, it has been recognised that the United Kingdom's vote to leave the EU is set to be a long phase of uncertainty in financial markets. Following the Brexit vote, the pound has been a huge focus of attention in the financial markets; moreover, sterling has been down to a 31-year low against the dollar and it is expected that British pound/U.S. dollar will fall gradually. In this regard, it can be inferred that the search for plausible restrictions in the PVAR models may well reflect the impacts from the macroeconomic variables of the United Kingdom to Canada, Czech Republic, Iceland, Israel, Korea, Mexico, Norway, Poland, Sweden and vice versa. For the case of DI restrictions, these may go from one country to another; however, they do not have to go in the reverse direction. **Table 2** indicates that lagged values of the variables of the United Kingdom appear in the PVARs of all remaining countries, while only the lagged values of Iceland, Israel and Sweden can have an impact on the variables of United Kingdom. More precisely, the DI restrictions of the model imply that the determination of international transmission channels from the United Kingdom to the global economy should be determined. It can also be inferred that economic activity in countries with different exchange rate and capital control regimes can influence the economic performance in the United Kingdom through trade and financial channels, despite DI restrictions indicating the importance macroeconomic developments in Iceland, Israel and Sweden for the United Kingdom.

Along with DI restrictions, the relationship between the macroeconomic variables of the countries included in the PVAR 2 can be examined by the search for the SI restrictions. SI restrictions are symmetric in contrast to the DI restrictions; more specifically, if there are SIs from two countries, there are also SIs in the opposite direction. Hereby, we can determine whether the correlations among the errors of two countries are zero or non-zero. **Table 3** shows that among all countries under investigation, Iceland and Israel have SIs with every other country. More precisely, the United Kingdom is particularly under the influence of the changes in the

To	From	Number of DI restrictions
Canada	Czech Republic, Iceland, Israel, Korea, Mexico, Norway, Poland, Sweden, United Kingdom	9
Czech Republic	Canada, Iceland, Israel, Korea, Mexico, Norway, Poland, Sweden, United Kingdom	9
Iceland	Czech Republic, Israel, Sweden, United Kingdom	4
Israel	Iceland, Sweden, United Kingdom	3
Korea	Canada, Czech Republic, Iceland, Israel, Mexico, Norway, Poland, Sweden, United Kingdom	9
Mexico	Canada, Czech Republic, Iceland, Israel, Korea, Norway, Poland, Sweden, United Kingdom	9
Norway	Canada, Czech Republic, Iceland, Israel, Korea, Mexico, Poland, Sweden, United Kingdom	9
Poland	Canada, Czech Republic, Iceland, Israel, Korea, Mexico, Norway, Sweden, United Kingdom	9
Sweden	Canada, Iceland, Israel, Norway, United Kingdom	5
United Kingdom	Iceland, Israel, Sweden	3

Table 2. Countries where DI restrictions do not hold.

Country pairs		
C1	**C2**	**Number of CSH restrictions**
Canada	Iceland, Israel, Korea, Mexico, Norway, Poland, Sweden	7
Czech Republic	Iceland, Israel, Korea, Mexico, Norway, Poland, Sweden, United Kingdom	8
Iceland	Mexico, Norway, Poland, Sweden, United Kingdom	5
Israel	Korea, Mexico, Norway, Poland, Sweden, United Kingdom	6
Korea	Mexico, Norway, Poland, Sweden, United Kingdom	5
Mexico	Norway, Poland, Sweden, United Kingdom	4
Norway	Sweden	1
Poland	Sweden	1
Sweden	United Kingdom	1
Country pairs		
C1	**C2**	**Number of SI restrictions**
Czech Republic	Mexico	1
Iceland	Israel, Korea, Mexico, Norway, Poland, Sweden, United Kingdom	7
Israel	Korea, Mexico, Norway, Poland, Sweden, United Kingdom	6
Sweden	United Kingdom	1

Table 3. Countries where CSH and SI restrictions do not hold.

economics of Iceland, Israel and Sweden. Additionally, SI restrictions implied that the macroeconomic developments in the United Kingdom may mostly be transmitted to the macroeconomic and financial variables of Iceland, Israel and Sweden.

Both DIs and SIs exposed the role of the economy of the United Kingdom for OECD countries, and thus, the possible negative consequences of Brexit on OECD countries should be assessed. SIs highlighted the importance of Iceland and Israel's economic performance for the United Kingdom and the rest of the OECD countries. I can interpret these phenomena as a reflection of the on-going impact of Iceland who has failed to guarantee British savings, and Britain's use of anti-terror laws to freeze the assets of Iceland's crisis-hit banks. SIs also implied the key role of Israel's economy in the international transmission channels in line with the fact that the Israeli economy has been ranked as one of the world's most durable economy in the face of crises; also, Israel is ranked second among foreign countries in the number of companies listed on US stock exchanges. Thus, I can assert that the channels through which the economic and financial crisis spread to the global economy should be clarified by the economic policymakers. On the other hand, 38 of the 45 possible CSH restrictions were not imposed. It was indicated that Canada, Czech Republic, Iceland, Israel, Korea and Mexico are the countries with the fewest heterogeneities with the other countries, whereas Norway, Poland, Sweden and the United Kingdom tend to have homogeneous VARs. The coefficients of the lagged variables of Norway, Poland, Sweden and the United Kingdom were the same; thus, it can be asserted that there may be similar patterns in the relationships between exchange rate volatility and macroeconomic and financial variables in these countries. Moreover, I can assert that the possible consequences of the Brexit phenomena on Norway, Poland, Sweden and the United Kingdom can be identical, leading to the need for similar macroprudential policies.

Additionally, I performed impulse response analysis, focusing on the effects of a positive shock in exchange rate volatility in the United Kingdom, whereupon the effects of Brexit on the variation in exchange rates and its consequences on economic activity were identified. More precisely, I detected the responses of the exchange rate volatility in Canada, Czech Republic, Iceland, Israel, Korea, Mexico, Norway, Poland and Sweden to a 1% increase in British pound/US dollar exchange rate volatility (filtered series) for the following 36 months. According to **Figure 2**, it can be seen that a positive shock in the volatility of British pound/US dollar exchange rate volatility does not lead to significant changes in the values of the currencies of all countries against the U.S. dollar except for the Czech Republic. PVAR 2, considering the role of DI, SI and CSH and restrictions in the estimation process, indicated that volatility in the US dollar/Czech koruna exchange rate may exhibit a statistically significant increase in the following months. Although it is generally recognised that Brexit can cause uncertainties and instability in currency markets, the impact direction of an increase in the volatility of British pound/US dollar on other currencies could not be determined statistically significantly. Additionally, the finding of PVAR 2 could be interpreted as showing that the negative consequences of Brexit may not be transmitted to the rest of the OECD economies and the world through exchange rate markets, despite the high amount of foreign-asset holdings of the United Kingdom.

Impulse responses computed from the PVAR 2 provided results supporting the assertion that the international transmission of Brexit's possible negative consequences can be detected by other channels. More precisely, the empirical exercise in this study suggested the identification

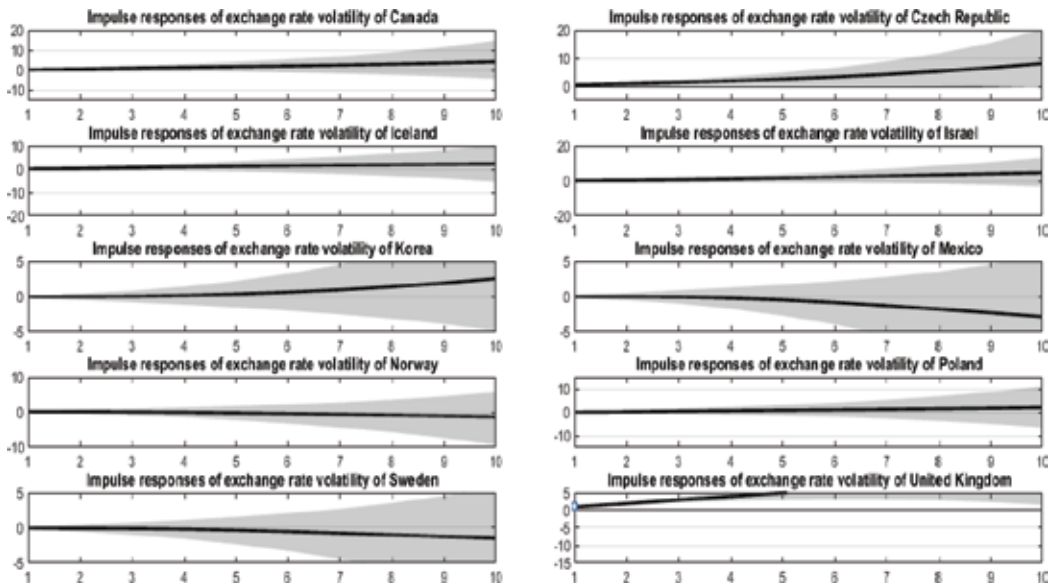

Figure 2. IRFs for PVAR 2 model with filtered overall exchange rate volatility.

of trade and financial channels in detail. Accordingly, I can infer that the possible impacts of a fall in the United Kingdom's export demand on OECD countries should be parameterized by the policy-makers to construct a plausible economic policy. More specifically, plausible quantitative models such as DSGE and VARs can be employed as an empirical framework to study the global effects of consumption and investment shocks. Along with the detection of interactions between consumption and investment patterns of the United Kingdom and OECD countries, my findings highlighted the major role of financial systems in the transmission of Brexit's consequences. It is critically important to determine the effects of the variations in the money and stock markets of the United Kingdom on OECD countries. Herein, the Bank of England's monetary policy decisions can play an important role when the proportion of foreign-asset holdings in the United Kingdom's financial system is taken into account.

5. Conclusions

The estimations of PVAR 1 model indicated that contractionary monetary policy implementation in Canada, Czech Republic, Iceland, Israel, Korea, Mexico, Norway, Poland, Sweden and the United Kingdom can lead to volatility in the exchange rates of these countries, which in turn may influence foreign competiveness and, thus, their current accounts negatively. The VDCs of PVAR 1 did not highly support IRFs, implying that the impacts of changes in short-term interest rates relative to the USA can be small in these countries. Nevertheless, changes in the monetary policy stance of the FED may induce a high amount of variation in macroeconomic and financial variables in the global economy and many economic relationships may be influenced by the FED's possible raising interest rate policy. Eventually, this process may also trigger other central banks to increase their short-term interest rates, which in turn deteriorates

the real economic activity and negatively affects macroeconomic and financial stability. In this respect, relatively low interest rate policies can be important in terms of decreasing and controlling the volatility in exchange rates. According to the IRFs for PVAR 1, industrial production growth can lower the exchange rate volatility, implying that a rise in economic activity in these countries can result in increased export performance, which, in turn provides the amount of US dollars to curb volatility in US dollar quotations. The VDCs of PVAR 1 obtained outcomes parallel to IRFs, revealing that factors causing an increase in aggregate demand and aggregate supply that control inflation and increase economic growth, can be determinative for lowering exchange rate volatility in Canada, Czech Republic, Iceland, Israel, Korea, Mexico, Norway, Poland, Sweden and the United Kingdom. In terms of lowering the exchange rate volatility, sustaining the development of the financial sector can also be crucial since the financial depth will increase. My findings showed that increases in stock returns in the countries considered can promote the flow of funds to domestic financial markets and decrease exchange rate volatility. In this respect, I suggest that monetary policy authorities in these countries employ an open economy DSGE model framework allowing for the role of different preferences and shocks to determine which factors may decrease exchange rate volatility.

Although my study does not focus on the determination of exchange rate and capital control policies to reduce the volatility in exchange rate in the OECD countries under investigation, I suggest that the monetary conducted by the monetary police authorities of those countries should consider the possible impacts of exchange rate shocks, capital and trade flows as shock process within DSGE model. Herein, Brexit has brought a new dimension to the discussion of international transmission mechanisms since it is generally recognised as a crucial factor that may lead to a high amount of variations in currency markets. The possible negative impacts of Brexit were also examined in this study and it was noted that the possible negative outcomes of Brexit cannot be investigated through the links in the exchange rates of OECD countries. Findings of this study implied the identification of other transmission channels by the central banks to analyse the consequences of Brexit, while a high amount of foreign-asset holdings of the United Kingdom can serve as an automatic stabiliser with regard to the trade channel. In this respect, PVAR 2 shows that the economic performance of the United Kingdom can be mostly interrelated with the macroeconomic and financial variables of Iceland and Israel.

Author details

Oguzhan Ozcelebi

Address all correspondence to: ogozc@istanbul.edu.tr

Department of Economics, Istanbul University, Istanbul, Turkey

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Chapter 7

Impacts of Exchange Rate Volatility on Macroeconomic and Financial Variables: Empirical Evidence from PVAR Modeling

Oguzhan Ozcelebi

Additional information is available at the end of the chapter

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Abstract

In this study, Panel Vector Autoregression (PVAR) models are used to determine the impacts of exchange rate volatility on industrial production growth rate, consumer price inflation, short-term interest rates and stock returns for 10 OECD countries. The variance decompositions (VDCs) found that exchange rate volatility can be a secondary factor for the variations in immediate interest rates, implying that Uncovered Interest Rate Parity (UIP) condition should be analyzed by the inclusion of other macroeconomic variables. Impulse response functions (IRFs) expose that volatility in exchange rates can have a positive impact on the liquidity conditions in money market and an increase in real economic activity because investors have to move their money away from currency markets to money markets. The relatively lower impact of exchange rate volatility may arise from the zero bound problem, thus it is emphasized that the examination of impacts on exchange rate volatility on macroeconomics variables should be made both considering conventional and unconventional monetary policy. Although impulse response functions (IRFs) did not detect the significant impact of exchange rate volatility on inflation, VDCs obtained supporting results to exchange rate pass-through (ERPT). I suggest that the monetary policy to be developed should clarify alternative channels that exchange rate may affect inflation.

Keywords: panel vector autoregression, exchange rate volatility, uncovered interest rate parity, exchange rate pass-through, OECD countries

1. Introduction

Introducing financial variables other than exchange rates particularly into the Taylor rule to explore the linkages among economic activity and the financial sector has become familiar

practice in the monetary policy setting [1–3]. Herein, dynamics in stock markets have also been described as an important indicator of the functioning of the economy since a large amount has been invested in stock markets in the prevalent financial integration process. However, currency markets are a promising investment area leading to a great expansion in other financial markets by offering potential high returns on investments and opportunities for expanded diverse portfolios. Additionally, currency markets can be the center of economic analyses since variations in major currencies can be the source of fluctuations in financial markets and have consequences in economic activity that monetary policy authorities should consider. The relationship between interest rates and exchange rates is generally explained by the Uncovered Interest Rate Parity (UIP) rule, stating that the difference in interest rates between two countries is equal to the expected change in exchange rates among the countries' domestic currencies. In this respect, it can be inferred that interest rates may also influence the real exchange rates and, thus, the foreign competitiveness of a country. When the scientific literature is examined, it has been recognized that there have been various studies examining the consistency UIP and focusing on the determination of factors which may lead to deviations from the rule. The validity of UIP rule was also tested by recent studies made after the 2008–2009 Global Financial Crisis in terms of the possible impacts of monetary policy changes on the rule. For instance, [4] obtained results with a Markov-switching vector autoregression (VAR) supporting the consistency of UIP framework, especially in the case of Spain-UK, after the entrance of Spain into the EU. Conversely, [5] found empirical evidence against the UIP in response to an unexpected monetary policy tightening for the UK. After the recent financial crisis, it has become necessary to develop the UIP rule by adding new variables in line with [6]. In the relevant study, they extended the traditional parity condition model by including non-parity factors, namely, trade, productivity and foreign reserves. The results of [6] found support for both Purchasing Power Parity (PPP) and International Fisher Effect (IFE) theorems.

Exchange rate volatility may have negative impacts on economies; however, volatility computations with different methods may lead to considerably different relationships between exchange rate volatility and macroeconomic and financial variables. In this respect, the study by [7] has been recognized as a pioneering approach analyzing the relationship between different exchange rate volatility measures and macroeconomic variables. Grossmann et al. [7] found that there was not strong evidence of significant differences in the responses of macroeconomic and financial variables to the overall volatility vis-à-vis volatility attributed to the high-frequency components. Following to [7], the exchange rate volatility series was transformed into its frequency components. Thus, I generated filtered series with Inverse Discrete Fourier Transform (IDFT) and included them in my Panel VAR (PVAR) model. For the selection of countries to be included in the PVAR model, it is assumed that fixed exchange rates are not supposed to show changes, and thus, exchange rates have no volatility, whereas exchange rates are expected to have a degree of volatility in floating exchange rate regime. Moreover, I limited the extent of my study for the case that exchange rate policy cannot be used to mitigate currency fluctuations. Countries included in the panel data set have both floating currency regimes, while countries having capital control regimes that are not classified as "Wall" according to the IMF are also included in the empirical exercise. Thus, I assumed that capital control policies cannot be implemented by the economic policy makers of those

countries to mitigate exchange rate volatility. In line with the Taylor rule framework, this study examines the interactions between the industrial production growth rate, consumer price inflation, short-term interest rates, stock returns and exchange rate volatility by employing PVAR methodology for 10 OECD countries outside the Euro area (Canada, Czech Republic, Iceland, Israel, Korea, Mexico, Norway, Poland, Sweden and the United Kingdom). More specifically, the possible impacts of exchange rate volatility on the industrial production growth rate, consumer price inflation, short-term interest rates and stock returns are studied. In this respect, the aims of this study are: (i) to compute the proportion of changes in industrial production growth rate, consumer price inflation, short-term interest rates, stock returns that are due to their own shocks, versus shocks from exchange rate volatility and the other variables by estimating the variance decompositions (VDCs) of PVAR model and (ii) to show the responsiveness of the industrial production growth rate, consumer price inflation, short-term interest rates, stock returns in the PVAR to shocks for exchange rate volatility by computing impulse response functions (IRFs). The main hypothesis of this paper is whether volatility in exchange rates has an impact on GDP, consumer price inflation, short-term interest rates and share prices in the following periods. Therefore, the research question of this study is formulated as follows: whether changes in exchange rate volatility causes changes in the monetary policy stance of countries under investigation. It is also intended that the policy implications and suggestions derived from this study shed light on the optimal approach for monetary policy conduction in those countries.

