Chapter

Introductory Chapter: Some Current Issues on Accounting and Finance

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1. Introduction

This book deals with new perspectives on banking, financial statements, and reporting. The introductory chapter focuses on the following overviews regarding accounting and finance, and it gives the target audience the opportunity to be familiar with recent developments in accounting and finance.

2. Accounting overview

Accounting is an information that collects financial data from the operations of a business entity to create financial statements which consist of an integral part of financial communication so that related parties are informed about the financial situation, financial performance, and cash flows of a business. In recent years, financial reporting side of accounting became very important rather than traditional bookkeeping side of accounting. Within the framework of transparency and accountability concepts of corporate governance, countries started to integrate International Financial Reporting Standards (IFRS) into their regulations so that publicly accountable entities can prepare understandable, reliable, transparent, comparative financial statements particularly to investors and creditors in the global context. In addition, some countries started to adopt "think small first approach" in terms of nonpublicly accountable entities focusing on financial reporting based on the size of a business enterprise. That is why either they adopted International Financial Reporting Standard for Small and Medium-Sized Entities (IFRS for SMEs) or they prepared a new financial reporting standard under the influence of international practices and national accounting rules by considering some exemptions in order not to create additional reporting costs for small and micro-sized entities [1]. Even if this is the case, there are still some countries that continue to use their national GAAP.

On the other hand, another reporting issue that complements financial reporting refers to corporate social responsibility (CSR) or sustainability reporting. Sustainability reporting gives (1) economics data, (2) environmental data, and (3) social data about a business entity [2]. Therefore, financial reporting data of a business enterprise is supported by other three aspects of a business so that related parties are informed about the business entity as a whole.

No matter which accounting practice is adopted by a business enterprise, financial statements create the basis and provide the necessary infrastructure so that investors and creditors can financially analyze the business entity using different scenarios such as financial development and survivorship under different accounting metrics.

3. Finance overview

Financial institutions are public or private organizations responsible for the supply of money in a marketplace. They do this by collecting money and investing in assets such as bank deposits, stock, bonds, and loans. Consequently, they act as an intermediary between savers and borrowers; they play a very important role in society. Financial institutions are not just commercial banks; they can also be national banks (e.g., Bank of England), brokerage firms, money services, insurance companies, and even casinos [3, 4].

The financial institutions are the most critical institutions in the world, since they play a very important role in society. Financial institutions are among the largest employers in many countries, and the development of a nation's economy is closely related to the performance of its financial institutions. The banking system among financial institutions has such a heavy responsibility that is considered as one of the most important parts of a country's economy. The bank represents services, in which without them the economic system of a country would stop. The available capital in banks is the main resource of purchasing products and services; moreover, their donated loans are resources of credit for all units of the economy like families, occupations, companies, and government. Therefore, banks' optimum activity and efficient use of their available facilities are important to help them to reach their goals. Appropriate allocation of capital and resources of different financial activities will ultimately conclude to the improvement of the whole economic situation of a country [5].

Threats and pressures of globalization and rapid development of non-bank credit and financial institutions in recent years have forced the managers of banks to establish research centers and launch research activities in their own status field to stay afloat in the market and compete with other financial institutions in domestic and international markets. In this respect, banks need to determine their weaknesses and strengths in the markets and improve productivity by finding a logical and efficient solution for their activities. A bank or financial institute would be successful in this competitive world if high efficiency can be obtained in its activity. The final goal of a bank is to reach the highest efficiency with the lowest cost. The cost phenomenon is one of the most important issues that will have an effect on the efficiency of banks. An economic project with high efficiency can be achieved when you get a better and economic result toward your goals with lower costs [6, 7].

4. Summary

In this respect, some concepts raise particularly for investors and creditors such as bankruptcy, efficiency of financial markets, transparency, accountability, financial information quality, and survivorship. The overall objective of this book is to discuss these concerns to help the investors, creditors, and the managers of financial institutions to better recognize and analyze particular financial problems and solve them successfully. Moreover, the main purpose of this book is to help the managers of the financial institutions and the users of accounting information, especially bank, investors, and creditors, to find the possible solution to improve the performance of firms and financial institutions.

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Chapter

National Accounting Standards in Turkey

Birsel Sabuncu

Abstract

This study describes the accounting standards being implemented in Turkey. Uniform Accounting System and Uniform Chart of Accounts, Turkish Financial Reporting Standards (TFRS), and Financial Reporting Standards for Large- and Medium-Sized Enterprises (FRS for LMEs) are simultaneously applied in Turkey. TFRS are a direct translation of the International Financial Reporting Standards (IFRS). Enterprises that are subject to independent audit apply TFRS. FRS for LMEs is a financial reporting framework that is subject to independent audit and is valid for financial statements presented to general assemblies of enterprises that do not apply the TFRS. Enterprises that are not subject to independent audit apply Uniform Accounting System. Uniform Chart of Accounts is used by all these businesses. Despite these new practices, a revision has not been carried out in Uniform Chart of Accounts. Because of these applications, it is necessary to define the new accounts needed and to review Uniform Chart of Accounts. Banks, insurance and pension companies, finance companies, financial leasing and factoring companies, and asset management companies are required to use a different account plan despite the application of TFRS.

Keywords: Uniform Accounting System, Uniform Chart of Accounts, Turkish Accounting Standards (TAS), Turkish Financial Reporting Standards (TFRS), Financial Reporting Standards for Large- and Medium-Sized Enterprises (FRS for LMEs)

1. Introduction

Every country initially established its own accounting techniques to report the results of the activities of the enterprises to the relevant interest groups. Due to economic, historical, and traditional differences, there are differences between the accounting techniques. A need to standardize accounting techniques was born both locally and internationally in order to eliminate these differences, which caused negativity about the consistency and comparability of the information in the financial statements. The existence of different accounting systems for different countries can cause various difficulties for international money flow, while a Uniform Accounting System makes it easier for businesses. The existence of a single accounting system to be implemented by all enterprises increases the speed of international transactions, facilitates transparency, and supervision in financial statements and also facilitates transactions.