2. Literature review

Due to economic and financial liberalization, international trade and capital flows have increased among countries, leading to significant fluctuations in foreign exchange rates. This phenomenon has caused the development of empirical literature explaining the exchange rate volatility with the related models in both developed and developing countries. Additionally, the number of studies analyzing the effects of foreign exchange volatility is increasing rapidly in the scientific literature. Herein, variations in international mutual fund flows have become critically important since they can influence the relationship among bond, equity and foreign exchange rate markets. In this respect, [8] used VAR modeling by decomposing international equity and bond market returns into changes in expectations of future real cash payments, interest rates, exchange rates, and discount rates. By providing evidence from the US and global markets, they found that inflation news was the main driver of international bond returns. Based on the results of [8], it can be asserted that news related to the macroeconomic developments can also influence the relationship between exchange rates and interest rates and other macroeconomic variables. More specifically, it can also be assumed that deviations from the UIP rule can be analyzed by economic and non-economic factors. In this respect, [9] stressed the role of volatile risk premium to resolve the UIP puzzle. Thus, it is implied that political and social factors in a country can also increase the risk that economic variables are opposed to. According to [10], the deviation from UIP rule could be explained by high uncertainty environments. Ismailov and Rossi [10] derived new exchange rate uncertainty

index using five industrialized countries vis-a'-vis the US dollar, whereupon they measured how unpredictable exchange rates were relative to their historical past. In order to analyze the risk factors that the relationship with exchange rates and interest rates is opposed to, some indicators can be incorporated into the empirical analysis. In this respect, [11] adopted Credit Default Swaps Spreads (CDS) for bonds as a measure of risk premium into wavelet coherency analysis in order to investigate the relationship between the exchange rate changes and interest rates in emerging economies. It was revealed that exchange rates were related to interest rate differentials, risk premium, the FED's monetary policy implementation and its policy uncertainty.

With the 2008–2009 Global Financial Crisis, monetary policy emerged as the most important risk factor for deviations from the rule [12–14]. In this respect, [12] investigated which type of Taylor rule may resolve the UIP puzzle by representing monetary policy as foreign and domestic Taylor rules. On the basis of their model, [12] found that the foreign Taylor rule responded to exchange rate variation but the domestic Taylor rule did not and the model performed better. More specifically, calibrations of [12] showed that the model consisting of foreign and domestic Taylor rules was in line with Fama's negative correlation between interest rate differentials and currency depreciation rates. The significance of Taylor rules in explaining the deviations from the UIP was also confirmed by [14] who exposed that there was a tendency of high interest rate currency to appreciate which in turn caused the deviation from UIP. Tambakis and Tarashev [14] employed a small open-economy model that is subject to domestic and foreign shocks. Along with Taylor rules, [14] enhanced their analysis by the inclusion of IS and New-Keynesian Philips curve equations and it was found that forward-looking rule based on CPI inflation could cause strong UIP violations. In a similar approach, [13] incorporated an open macroeconomic model and it was indicated that UIP puzzle became more pronounced when the monetary policy rule was stricter against inflation. The validity of [13]'s model was tested with regression of future exchange rate returns on interest rate differentials before and after the recent global financial crisis. Park and Park [13] found that economies reducing the reaction of the policy interest rate to inflation in response to the crisis had positive slope coefficients in the UIP regressions after the crisis. On the other hand, interactions between exchange rates and interest rates can be examined without being limited by the UIP theory because the central banks in emerging countries tend to employ the interest rate and exchange rate policies in order to maintain price stability. The transmission channels between exchange rates and interest rates can vary according to the level of development and structural characteristics of countries. The empirical literature on the relationship between exchange rates and interest rates focused on developed countries applying floating exchange rates. Because developing or emerging countries have generally applied fixed of managed type of exchange rate regimes, the empirical exercises on the relationship between exchange rates and interest rates are fewer. Most recently, [15] examined the interactions between interest rates and exchange rates using wavelet-based methodologies for the case of Romania. It was revealed that the short-term relationship was negative in line with the sticky-price models, whereas the relationship was positive and confirmed the Purchasing Power Parity theory in the short term. Andrieș et al. [15] exposed that the relationship between exchange rates and interest rate was fundamentally different in countries implementing a direct inflation targeting because their

central banks had to pay simultaneous attention to both variables in order to achieve their monetary policy targets.

The impacts of exchange rates and macroeconomic variables can also be analyzed within the inflation targeting framework. More specifically, Taylor rules can also be modified by the inclusion of exchange rates and thus variations in exchange rates can have significant consequences on monetary policy conduction. This kind of approach is not limited to a specific framework, but rather contributes to the analysis of more macroeconomic factors. As an asset, exchange rates can be included in the monetary policy formulations of central banks particularity using the Taylor principle as a framework. Mackiewicz-Łyziak [16] investigated the Czech Republic, Hungary, and Poland and found the analyzed central banks might respond to exchange rate changes by increasing interest rates in the case of depreciation of the currency, or vice versa. In addition, central banks can focus on the role of the effects of exchange rates on real economic activity when determining their interest rate policy. Accordingly, [17] employed a theoretical model, namely a type of DSGE model to analyze the consequences of real exchange rate volatility on business cycles. Output volatility increased by up to 22% as the share of foreign denominated debt increased from 0 to 100%. Gumus and Taşpınar [17] also found that real exchange rate fluctuations could be an important source of volatility in emerging markets through their effect on borrowing costs when countries borrowed in foreign currency. On the other hand, both monetary policy and exchange rates can influence macroeconomic variables simultaneously and thus these impacts can be detected with VAR-type of models. In this respect, [18] employed the Bayesian time-varying VAR approach with stochastic volatility model of [19] to explore whether the reaction of output and prices to interest rate and exchange rate shocks changed over time (1996–2012) in the Polish economy. Estimations by [18] showed that interest rate and exchange rate shocks had a time-varying impact on output. Consumer prices might respond to interest rate shocks during high inflation periods, while the effects of exchange rate shocks on price level might decrease over time. By developing a simple open-economy model with imperfect capital mobility, [20] examined whether the policy interest rate and sterilized foreign exchange market intervention could stabilize inflation and output in emerging market countries while attenuating disequilibrium currency movements. According to the calibrations of their model allowing for the role of aggregate demand and foreign real interest rate shocks, foreign exchange intervention led to an improvement in welfare under discretionary monetary policy and inflation targeting. Further, (two-way) sterilized intervention-cum-inflation targeting could provide more positive outcomes in the presence of imperfect capital mobility/asset substitutability.

In order to analyze the impacts of exchange rate variations on economic activity, the concept of exchange rate pass-through to the consumer prices (ERPT) should be clarified. It has generally been acknowledged that the exchange rate pass-through to domestic consumer prices operates in three stages. Firstly, impost prices are influenced; secondly, the changes in exchange rates have impact on producer prices. Consequently, there also exist a channel form producer prices to consumer prices. Additionally, the completion of ERPT is determined by the assumptions of perfectly competitive markets, fully flexible prices and the consistency of law of one price. Thus, it can be inferred that deviations from those situations can cause incomplete ERPT [21]. The vast body of empirical literature on ERPT indicates that pass-through is highest for import

prices and lowest for consumer prices, while cross-country variation in the pass-through can be accepted as a major factor. In terms of the analysis of the role of cross-country variation, [22] used VAR type of models and it was revealed that ERPT was high and relatively rapid in most Commonwealth of Independent States (CIS) countries as well as a large heterogeneity among countries. CIS countries are also studied with VAR-type of models by [23]. More specifically, they performed short- and long-term analysis for ERPT using heterogeneous panel frameworks and control for cross-sectional dependence. Beckmann and Fidrmuc [23] showed that average pass-through after 1 year was 30–50% for the dollar and around 20% for the euro. According to the estimates of [23], there existed heterogeneous short-run ERPT across countries and countries with high-energy imports from Russia generally had higher exchange rate pass-through. Beckmann and Fidrmuc [23] also exposed that the long-run pass-through was around 60% for both currencies. Most recently, [21] studied the ERPT for the case of CIS countries using heterogeneous panel frameworks and control for cross-sectional dependence. It was found that the ERPT was relatively high and rapid for CIS countries in the case of the nominal effective exchange rate, but not significant for the bilateral rate with the US dollar.

Inflation dynamics can also be closely related to the degree of ERPT particularly in countries having current account deficits. Accordingly, this phenomenon can also become a determinative factor in the formulation of monetary policy. According to some studies in the literature [24–26], there was a lower inflation rate to be associated with lower ERPT and thus it was implied that a credible inflation targeting policy could reduce ERPT. For instance, [25] used both a theoretical and empirical OSL model to analyze the ERPT using a large database that includes 1979–2000 data for 71 countries. It was found that there was a strong evidence of a positive and significant association between the pass-through and the average inflation rate across countries and periods. Barhoumi and Jouini [24] used quarterly data for 8 developing countries over the period 1980–2003 for their empirical model and it was found that a decline in the pass-through to consumer prices could influence the conduct of monetary policy because changes in exchange rate pass-through had important implications for the international transmission of shocks. Barhoumi and Jouini [24] also showed that "expenditure-switching" effects might occur when import prices were less responsive to movements in the exchange rate. Along with inflation targeting policy, some studies in the literature suggested that more flexible exchange rate regime led to decrease in ERPT, particularly for emerging markets [27, 28].

Due to the possible negative impacts of exchange rate volatility, economic agents and particularly the firms can highly be opposed to exchange rate risk. Additionally, [29] stated that a trader's response to exchange rate risk was related to the risk attitude. More specifically, the risk-averse trader would avoid trade in response to an increase in exchange rate fluctuations. On the other hand, the risk-tolerant trader would raise trade today to decrease any loss of income in the future. Accordingly, it can be asserted that the overall dominance of risk-averse or risk-tolerant traders may determine the ultimate impact of exchange rate uncertainty on trade flows. Influences of exchange rate volatility on trade follows can be studied both between one country and the rest of the world and aggregate trade flows between two countries. Nevertheless, [30] obtained empirical results supporting the rate volatility could have positive and negative effects on the trade flows and those effects could be country specific. The outcomes of [30] were also supported by recent studies conducted by [31–34]. Following to [30, 35] assumed that the effects of exchange rate volatility on trade flows could

be asymmetric and they are sourced from the change in expectations of traders when a currency depreciates as compared to a case when that currency appreciates. More specifically, [35] investigated the asymmetric effects by using monthly data from 54 Malaysian industries that export to the US and from 63 Malaysian industries that import from the US. It was found that there existed both short-run and long-run asymmetric impacts in almost one-third of the industries. Moreover, [35] identified industries that were affected when volatility increased versus those that were affected when volatility decreased. The results of [35] were partially supported by [36] who explored the effects of exchange rate volatility on the exporting behavior of firms using a very rich Turkish firm-level data for the period of 1989–2013. It was found that although exchange rate volatility had a negative impact on foreign sale share of firms, the magnitude and the sign of the effect differed substantially across firm classifications. It has also been generally recognized that one of main international transmission channels of exchange rates operates through stock markets due to the rising volume of international trade among firms quoted in stock markets. In this respect, [37] investigated the relationship between exchange rates and stock markets by the inclusion of oil prices and global economic activity into their empirical model. More specifically, they employed a Structural VAR (SVAR) and a trivariate DIAGONAL BEKK GARCH model to analyze the interactions among exchange rate changes, and stock market returns in China and the US from February 1991 to December 2015. Bai and Koong [37] found that there was a significant parallel inverse relation between the US stock market and the dollar and between the China stock market and the exchange rate. Furthermore, the possible impacts of exchange rates on international trade can be studied within logistics perspective. Kim [38] studied the effects of exchange rates on South Kore's loaded port cargo throughput along with global economic activity and the volatility of Baltic Dry Index as dependent variables using cointegration techniques. Kim [38] concluded that appreciation of exchange rate and increase in global economic activity had positive impacts on loaded port cargo throughput.

3. Research methodology

In this study, PVAR modeling was employed to estimate the relationship between exchange rate volatility and macroeconomic and financial variables over the period 1999:M1 to 2017:M6,[1] taking into account the availability of data for all countries. More specifically, we intended to detect the possible effects of the exchange rate volatility on industrial production growth rate, consumer price inflation, the difference between short-term interest rates and stock returns, and discuss the possible impacts of exchange rate volatility on economic and financial conditions for the following periods by estimating IRFs and VDCs. As for the empirical exercise, daily exchange rate data (exchange rate of a currency against the US dollar) were used to obtain quarterly standard deviations, which measured the overall volatility ($volex_t$). I generated the filtered series ($filvolex_t$) with Inverse Discrete IDFT, using a subset of the frequency spectrum of the original exchange rate volatility series.[2] Industrial production

[1] Panel models are generally estimated with annual data, however the scientific literature contains studies using panel-type models with monthly and quarterly data [39, 40].

growth rate ($indg_t$) was computed as percentage of changes in the related index (base year 2010 = 100) over the previous period. Similarly, consumer price inflation ($cpri_t$) denotes the change in CPIs (base year 2010 = 100) over the previous period of the current year. The difference between short-term interest rates ($dirt_t$) was generated by subtracting immediate central bank interest rates in the US (irt_t^{usa}) from the immediate central bank interest rates of each country (irt_t^c). I obtained the stock returns (sto_t) as the percentage of change in the stock market index (base year 2010 = 100) from the previous month. This paper contributes to the existing literature by including the differences between interest rate policies of monetary authorities reflected in the short-term interest rates. The PVAR model incorporates the role of consequences of the 2008–2009 Global Financial Crisis by using dummy variables taking the value of 1 for the period from 2008:M1 to 2017:M6. In order to derive the variables of the model, the database from the OECD and databases from the relevant central banks are applied.

I firstly performed panel unit root analysis to determine the appropriate type of my empirical model. Panel root tests with different assumptions indicated that the variables were stationary at levels, even at the 1% significance level.[3] Thus, I employed PVAR modeling due to the theoretically assumed interactions among the variables. The ordering of the variables in the vector is expressed as ($filvolex_t, indg_t, cpri_t, dirt_t, sto_t$), implying that the critical importance is given to the exchange rate volatility in my study. More precisely, I accepted that exchange rate volatility may be harmful to the economy by raising the risk factor for domestic firms trading internationally and increased prices to hedge against the additional risk premium. I also considered the fact that volatility in exchange rates may have negative impacts on real economic activity via changes in international competitiveness. Within Cholesky decomposition, it was assumed that changes in exchange rates have impact on industrial production and inflation, particularly through the trade channel. Another assumption determining the ordering of the variables in my PVAR model is that changes in economic activity influence the monetary policy stance, which in turn affects the share market. Although different theoretical assumptions can cause changes in the identification of VAR-type of models, alternative ordering of PVAR models' variables showed no significant differences, supporting the robustness of estimation results of my PVAR model.

4. Results and discussion

PVAR models have been recognized as an effective tool to analyze the impacts of macroeconomic policy conduction because imposing a prior constant on the relationship between the variables is not needed. However, it is necessary to impose the same underlying structure for each cross-sectional unit (country), while a constraint may be violated in practice. In line with [40], I used the Helmert procedure to remove the fixed effects because fixed effects may be

[2] I chose the number of steps as 20 for the magnitude and the phase for the IDFT analysis. The robustness of the results was verified because alternative frequency component indexes showed little difference from my IDFT analysis.

[3] I can provide panel unit root test results upon request.

correlated with the regressors. Accordingly, I used the lagged regressors as the instruments of the model instruments to estimate the coefficients with the GMM procedure. The optimal lag length of the PVAR model was suggested by the Moment and Model Selection Criteria (MMSC), whereupon PVAR model was estimated and VDCs and IRFs were computed based on a PVAR (1) model.

4.1. Variance decomposition analysis results

The degree of transmission of exchange rate volatility on the volatility of other financial and economic variables is a crucial issue addressed by monetary policy makers. As shown in **Tables 1–4**, VDCs of PVAR revealed that the proportion of exchange rate volatility to variation in GDP growth rate, inflation, differences in short-term interest rates between the US and OECD countries, and returns on stock price index were not found as the primary decisive factor. These findings revealed that exchange rate volatility may not become a primary factor leading to volatility in industrial production growth rate, inflation, short-term interest rates and stock prices partially in line with [17, 18]. According to the VDCs of PVAR, it was indicated that exchange rate volatility accounted for nearly 10% of the variation in industrial production growth up to the following 36th month. In this respect, it can be inferred that exchange rate volatility can influence the supply and demand dynamics significantly by leading to changes in international competitiveness level of the OECD countries under investigation. Due to the foreign currency denominated debt level in those OECD countries, economic agents can be significantly opposed to exchange rate risk arising from exchange rate volatility. The role of exchange rate volatility in affecting the variations in inflation rate was found as in a significant level. VDCs showed that variations in inflation level were approximately explained for 10% by exchange rate volatility up to the following 36th month, revealing the importance of ERPT for the OECD countries under investigation. According to VDCs of PVAR, industrial production growth rate and inflation were primarily explained by their own past values, indicating the importance of supply and demand dynamics and inflation expectations. Financial markets and monetary policy decisions played a secondary role in explaining the variations in industrial production growth rate and inflation, revealing that these financial markets cannot be the main source of the deterioration in the economic activity of these countries despite the fact that financial markets have been developing over the last decades. Thus, I suggest the investigation of supply and demand shocks on industrial production growth and inflation considering the role of the decisions of different economic agents in a

Forecast horizon	VDCs				
	$filvolex_t$	$indg_t$	$cpri_t$	$dirt_t$	sto_t
1	0	1	0	0	0
12	0.058926	0.880153	0.035353	0.000249	0.025318
24	0.109118	0.82907	0.035718	0.000795	0.025299
36	0.119114	0.818611	0.035747	0.001238	0.02529

Table 1. VDCs of industrial production growth rate from PVAR.