To eliminate the differences in accounting practices; to perform uniformity in the accounting principles; to ensure that the financial statements are clear,

appropriate, understandable, objective, and comparable; to prevent misappropriation of the individuals and institutions related to enterprises; to prevent wrong decisions; and to create a common language during the production and presentation of financial information, Uniform Accounting System and Uniform Chart of Accounts came into force in Turkey in 1994 and still continue today.

As with financial reports prepared in accordance with the different legal and financial structures of countries, International Accounting Standards (IAS) were made compatible which resulted in an exact translation of the International Accounting Standards (IAS), and International Financial Reporting Standards (IFRS) were entered into force as Turkish Financial Reporting Standards (TFRS) in Turkey. Public Oversight, Accounting and Auditing Standards Authority (POAASA) is authorized for the creation, publishing, and monitoring of changes of the accounting standards that are in compliance with international standards. POAASA aims to ensure the transparency, reliability, comprehensibility, comparability, and consistency of the financial statements of the firms. Currently, there are various accounting practices in Turkey, and the preference of which one to be used depends on being subject to independent audit by the enterprises. Companies whose shares are traded on the stock exchange and that are subject to independent audit apply TFRS, while Large- and Medium-Sized Enterprises which are subject to independent audit but whose shares are not traded on the stock exchange and do not apply TFRS, apply Financial Reporting Standards for Large- and Medium-Sized Enterprises (FRS for LMEs). Enterprises that are not subject to independent audit apply Uniform Accounting System.

Uniform Chart of Accounts is used by all businesses. Despite the application of new accounting standards in Turkey, there are no new regulations regarding the needs of Uniform Chart of Accounts, which are used by the companies that perform accounting and reporting in accordance with these new standards. In Uniform Chart of Accounts, there is a need for a revision of the needs of enterprises.

Banks and insurance companies: private financial institutions: financial leasing, factoring, and financing companies: security mutual funds, brokerage houses, and investment trusts are subject to Banking Regulation and Supervision Agency (BRSA) legislation and have a different chart of accounts, and a revision has been performed for this chart of accounts. The mentioned company activities are accounted in accordance with the declarations of BRSA and TFRS.

2. Uniform Accounting System

Before 1994, there was no standard in accounting applications and in accounting principles in Turkey. As of 1.1.1994, there has been a transition to the standard Uniform Accounting System in accordance with the Accounting System Application General Communiqué, Order No.1 published in the Official Gazette dated 26.12.1992 and numbered 21,447 (repeated). With the regulation, it was aimed to provide uniformity in all accounting applications in Turkey and to have the same operating language for all segments. Accordingly, natural and legal persons holding books according to balance sheet basis are obliged to apply the accounting procedures and principles stated in the General Communiqué on Accounting System.

Tax regulations in Turkey may directly interfere with accounting practices and education in time. This relationship between tax regulations and accounting causes accounting in Turkey to be intended for tax and focused on tax regulations. Tax Procedure Law obligates application of the conditions required by the General Communique on Accounting System Application and Tax Procedure Law simultaneously. The arrangements made with the General Communique on Accounting System

Application do not regulate or modify any matter related to tax legislation. The difference between period income and taxable income shall not be settled on balance sheets or income statements; taxable profit shall be calculated outside of financial statements.

Uniform Accounting System is defined as the use of the same chart of accounts in accounting applications, adopting the same accounting principles, benefiting from the same accounting concepts, and providing accounting information in uniform financial statements and reports.

Uniform Accounting System is a system that includes financial statements, charts of accounts, account codes, and similar details. This regulation related to the transition to Uniform Accounting System was made in order to facilitate and provide a sound and reliable follow-up of the results of the undertakings and enterprises belonging to real and legal persons holding books on a balance sheet basis and to ensure that the information presented to the related parties through the financial statements reflects the real situation while maintaining the consistency and comparability characteristics of the audit.

It is the responsibility of the business to be in compliance with the procedures and principles seen in changes made in the name of Uniform Accounting System and organization of reports and declarations for related legislation provisions. Regulation [1]:

- Full and direct delivery of accounting information to respective persons making a decision.
- To compare different periods of the same enterprise with different enterprises.
- Account names in the financial statements give the same meaning to all segments.
- Retaining accounting term uniformity while remaining understandable.
- Aims to establish trust between businesses and those concerned.

Uniformity of the financial statements to be prepared within the framework of the procedures and principles related to the regulation and presentation of financial statements in Uniform Accounting System cannot be changed. In the determination of the taxable income, companies are required to make the necessary adjustments and calculations in accordance with tax legislation. The accounting principles and procedures of the Uniform Accounting System are explained in five sections as follows:

- Basic concepts of accounting
- Explanation of accounting policies
- Principles of financial statements
- Arrangement and presentation of financial statements

Uniform account framework, chart of accounts, and descriptions of accounts. Businesses must establish their accounting systems in accordance with the uniform accounting framework and the chart of accounts. The basic concepts of accounting in Turkey are the concept of social responsibility, the concept of business entity, the going-concern concept, the concept of periodicity, the concept of monetary unit, the concept of cost basis, the concept of objectivity and documentation, the

consistency concept, the full disclosure concept, the concept of prudence, the concept of materiality, and the concept of substance over form.

In the Uniform Accounting System, it is not required to disclose them if they are prepared on the basis of the concepts of going-concern, consistency, and periodicity in the preparation of financial statements. However, in the case of deviation from these concepts, the disclosures of the financial statements should explain this deviation together with their reasons. All significant accounting policies included in the financial statements should be clarified and explained briefly. Financial statements should be comparable in terms of periods. If a change is made in the current period or will occur in future periods, which has a significant effect on financial policies, it should be explained together with the reasons and the effects of these changes on financial statements. The financial statements consist of the following ones [1]:

- Balance sheet
- Income statement
- Statement of cost of sales
- Fund flow statement
- Cash flow statement
- Statement of profit distribution
- Statement of changes in equity

Providing useful information in making decisions for investors, lenders, and other interested parties; providing useful information on assessing future cash flows; providing information about assets, resources and changes in these items; and obtaining information about the business activities, these statements should be understandable, appropriate, reliable, comparable, and promptly arranged so that the information in the financial statements can be used in the best possible way by decision-makers.