Forecast horizon	VDCs				
	$filvolex_t$	$indg_t$	$cpri_t$	$dirt_t$	sto_t
1	0	0.002346	0.997654	0	0
12	0.043537	0.013542	0.924498	0.016763	0.00166
24	0.10393	0.016113	0.857737	0.020293	0.001927
36	0.124067	0.017302	0.834486	0.022104	0.002041

Table 2. VDCs of consumer price inflation from PVAR.

Forecast horizon	VDCs				
	$filvolex_t$	$indg_t$	$cpri_t$	$dirt_t$	sto_t
1	0	0.034652	0.094121	0.871227	0
12	0.047749	0.264064	0.048448	0.624629	0.01511
24	0.05082	0.280703	0.040757	0.609567	0.018153
36	0.052191	0.287624	0.037563	0.603167	0.019455

Table 3. VDCs of short-term interest rate difference from PVAR.

Forecast horizon	VDCs				
	$filvolex_t$	$indg_t$	$cpri_t$	$dirt_t$	sto_t
1	0	0.0151747	0.003866	0.0038903	0.9770691
12	0.0470597	0.0217683	0.066185	0.004263	0.860724
24	0.0473945	0.0218706	0.0671909	0.0060914	0.8574527
36	0.0472988	0.022397	0.0671949	0.0075241	0.8555852

Table 4. VDCs of stock returns from PVAR.

plausible DSGE framework. Nevertheless, PVAR model's VDCs highlight that the value of exchange rates and their volatility can have considerable consequences on economic conditions and thus cause financial and economic instability.

Similarly, the variations in the immediate rates were mainly driven by their own shocks up to the following 36th month in these countries, emphasizing that the way in which immediate interest rates are influenced by their past values should be parameterized. Hence, the monetary policy authorities, intending to control economy-wide interest rates and achieve the objectives of monetary policy, should determine money market dynamics and interactions among interest rates at different maturities. On the other hand, determination of the role of exchange rate volatility on short-term interest rates within VDCs can expose what level of deviation from the UIP rule may be in the following periods. VDCs of PVAR showed that exchange rate volatility accounted for nearly 5% of the variation in difference between immediate interest rates. Up to the following 36th month, industrial production growth explained

for nearly 30% of the variation in difference between immediate interest rates, whereas inflation dynamics has a minor role on the same variable. VDCs implied that interest rate decisions taken by the central banks of relevant OECD countries and the FED are due to the change in real economic activity. More specifically, developments in goods and services markets are crucial for the variations in short-term interest rates for the countries under investigation. VDCs of PVAR model stressed the minor importance of capital market for explaining the variations in difference between short-term interest rates. Stock returns account for nearly 2% of the variation in immediate interest rate in those countries. Accordingly, VDCs of PVAR indicated that deviations in the difference between immediate interest rates can be significantly explained by the other variables of the model. In line with [12–14], it can also be interpreted that UIP rule cannot be recognized as sufficient enough to explain the variations in short-term interest rates. VDCs suggested enhancement of the UIP rule by the inclusion of macroeconomic and financial variables parallel to [6]. Furthermore, I found that a considerable portion of the variations in stock prices was accounted for by their past values in PVAR. Firms quoted on the stock exchanges of these countries can be exposed to interest rate and/or exchange rate risk. Moreover, exchange rate volatility and past values of stock prices may play a major role in analyzing the future trends of stock prices; therefore, investors and policy makers along with the incorporation of economic and political factors can employ technical analysis methods.

4.2. Impulse response analysis results

The IRFs revealed that the value of a home currency is a crucial factor for interest rates. More precisely, changes in exchange rate markets led to significant changes in the dynamics of money markets, and this phenomenon also influenced monetary policy implementation and vice versa. IRFs depending on PVAR revealed that immediate interest rates of the countries studied were negatively affected due to positive shocks in exchange rate volatility. This finding is consistent with the IFE and in line with [6, 8], implying that despite a domestic flow of funds causing instability in currency markets, it may promote real economic activity through the credit channel. Volatility in exchange rates may prompt investors to move their money away from currency markets to money markets in these countries. Impulse response exercise revealed that pricing in bond markets can be positively affected by exchange rate volatility due to capital inflows to these countries along with the possible increase in firm values (**Figure 1**).

Despite being generally assumed that exchange rate volatility may negatively influence the financial and economic stability, IRFs of PVAR revealed that economic growth in these countries was triggered due to the increasing availability of domestic funds for households and firms. Since the decisions of economic agents are influenced by the value of exchange rates, exchange rate volatility is also crucial in terms of affecting the supply and demand dynamics and thus the price level. Despite the impulse responses implying that real economic activity can be triggered due to the increase in variations in exchange rates, no statistically significant responses of inflation to exchange rate volatility were found. Thus, exchange rate volatility may not have a significant impact on the direction or the supply and demand that can change the price level permanently. More precisely, capital flows in these countries may affect the economic conditions without having an impact on the price level in terms of increasing and

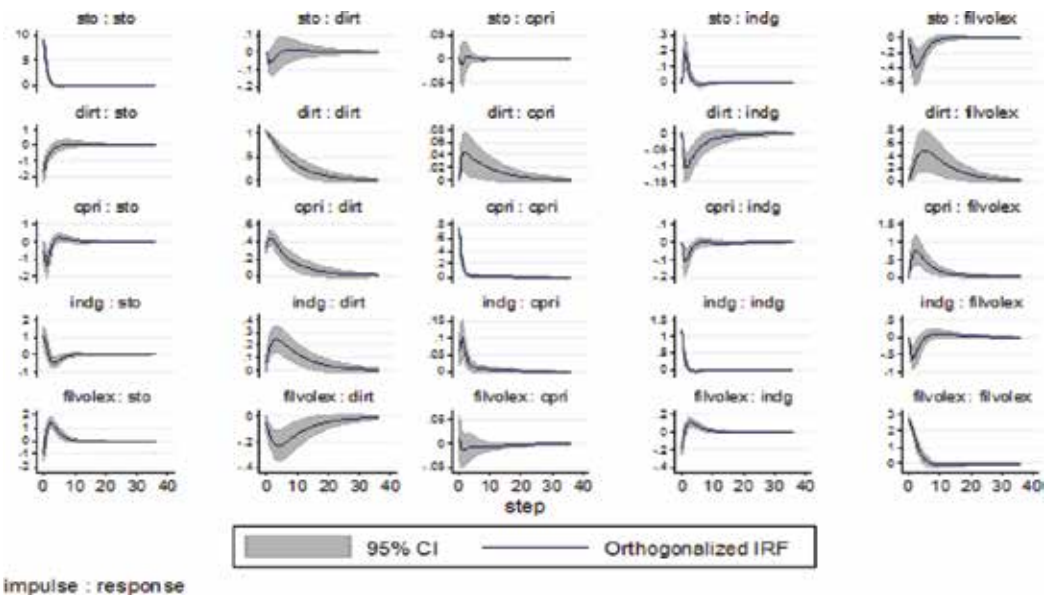

Figure 1. IRFs for the PVAR with filtered exchange rate volatility.

decreasing inflation. Accordingly, exchange rate volatility may not cause a considerable amount of volatility in the price level in these countries in contrast to ERPT.

5. Conclusions

In this study, the PVAR model is estimated considering the interactions between industrial production growth rate, consumer price inflation, short-term interest rates, stock returns and exchange rate volatility for 10 OECD countries outside the Euro area. In this respect, VDCs analysis is performed to determine the role of exchange rate volatility in explaining the variations in the other variables of the model for the following periods. According to the VDCs of my PVAR model, it is implied that there can be variations from the UIP rule. More specifically, VDCs indicated that exchange rate volatility may have a secondary role in explaining the variations in immediate interest rate difference between the US and selected OECD countries. According to the VDCs of my PVAR model, the importance of the enhancement of the analysis of the UIP rule by the inclusion of other variables is revealed. VDCs showed that variations in immediate interest rate difference are mainly explained by the past its past value, thus I can interpret that the FED's and ECB's interest rate policy decisions can be crucial as a conventional monetary policy tool. Because VDCs showed that industrial production growth is also important to the variation in the immediate interest rate difference, I can assert that it might be useful to study the effects of supply and demand shocks in the open-economy framework by the DSGE. Along with the UIP rule, VDCs did also not have strong evidence for the consistency of IFE because VDCs found that only a small part of the variations in short-term interest rate difference is explained by

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the consumer price inflation. The relatively lower impact of inflation and exchange rate volatility on immediate interest rates differences can be sourced from the possible zero bound interest rate problem in the US. However, it can be assumed that inflation and exchange rate volatility may have considerable effects on different interest rates in the money market and also inflation and exchange rate volatility may have impact on indicators related to unconventional monetary policy. Thus, I suggest that the impacts of exchange rate volatility and inflation should also be explored in an unconventional monetary framework. Empirical finding of the study also stresses the derivation of optimal monetary policy framework examining the effects of exchange rate volatility on economic activity through alternative channels because VDCs indicated that exchange rate has a significant impact on inflation in line with ERPT.

On the other hand, impulse response analysis from PVAR showed that volatility in exchange rates of these countries may lead to a fall in their interest rates, which, in turn, may stimulate real economic activity via the credit channel. I can infer that even though exchange rate volatility in these countries may arise from capital inflows, these flows may increase the liquidity in money markets and thus decrease the interest rate difference relative to the US interest. Volatility in exchange rates can affect the risk-taking behavior of investors in exchange rate markets negatively and can canalize the investors' portfolios into money markets. These implications have also been supported by the findings of impulse response analysis showing that exchange rate volatility may have a positive impact on economic growth. Thus, investors can move away from currency markets to money markets due to the increasing exchange rate volatility, while economic growth may be promoted within the credit channel framework. However, there has been a consensus on economic grounds that exchange rate volatility may be the major source of macroeconomic instability due to the contagion effects among financial markets and economies. Despite exchange rates highly influencing inflation trends through the changes in import prices, impulse response analysis did not detect a statistically significant effect of exchange rate measures on inflation. According to the IRFs from PVAR, exchange rate volatility did not have a significant impact on aggregate demand and aggregate supply to lead to considerable changes in inflation. Thus, exchange rate volatility cannot influence the dynamics of business cycles and thus cannot become a major factor leading to an inflation problem. However, exchange rate volatility can determine the amount of exchange rate risk that firms can be opposed to; therefore, exchange rate volatility is a crucial issue that should be monitored by central banks in order to prevent contagion of negative microeconomic developments to macroeconomic activity and stability.

Author details

Oguzhan Ozcelebi

Address all correspondence to: ogozc@istanbul.edu.tr

Department of Economics, Istanbul University, Istanbul, Turkey

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Chapter 8

Struggles of Rural Micro, Small and Medium Enterprises for Bank Finance: Role of District Industries Centres in India

Maumita Choudhury

Additional information is available at the end of the chapter

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Abstract

MSMEs are particularly important for emerging countries, primarily because of their potential in job creation. The MSEs are more than just GDP earners; they are instruments of inclusive growth which touch upon the lives of the most vulnerable, marginalised, women and the most skilled. Being the largest source of employment after agriculture, the MSE sector in India enables 650 lakh people. MSEs also act as ancillary industries for large scale industries. Yet, lack of access to finance is a major obstacle to their growth. In addition to limited development of industries in NER, there is limited availability of data on whatever industries exist there. Around 54% of industrial units are concentrated in Assam among NE states. There were 37,356 registered MSME units in Assam providing employment to 2.05 lakh persons till the end of March 2013. The SLBC data showing the credit disbursals towards MSME sector by commercial banks inAssam do not show a favourable picture. Formal lending sector is always preferred over informal sector by the MSMEs. The study aims to find out the characteristics of MSMEs operating under rural villages in Assam and also the various problems encountered by them in obtaining finance from banks.

Keywords: rural MSME, MSME financing, bank loans, DIC

1. Introduction

The definition of MSMEs differs across nations. In India, the limits for manufacturing/service enterprise, as notified by Ministry of Micro, Small and Medium Enterprises are as mentioned in **Table 1**.

Manufacturing sector	
Enterprises	**Investment in plant and machinery**
Micro	Does not exceed 25 lakh rupees
Small	More than 25 lakh rupees but does not exceed 5 crore rupees
Medium	More than 5 crore rupees but does not exceed 10 crore rupees
Service sector	
Enterprises	**Investment in equipment**
Micro	Does not exceed 10 lakh rupees
Small	More than 10 lakh rupees but does not exceed 2 crore rupees
Medium	More than 2 crore rupees but does not exceed 5 crore rupees

Table 1. Limits of investments for micro, small and medium enterprises.

MSMEs are particularly important for emerging countries, mainly because of their potential in job creation. The Eleventh Five Year Plan reports that MSMEs have been recognised as engines of economic growth. The MSEs are more than just GDP earners; they are instruments of inclusive growth which touch upon the lives of the most vulnerable and the most marginalised. Being the largest source of employment after agriculture, the MSE sector in India enables 650 lakh people. MSEs also act as ancillary industries for large scale industries providing them with raw materials, vital components, and backward linkages. This sector seeks to empower people to break the cycle of poverty and deprivation. In addition to limited development of industries in NER, there is limited availability of data on whatever industries exist there. Around 54% of industrial units are concentrated in Assam among NE states. There were 37,356 registered MSME units in Assam providing employment to 2.05 lakh persons till the end of March 2013.

MSMEs need special credit policy especially at the start up stages. The study aims to find out the characteristics of MSMEs operating under rural villages in Assam and also the various problems encountered by them in obtaining finance from banks.

1.1. Registering with DIC

The District Industries Centre is the institution at the district level, which provides all the services and support facilities to the entrepreneur for setting up micro, small and medium enterprises. This included identification of suitable schemes, preparation of feasibility reports, arrangements for credit facilities, machinery and equipment, provision of raw materials and development of industrial clusters etc. The various schemes that are being implemented by the DIC, Kamrup to provide financial assistance to the MSME units are as follows:

1. Sarothi: The basic objective of the scheme is to provide financial assistance in the form of loan with Interest subvention @ 5% P.A through a designated bank.

2. Biponi: The objective of the scheme is to support to the micro & small enterprises to participate in different trade fairs and events within the state, in the country and abroad for marketing of their products and also getting the exposure.

3. Boneej: This is a special scheme to assist the rural industries of the state by providing special grant for rural industrial enterprises in traditional and micro sector in Assam. It is proposed to provide Rs. 25,000.00 (Rupees twenty-five thousand) as a grant to the industries located in Rural areas only where the annual turnover is less than Rs. 5 lakh.

4. Transport Subsidy Scheme (TSS, 1971)/Freight Subsidy Scheme (FSS), 2013: The transport subsidy scheme (TSS) was introduced on July 23, 1971 to develop industrialisation in the remote, hilly and inaccessible areas and re-introduced as freight subsidy scheme from 2013. Under the scheme, transportation cost on movement of raw material/finished goods to and from the location of the unit to the designated rail head is reimbursed for a period of 5 years from the date of commencement of commercial production. However, fresh registration has been discontinued from 2016.

5. Angel Fund Scheme: The angel fund scheme is designed to give gainful employment to the first generation entrepreneurs through providing soft loan. The purpose of the scheme is to provide easy loan to skilled as well as un-skilled entrepreneurs for starting or developing micro enterprises under Manufacturing & Service sector, Agriculture & Allied activities or any other sector for gainful employment.

6. North-East Industrial and Investment Promotion Policy (NEIPP), 2007: Under this scheme, all new units as well as existing units which go in for substantial expansion and which commence commercial production within the 10 year period from the date of notification of NEIIPP, 2007 will be eligible for incentives for a period of 10 years from the date of commencement of commercial production.

7. Prime Minister's Employment Generation Programme (PMEGP): Government of India has approved the introduction of a new credit linked subsidy programme popularly known as DIC loan, by merging the two schemes that were in operation till March 31, 2008 namely Prime Minister's Rojgar Yojana (PMRY) and Rural Employment Generation Programme (REGP).

The limits of funding under PMEGP are as shown in **Table 2**.

The balance amount of the total project cost will be provided by Banks as term loan as well as working capital. As per RBI guidelines the project costing up to Rs. 5 lakhs under PMEGP loans are free from collateral security.

Though registering with DIC is not compulsory for the MSME units, doing so is beneficial for the economy and the MSMEs. It helps them avail some benefits for such units such as:

- Credit direction (Priority sector lending)
- Differential interest rates

Categories of beneficiaries under PMEGP	Beneficiary's contribution (of project cost)	Rate of Subsidy (of project cost)	
		Urban	Rural
General category	10%	15%	25%
Special (including SC/ST/OBC/Minorities/Women, Ex-servicemen, physically handicapped, NER, hill and border areas, etc.	5%	25%	35%

Table 2. Funding under PMEGP according to categories.

- Excise exemption schemes
- Exemption under direct tax laws
- Statutory support such as reservation and the Interest on Delayed Payments Act.

Gurjar and Sudindra [1] found through trend analysis that the registration of MSMEs in India has a fluctuating trend and declined in growth rate over the last few years. It has declined by 22% in 2007–2008, 21% in 2008–2009, 23% in 2009–2010, 31% in 2010–2011, 41% in 2011–2012, 33% in 2012–2013 and 14% in 2013–2014. Average growth rate of registered MSMEs has declined by 23%. Yadav [2] reported from annual MSME census that only 1.5 million MSMEs are in registered segment while the remaining 24.5 million that constitute 94% of the units are in unregistered segment.

2. Review of literature

Venkatesh and Kumari [3] states that the significance of MSMEs is attributable to their calibre for employment generation, low capital and technology requirement, promotion of industrial development in rural areas, use of traditional or inherited skill, use of local resources, mobilisation of resources and exportability of products. The sector generates around 100 million jobs through over 46 million units situated throughout the geographical expanse of the country. With 38% contribution to the nation's GDP and 40 and 45% share of the overall exports and manufacturing output, respectively, it is easy to comprehend the salience of the role they play in social and economic restructuring of India. They further stated that only 4% of micro, small and medium enterprises (MSMEs) fall within the purview of the Indian banking system and therefore the small scale industries need to be strengthened and supported. The numerous initiatives introduced in the past few years are a step in the right direction as they contribute to the well-being of the individuals engaged in small scale industries which positively affects the progress of the economy as a whole. Shilpi [4] found that the contribution of the micro, small and medium non-farm activities is substantial both in terms of employment and value added in Bangladesh. There are about 4.25 million MSM enterprises in Bangladesh and nearly 70% of them are located in rural areas. The rural financial markets

in Bangladesh include formal and micro-finance institutions and informal sources and continue to be inadequate to meet the demand of the rural population. The author added that the transaction costs of providing and receiving financial services in rural areas are high, because of smaller loan sizes, more dispersed geographical coverage, lack of information about potential borrowers, high risk of default, and difficulty of enforcing contracts in the case of default.