Uniform Accounting System includes real and legal persons holding books according to the balance sheet basis. However, there are institutions that need to use different accounting techniques in terms of their activities. These include bank and insurance companies; private financial institutions; financial leasing, factoring, and financing companies; security investment funds; brokerage houses; and investment trusts. These institutions are subject to BRSA's legislation, and they are required to comply with the basic principles of accounting, explanation of accounting policies, and principles of financial statements in Uniform Accounting System. They have a different chart of accounts and do not have to fulfill other obligations.

Banks are required to account for their activities in accordance with the communiqués published by BRSA and within the framework of the conceptual provisions of POAASA. However, the accounting for subsidiaries, jointly controlled entities and associates and consolidated financial statements, financial statements to be disclosed to public, and procedures and principles regarding the disclosure and footnotes are determined by the communiqués issued by BRSA.

In accordance with Banking Law, banks are obliged to implement a uniform order in accounting systems in accordance with the procedures and principles determined by BRSA by taking the opinion of the POAASA. Banks must be able to account for all transactions in accordance with their real nature in accordance with the accounting and Financial Reporting Standards issued by POAASA in a manner

that is capable of meeting the need to obtain financial reports in an understandable, reliable, and comparable style, suitable for auditing, analysis, and interpretation. Banks are required to achieve transparency and uniformity in accounting and reporting systems, by preventing transactions from being left out of record and by accounting for all activities in a timely, healthy, and secure manner within the framework of correct and timely preparation, reporting, and publishing of financial statements showcasing financial performance and management.

The "Declaration in Reference to the Uniform Chart of Accounts and Prospectus" published in 26.01.2007 and 26,415 (repeated) numbered Official Gazette based on the regulation of procedures and principles for the accounting of bank's accounting practices and documents provides uniformity in terms of accounting and financial reporting for banks and direct acquisition of a single type of balance sheet and income statement, obtaining direct and healthy information in a verifiable and auditable manner in order to ensure supervision and monitoring and to provide the information needed for various analyses and interpretations in a standardized way.

2.1 Uniform Chart of Accounts

The chart of accounts is expressed as a list of accounts to be used in accounting. Uniform Chart of Accounts is a system that is organized for the systematic execution of all accounts held in an enterprise and to ensure that the same events are always recorded in the same accounts.

In Turkey, Uniform Chart of Accounts mentioned in the Accounting System Application General Communiqué, Order No.1 published in the Official Gazette dated 26.12.1992 and numbered 21,447 (repeated) became a necessity for all businesses and accounting activities as of 01.01.1994. Thus, it is aimed to provide unity in accounting practices in enterprises. Uniform Chart of Accounts is a scale that shows the accounts of the activities of the enterprises, and the enterprises comply with the chart of accounts and transfer the same type of documents to the accounting records and financial statements according to the same chart of accounts and the same accounting system. The purpose of the Uniform Chart of Accounts is to use the same chart of accounts for companies holding books on the balance sheet basis and to include the economic events occurring in enterprises in the same accounts within the framework of the same systems and principles. Uniform Account Chart framework [1] is as follows:

1. Current assets
2. Noncurrent assets
3. Short-term liabilities
4. Long-term liabilities
5. Equity
6. Income statement accounts
7. Cost accounting accounts
8. Free
9. Off-balance sheet accounts

Uniform Chart of Accounts is divided into nine account classes, from 1 to 9. Likewise, each account class is divided into ten account groups, ranging from 0 to 9. There are a total of ten main accounts in each account group, from 0 to 9. The main accounts are given three-digit numbers. For instance; 1 Current assets (account class), 10 Cash and Cash Equivalents (account group), 100 Cash (main account). In the Uniform Chart of Accounts coding, various code systems are used while numbering the accounts. Account codes make it easy to distinguish between account groups and accounts.

According to the Uniform Accounting System, enterprises have to establish their accounting systems in accordance with the uniform accounting framework and chart of accounts. Businesses plan their accounts in advance and make a list of them. With the introduction of new standards in Turkey, there was a need for new account codes. There are a number of problems related to the definition of new account codes due to new applications of the Uniform Chart of Accounts related to the application of TFRS and FRS for LMEs such as account of investment property and account of qualified assets held for sale purpose. Therefore, a serious review and revision is needed.

The draft chart of account has been drawn up by POAASA that will enable the companies to establish their accounting systems so that they can prepare their financial statements. In the drafting of the chart of account, account groups and accounts have added to ensure that all companies have access to financial statement data directly. This draft chart of account was submitted to the public on 25.12.2018. After taking the comments of the public and related institutions and organizations, the final version of the new chart of account will be given. These accounts have added in the draft chart of account [2]:

- Financial investments whose fair value difference is measured at amortized cost by financial investments reflected in other comprehensive incomes (accounts 111, 112, 201, and 202)

- Financial assets from ongoing construction (undertaking), project or service contracts, and obligations arising from these contracts and construction works performed in advance (groups 14 and 24 with the exception of accounts 142 and 242 and groups 34 and 44)

- Live assets and gains and losses related to them (account numbers 17 and 27 and account numbers 643 and 653)

- Liabilities related to noncurrent assets classified for sale and groupings classified as held for sale (account numbers 196–199 and account numbers 396–399)

- Investment properties and related income and expenses (accounts numbers 245–249 and account numbers 647 and 657)

- Deferred tax assets and liabilities and deferred tax income and expense effects (account numbers 289 and 489 and account numbers 692 and 696)

- The effect of mergers involving enterprises or enterprises subject to joint control (account number 516)

- Income and expenses accumulated in shareholders' equity (groups 55 and 56)

- Other comprehensive income and expenses for the period (groups 80, 81, 82, and 83)

- Income and expenses relating to discontinued operations and taxes on these income and expenses (accounts 684 and 697)