Chauhan [5] wrote that the majority of India's population resides in villages and agriculture and allied activities constitute their major occupation, but the traditional occupational structure of India got destroyed by replacement of agriculture and craftsman production by the British superimposed colonial mode of production. A SWOT analysis conducted by the author on micro and small enterprises in rural areas revealed one of their major weaknesses as high rate of interest on available modes of finance. Das [6] conducted a study in the District of Ganjam in Orissa, which found that the largest weakness for small business owners is to raise finance. The author stated that many small business owners were found to be forced to invest their own funds into their business because institutional lenders like banks and government financial corporations are unwilling to advance money to these small units. According to Barslund and Tarp [7], rural households strongly rely on informal credit arrangements with neighbours, friends and relatives to start a micro enterprise rather than the availability of formal credit institutes. They found that local access to formal finance does not seem to be an important factor when it comes to the individual decision to start a micro enterprise. Priscilla et al. [8] have found that most small business owners do not keep records, have limited access to financial services and are mainly dependent on unregulated financial institutions. Low levels of financial literacy of the small business owners make them more prone to business shocks and more difficult to sustain or stir a business to grow. Kumar and Sharma [9] stated that finance is the lifeblood of business but majority of Indian MSMEs are falling in unorganised sector and hence struggling for regular credit flow. MSMEs require timely and adequate capital infusion which is not feasible through informal sources but through term loans and working capital loans by formal sources. The author has noted that over the years there has been a significant increase in credit extended to this sector by the banks but there still exists a huge gap between credit supply and demand by the sector. MSMEs face problem with access to adequate and timely credit at a reasonable cost. The statistics compiled in the fourth census of MSME sector revealed that only 5.18% of the units had availed finance through institutional sources, 2.05% through non-institutional sources and 92.77% of MSME units dependent on self-finance of informal sources. Sambrani et al. [10] noted that the Indian rural entrepreneurs are been face some major challenges such as low scope for external funds mainly due to lack of ability to produce tangible security. Loan sanctioning is a tedious process and is time consuming. Rural entrepreneurs face lack proper financial knowledge and have very low access to financial training. Rural entrepreneurs are seen to prefer borrowings from local Zamindars (Landlords) or from regional rural banks who sometimes charge unreasonable interest rates.

Sohns and Diez [11] said that the mere existence of a bank in the village is not sufficient for starting a micro enterprise. They said that it is more important that the bank provides

affordable micro loans. Kumar et al. (2014) in his study in Orissa observed that public sector banks are playing the dominant role in catering to the MSME sector. One reason behind this could be that PSU bank branch network has been growing at a much faster rate than their private sector counterparts especially in rural areas. Arsjah and Djamaris [12] inform that the Indonesian government encourages the banks to have at least 20% of their portfolio in small medium enterprise (SMEs). This policy requires a lot of commitment from banks as lending to this sector requires specific treatment. Developing microenterprises must be a priority in order to prepare the facing challenges. The clients' limitation and the banks' interest must be formulated such that the loans delivery mechanism can provide access for microenterprises without eliminating principles and prudential banking. Patnaik et al. [13] has tried to focus on how sometimes stringent banking requirements makes it difficult for MSME borrowers to obtain desired credit. Author has observes from MSME reports that 92% of the MSMEs have no finance, 5% are getting loan from institutional sources and 3% are receiving credit from non-institutional sources. Therefore he feels that simplification of documentation process can help to ease credit procurement and will certainly provide a big push for the sector. Mandalaa et al. [14] conducted a case study in a rural bank in Bali, which followed the procedure of submitting application, data verification and approval or disapproval decision for the credit assessment process. The data used by the bank for assessment are gender, age, credit amount, monthly income, expenditure of each month, current payment per month, savings, collateral types, collateral values, loan period, type of business activities, sources of funding and previous credit status/rating. Based on the results, the study found that collateral value is the most important criterion in credit assessment. Ikasari et al. [15] have subdivided the dimensions of access to finance as accessibility, eligibility and affordability. They have found that small business owners and banks in Indonesia and Thailand do not have issues with access to finance but are seen to have mutual trust issues. In Indonesian banks, it was found that collateral quality remained an issue whereas Thai banks did not express significant concern related to collateral. Paramasivam and Mari Selvam [16] feel that attitude of bank officials need to be improved while sanctioning loans to the MSME sector. Arora et al. [17] from their study in Punjab reveals that though all the nationalised banks have delved into microfinance, a lot of effort is still required to pave the way for microfinance in the commercial banking sector. The problem is how many target beneficiaries are aware of various schemes available and how many actually avail these schemes presents a dismal picture. Most bankers have reported that microfinance clients make up less than 5% of their total number of clients.

Gupta [18] has tried to address the issue of urban migration. The author has stated that 38% of migration happens for employment. Uncontrolled migration adversely affects both the origin place and the labour market of destination place. Migrants also affect income, expenditure pattern and investment and change relation at household and community level. He further highlighted how in a country like India where the 73% population are from rural or semi urban area, and more than 50% are working in agricultural and allied activity, the growth in rural to urban migration for various reasons can affect aversely the uniform growth of the nation. The main reason behind rural to urban migration is the

industrial development in urban areas which gives more opportunities for employment. Therefore to control migration, development of MSMEs in rural area is one of the vital solutions because it could create income and employment opportunities to local people. Lavanya et al. [19] stated that as per OECD report 2005, rural areas are affected by problems of reduced employment opportunities in primary industries and an ageing population due to migration of young population to urban areas in search of employment opportunities. There exists a wide gap between rural and urban areas in terms of infrastructure, market and financial access etc. The author feels that development of rural areas is the only solution to solve these issues.

2.1. Research gap

From the literature review, it has been found that considerable problems exist in financing rural MSMEs all over the world. But there are very limited findings on this issue, especially in the state of Assam. Also, the author has found limited studies in Assam that has evaluated the role of DICs in improving the bank financing of MSMEs.

3. Objective

The study aims to find out:

1. A comparison between demographic and financial characteristics of registered and unregistered rural MSMEs.
2. A comparison between problems being experienced by registered and unregistered rural MSMEs in obtaining bank loans.

3.1. Limitations of the study

The study is not free from limitations such as:

1. The whole state of Assam could not be covered due to time and financial constraints.
2. The viewpoint of the bankers could not be taken.
3. There is possibility of personal bias in answering the questionnaire by the MSME units as respondents.

3.2. Scope for further study

The study can be extended geographically to include other districts of Assam. Also the bankers' side of the story has not been included which could be a basis for a further study on the issue.

4. Research methodology

4.1. Geographical area

The geographical area for the study is Kamrup (rural), Nagaon (rural) and Dibrugarh (rural) districts in the state of Assam as combined they constitute more nearly 50% of MSME units in Assam.

4.2. Population

Population of the study includes registered and unregistered MSMEs operating within Kamrup (rural), Nagaon (rural) and Dibrugarh (rural) districts in the State of Assam.

4.3. Sampling design

4.3.1. Sample size

The study has taken the responses of 100 sample units, out of which 50 were registered under DIC and 50 were not registered. Out of each 50, 25 were from Kamrup district, 15 from Dibrugarh district and 10 from Nagaon district. The sampling unit is MSME units and sampling element is owner/s, proprietor/s, manager/s or competent representative.

4.3.2. Sampling procedure

For registered MSME units, Random Sampling method was used to select samples. The website stattrek.com was used to generate random numbers. The EM-II list of MSMEs compiled by DIC, Kamrup was consulted using the random numbers generated to select the samples for the study. For unregistered MSME units, snowball and convenience sampling method was used. The respondents were selected on the basis of location, availability and willingness to respond.

4.3.3. Data collection

Primary and secondary data were used for the study. The primary data collection was carried out with the help of questionnaires presented to MSME units. Secondary data was collected from published reports and other data source from websites and personal visits to offices, such as RBI reports, SLBC reports, reports and lists by District Industries and Commerce centres, Annual Reports by MSME Development Institutes, Planning Commission Reports, journals and articles.

5. Data analysis

5.1. Sample profile

The sample characteristics of MSME units as per their demographic characteristics as a comparison between registered and unregistered units are presented in **Table 3**.

Profile of respondents	Frequency	
	Registered units	Unregistered units
Gender of the owner		
Male	23	35
Female	27	15
Age of the owner		
Upto 30 years	1	7
F 30–40 years	21	29
F 41–50 years	24	11
Above 50 years	4	3
Education status of the owner		
10th	2	1
10 + 2	20	19
Graduate	27	26
Post Graduate	1	4
Unit type		
Micro	46	49
Small	4	1
Form of business		
Proprietorship	29	38
Partnership	21	12
Nature of business		
Manufacturing	28	19
Service	22	28
Both	0	3
Whether owned premise		
Yes	48	44
No	2	6

Table 3. Comparative profile of registered and unregistered MSMEs.

It can be observed from **Table 3** that both registered and unregistered units have very similar demographic characteristics. The number of female MSME owners is higher in case of registered MSMEs possibly due to the fact that government has launched many schemes targeting women entrepreneurs in the past few years. Similarly there are more manufacturing units which are registered MSMEs, as government also has many schemes for the manufacturing sector.

From the financial profiling of MSME units (**Table 4**) it can be seen that there is a very similar pattern in case of amount of capital invested, yearly turnover and amount of loan sanctioned

Profile of units	Frequency	
	Registered units	Unregistered units
Capital invested		
Upto 100,000	19	25
100,001–500,000	28	19
500,001–1,500,000	1	4
15,000,001–2,500,000	2	2
Yearly turnover		
Upto 100,000	28	31
100,001–500,000	17	18
500,001–1,000,000	5	1
Amount of loan applied		
Upto 100,000	38	41
100,001–500,000	10	8
500,001–1,000,000	2	1
Source of finance (Other than banks)		
Other formal finance institutions	0	2
Own funds	28	48
Funds from relatives and friends	19	23
Funds from moneylenders	4	15
Utilisation of loan		
To start business	44	38
Operational needs	6	12
Repayment of previous loans	9	14
Business expansion	4	9

Table 4. Comparative financial profile of registered and unregistered units.

among registered and unregistered units. With respect to sources of finance we can see that more proportion of unregistered units have additionally obtained their funds from non-bank sources as compared to registered units. Informal sources of credit are not always healthy for a business and therefore more MSMEs need to be brought under the formal financial system as confirmed by many studies (Barslund and Tarp, 2008) [7, 8]. It is also observed that more unregistered units have utilised their loans for operational needs and repayment of previous loans. This could be because of the fact that majority of DIC's schemes of bank finances are exclusively for new businesses only.

After comparing firm and financial characteristics between registered and non-registered MSME units, we have found that possibly since DICs implement a number of schemes for women, there more female entrepreneurs who are registered. Also because of schemes specifically for the manufacturing sector such as Boneej and various subsidy schemes; we find a

strikingly large number of manufacturing units registered under DIC. It is also found higher numbers of registered units seem to have used the loan to start the business which could be because DIC has more schemes for new units when compared to existing ones. This could be a reason why existing MSME units are not motivated to get registered under DIC.

5.2. Statistical analysis of data

In order to further fulfil our objectives various tests using SPSS has been done and the following are the results obtained:

5.2.1. Registration and satisfaction with source of finance

It is believed that registration will help in obtaining desired amount of loan. A chi-square test was done as shown in **Table 5** to check for association. The hypothesis formulated was as follows:
H_0 = There is no association between registration status of firms and satisfaction with source of finance.
H_1 = There is an association between registration status of firms and satisfaction with source of finance.

Since the p-value is more than 0.5, we do not have sufficient evidence to reject the null hypothesis. It can be concluded that there is no association between registration status and satisfaction with source of finance.

5.2.2. Registration and time taken to sanction loan

It is expected that registration will help in obtaining bank loans quickly. A chi-square test was done as shown in **Table 6** to check for association. The hypothesis formulated was as follows:

H_0 = There is no association between registration status of firms and time taken to sanction loan.
H_1 = There is an association between registration status of firms and time taken to sanction loan.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	0.056[a]	1	0.812
Continuity correction[b]	0.000	1	1.000
Likelihood ratio	0.056	1	0.812
Fisher's exact test			
Linear-by-linear association	0.056	1	0.813
No. of valid cases	100		

[a]0 cells (.0%) have expected count less than 5. The minimum expected count is 11.50.
[b]Computed only for a 2x2 table.

Table 5. Chi-square tests for registration status of firms and satisfaction with source of finance.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	13.724[a]	4	0.008
Likelihood ratio	14.445	4	0.006
Linear-by-linear association	11.886	1	0.001
No. of valid cases	100		

[a]Two cells (20.0%) have expected count less than 5. The minimum expected count is 0.50.

Table 6. Chi-square tests for registration and time taken to sanction loan.

Since the p-value is less than 0.5, we reject the null hypothesis. It can be concluded that there is an association between registration status and time taken to sanction loan.

5.2.3. Registration and satisfaction with sanctioned amount

It is believed that registration will help in obtaining desired amount of loan. A chi-square test was done to check for association (**Table 7**). The hypothesis formulated was as follows:
H_0 = There is no association between registration status of firms and satisfaction with sanctioned amount.
H_1 = There is an association betweenregistration status of firms and satisfaction with sanctioned amount.

Since the p-value is more than 0.5, the null hypothesis cannot be rejected. It can be concluded that there is no association between registration status and satisfaction with sanctioned amount of loan.

5.2.4. Registration and difficulties faced

Here, 37 statements have been used in a Likert scale to identify whether MSMEs face difficulty in borrowing from banks. It has been attempted to try and find out whether those MSMEs which have registered with DIC experience same or different levels of difficulty in obtaining bank loan for MSMEs. Firstly, the aggregate difficulty scores for each respondent have been calculated by simple addition of difficulty response points assigned by the respondent. The

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	1.382[a]	1	0.240
Continuity correction[b]	0.614	1	0.433
Likelihood ratio	1.425	1	0.233
Fisher's exact test			
Linear-by-linear association	1.369	1	0.242
No. of valid cases	100		

[a]2 cells (50.0%) have expected count less than 5. The minimum expected count is 3.50.
[b]Computed only for a 2x2 table.

Table 7. Chi-square tests for registration and satisfaction with sanctioned amount.

		Levene's test for Equality of Variances		t-test for equality of means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference	95% confidence interval of the difference	
									Lower	Upper
Agg_diff	Equal variances assumed	0.688	0.409	0.329	98	0.743	1.000	3.042	−5.038	7.038
	Equal variances not assumed			0.329	97.011	0.743	1.000	3.042	−5.038	7.038

Table 8. Independent samples test between registration and difficulties faced.

difficulty response is a five-point Likert scale (Strongly disagree, disagree, neutral, agree and strongly agree).

Next an independent sample t-test was conducted as shown in **Table 8** between difficulty scores and registration status to find out whether there is any effect of registration on difficulty scores.

The hypothesis formulated is as follows:

H_0 = There is no difference between average difficulty score for registered and non-registered borrowers.

H_1 = There is difference between average difficulty score for registered and non-registered borrowers.

Since the Levene's test for equality of variance could not be rejected, it was assumed that there is equality of variance and select the p-value of t-test results accordingly. Since p-value >0.05, there is no sufficient evidence to reject null hypothesis. Therefore it implies that there is no significant difference between average difficulty scores for registered and non-registered borrowers.

6. Conclusion and suggestions

The following conclusions are arrived at from the study:

- **i.** Registration status has no association with the satisfaction level of the borrowers with respect to their source of finance. DIC has therefore not been successful in influencing bank borrower's experience.
- **ii.** Registration status has an influence over time taken to sanction loans. Registered units who wish to borrow through DIC have to go through a preliminary screening before

being referred to a bank. The bank then performs its routine screening policy as per their individual policies. This may have influenced the total time taken by the bank is sanctioning the loans.

iii. Registration with DIC also has no association with satisfaction with respect to amount of loan sanctioned by the bank for MSME borrowers. Therefore it is possible that bank's decision of sanctioning amount of loan is not influenced by the registration status of the MSME unit.

iv. Registration also was seen to have no influence over the average aggregate difficulty scores experienced in getting loans from bank. Therefore it is seen that borrowers were subjected to similar levels of difficulty whether or not they were registered under DIC.

From the study, it can be concluded that DIC has been able to influence only the time duration of the loan process. It has not been able to influence satisfaction level with source of fund, satisfaction level with amount sanctioned by the bank and difficulties with borrowing. In order to invite more registrations under DIC, there has to be benefits which can motivate the MSMEs. Therefore only with incorporation of stronger and better procedures to achieve their objectives of helping the MSME sector can be achieved. Studies on bank-MSME relationships have produces similar results in different states and countries highlighting the need for stronger customer bond with MSMEs [12–16]. Banks being an important channel to bring MSMEs under the formal financial system, bank services need to be specialised for MSMEs.

Author details

Maumita Choudhury

Address all correspondence to: momitachoudhury@gmail.com

Research Scholar, Department of Business Administration, Tezpur University, Tezpur, India

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Section 4

Some Technical Issues of Global Operations

Chapter 9

On Simulation of Various Effects in Consolidated Order Book

Alexander Glekin, Alexander Lykov and
Kirill Vaninsky

Additional information is available at the end of the chapter

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Abstract

This chapter is devoted to numerical computer simulation of the market mechanism, the consolidated order book (COB). The chapter consists of two parts. The first part is devoted to empirical analysis of consolidated order book (COB) for the index Russian trading system (RTS) futures. In the second part, we consider Poissonian multi-agent model of the COB. By varying parameters of different groups of agents submitting orders to the book, we are able to model various real-life phenomena. In particular, we model the spread, the profile of the book and large price changes. Two different mechanisms of large price changes are considered in detail. One such mechanism is due to a disbalance of liquidity in the COB, and another one is arising from the disbalance of sell and buy orders in the order flow.

Keywords: market mechanism, multi-agent model, price change

1. Introduction

Price changes and its causes have been a classical topic of economic research for a long-time. The answer to traditional question "why prices change" in the theory of effective market is that the market absorbs new information, which forces market participants to reconsider the price of securities, currencies, futures, and so on.

For a novice in the field, we say that the order matching mechanism of an exchange is called consolidated order book (COB) or simply the book. At the level of micro-structure an investigation of a price change became possible only after historical data about all orders and events in the book became publicly available. In this work, we do not consider the causes that

determine the rate of submitting limit and market orders to the book by market participants. Instead, the main emphases are made on a study of various book statistics and a price changing mechanisms. In this work, we assume that all rates are constant in time, that is, we stay in the realm of "zero" intelligence traders [1].

It turns out that there are two basic mechanisms of the price change. In one case, it is a disbalance between demand through the flow of market orders and supply of limit orders in the book. Nevertheless, the simple rule is telling us what is happening if the demand exceeds supply and it does not necessarily lead to a price change. Another cause of the price change is a disbalance of liquidity in the order book. In reality two of these mechanisms contribute in a certain combination.

Our work consists of two parts. The first part is devoted to studying of empirical statistics of the book and the order flow for futures on the Russian trading system (RTS) index. Similar investigation was previously performed on stocks traded on French and USA equity exchanges [2, 3]. The Russian trading system (RTS) is a stock market established in 1995 in Moscow, consolidating various regional trading floors into one exchange. Originally RTS was modeled on NASDAQ's trading and settlement framework. The RTS Index, RTSI, the official exchange indicator, was first calculated on September 1, 1995, and it is similar to the Dow Jones Index. Nowadays, the value of contracts traded in RTS Index futures and options exceeded tens of billion dollars. The number of open positions (open interest) exceeds 250,000 contracts. The excellent liquidity allows us to compute various statistics of the order book from historical data provided by RTS.

The second part of this work contains simulations performed with the use of Poissonian multi-agent model of the order book. For the first time, Poissonian models were considered by Farmer et al. in [4–6]. We formulate our model using multi-agent framework [7, 8]. We present results of numerical simulations, which are similar to real statistics of the RTS index futures. We have to mention that some of these simulations already appeared in [9]. The limiting case of the model corresponding to the book of fixed density one was rigorously considered by us in [10] and [11].

For the convenience of the reader, we start our presentation in Section 2 with a detailed description of the order book. Empirical statistics of the book for the RTS index futures are described in Section 3. Section 4 introduces our Poissonian model. Section 5, the final section of the paper, describes results of numerical simulations of the Poissonian model [12].

2. The order book

In this work, we consider an exchange with continuous double auction as the order matching mechanism. Market participants submit to the exchange orders of two types, namely limit orders and market orders.

The limit orders are specified by three parameters, the price level, the volume, and the direction (buy or sell). The price is the worst price at which the order can be executed. The volume of an order is a number of contracts, which constitute the order.

level	bid	price	ask	level
		150015	32	3
		150010	23	2
		150005	68	1
1	9	150000		
2	13	149995		
3	20	149990		

Figure 1. Consolidated order book.

The consolidated order book is shown in **Figure 1**. The mid-column is a price ladder for a security. The step of a price change is five. Each limit order is placed in the order book at the level specified by its price. The minimal price of sell orders is called an ask price, and the maximal price of buy orders is called a bid price. The first column represents a price level counted from the best "ask" price. Namely, the price level for "buy" orders are counted from the best price offer (ask price) at the moment

$$l(p) = \frac{p_{ask} - p}{s}, \qquad p < p_{ask}; \tag{1}$$

where p_{ask} is the smallest price to sell and $s = 5$ is the size of the price ladder step. The second "bid" column represents a total volume of orders that can be bought at the specific price.

On the right from the middle column, the situation is identical but reversed. The last the fifth column is a price level counted from the best "ask." Again, the price level for "sell" orders is counted from the best price offer (bid price):

$$l(p) = \frac{p - p_{bid}}{s}, \qquad p > p_{bid}; \tag{2}$$

where p_{bid} is the biggest price to buy. The fourth column is the total volume of orders at the specific price level.

Limit order stays in the book until they get executed or just canceled. Execution of orders in each queue is determined by the rule, that is, first-in,-first-out (FIFO).

The state of the book is given by a vector $X = \{X_i\}$, where $|X_i|$ is aggregated volume of orders at level i. The component X_i is positive if these are buy orders and negative if these are sell orders. Note that:

$$i = \frac{price}{s}, \qquad i_{ask} = \frac{p_{ask}}{s}, \qquad i_{bid} = \frac{p_{bid}}{s}. \tag{3}$$

We define instant liquidity to sell as:

$$s(l) = \sum_{i=i_{ask}}^{i_{ask}+l} X_i, \qquad s = s(\infty); \tag{4}$$

And instant liquidity to buy as:

$$d(l) = \sum_{i=i_{bid}}^{i_{bid}-l} X_i, \qquad d = d(\infty). \tag{5}$$

Market orders are the orders, which have no specific price and the only volume is specified. Such orders are executed at the best available price at the moment they are submitted. If, for example, in the book shown in **Figure 1** submitted a market order to buy of the size 70, then the part of it (68 orders) is executed at the price 150,005, and the remaining two orders are executed at the price 150,010.

3. The empirical statistics of the RTS futures order book

3.1. The rate of submitting or canceling orders

The empirical rate of submitted limit orders $\widehat{I}_L(l)$ can be measured from historical data. We used the futures contract on index RTS and represented the rate of submitting limit orders in **Figure 2** on the logarithmic scale. The vertical axis represents the number of contracts per second on both buy and sell side, and the horizontal axis represents the price level. Starting from level 10, the order submitting rate follows the power law $\widehat{I}_L(l) \sim l^{-\mu}$, $l > 10$. For RTS futures $\mu \approx 2.5$.

Similarly, the empirical rate of canceling limit orders $\widehat{I}_C(l)$ on the logarithmic scale is presented in **Figure 3**. For level 10 and higher, the rate of canceling orders follows the power law $\widehat{I}_C(l) \sim l^{-\mu}$ with $\mu \approx 2.5$.

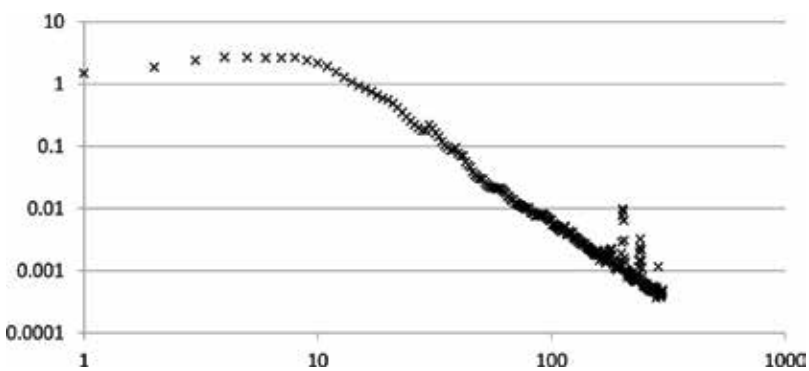

Figure 2. The rate $\widehat{I}_L(l)$.

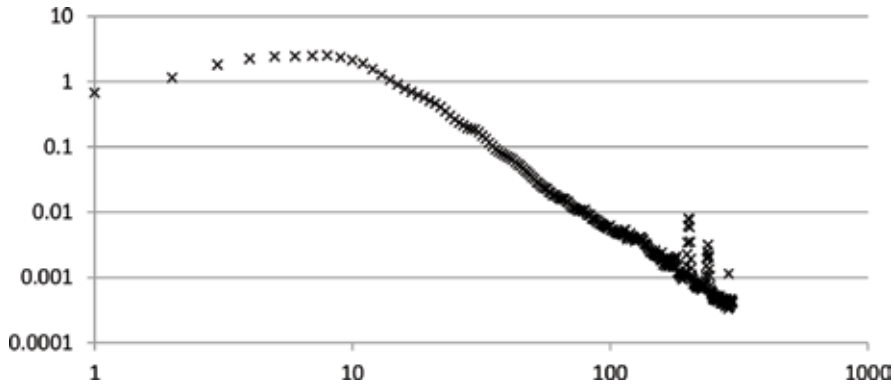

Figure 3. The rate $\widehat{I}_C(l)$.

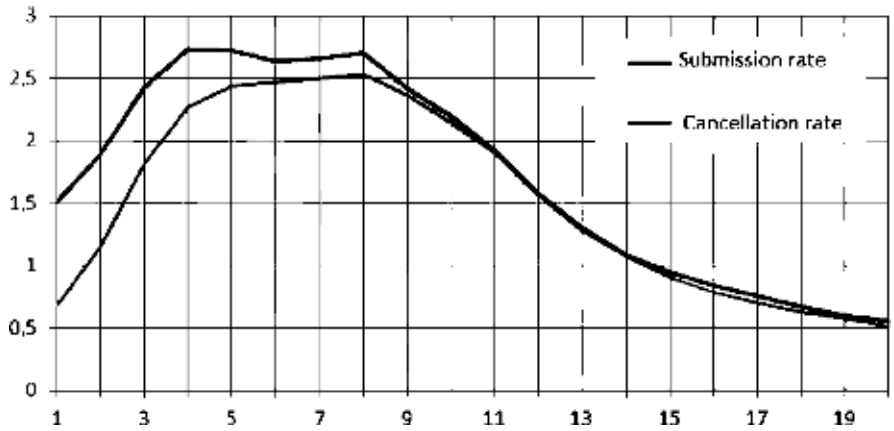

Figure 4. The smoothed curves for rates $\widehat{I}_C(l)$ and $\widehat{I}_L(l)$.

Moreover, $\widehat{I}_C(l) = \widehat{I}_L(l)$, for $l > 10$. At the same time, $\widehat{I}_C(l) < \widehat{I}_L(l)$ for $l < 10$ as shown in **Figure 4**.

3.2. The order volume

The empirical distribution of market orders volumes $\widehat{p}_M(v)$ is shown in **Figure 5**. The empirical frequency is depicted on the vertical axis and the volume on the horizontal axis. This distribution can be approximated by the power law $\widehat{p}_M(v) \sim v^{-\gamma}$, $\gamma \approx 2.5$.

The distribution of limit order volume $\widehat{p}_L(v)$ is more complicated and given in **Figure 6**. The volume of orders has a tendency to be multiple of 10. If one excludes orders with the volume multiple of 10 then $\widehat{p}_L(v) \sim v^{-\gamma}$, $\gamma \approx 2.8$. For orders multiple of 10, the distribution is the same with $\gamma \approx 2.5$. For orders multiple of 100, the law is also the same but $\gamma \approx 2.0$.

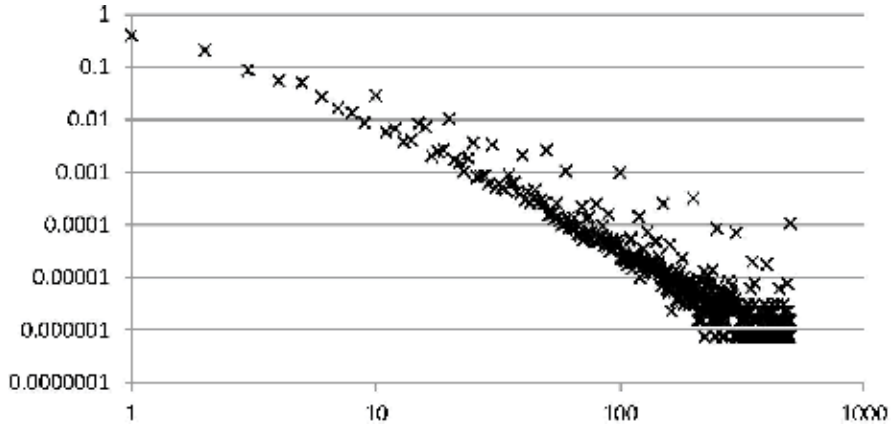

Figure 5. The empirical distribution $\widehat{p}_M(v)$ of volume of market orders.

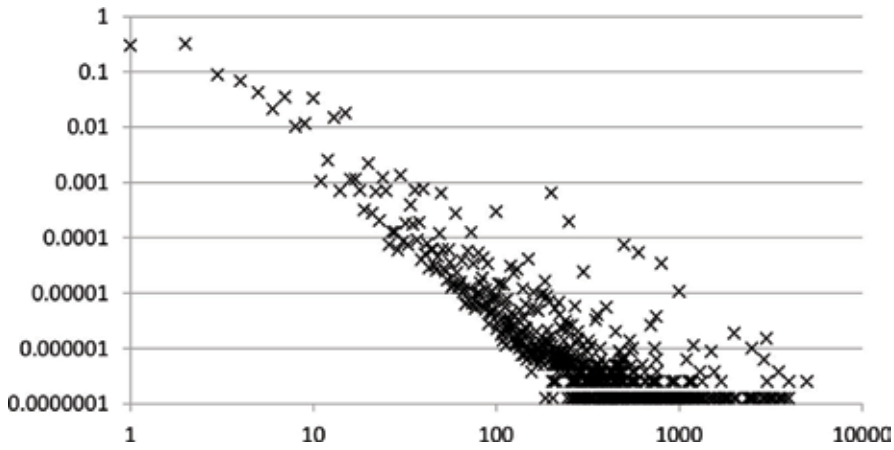

Figure 6. The empirical distribution $\widehat{p}_L(v)$ of volume of limit orders.

3.3. The book profile

The book profile was determined by averaging the volume at particular level counted from the mid price

$$m = \frac{i_{ask} + i_{bid}}{2}. \tag{6}$$

The averaged book profile for the first 20 levels is given in **Figure 7**. The averaged book profile for the first 1000 levels is given in **Figure 8**.

One can look at the time dynamics of the total order volume at first 100 levels on the sell and buy side. These are exactly the quantities $\widehat{s}(100)$ and $\widehat{d}(100)$ defined above. The volume is measured for each second. The results are presented in **Figure 9**.

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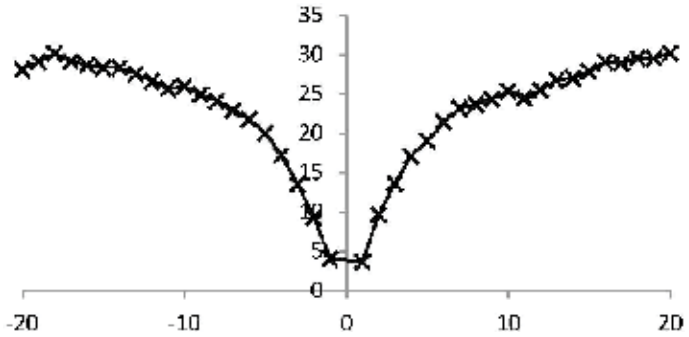

Figure 7. The book for the first 20 levels.

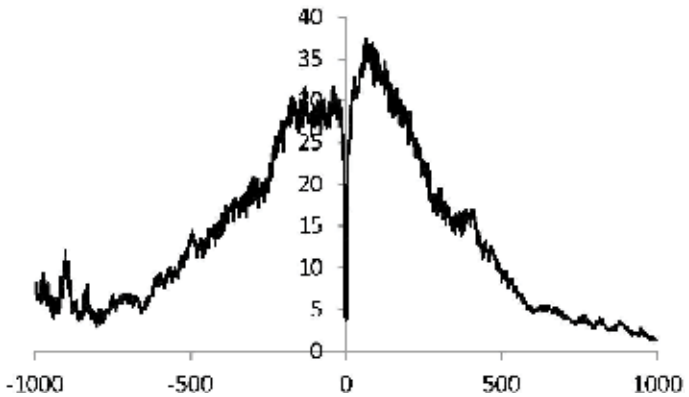

Figure 8. The book for the first 1000 levels.

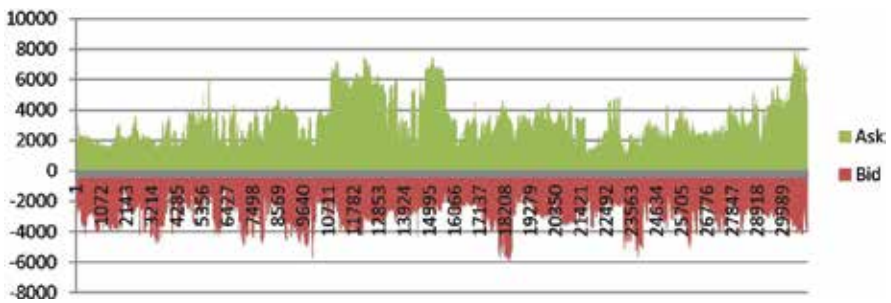

Figure 9. The time dynamics of the aggregated volumes $\widehat{s}(100)$ and $\widehat{d}(100)$.

3.4. The time between orders

The empirical distribution of time between market orders can measured (in seconds) and is given in **Figure 10**.

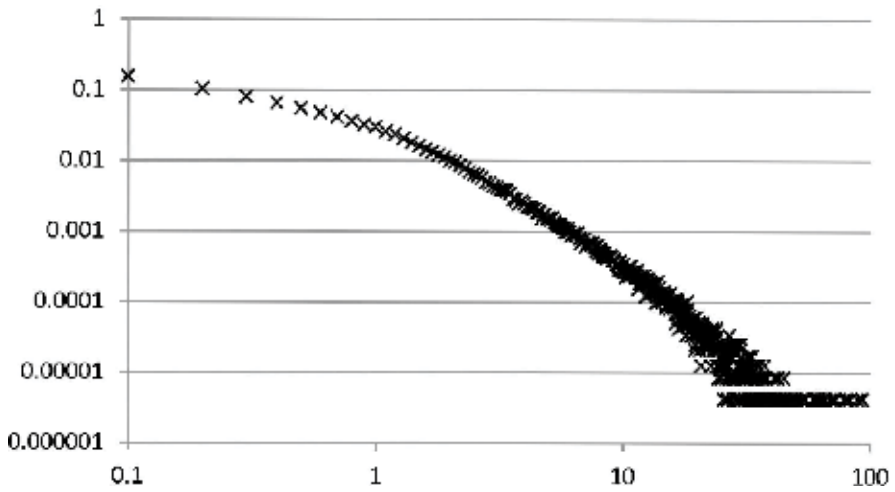

Figure 10. The empirical distribution of time between market orders.