2.2 Bank Uniform Chart of Accounts

Banks and leasing and factoring companies have a Uniform Chart of Accounts different from the other entities due to the different types of activities and operations of the financing companies. The operations of such institutions are recorded by using Bank Uniform Chart of Accounts that is recognized under the provisions of the Banks Association of Turkey. Banks are subject to the Bank Uniform Chart of Accounts and the regulatory authority, BRSA. Bank Uniform Chart of Accounts consists of the following groups [3]:

0. Return values

1. Credits

2. Investment values and other assets

3. Deposits and other foreign resources

4. Equity

5. Interest income

6. Interest expenses

7. Noninterest income

8. Noninterest expenses

9. Off-balance sheet accounts

The accounts in each group are divided into two as Turkish currency and foreign currency. The foreign currency-denominated accounts are the accounts in which the amounts arising from the foreign currency transactions of the bank are recorded. Foreign currency balances in these accounts are valued at the end of the period and transferred to related accounts. Foreign currency interest, commissions, and income received from foreign currency accounts and transactions are translated into Turkish Lira at the exchange rates prevailing at the transaction date and recorded in the related foreign currency profit/loss accounts. Even if the revenues are collected in Turkish currency instead of foreign currency, they are recorded in the related foreign currency profit and loss accounts. In the Uniform Chart of Accounts, the accounts working for Turkish Lira and foreign currency transactions are separated at the general ledger level. If the last digit of the general ledger accounts is an even number, then it is in Turkish Liras, and if the last digit is an odd number, then it indicates a foreign currency account.

A new account cannot be opened in the book at a new level without the permission of the BRSA. For the accounts that are opened at the level of general ledger and do not have any subaccounts, banks can open auxiliary, sub-, and subordinate accounts if needed. If there is no special account in which to record a transaction, a special account must be opened with permission from the BRSA for such transactions.

3. Turkish Financial Reporting Standards (TFRS)

In the POAASA's decision dated 13.09.2018 numbered (03/161), TFRS are redefined. They cover the standards published under the names of TAS, TFRS, TAS Interpretation, and TFRS Interpretation [4].

The financial statements are prepared and presented by their preparers across the globe for their users. There are some differences due to the use of different financial statements by different countries during the creation of national regulations for social, economic, and legal reasons. The efforts of the International Accounting Standards Board (IASB) to form a common language in the process of globalization are in question. IASB aims to reduce the differences by harmonizing the rules and accounting standards and application procedures for the preparation and presentation of financial statements.

As the common language used by businesses in terms of financial reporting, IFRS are the standard set which directs financial reporting in the world and are formed by the IASB that is the authority for financial reporting in terms of the level of implementation and adoption by the world. The purpose of the IFRS is to increase international investments and trade through a comparable, reliable, understandable, and transparent presentation of financial statements. TAS/TFRS and TAS/TFRS Interpretations are literal translations into the International Accounting Standards/International Financial Reporting Standards/International Financial Reporting Interpretation Committee (IAS/IFRS/IFRIC) as issued by the IASB.

A set of financial statements prepared under the TFRS [5] are as follows:

- Statement of financial position.
- Statement of profit or loss and other comprehensive incomes.
- Statement of cash flows.
- Statement of changes in equity.
- Financial statements are composed of footnotes.

TFRS are prepared to meet the needs of the users of the securities and their financial statements.

The accounting records of companies of the specified nature and scale determined by the decision of the Council of Ministers which was formed around the decision of the POAASA following 01.01.2013 continue to be done in accordance with Tax Procedure Law with compatibility to TFRS [6].

The publication of TAS/TFRS does not mean that Uniform Accounting System has completed its function, but rather increases its importance in order to ensure their healthy implementation, comparability, and reliability [7].

With the application of TAS/TFRS, there are some changes in the format and classification of the financial statements in the Uniform Accounting System which have been compulsory since 1994, and the formal structure is changing. The importance of information is emphasized in the standards, and it is required to present important information in a truthful manner. TAS/TFRS also made significant changes in the valuation of balance sheet items and income statement items. These changes in measurement and valuation significantly affect the reported amounts of items in financial statements [8].

In the POAASA's decision dated 13.09.2018 and numbered (03/161), TAS are redefined. TAS cover TFRS mentioned above and FRS for LMEs and other standards determined by the agency. TAS of the decision for determining the scope of application is detailed below [4]:

- Institutions that require TFRS to be used in the preparation of their individual and consolidated financial statements: (A)—(i) Joint stock companies traded on the stock exchange; (ii) Investment institutions; (iii) Collective investment institutions; (iv) Portfolio management organizations; (v) Mortgage financing institutions; (vi) Housing finance and asset financing funds; (vii) Asset leasing companies; (viii) Central clearing houses; (ix) Central lending organizations; (x) Data storage organizations; and (xi) Capital market instruments that are not traded on the stock exchange, but which provide at least two of the three criteria from publicly traded companies in the capital market: (a) Total of 15 million and more Turkish Lira; (b) Annual net sales revenue of 20 million and more Turkish Liras; (c) Number of employees 50 and above. (B)—Businesses subject to the regulation and supervision of the BRSA in accordance with Banking Law—(i) Banks; (ii) Financial leasing companies; (iii) Factoring companies; (iv) Financing companies; (v) Asset management companies; (vi) Rating agencies; (vii) Financial holding companies; (viii) Companies holding financial holding companies; and (ix) Payment agencies. (C)—Insurance, reinsurance, and pension companies. (D)—Corporations, which are allowed to operate in Borsa Istanbul, joint stock companies.

- Subject to independent audit and the implementation of FRS for LMEs in the preparation of individual and consolidated financial statements of institutions, establishments, and enterprises other than the above; however, it will be able to implement the TFRS upon request of the institutions, organizations, and enterprises in question.

TFRS is the basis of the policy. It does not give businesses the chance to use the account name according to their needs. In the principle-based approach, only the account framework is determined, and the chart of accounts is not compulsory. Each business determines its own chart of accounts.

4. Financial Reporting Standards for Large- and Medium-Sized Enterprises (FRS for LMEs)

IFRS is divided into two as IFRS full set and SME sets in the world and in Turkey, although TFRS for SMEs that was in line with IFRS for SMEs was published in 2010 in the official gazette, but there has been no chance to implement it. Later, FRS for LMEs was issued by POAASA instead of the TFRS for SMEs. FRS for LMEs, entered into force on the date of publication, to be applied in the accounting periods beginning on or after 01.01.2018. It consists of 27 chapters and sets out the accounting principles for all accounting transactions that the companies may encounter in general.

The purpose of the IASB is to prepare a separate standard for SMEs as a set of accounting principles derived from IFRS, which will be used by small, simplified entities whose stocks are not listed on the stock exchange. IASB has defined IFRS for SMEs as a set of simple and simplified Financial Reporting Standards derived from IFRS that will be used by nonpublic entities [9].

FRS for LMEs was issued by replacing TFRS for SMEs with certain additions. This standard includes interest costs, fair value application, receivables and asset

provisions, depreciation, severance pay, receivable and debt aging, inflation adjustment, and consolidation matters. It is essential that the fair value application and active registered fixed assets are valued. This issue has been added to FRS for LMEs while it was not included in TFRS for SMEs.

The purpose of FRS for LMEs is to provide financial statements that are in compliance with financial information needs. Four financial statements are required to be prepared in the FRS for LMEs [10]:

- Statement of financial position
- Statement of Profit or loss
- Statement of changes in equity
- Statement of cash flows

The objectives of the FRS for LMEs are defined as follows:

- Real
- Fits financial information requirements
- Providing the preparation of comparable financial statements

Since the FRS for LMEs has set a standard for the determination of commercial profit in Turkey and can be applied more easily than TFRS, it will contribute to a clearer understanding and proper implementation of the full set of standards. Thus, the main task of accounting, real activity result reporting, real situation detection, planning, and control will be available to produce information, and commercial purposes to use financial data will be become a habit [11].

FRS for LMEs is an important development in terms of accounting practices in Turkey. It is a financial reporting standard that enables the financial statements of the enterprises that are subject to independent audit and are not obliged to be accountable to the public and do not prefer to apply TFRS, to be understood by investors and lenders with their fair presentation, needed for financial information, and provides comparability of financial statements [12].

FRS for LMEs prepared by POAASA has been prepared in a simpler language than TAS/TFRS, avoiding the details that are not necessary for large- and medium-sized enterprises and addressing the basic principles of related subjects only [13].

The primary objective of the Accounting System Application General Communiqué issued based on the Tax Procedure Law is to show the financial position of the taxpayers against tax. FRS for LMEs is subject to independent audit and replaces the Accounting System Application General Communiqué and Supplementary Issues in entities not applying TFRS. The financial reporting framework that will be the basis for the preparation of the financial statements of the companies which are subject to independent audit and which will not be subject to TFRS in accordance with the Turkish Commercial Code; the base financial report must be FRS for LMEs.

In the POAASA's decision dated 13.09.2018 and numbered (03/161), FRS for LMEs are redefined. FRS for LMEs is a financial reporting framework that is subject to independent audit and is valid for financial statements presented to general assemblies of enterprises that do not apply the TFRS. It has been decided that may apply FRS for LMEs in the preparation of the individual and consolidated financial statements of the institutions, establishments, and enterprises other than those which are obliged to apply TFRS. However, it has been decided that such institutions, organizations, and enterprises may apply TFRS on demand [4].

5. Conclusion

Accounting shows the financial structure of the enterprise and the results of its economic activities. Accounting practices constitute the source of accounting practices including basic accounting concepts, accounting principles, and accounting policies. Accounting standards is a set of rules that are formed in order to enable the comparison of the information generated in the accounting information system as a result of the business activities with confidence in accordance with the reality without considering the distinction of events of the same nature.

The subject of accounting is the financial statements and reports to be prepared for public disclosure. Therefore, the concept of public disclosure is in a sense also the purpose of generally accepted accounting standards. In order to meet the increasing need for trust in an environment of global competition, the rapid increase of standardization movements has also emerged in the accounting field.

Works aiming for standardization of both national and international dimensions of accounting are implemented in Turkey. Uniform Accounting System which has been in use in Turkey for a long period of time is a topic of discussion. However, as a result of this change, the Turkish translations of IAS/IFRS are in use as TAS/TFRS. TAS and TFRS-applicable Financial Reporting Standards also continues to use the Uniform Accounting System which has been applied for a long time. In addition, the financial reporting standard has been enacted for large- and medium-sized enterprises. Despite the fact that Full Set TAS/TFRS is translated into Turkish, FRS for LMEs has been put into effect instead of IFRS for SMEs because it is a closer match. Companies that are subject to independent auditing and that do not apply TFRS are required to apply FRS for LMEs in the presentation of their consolidated financial statements.

International Accounting Standards have emerged as a result of the harmonization of financial reports prepared according to the standards determined by the legal or financial structures of different countries in order to enable users to compare the same criteria for information users in different countries. The consolidated financial statements of companies whose stock is traded in the stock exchange and that are subject to independent auditing must be prepared in accordance with TFRS.

Banks, insurance, reinsurance and pension companies, factoring companies, finance companies, financial leasing companies, and asset management companies are required to implement TFRS and have their own chart of accounts.

FRS for LMEs is applied by companies subject to independent audits but do not apply TFRS and provides comparable financial information. The purpose of FRS for LMEs is to provide financial statements that are in compliance with financial information needs. The companies that are not subject to independent audits are generally required to prepare their financial statements in accordance with Uniform Accounting System.

The application of the Accounting System Application General Communiqué and its annexed Uniform Chart of Accounts as prescribed by the Tax Procedure Law is still in progress. The combination of all these applications may cause confusion in some cases. In addition, it is necessary to review Uniform Chart of Accounts as soon as possible to define and reorganize the account codes that businesses need due to new applications.