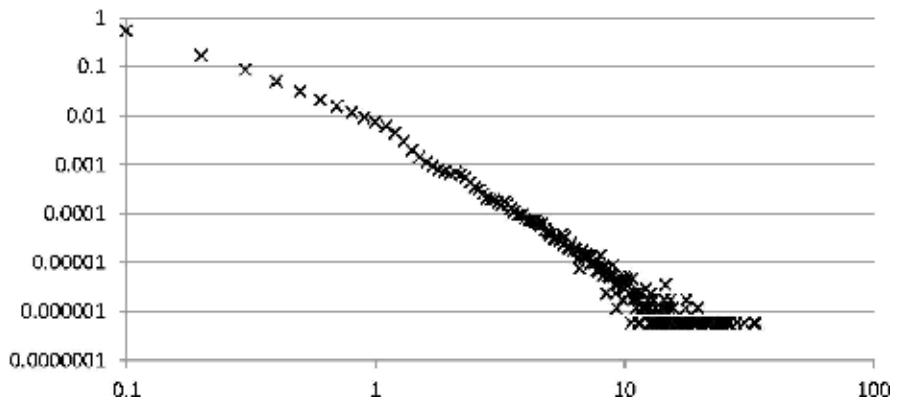

Figure 11. The empirical distribution of time between limit orders.

The empirical distribution of time between limit orders can also be measured (in seconds) and is presented in **Figure 11**.

4. The Poissonian multi: agent model

4.1. Market participants

In accordance with a mechanism of the double auction, there are six types of events that can occur in the order book:

- Liquidity provider submits buy limit order.
- Liquidity provider submits sell limit order.

- Liquidity taker submits market buy order.
- Liquidity taker submits market sell order.
- Liquidity taker cancels buy limit order.
- Liquidity taker cancels sell limit order.

These events can be produced by six agents or market participants. One group is agents providing liquidity to the book, and another group is agents taking liquidity from the book.

One group is liquidity providers, which differ from each other by a direction of limit orders. Providers of sell liquidity submit sell limit orders to the book and providers of buy liquidity submit buy limit orders to the book.

Another group is liquidity takers. Liquidity takers submit market orders to the book and also differ from each other by a direction. For example, liquidity takers of buy orders send market sell orders to the book. Similarly, liquidity takers of sell orders send buy market orders. Another type of liquidity takers cancel active buy or sell limit orders.

Everywhere below we assume that the events in our model form a Poissonian flow. Namely, the time τ between two consecutive events is exponentially distributed with the distribution $Prob\{\tau \geq t\} = \exp(-It)$, where the parameter $I > 0$ is called the rate.

Parameters for providers and takers of *buy* liquidity we denote with the lower subscript *bid* and parameters of takers and providers of *sell* liquidity are denoted with the subscript *ask*. The superscript specifies a type of order and stands for the following:

- L limit order,
- M market order, and
- C cancelation of an active limit order in the book.

Every group of market participants acts with the Poisson rate I_{side}^{type} where the subscript stands for the direction and the superscript for the type of action. The total rate of all events in the exchange is defined by the formula:

$$I = I_{ask}^{L} + I_{bid}^{L} + I_{ask}^{C} + I_{bid}^{C} + I_{ask}^{M} + I_{bid}^{M}; \tag{7}$$

where.

I_{bid}^{L} the rate of submitting limit buy orders;

I_{ask}^{L} the rate of submitting limit sell orders;

I_{ask}^{M} the rate of submitting market buy orders;

I_{bid}^{M} the rate of submitting market sell orders;

I_{ask}^{C} the rate of submitting cancelation request for limit sell orders; and.

I_{bid}^{C} the rate of submitting cancelation request for limit buy orders.

On each step of simulation, only one of these six events occurs. The time between two consecutive events is exponentially distributed with the rate I. The probability of an event of specific type is given by the formula:

$$\frac{I_{side}^{type}}{I}. \tag{8}$$

For example, the probability of cancelation of some buy limit (bid) order is:

$$\frac{I_{bid}^{C}}{I}. \tag{9}$$

4.2. Liquidity providers

Liquidity providers submit limit orders buy or sell of volume v at some price level l. Price level also takes integer values $1, 2, \cdots, K;$ with the probability $q^L(l)$. We also assume that maximal price level $K = 1000$. The distribution function $q^L(l)$ is determined by the empirical rate $\widehat{I}_L(l)$. The volume v of an order takes integer values $1, 2, \cdots, V^L;$ with probability $p^L(v)$. We assume that maximal volume $V^L = 1000$. The distribution $p^L(v)$ is modeled upon the empirical distribution $\widehat{p}^L(v)$. The distribution functions for the volume and the price level are the same for providers of sell and buy orders.

The limit orders can be executed partially, meaning that if they are bigger than the size of a market order then just some part of them is executed.

The infinitesimal rate of submitting liquidity, that is, limit orders to the book are:

$$V_{in} = S^L\left(I_{ask}^L + I_{bid}^L\right), \tag{10}$$

where S^L stands for the average size of a limit order:

$$S^L = \sum_{v=1}^{V^L} v p^L(v). \tag{11}$$

4.3. Liquidity takers

Liquidity takers submit either market orders or just cancel existent limit orders in the book. Market orders have a random volume v, which takes values $1, 2, \cdots, V^M;$ with probability $p^M(v)$, which is modeled upon the empirical distribution $\widehat{p}^M(v)$. The maximal volume $V^M = 100$.

4.4. Conditions of equilibrium

Cancelation of limit orders happens with an equal probability for all active limit orders buy or sell. Let us define:

$$S^C = \sum_{v=1}^{V^L} v p^C(v), \tag{12}$$

where $p^C(v)$ is the probability of canceling limit order of volume v. Active limit orders in the book are subjected to the flow of market orders. Market orders can take limit orders completely or just make the size of limit orders smaller than when they were actually submitted. Therefore,

$$S^C < S^L. \tag{13}$$

The rate of liquidity consumption is defined as:

$$V_{out} = S^M\left(I^M_{ask} + I^M_{bid}\right) + S^C\left(I^C_{ask} + I^C_{bid}\right), \tag{14}$$

where

$$S^M = \sum_{v=1}^{V^M} v p^M(v). \tag{15}$$

The quantities s and d determine instant liquidity in the book. The infinitesimal rate of change of instant liquidity is given by:

$$\Delta s = I^L_{ask} S^L - I^M_{ask} S^M - I^C_{ask} S^C, \tag{16}$$

and

$$\Delta d = I^L_{bid} S^L - I^M_{bid} S^M - I^C_{bid} S^C. \tag{17}$$

Obviously in the stationary regime $\Delta s = \Delta d = 0$ and the following identities hold:

$$S^L I^L_{ask} = S^M I^M_{ask} + S^C I^C_{ask}, \tag{18}$$

$$S^L I^L_{bid} = S^M I^M_{bid} + S^C I^C_{bid}. \tag{19}$$

These imply $V_{in} = V_{out}$. When market orders are not present $I^M_{bid} = I^M_{ask} = 0,$ we have:

$$S^L I^L_{ask} = S^C I^C_{ask}, \tag{20}$$

$$S^L I^L_{bid} = S^C I^C_{bid}. \tag{21}$$

Let us also define aggregated supply of sell orders:

$$S = I^L_{ask} S^L + I^M_{bid} S^M - I^C_{ask} S^C, \tag{22}$$

and buy orders

$$D = I^L_{bid} S^L + I^M_{ask} S^M - I^C_{bid} S^C. \tag{23}$$

We are going to study price dynamics in terms s, d, S, D.

5. Results of simulation

We would like to note that sometime during simulation there are no limit orders in the book on sell or buy side. In other words, due to randomness liquidity in the book can drop to zero, meaning $s = 0$ or $d = 0$. In such case when market order arrives, it will be no limit orders in the book to match market order. In order to avoid this we impose the following conditions:

$$s > s_{min}, \qquad d > d_{min}, \tag{24}$$

where $s_{min} > V^M$ and $d_{min} > V^M$. Once any of these conditions have been violated we need to stop the flow of market orders and also stop cancelations:

$$I^M_{bid} = I^C_{bid} = 0, \qquad \text{if} \quad d < d_{min}, \tag{25}$$

or

$$I^M_{ask} = I^C_{ask} = 0, \qquad \text{if} \quad s < s_{min}. \tag{26}$$

Another problem in running simulations is an unlimited growth of a number of limit orders in the book; in other words, instant liquidity cannot grow indefinitely. We arrange parameters (the rates I^{type}_{side}) such that aggregated rate of liquidity supply is less than aggregated rate of liquidity consumption. This implies that the rates have to be such that the following conditions hold:

$$\Delta d < 0, \qquad \text{for} \quad d > d_{min}, \tag{27}$$

and

$$\Delta s < 0, \qquad \text{for} \quad s > s_{min}. \tag{28}$$

5.1. The profile of the book and the spread

Let us define profile of the book as the state of all queues at a particular moment of time. Average profile is computed by averaging instantaneous profiles for each second on a particular time interval.

The response of the book profile to the flow of market orders can be easily understood. When the market orders are absent $I^M_{bid} = 0$, and $I^M_{ask} = 0$ all existent orders are canceled without exception and $S_L = S_C$. This implies that:

$$I^L_{ask} = I^C_{ask}, \qquad I^L_{bid} = I^C_{bid}. \tag{29}$$

http://dx.doi.org/10.5772/intechopen.78670

Since in our model the size of limit order is independent from the price and direction of the trade then the book is filled uniformly with the limit orders as it is shown in **Figure 12**.

Consider now the spread:

$$\delta = \frac{p_{ask} - p_{bid}}{s} = i_{ask} - i_{bid}, \tag{30}$$

and let us study how it depends on the size of a market order.

When the market orders submission rate is small:

$$\frac{I^M_{ask}}{I} < 0.01, \qquad \frac{I^M_{bid}}{I} < 0.01, \tag{31}$$

then the book profile remains unchanged as shown in **Figure 13**.

The spread (after the market order has been executed) depends linearly on the size v^M of a market order:

$$\delta \sim v^M. \tag{32}$$

The empirical relation between the size and a spread is depicted in **Figure 14**. The size of limit order is depicted on the vertical axis, and the spread is shown on the horizontal axis.

When the rate of market orders increases:

$$\frac{I^M_{ask}}{I} \sim 0.1, \qquad \frac{I^M_{bid}}{I} \sim 0.1, \tag{33}$$

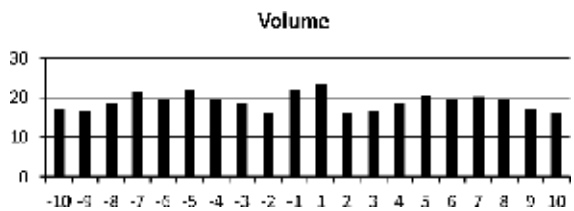

Figure 12. The book profile without market orders.

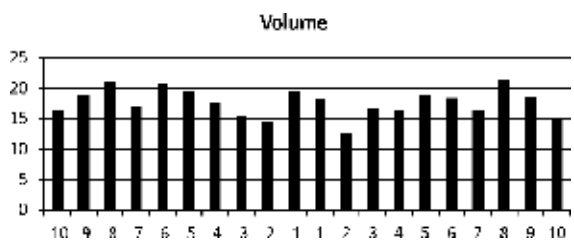

Figure 13. The book profile with small rate of market orders.

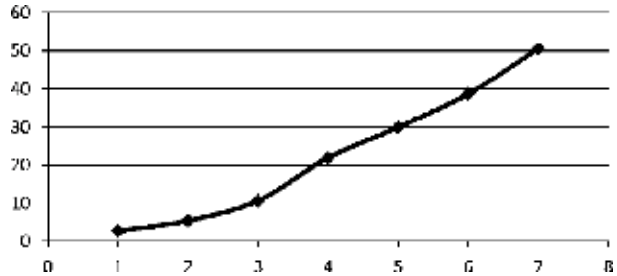

Figure 14. The size of market orders as the function of spread.

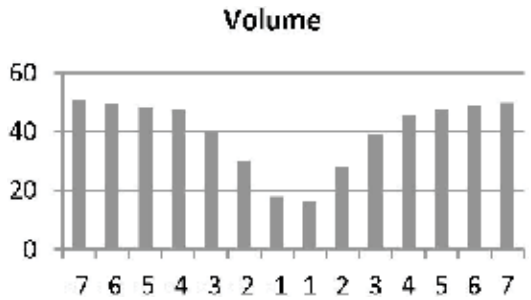

Figure 15. The book profile with the high rate of market orders.

then the book profile changes. On the levels closest to the bid or ask the size of the book is almost linearly depends on a level number as shown in **Figure 15**:

$$|X_{i_{bid}-l}| \sim l, \qquad |X_{i_{ask}+l}| \sim l, \tag{34}$$

Parameter	Model	RTS
S_L	3.92	3.92
S_C	4.10	3.86
S_M	5.40	5.40
I^L_{ask}	46.5	45.5
I^L_{bid}	46.5	45.2
I^C_{ask}	40.1	41.3
I^C_{bid}	40.1	41.0
I^M_{ask}	3.37	3.43
I^M_{bid}	3.37	3.43

Figure 16. Parameters in the balanced case.

where $l > 0$. When market order arrives, it annihilates limit orders at the level proportional to the square root of the volume v^M and:

$$\delta \sim \sqrt{v^M}. \tag{35}$$

5.2. The balance of liquidity in the book and in the order flow

We define the parameter $I = 179$ events/s. All other parameters in the balanced case are given in the table (**Figure 16**).

A sample of the price evolution in our model is given in **Figure 17**.

Apparently the price does not exhibit any preferred direction. We refer to [9] for details of this simulation.

5.3. The disbalance of liquidity in the book

By adjusting s_{min} and d_{min} one can model price movements. We assume that the all other rates on the sell and buy side are equal:

$$I^M_{bid} = I^M_{ask}, \qquad I^C_{bid} = I^C_{ask}, \qquad I^L_{bid} = I^L_{ask}. \tag{36}$$

If $s_{min} > d_{min}$ then the book is thinner on the buy side (below the price) and this leads to price decrease. If on the opposite $s_{min} < d_{min}$ then the book is thinner on the sell side (above the price) and this leads to price increase.

Indeed, the dependence of δ_{sell} on the volume of sell market order v_M is getting bigger as soon as d_{min} is getting smaller. Similarly, dependence of δ_{buy} on the volume of buy market order v_M is getting bigger as soon as s_{min} is getting smaller. As a very crude approximation we can take buy market order:

$$v_M \sim \delta_{sell} d_{min}, \tag{37}$$

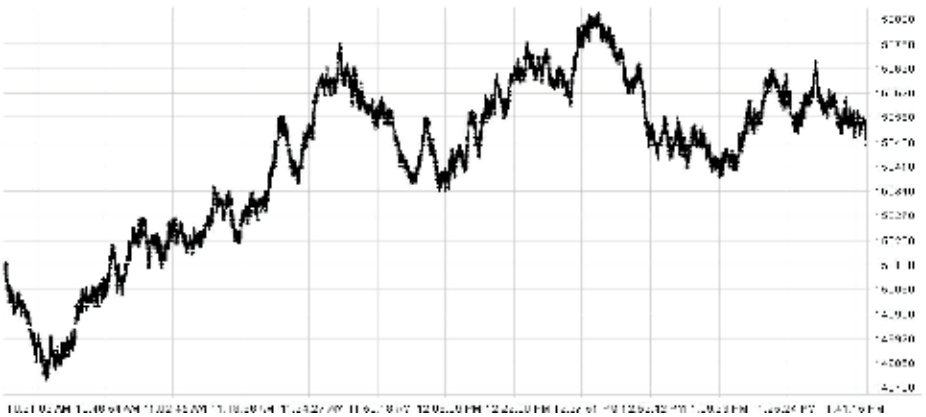

Figure 17. Price in the balanced case.

and for sell market order:

$$v_M \sim \delta_{buy} s_{min}. \tag{38}$$

Therefore,

$$\frac{\delta_{sell}}{\delta_{buy}} \sim \frac{s_{min}}{d_{min}}. \tag{39}$$

If $s_{min} < d_{min}$, then:

$$\frac{\delta_{sell}}{\delta_{buy}} < 1 \tag{40}$$

and the price has to increase. If $s_{min} > d_{min}$, then:

$$\frac{\delta_{sell}}{\delta_{buy}} > 1 \tag{41}$$

and the price has to decrease.

This is illustrated in **Figure 18**. The first graph is a price and the second graph, which is the vertical column is the volume. The third graph is the graph for instantaneous liquidity s and d. The white and green lines are the graphs s_{min} and d_{min}. Depending on the relation between s_{min} and d_{min} one can observe increase or decrease of the price.

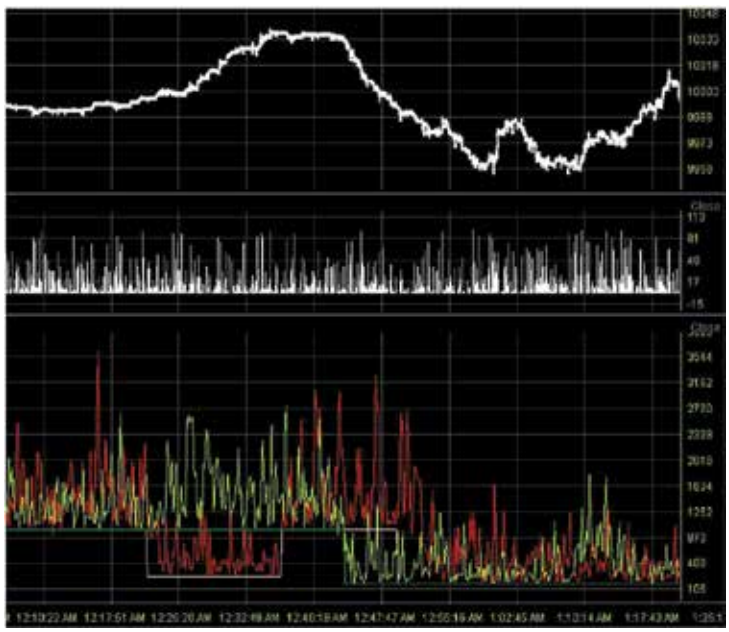

Figure 18. Thinning of the book on the buy or sell side.