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Chapter

CSR Training and Financial Statement "Disclosure": The Case of Italy

Maria-Gabriella Baldarelli

Abstract

The objective of the chapter is to analyse the impact that CSR (corporate social responsibility) training had on non-financial information that is contained in financial statements following the EU directive 2014/95/EU and the Italian law: 254/2016. Literature review is based on institutional theory and social and environmental accounting as emancipatory tool to ameliorate the quality of life. The case analysed is the territory of Rimini, Italy. The case has been chosen because Rimini represents one of the most important concentrations within the hospitality and tourism industry in Europe. Another reason is that in the area of Rimini, 13 years ago, CSR training courses had been promoted for profit-making enterprises by the Chamber of Commerce along with public and private organisations. These training courses created a very important background for collocating the new EU directive regarding non-financial information that must necessarily be contained within the financial statements of enterprises. The objective of the chapter is to analyse the impact that the CSR training had on non-financial information that is contained in financial statements following the EU directive 2014/95/EU and Italian law: 254/2016.

Keywords: non-financial information, corporate social responsibility, financial statements, institutional theory, social and environmental accounting

1. Introduction

The idea behind the research project, which we will deal with in this study, derives from the combined results of two important processes which in the area of Rimini developed at different times, though they were both directed towards making the content of the financial statements and of the information the company supplies to the various stakeholders more complete.

Of these two processes, the former has had, and continues to have, the function of "fertilising" culture towards appreciation of environment and stakeholders and this has been realised by way of the PERCORSI project since 2008.

The latter process is more recent; indeed, it dates to 2014 and concerns the progressive attention of the EU to include non-financial information to the financial statements of companies quoted on the stock exchange. This, in Italy, culminated in law 254/2016, which makes inclusion of non-financial information in financial statements of companies quoted on the stock exchange mandatory.

The subject of this work is to verify, through an analysis of financial statements of companies that attended the training courses on CSR within the PERCORSI project, in order to be able to understand what the starting point is from which information can be extracted for investigations following the implementation of law 254/16.

We may define corporate social responsibility as the awareness by the company of the existence of an external environment that cannot be measured in purely economic terms, but which refers to the expectations that various stakeholders have. It also implies the attempt of the company to meet these expectations, in order to increase the consent or, at least, to reach the legitimacy that it needs to perform its objectives and to create strategic value [1].

Our work considers CSR training courses that are a useful framework towards implementing accounting disclosure and making social, environmental and sustainability reporting.

Therefore, the research question is thus: "How much did the training courses on CSR influence the area of Rimini in order to increase non-financial information contained in company financial statements?"

The research design is based upon use of institutionalist theory [2] and particularly upon part of the same which was declined in terms of sustainable development considering certain, more recent, thoughts on the role of accounting and accountability [3].

Literature review also points to social and environmental accounting as an emancipatory tool to ameliorating the quality of life. The case analysed is the Rimini area of Italy. The case had been chosen because Rimini has one of the most important hospitality and tourism industry concentrations in Europe.

Another reason is that in the Rimini territory, 13 years ago, CSR training courses had been stimulated for for-profit enterprises by the Chamber of Commerce along with public and private organisations.

These training courses created a really important background within which to collocate the new EU Directive about non-financial information, which must be compulsorily contained in the financial statements of enterprises.

The empirical section, instead, concerns use of "content analysis" which was applied in the first 6 months of 2018 in order to summarise it in the second half of the year.

The chapter includes the following sections: the first section contains the literature review, the second one concerns the Italy-Rimini background for social accounting and CSR training courses, the third one analyses empirical research results and the fourth one contains our conclusions.

2. Literature review regarding institutional theory and social accounting

In choosing the theoretical framework as the basis of empirical research, institutionalist theory helps us to understand up to what point we may consider the process that, put into operation by the norm, induces a uniformity of behaviour in organisations, and therefore, in companies as well. Indeed, such an institutionalist theory takes the phenomenon of "isomorphism" [2] into consideration. On opposing sides, however, are authors who, together with such a phenomenon, have analysed companies which tend towards behaviours that are similar just in certain aspects.

Focus of institutionalist literature is inertia as well as the tendency to conform to behaviours that spread throughout organisations in order to adhere to the requests made by the economic, political, and environmental system wherein they operate.

Indeed, those aspects that characterise the process of homogenisation of the organisations, from which institutionalisation derives, are called "mechanisms" by [4], whereas Scott [5] names them "structures". Such mechanisms can be grouped into three main areas, among which the first is labelled "coercive" and is relative to the pressures that prevalently come from politics, law and the market. They influence the behaviour that the organisations, therefore the companies as well, have to follow in order to survive. The second area regards those mechanisms defined as "normative", which have their origin in the strong influence of the professional networks, education and common values. The third area concerns the mechanisms defined as "mimetic". In this area, organisations emulate others that are considered best practices [4]. These mechanisms are respectively defined as regulative, normative and cognitive structures by Scott [5].

Catturi and Riccaboni [6], partially basing their theory on business administration [1, 7, 8], mainly focus on unwritten rules. The unwritten rules represent mechanisms/structures to push organisational change. From this, it emerges that for each company, the standard indicators represent a starting point but, at the same time, a limited part of performance evaluation. Companies' performance evaluation is also better monitored through qualitative social and institutional-type features [6].

Lai [9] traces the evolution of business theory basing it on the explanation supporting Zappa's theory [7]. According to Lai [9], institutionalism theory firstly affirms itself as opposed to the individualistic behaviour logics of social phenomena interpretation. Moreover, the principal aspect of the institutionalist theory is that there are norms and rules which allow, by way of the institution, the resolution of conflicts and the promotion of civil life. The third important aspect to underscore regards a dimension internal to institutionalist theory, which is relative to the governance of the company. Alongside this final one is the context external dimension wherein the norms, usages and coordination allow its development, since they are able to direct development of organisational layouts ([9], pp. 66–67). The point of view of institutionalism considers the company as a collection of upper subsystems, segments and sub-segments, which develop relational behaviours representing bonds of interdependence to such an extent as to require a direct approach [9].

Otherwise in the literature, "engagement research" has been put forward as a strong approach in developing theories in order to understand SEAR/SER (Social and Environmental Accounting Research/Social, Environmental Reporting) and to enhance organisational practices and performances [10, 11, 33] as well as in order to explore diverse issues, including change within organisations and mediation pathways [12–15].

Furthermore, Larrinaga-González [3, 16, 17] has adopted the institutionalist [4, 5] and neo-institutionalist theories [18] as a theoretical framework to point out the adjustment or, at least, to explain the procedures of SER (social and environmental reporting) and to understand the drivers of institutional modification. So they have also released up new directions in institutional theory [3, 19].

Considering the presence of numerous organisational fields around the issue of SR (sustainability reporting) as a possible clarification, the question, that Larrinaga-González [15] emphasises, is whether there is a sole global organisational field rather than different local organisational grounds for SR. Reflecting on the variance of SR practices, he pointed out the presence of locally based SR fields (i.e.: Environmental Management and Audit Scheme; European Commission, 2001; Triple bottom line; Global Reporting Initiative; ISO 14001, UN SDGs, etc.).

Especially, outlining prior research that had been conducted in sustainability management and reporting using a neo-institutional lens, Larrinaga-González [16] uses the neo-institutional viewpoint to construct an institutional description of the expansion of SR and to ascertain the consequences of the institutionalisation of SR.

He remarks that the observed studies of sustainability management and social reporting deliver some evidence for the institutionalisation of such practices. SR is the consequence of a combination of the mechanisms/structures that we described above. Larrinaga-González [16] hints that SDR (sustainability development reporting) is not yet entirely institutionalised and may be the outcome of additional general social/environmental awareness being institutionalised in some situations. Lastly, Larrinaga-González [16] faces the matter of modification and institutionalisation of SR and recognises some investigation designs. The former is about the initiating event that may change the institutional engagements and what elements play a role in changes to coercive/normative/cognitive mechanisms/structures. The latter is about the analysis of what interactions occur between competitive forces and institutional constructions in the progression of institutionalisation [19]. In the next section, we focus on the Italian peculiarities.

3. Framework of institutional factors and SEAR in Italy

In Italy, there are some important factors that sustain the need for social and environmental accounting and reporting to emancipate economic, social relationships and democracy.

Following Contrafatto and Rusconi's idea [20], social and environmental accounting (SEAR) theory in Italy had its origins in the 1970s [21], but until the 1990s, we did not find empirical social and environmental reporting excluding the Merloni-Battelle experience. The reasons of interest in this theory are due to the fact that financial accounting and reporting law was not so exhaustive so there was a wide-open space to cover with social and environmental accounting theory.

In the 1980s, there was a lot of publications concerning this subject [17, 22–25], but organisation culture was not yet ready to accept these issues, as we can read: "This was partly, at least, a result of mutual distrust between corporations, public authorities and trades unions" ([8], p. 4).

Despite difficulties, there are some important factors in favour of SEAR; among them firstly, there is a common platform of "Economia Aziendale" [20] where financial accountants and social and environmental accountant scholars can dialogue quite easily.

The concept of an organisation following institutional theory [9] opens a holistic view of it and involves social and environmental subjects too.

Secondly, involvement in the economic system of different organisations, such as the state with public organisations, for-profit organisations and private, not-for-profit ones, pushed transparency in order to face crisis and to go on globalisation challenges. So, this evolution made it more and more important to have one common platform of information for dialogue so all economic partners had been more oriented towards disclosing their behaviour as regards the stakeholder.

In the following years, SEAR developed into a theory [2, 19, 26–30], but above all in practice, due to a lot of European initiatives (Stakeholder forum and Green papers 2001 and subsequent).

We have to remember, among other things, two important projects regarding SEAR: the first one had its origins in 1988 and its name is SBG (social balance group) that stated and is stating some principles that form SEAR (http://www.gruppobilanciosociale.org/).

The second important initiative for Italy was CSR-SC, 2003, which saw the progressive spreading of the debate on corporate social responsibility, both because the Italian government placed it among the five priorities of its European semester and because the European Campaign promoted by the European Commission, the CSR-Europe and the Copenhagen Centre realised events and actions.

The EU Commission identifies some guiding trains of thought regarding socially responsible conduct like the codes of conduct, managerial rules and regulations, accounting, auditing and the drawing up of reports, labels, and socially responsible investments.

From the point of view of provisions and policies issued by the Government, the partial Italian response is also substantiated in the CSR (corporate social responsibility)—SC (social commitment) project promoted by the Italian Ministry for Labour and Social Policy (http://www.camcom.gov.it/cdc/).

Until 2006, SEAR implementation in Italy was voluntary, from this date on, there has been the Italian law of 24th March 2006, No. 155: "The discipline of social enterprise", which at article 10 requires the compulsory drawing up of a social report. It is the first time that the Italian Parliament deliberated on a compulsory rule concerning SEAR.

The legislative decree of 30th December 2016, No. 254 was issued following implementation of directive 2014/95/EU of the European Parliament and of the European Council of 22nd October 2014, which modified directive 2013/34/EU as far as the communication of non-financial information and information on diversity by certain companies and certain large-scale groups are concerned. The decree came into effect on 25th January 2017 and the measures therein contained apply to financial years starting from 1st January 2017. This decree represents an important novelty since, for the first time in Italian for-profit businesses, the need for non-financial accounting is ratified.

4. CSR training and activities in the Rimini region

We chose the Rimini case, because the influence on the environment especially of tourist entities (17,000) is great, as there is the main concentration of the hospitality industry in Europe.

In 2004, Rimini began a process to spread CSR (corporate social responsibility) in the territory and to create a new culture using networks (PERCORSI Project). In the