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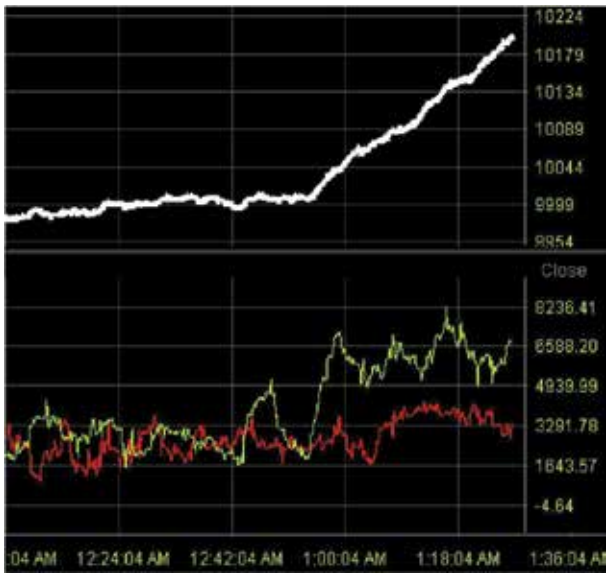

Figure 19. The upward trend.

Figure 20. The upward trend.

5.4. The disbalance of sell and buy orders in the order flow

Such disbalance occurs when $I^M_{bid} \neq I^M_{ask}$. At the same time the condition $\Delta s = \Delta d = 0$ holds. **Figure 19** shows monotonous increase of the price. The first graph represent the price and the second two red and yellow lines are $s(5)$ and $d(5)$.

Figure 20 also shows monotonous increase of the price but instead of $s(5)$ and $d(5)$ it has graphs of s and d.

Author details

Alexander Glekin[1], Alexander Lykov[2] and Kirill Vaninsky[3]*

*Address all correspondence to: vaninsky@math.msu.edu

1 Institute of System Analysis, RAN, Moscow, Russia

2 Faculty of Mathematics and Mechanics, Moscow State University, Moscow, Russia

3 Department of Mathematics, Michigan State University, East Lansing, MI, USA

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Chapter 10

Can Fundamental Analysis Provide Relevant Information for Understanding the Underlying Value of a Company?

Raúl Navas, Ana Paula Matias Gama and
Sónia R. Bentes

Additional information is available at the end of the chapter

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Abstract

This chapter investigates the relevance of fundamental analysis (FA) for companies listed on the Euronext 100 index. Can FA provide relevant information that increases understanding of the underlying value of a company? This study leverages an FA strategy to select shares in a portfolio that can systematically yield significant, positive excess market buy-and-hold returns, 1 and 2 years after the portfolio formation. Using annual financial data available from 2000 to 2016, this analysis calculates three scores applied to construct the portfolios: the L-score, F-score, and PEIS. These insights inform investors' potential uses of fundamental signals (scores) to obtain abnormal returns. The results show that portfolios formed with high versus low scores earn 1- and 2-year abnormal returns between 2000 and 2016. This chapter contributes to scarce accounting research in European capital markets by furthering understanding of the possibility of mispriced securities.

Keywords: capital markets, markets efficiency, accounting fundamentals, scores, abnormal returns

1. Introduction

In an efficient market, prices incorporate available information in a timely manner [1–6]. According to valuation theory, over time accounting earnings get converted into free cash flows to investors, creditors, and the firm, which provide the main input for estimating the intrinsic value of the firm, as reflected in stock prices [5–7]. If information is not incorporated

into the stock returns in a timely manner though, an anomaly arises, and arbitrage opportunities may emerge. In this sense, a market anomaly is a pattern of stock returns that appear to contradict traditional asset pricing models [8]. Although stock returns may be affected by multiple pieces of information, financial statements are the primary source, in that they summarize firm performance. In turn, a fundamental analysis (FA) undertakes an examination of detailed accounting data contained in financial statements to clarify how efficiently and effectively a firm generates earnings over time, as well as its potential to grow and convert these earnings into free cash flows [5]. One means to summarize the information contained in financial statements is to build measures or scores that integrate a set of signals (j) drawn from the accounting information (i.e., positive/negative news) about the firms (i) in the present year (t), or

$$Score_{it} = \sum_{1}^{j} Signal_{j} \tag{1}$$

This chapter investigates whether investors can exploit documented abnormal returns to fundamental signals, as reflected in financial statement information. To do so, we revisit previously documented anomalies, including the L-score [1], which summarizes 12 signals from financial statements; the F-score [2], which is constructed on the basis of nine signals from financial statements; and the predicted earnings increase score (PEIS) [3], composed of six signals (positive, negative, or no news) that reflect a firm's quintile position on six accounting ratios. Therefore, we examine whether anomalies based on fundamental scores exist several years after the anomaly has been identified and thereby whether portfolios formed on the basis of such strategies can systematically yield significant, positive returns in the 1 and 2 years following portfolio formation.

The results we obtain from companies listed on the Euronext 100 index during 2000–2016 reveal that Piotroski's F-score and Lev and Thiagarajan's L-score effectively catch market anomalies, such that they allow for abnormal returns. In contrast, Wahlen-Wieland's PEIS does not provide a good source to identify market anomalies during our sample period.

With these findings, we make several important contributions. First, we provide evidence of the persistence of fundamental signals, which informs the debate about the information impounded in prices. Second, we show that two anomalies, Piotroski's and Lev and Thiagarajan's, enable investors to construct hedge portfolios that earn 1- and 2-year buy-and-hold abnormal returns. These findings in turn suggest that markets may not be semi-strong efficient; alternatively, the scores could capture some underlying risk. To establish these contributions, in Section 2 we review extant literature. Then Section 3 describes the research design, which tests whether the predictive ability of various fundamental signals documented in previous literature can be exploited in European markets, as we report in Section 4. Finally, we conclude in Section 5.

2. Literature review

Efficient markets have two characteristic features [8]: Investors have essentially complete knowledge of the fundamental structure of their economy (i.e., information), and they are

rational information processors who make optimal decisions (i.e., rationality). If either of these two assumptions fails to hold, abnormal stock returns may arise. Employing FA, we examine whether abnormal stock returns can be obtained, years after the anomaly has been discovered.

A firm's stock price theoretically reflects both supply and demand sides of the market, such that it indicates investors' views of the corporate valuation. If the capital market is efficient in reflecting all available information, nothing outperforms its assessments of a firm's value. However, information collection is costly, so some groups of people may value the firm better than the market does [9]. According to [10], following the release of large traders' position information, a futures market reports semi-strong efficiency. Studying European indexes, [11] reports results in line with a weak efficiency market hypothesis (EMH) for the period between January 1993 and December 2007 and reaches the conclusion that daily and weekly returns are not normally distributed, because they are negatively skewed, are leptokurtic, and display conditional heteroscedasticity. Noting the mixed evidence across nations, [11] also rejects the EMH for daily data from Portugal and Greece, due to the first-order positive autocorrelation in the returns, but reports empirical tests that show that these two countries approach Martingale behavior after 2003. The French and U.K. data also reject EMH, but in these cases, it is due to the presence of mean reversion in the weekly data.

A FA seeks to translate information contained in financial statements into estimates of values to distinguish "winners" (undervalued firms) from "losers" (overvalued firms). One approach is to obtain the firm's intrinsic value and systematic errors in market expectations [12]. Another method trades on signals of financial performance. The abnormal returns generated by these signals could be due to the market's inability to comprehend a particular piece of information or to gaps in the rational decision-making process [2, 13].

Prior literature provides various examples of individual signals, such as accruals and post-earnings announcement drift, as well as composite signals built on various pieces of information, such as the F-score [2], PEIS [3], and L-score [1]. These latter, composite signals aggregate information contained in an array of performance measures or screens from financial statements and form portfolios on the basis of firms' overall signals. Previous research indicates that these investment strategies earn abnormal buy-and-hold returns [9–11]. For example, [2] builds an F-score based on nine individual binary signals derived from accounting data (profitability, financial leverage/liquidity, and operating efficiency). Strong (high F-score) value firms (with low book-to-market ratios) experience enhanced future performance and stock returns, compared with weak (low F-score) value firms, suggesting that the market does not impound financial statement information into prices in a timely manner. Many authors use this score to capture signals, such as [14, 15] in the U.S. market, [4] in European markets, and [5, 16] in emerging markets.

In proposing the L-score, [1] investigate a set of financial variables (fundamentals) that analysts claim are useful for security valuation, then examine these claims by estimating the incremental value relevance of the variables over earnings. Their findings support the incremental value relevance of most fundamentals; in the 1980s, fundamentals added approximately 70% to the explanatory power of earnings with respect to excess returns, on average. This U.S.-based score also is applicable to emerging markets [5, 16].

From [3], we obtain the predicted earnings increase score (PEIS), which seeks to determine whether financial statement information can be exploited to identify firms that are more likely to achieve future earnings increases. The findings demonstrate that high-score stocks are more likely to enjoy greater future earnings and abnormal returns, and a hedge portfolio traded on these signals exceeds consensus recommendations of analysts.

3. Research design

3.1. Fundamental scores: F-score, L-score, and PEIS

The F-score is based on 9 fundamental signals defined by [2]; the L-score is based on 12 fundamental signals suggested by [1], and the PEIS relies on 6 fundamental signals [3]. The composite F-score conveys information about annual improvements in firm profitability, financial leverage, and inventory turnover. It ranges from 0 (low) to 9 (high), reflecting nine discrete accounting fundamental measures at time t (see Appendix 1). The F-score equals the sum of F1 through F9, and higher scores imply potential abnormal positive returns and future growth. It also is robust to different levels of financial health, future firm financial performance, asset growth, and future market value [8]. It has proven useful for differentiating winners from losers among groups of firms with varied historical profitability levels [13], as well as in emerging markets such as India [16] and Mexico [5].

The L-score uses annual data to obtain fundamental signals that measure percentage changes in inventories, accounts receivable, gross margins, selling expenses, capital expenditures, gross margins, sales and administrative expenses, provisions for doubtful receivables, effective tax rates, order backlogs, labor force productivity, inventory methods, and audit qualifications. These 12 fundamental signals relate consistently to contemporary and future returns [17, 18]. Due to data restrictions though, the current study computes the L-score using only nine fundamental signals for each firm (see Appendix 2).

Finally, the PEIS determines whether financial statement information can be exploited to identify firms with more likely future earnings increases. The signals measure percentage changes in the net operating assets, gross margins, sales and administrative expenses, asset turnover, and accruals [3]. These six fundamental signals range from -1 to 1 (including 0), depending on the quintile of the sample. The small number of observations available in the low and high original PEIS (see **Table 5**) could bias the results, so we adapt this original score to ensure that each signal ranges from 0 to 1 (similar to the F- and L-scores). In turn, we refer to this measure as PEIS2, which ranges from 1 to 6 (sum of the 6 metrics). For the current study, we compute both PEIS versions (see Appendixes 3 and 4).

3.2. Data collection and the Euronext 100 stock market

Market-adjusted prices and financial data were collected annually from the Datastream database for all active firms in the Euronext 100 stock market between 2000 and 2016. Daily and annual data for the market index inform the computation of the market returns. The financial

statements from year t are available at the end of March t + 1. The returns also include dividends paid plus stock splits and reverse stock splits; taxation is not included, so the results are gross values. The annual returns thus can be computed as:

$$R_t = \frac{P_t}{P_{t-1}} - 1. \quad (2)$$

The Euronext 100 is a blue-chip index of Euronext N.V., spanning about 80% of the major companies on the exchange. Unlike most indexes, it includes companies from various countries within Europe, comprising the largest and most liquid stocks traded on four stock exchanges: Amsterdam, Brussels, Lisbon, and Paris. Each stock must trade more than 20% of its issued shares.

French firms represent 66% of the firms listed in the Euronext 100, Dutch companies account for 20%, and Belgian and Portuguese companies represent 9 and 5%, respectively, as detailed in **Table 1**, **Panel A**. The firms that comprise the Euronext 100 index are distributed uniformly by industry (not reported for brevity, but available on request), and the number of firms listed increased from 72 firms in 2000 to 96 firms in 2015 (**Table 1**, **Panel B**).

Panel A. Firms in the Euronext 100 by stock exchange

Stock exchange	Number of firms listed, 2000–2015	%
Amsterdam	19	20
Brussels	9	9
Lisbon	5	5
Paris	63	66
Total/total/average	96	100

Panel B. Number of firms by year

Year	Number of firms
2000	72
2001	76
2002	76
2003	76
2004	77
2005	79
2006	82
2007	85
2008	86
2009	88
2010	93
2011	94

Panel B. Number of firms by year	
Year	**Number of firms**
2012	96
2013	96
2014	96
2015	96

Source: Euronext 100 index.

Table 1. Sample description.

4. Empirical results

4.1. Descriptive analysis

To determine whether the measures provide complementary or substitutive information, we perform a correlation analysis. **Table 2** contains the Pearson correlations among the four individual fundamental signals.

In general, the correlations across the four scores are low, indicating that the scores probably capture different aspects of firm performance. The most strongly correlated scores are the F-score and PEIS2, at 0.477, a value that is statistically significant at the 1% level. To test further whether the documented scores, which are useful for constructing successful U.S. strategies (e.g., [13, 14, 19]), also can be successful in Europe, we construct portfolios based on the four scores.

4.2. Buy-and-hold returns for an investment strategy

To construct portfolios based on the four focal scores, we group each observation according to its corresponding signal, by year. Then, we compute, for each score, 1- and 2-year subsequent raw returns and excess market returns, such that the multiperiod (2000–2016) returns are continuously compounded. The 12-month returns are calculated from April of year t to March of year t + 1, and the respective score refers to year t. The 24-month returns run from April in

	F-SCORE	**L-SCORE**	**PEIS**	**PEIS2**
F-SCORE	1			
L-SCORE	0.118**	1		
PEIS	0.219**	0.005	1	
PEIS2	0.477**	0.070*	0.091**	1

Notes: **, and * indicate statistical significance at the 5 and 10% levels (two-tailed), respectively.

Table 2. Analysis of score correlations.

t + 1 to March in t + 2, and the respective score is for year t. The estimate of future returns uses equally weighted portfolios. We also compute a hedge strategy that takes a long position in firms with high scores and short position in those with low scores, on a yearly basis. Thus, we form two groups, high (H) and low (L), and calculate the difference between them, as well as presenting the t-statistics.

Table 3 contains the buy-and-hold returns for 1 and 2 years. In the 12-month returns observed after the portfolio formation, both raw returns and market excess firm returns increase as the F-score increases, though not consistently. The F7 score indicates the highest result, with a value of 23.29% (18.20%) for raw returns (excess market returns) on the 1-year buy-and-hold strategy, whereas the F9 score offers a high value of 24.46% (16.27%) for raw returns (excess market returns) for the 2-year strategy. The average return difference between portfolios of firms with high versus low F-scores is positive and the model shows to be statistically significant at the 1% level in all metrics (raw returns and excess return, for 1 and 2-year-buy-and-hold), which confirms the explanatory power of the F-score. That is, it is possible to use the F-score to discriminate growth stocks from value stocks, relative to those with little potential to provide positive abnormal returns. For example, if an investor implements a hedge fund

	One-year			Two-year		
F-score	**N**	**Mean raw returns**	**Mean excess market returns**	**N**	**Mean raw returns**	**Mean excess market returns**
0	2	11.77%	−25.93%	2	−63.42%	−52.95%
1	10	−2.38%	6.61%	9	−14.03%	0.11%
2	33	−11.71%	−8.36%	29	−19.93%	−12.57%
3	135	0.08%	2.44%	132	−2.83%	1.69%
4	225	8.93%	7.92%	216	3.18%	5.15%
5	267	10.30%	9.43%	253	4.73%	5.52%
6	289	15.07%	11.35%	270	11.30%	8.77%
7	232	23.29%	18.20%	222	19.81%	13.89%
8	133	23.10%	17.47%	123	21.39%	13.15%
9	41	14.85%	10.96%	40	24.46%	16.27%
Low F-score [0 + 1 + 2]	45	−8.59%	−5.81%	40	−20.77%	−11.73%
High F-score [8 + 9]	174	21.16%	15.93%	163	22.14%	13.92%
High-Low		29.75%	21.74%		42.91%	25.65%
t-Stat		5.64***	4.68***		11.11***	7.21***
Total	1367	13.04%	10.71%	1296	9.06%	7.70%

Notes: The 12-month returns begin 3 months after the end of the fiscal year, which is December for all firms. We compute geometric means of the returns. The 24-month returns also begin 3 months after the end of the fiscal year, which is December for all firms. We compute annualized means of the returns.
***, **, and * indicate statistical significance at the 1, 5 and 10% levels, respectively.

Table 3. Buy-and-hold returns by F-score.

strategy, shorting the low score companies and taking long positions in high score companies, it would achieve profitability of 29.75% (42.91%) with a 1-year (2-year) buy-and-hold strategy. These results outperform a strategy that uses the market index for the same period, obtaining the investor 21.74% (25.65%) greater raw returns (excess market returns) with the 1-year (2-year) buy-and-hold strategy. Thus, an FA strategy appears more efficient for predicting returns, 1 and 2 years in the future.

These results align with prior literature. For example, the high score raw returns for a 1-year buy-and-hold strategy are approximately 21.16%, similar to the 31% reported in [2] for a different period (i.e., 1975–1995) in the U.S. market. For the Mexican market during 1991–2011, [5] identifies a value of 21%. Then [14] obtain a raw 1-year return of approximately 31% for 1975–2007. An application of the F-score to several European firms produced a value greater than 29% for the period between 1989 and 2011 [4]. These findings suggest that the F-score works well for firms listed in Euronext 100 during 2000–2016, though not as well as it has in some other studies. This result might stem from the international financial crisis of 2008–2009 and the sovereign debt crises in Europe [20, 21]).

The results of L-score appear in **Table 4**.

	One-year			**Two-years**		
L-score	**N**	**Mean raw returns**	**Mean excess market returns**	**N**	**Mean raw returns**	**Mean excess market returns**
0	5	−41.93%	−9.75%	5	−20.63%	−0.74%
1	45	−2.75%	2.46%	42	4.14%	5.51%
2	153	9.82%	9.20%	144	7.17%	6.11%
3	274	14.18%	13.14%	255	9.76%	6.96%
4	356	10.14%	7.95%	334	8.14%	6.27%
5	323	12.16%	9.99%	312	8.86%	8.39%
6	164	17.97%	11.53%	157	11.31%	9.47%
7	44	50.01%	35.09%	44	19.38%	19.19%
8	3	28.41%	26.40%	3	11.69%	17.37%
Low L-score [0 + 1 + 2]	203	5.76%	7.24%	191	5.78%	5.80%
High L-score [7 + 8]	47	48.63%	34.53%	47	18.89%	19.08%
High-Low		42.88%	27.29%		13.11%	13.27%
t-stat		4.03***	2.27**		2.22**	2.66***
Total	1367	13.04%	10.71%	1296	9.06%	7.70%

Notes: The 12-month returns begin 3 months after the end of the fiscal year, which is December for all firms. We compute geometric means of the returns. The 24-month returns also begin 3 months after the end of the fiscal year, which is December for all firms. We compute annualized means of the returns.
***, **, and * indicate statistical significance at the 1, 5 and 10% levels, respectively.

Table 4. Buy-and-hold returns by L-score.

As expected, for both 1- and 2-year returns observed after portfolio formation, both the raw and the market excess firm returns increase as the L-score increases, with an implicit tendency, if not regularity. In general, the higher the L-score, the higher the future returns. The average return difference between portfolios of high versus low L-score firms is 42.88% (13.11%) for buy-and-hold 1-year (2-year) returns, the model is statically significant at the 1% (5%) level. Similar to the F-score, the FA results seem to outperform the excess market returns calculated on the basis of the Euronext 100 index, for the same period; the average return differences between the portfolios of high versus low L-score firms based on excess market returns are 27.29 and 13.27% for 1-year and 2-year buy-and-hold strategies. These results thus confirm the explanatory power of the L-score.

Table 5 provides the results for an investor that implements a strategy based on PEIS.

Similar to the F-score and L-score, in the 1-year returns observed after portfolio formation, both raw and excess market returns increase with the PEIS—though not consistently. A similar

	One-year			Two-years		
PEIS	**N**	**Mean raw returns**	**Mean excess market returns**	**N**	**Mean raw returns**	**Mean excess market returns**
−5	1	24.89%	−16.25%	1	−6.83%	5.01%
−4	7	2.63%	−0.23%	7	23.79%	14.17%
−3	45	5.53%	5.91%	40	11.80%	11.46%
−2	169	11.07%	8.41%	163	8.64%	7.71%
−1	297	9.76%	7.85%	285	7.89%	6.86%
0	349	15.53%	12.85%	327	12.27%	9.88%
1	273	15.07%	12.55%	255	6.04%	5.42%
2	161	14.63%	11.73%	156	10.47%	8.46%
3	51	13.72%	14.83%	49	1.33%	2.69%
4	11	14.00%	10.02%	10	22.17%	15.16%
5	2	13.46%	0.28%	2	−7.08%	5.04%
6	1	−4.37%	−22.61%	1	−6.05%	−19.11%
Low PEIS [−5–4-3]	53	5.51%	4.69%	48	13.22%	11.73%
High PEIS [4 + 5 + 6]	14	12.61%	6.30%	13	15.50%	10.97%
High-Low		7.10%	1.61%		2.28%	−0.76%
t-stat		1.47	1.72*		−0.79	−0.95
Total	1367	13.04%	10.71%	1296	9.06%	7.70%

Notes: The 12-month returns begin 3 months after the end of the fiscal year, which is December for all firms. We compute geometric means of the returns. The 24-month returns also begin 3 months after the end of the fiscal year, which is December for all firms. We compute annualized means of the returns.
***, **, and * indicate statistical significance at the 1, 5 and 10% levels, respectively

Table 5. Buy-and-hold returns by PEIS.

pattern emerges for the excess market returns. However, the results indicate substantial differences between the raw returns and the excess market returns. The average return difference for portfolios of firms with high versus low PEIS is 7.10% (2.28%) and 1.61% (−0.76%) for raw (excess market) returns with a 1-year and 2-year buy-and-hold strategy. These results could reflect the relatively few observations of both low and high PEIS (e.g., PEIS-5 and 6 reflect only one observation). Thus, we also simulate an investment strategy according to the modified PEIS, or PEIS2 (see Appendix 4). These results appear in **Table 6**.

In the 12-month returns observed after the portfolio formation, both raw returns and market excess returns increase together with the PEIS2, though again not consistently. The P5 score achieves the highest result, with values of 26.88% (21.18%) and 26.60% (16.02%) for raw (excess market) returns over 1 and 2 years. The average return difference between portfolios of firms with high versus low P-scores is positive and the all model is statistically significant at the 1% level for all metrics. If the investor implements a hedge strategy and shorts low score companies while taking long positions in high score companies, it would achieve profitability of 8.21% (30.36%) with a 1-year (2-year) buy-and-hold strategy. This result confirms the greater explanatory power of the PEIS2, compared with the original PEIS. A FA of a 2-year buy-and-hold strategy in turn appears to be more efficient for predicting returns.

The scores we analyze thus are robust, with high statistical significance and strong returns (including excess market returns). Therefore, researchers should examine more sophisticated investment strategies based on FA, including applications of portfolio theory to minimize risk and maximize

	One-year			**Two-years**		
PEIS2	**N**	**Mean raw returns**	**Mean excess market returns**	**N**	**Mean raw returns**	**Mean excess market returns**
1	159	4.31%	5.38%	155	−7.46%	−1.22%
2	278	10.84%	8.28%	268	3.35%	5.39%
3	326	7.91%	7.75%	307	7.40%	7.43%
4	291	15.58%	13.80%	268	17.90%	13.26%
5	165	26.88%	21.18%	155	26.60%	16.02%
6	72	12.52%	8.35%	67	22.89%	11.28%
Low PEIS [1]	159	4.31%	5.38%	155	−7.46%	−1.22%
High PEIS [7]	72	12.52%	8.35%	67	22.89%	11.28%
High-Low		8.21%	2.97%		30.36%	12.50%
t-stat		3.71^{***}	3.20^{***}		11.67^{***}	6.61^{***}
Total	1291	12.51%	10.69%	1220	10.23%	8.46%

Notes: The 12-month returns begin 3 months after the end of the fiscal year, which is December for all firms. We compute geometric means of the returns. The 24-month returns also begin 3 months after the end of the fiscal year, which is December for all firms. We compute annualized means of the returns.
***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Table 6. Buy-and-hold returns by PEIS2.

expected returns. It may be possible to predict financial crises and recessions, especially considering the strong volatility in the Euronext 100 index during the study period [19, 20].

5. Conclusions

This overview of FA stresses its implications for investors looking forward at least 1 or 2 years. It requires investors to use qualitative and quantitative information to identify companies that achieve strong financial performance and thus can face the future. This effort is a cornerstone of investing. With this study, we seek to extend and link several lines of investigation in capital markets accounting research. We focus on value-relevant fundamentals and conditional returns for the FA response coefficient. In addition, we test whether the L-score, F-score, and PEIS [1–3], originally documented in U.S. markets and based on financial statement analyses, can be used by investors to construct portfolios that enable them to earn abnormal returns in other markets. If markets are efficient, anomalies should tend to disappear once they have been discovered, whether by learning or arbitrage.

Among the firms listed in the Euronext 100 index during 2000–2016, we investigate the explanatory power of accounting signals for predicting annual returns in a different setting. The F-score and PEIS2 are statistically significant at the 1% level for all metrics (raw returns and excess returns, 1- and 2-year buy-and-hold). The impact of the L-score is also positive and statically significant (1–5% level). If they adopt an investment strategy and construct portfolios using F-scores, L-scores, and PEIS2, investors should be rewarded with abnormal returns on their 1- and 2-year buy-and-hold strategies. By selecting firms with high scores, investors can expect raw returns on their 1-year buy-and-hold approach that range between 12 and 48% (F-score 21%, L-score 48%, PEIS2 12%). In addition, an investment strategy that encouraged buying these expected winners and shorting expected losers could have generated 8–42% annual returns between 2000 and 2016 (F-score 30%, L-score 43%, PEIS2 8%). Portfolios composed of high score firms over 2-year returns also would produce increased raw and market excess firm returns. Because FA is based on various accounting reports that cover the most important financial aspects of a firm, it appears more efficient for implementing long-term investing strategies than a traditional market index, as also suggested in prior research [2, 4, 5].

The current study advances FA and capital market literature in several ways. First, the findings pertaining to the value relevance of accounting fundamentals provide insights into market efficiency in Europe. With regard to the type of market efficiency [22], we do not find support for the semi-strong form of the EMH, in which security prices reflect all publicly available information. Further research is needed to determine whether the value relevance of accounting fundamentals is an important signal of market inefficiency. In particular, some firms have high fundamentals that are not reflected in their security prices. These results may explain the lack of verification for the semi-strong form of the EMH [23]. Second, the results of using a fundamental strategy to form portfolios have practical implications for investors. Noting the evidence that accounting fundamental signals can provide important insights to investors as they make decisions about their resource allocations, research in European markets should explore this approach further, to provide alternative explanations for the value relevance of fundamentals, and investigate whether other strategies can predict periods of financial stress.

This study required all data to be available at the time the "back test" was run, so there were no survivorship issues, and the observations are based on information that would be available to all investors before they made investment decisions. It also uses annual data; perhaps results using quarterly data would be more accurate and potentially reflect a "post-earnings drift" effect. Regression models also can work well if an investor is diversified [2, 14].

This study also has several limitations. The scores do not include important macroeconomic variables, such as inflation rates, economic depressions, or regulatory changes in the market, beyond controlling for time effects. Additional out-of-sample tests could strengthen inferences about the usefulness of a given accounting attribute, to forecast either future earnings or future stock returns. If relevant institutional factors or other characteristics vary over time or across firms, this variation should be tested; any variation in the observed outcomes also might help strengthen the resulting inferences. Tests of the predictive ability of a given attribute also might be conducted in a more "fair" manner.

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Appendix 1. Original F-Score of Piotroski [2]

F-score	Ratio	Condition
1	$ROA_{(t)} > 0$	then F1 = 1; 0 otherwise
2	$CFR_{(t)} > 0$	then F2 = 1; 0 otherwise
3	$\Delta ROA > 0$	then F3 = 1; 0 otherwise
4	$\frac{CFR_t}{A_{t-1}} > ROA_{(t)}$	then F4 = 1; 0 otherwise
5	$\Delta\left(\frac{LTD}{A}\right) < 0$	then F5 = 1; 0 otherwise
6	$\Delta CR < 0$	then F6 = 1; 0 otherwise
7	Δ Equity > 0	then F7 = 1; 0 otherwise
8	$\Delta \left[\frac{GM_t}{A_{t-1}}\right] > 0$	then F8 = 1; 0 otherwise
9	$\Delta \left[\frac{Sales_t}{A_{t-1}}\right] > 0$	then F9 = 1; 0 otherwise

Notes: $ROA_{(t)}$ = return on assets at time t, or $\frac{NBID_t}{A_{t-1}}$; NIBD = net income before interest, taxes and depreciation, such that $NIBD_{(t)} = Sales_{(t)} - COGS_{(t)} - SGAE_{(t)}$; SGAE = selling, general, and administrative expenses; COGS = cost of goods sold; $A_{(t-1)}$ = total assets at the beginning of the period t; $CFR_{(t)}$ = cash flow from operations at time t, or EBIT + depreciation – taxes; EBIT = earnings before interest and taxes; $\Delta ROA = ROA_{(t)} - ROA_{(t-1)}$; LTD = long-term debt; $\overline{A}$ = Average of total assets; $\overline{A} = \frac{A_{t-1}+A_t}{2}$; CR = current ratio at time t; $CR = \frac{Current\ Assets}{Current\ Labilities}$; Δ Equity = change in common share outstanding (if the firm issued equity at t, this variable will be greater than 0); $\Delta\left[\frac{GM_t}{A_{t-1}}\right] = \frac{GM_t}{A_{t-1}} - \frac{GM_{t-1}}{A_{t-2}}$; GM = gross margin; and $GM_{(t)} = Sales_{(t)} - COGS_{(t)}$. The F-score = F1 + F2 + F3 + F4 + 5 + F6 + F7 + F8 + F9.

Appendix 2. Adaptation of Lev and Thiagarajan's [1] L-Score

L-Score accounting signal		Definition
1.	Inventory	Δ Inventory – Δ Sales
2.	Accounts Receivable vs. Sales	Δ Accounts Receivable – Δ Sales
3.	Capital Expenditure	Δ Firm Capital Expenditures
4.	Gross Margin	Δ Sales – Δ Gross Margin
5.	Sales and Administrative Expenses	Δ Sales & Administrative Expenses – Δ Sales
6.	Accounts Receivable	Δ Accounts Receivable
7.	Effective Tax	$PTE_t \times (T_{t-1} - T_t)$ PTE_t = pretax earnings at t. deflated by beginning price T = effective tax rate
8.	Labour Force	$\frac{\frac{Sales_{t-1}}{No\ of\ Employees_{t-1}} - \frac{Sales_t}{No\ of\ Employees_t}}{\frac{Sales_{t-1}}{No\ of\ Employees_{t-1}}}$
9.	Sales	Δ Sales

Notes: As an example consider how the inventory signal can be computed: Inventory $Change_{i,\ t} = \frac{[Inventory_{i,t} - E(Inventory_{i,t})]}{E(inventory_{it})}$ - $\frac{[Sales_{i,t} - E\ (sales_{i,t})]}{E\ (Sales_{i,t})}$; Inventory $Signal_{i,\ t}$ = 1 if Inventory Change $_{I,\ t}$ < 0, and 0 otherwise; E ($Inventory_{i,\ t}$) = $\left[\frac{Inventory_{i,t-1} - E\ (Inventory_{i,t-2})}{2}\right.$; and E ($Sales_{i,\ t}$) = $\frac{[\ Sales_{i,t-1} - E\ (Sales_{i,t-2})]}{2}$; where Inventory $Change_{i,\ t}$ = percentage change in inventory minus percentage change in sales of firm i in year t; Inventory $Signal_{i,\ t}$ = binary signal indicating a positive (1) or negative (0) signal of firm i in year t; E ($Inventory_{i,\ t}$) = last 2-year average of inventory for the corresponding year, which includes the average of inventory for years t – 1 and t – 2; and E ($Sales_{i,\ t}$) = last 2-year average of sales value for the corresponding year, which includes the average of sales for years t – 1 and t – 2. Thus, the L-Score = L1 + L2 + L3 + L4 + L5 + L6 + L7 + L8 + L9.

Appendix 3. Wahlen and Wieland [3] PEIS

P-score	Signal	Quintile scoring
		+1 0 –1
1	RNOA	Bottom Middle Top
2	ΔGM	Top Middle Bottom
3	ΔSGA	Bottom Middle Top
4	ΔAT	Top Middle Bottom
5	ΔNOA	Bottom Middle Top
6	$ACC_{(t)}$	Bottom Middle Top

Notes: RNOA = return on net operating assets, or operating income/[($NOA_t + NOA_{t-1}$)/2]; ΔGM = change in gross margin; ΔSGA = change in sales/selling, general, & administrative expenses; ΔAT = change in asset turnover; ΔNOA = change in net operating assets; and $ACC_{(t)}$ = [operating income – cash flow from operations]/Average NOA. PEIS = P1 + P2 + P3 + P4 + P5 + P6.

Appendix 4. Adaptation of Wahlen and Wieland [3], PEIS2

P -score	Ratio	Condition
1	ΔRNOA>0	then P1 = 1; 0 otherwise
2	ΔGM > 0	then P2 = 1; 0 otherwise
3	ΔSGA>0	then P3 = 1; 0 otherwise
4	ΔAT > 0	then P4 = 1; 0 otherwise
5	ΔNOA>0	then P5 = 1; 0 otherwise
6	$ACC_{(t)} > 0$	then P6 = 1; 0 otherwise

Notes: ΔRNOA = change in return on net operating assets, or operating income/[($NOA_t + NOA_{t-1}$)/2]; ΔGM = change in gross margin; ΔSGA = change in sales/selling, general, & administrative expenses; ΔAT = change in asset turnover; ΔNOA = change in net operating assets; and $ACC_{(t)}$ = [operating income – cash flow from operations]/average NOA. PEIS2 = P1 + P2 + P3 + P4 + P5 + P6.

Author details

Raúl Navas[1,2], Ana Paula Matias Gama[2,3]* and Sónia R. Bentes[1,4]

*Address all correspondence to: amatia@ubi.pt

1 Institute of Accountancy and Administration of Lisbon (ISCAL), Lisbon Polytechnic School (IPL), Lisbon, Portugal

2 Research Center in Business Sciences (NECE), Covilhã, Portugal

3 Management and Economics Department, University of Beira Interior (UBI), Covilhã, Portugal

4 Business Research Unit, Lisbon University Institute, Lisbon, Portugal

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International capital flows have become significantly important since the increasing trend in globalization of the early 1990s. The diversified global market has become one single market, the investment sector has strengthened itself and countries have started to allow investment inflows for economic growth. Empirical studies have revealed that political instability, political regimes and the quality of existing institutions, in addition to the transition procedure of a nation itself, have a deterministic effect on the linkage of economic growth and corruption. Additionally, exchange rate volatility can determine the amount of exchange rate risk that firms can be opposed to; therefore, exchange rate volatility is a crucial issue that should be monitored by central banks to prevent contagion of negative microeconomic developments to macroeconomic activity and stability. The significant transformation of banking markets raises many questions regarding the motives of financial organisations to finance SMEs, for example what are the factors that have an impact on these organisations' choice and market strategies?

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