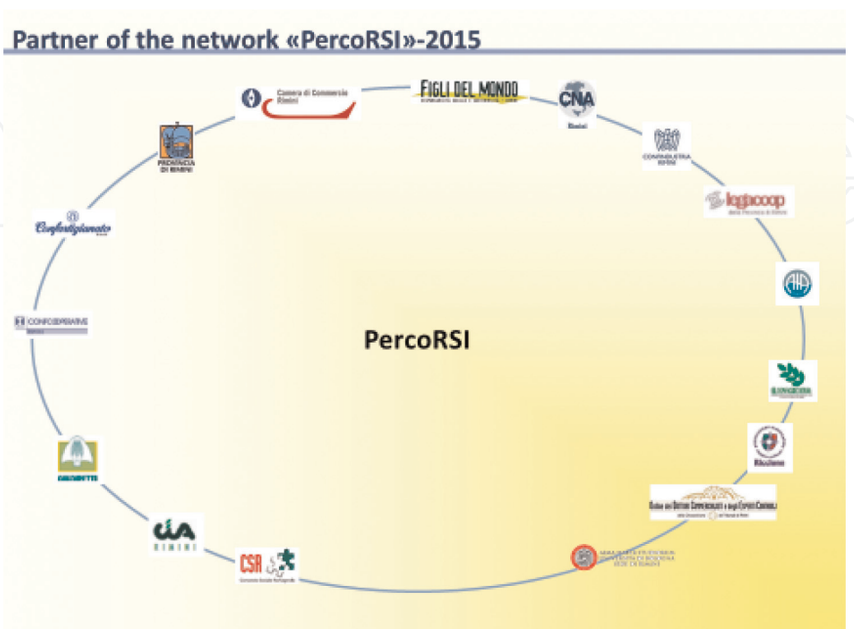


Table 1.
Parters of network percoRSI 2015.

Mechanisms ([4], p. 164)
Coercive • Since 2003, the Italian administration pushed Chambers of Commerce to spread social responsibility throughout the territory. • In 2006, the regulation has made it obligatory for Social entities to draw up a social report. • Directive 2014/95/EU regarding non-financial information had been originated. • Development of competing tourist alternatives has pushed Rimini to think of a socially responsible area. • Certain sector obligations relating to rules relative to workplace safety, climate change, environment emissions, etc. (for example: gas distribution sector and companies who manage waste). • Since 2016, law 254 has been issued concerning the obligation of non-financial information in the financial statements.
Normative • Development of a system of social and environmental accounting is the answer to a CSR culture, which is also based on essential reasons. • Organisation of training courses for companies had been started. • Involvement of professional associations: accountants and lawyers, as well as various business associations partly planned and coordinated by the Chamber of Commerce of the territory.
Mimetic: • Additional Italian areas have been involved by the local Chambers of Commerce in a process of applying social responsibility. • It is an imitative procedure founded on a series of choices of various agents, among whom the Chamber of Commerce, not-for profit organisations, etc. create a network of players all with the aim of developing a region that will become more and more socially responsible and sustainable.
Source: our elaboration.

Table 2.
Institutionalist in the Rimini area.

meantime, at the beginning, we carefully followed the whole "PERCORSI" project process. We had been impressed by the final objective: not only to realise SEAR but to modify entity culture into one of emancipation and social equality [10, 16].

In the case of Rimini, in a positive perspective of research, for-profit, non-profit entities, public administrations (municipality, Chamber of Commerce, and province), trade associations; Chartered Accountant Associations and other associations together with the University of Bologna formed narrowly joined networks to create a more socially responsible area [31], as you may see in the following **Table 1**.

The situation of the Rimini region using neo-institutional theory is represented in **Table 2**.

After the context presentation, we wonder if training activities have an impact on companies financial statements. In the following section, we will analyse the data of the empirical research, which help to provide an answer to such a question.

5. Research results[1]

The methodology avails of "content analysis" by way of searching eight keywords within consolidated financial statements. Especially, we focus the attention

[1] For the elaboration of data, we whole-heartedly thank Doctor Angelica Giammaria for the precious work done.

on the section of the balance sheet, where are the financial and non-financial information.

The elaborations were carried out using Excel sheets, which were later represented through graphics. Five enterprises were singled out: Pesaresi Giuseppe Ltd. (Limited), Petroltecnica Ltd., SCM Group Ltd., Focchi Ltd. and SGR Group Ltd [34].

The companies were chosen on the basis of the attendance of CSR courses activated within the PERCORSI project, as per above. Besides, they all belong to different sectors and are of different size.

This allows checking the different methods of impact upon the environment and society. Of these companies, only SGR draws, from 2011, the sustainability report, whereas the others throughout the period examined by the research project do not draw up any independent document where social, environmental or sustainability information is described.

For this reason, the case of SGR will be the last to be treated, in which we have included the sustainability report into the research as well. The choice does not make the data homogeneous but allows us to highlight the varying frequency due to a precise strategic choice of the company. Such a different approach allows us to highlight certain interesting considerations which we will later show.

The keywords have been chosen on the basis of relevance to the themes of work and are: social responsibility, sustainability, environment, development, safety, territory, stakeholder and innovation. An analysis of each financial statement from every company in the period 2008–2017 was carried out, since 2008 represents the beginning of the PERCORSI project and 2017 represents the year of change due to the quoted legislation. The consolidated financial statements come from the AIDA Database.

Below are the outcomes of the analyses, which are preceded by a brief outline which introduces each company.

The SCM Group S.p.A. was established in 1958 for the production of machine tools and is included in large-scale enterprises[2].

It is a world leader in technologies for the working of wood and advanced materials. At the end of 2016, employees numbered 1512; turnover was €331,006,785 and gross total invested capital was €356,554,493.

The parent-company is headquartered in Rimini, and has sister companies in: Europe, Asia, Australia and South America. At its overseas companies, employees numbered 3600 with turnover greater than € 700 million.

Companies in the group operate within the following sectors: construction, furniture-making, aerospace, shipping, automotive, and plastic material-making. **Graph 1** shows the summarised results of the conducted analyses whose values, on the vertical line, represent the frequency with which keywords are included in the financial statements.

From the graph, the words 'development' and 'safety' emerge in the main. The former is repeated 30 times and the latter 62.

This certainly means that the SCM Group S.p.A. in its activities surely pays particular attention to the development of new technologies for constructing industrial machines which are ever more advanced, but also to the training

[2] The European classification considers a SME a company with up to 250 employees. Above this quota, a company is considered a large-scale enterprise. There is also a size relating to turnover, that is a turnover above €10 million for a small-scale company and above €50 million for a medium-scale one. Legislative reference is recommendation 003/361/EC of the European Commission.

Graph 1.
Keyword trend of SCM group. Source: our elaboration.

development of its employees, wishing to improve the competences of human capital, fulcrum of success for this company.

'Safety' is repeated 11 times in the following 3 years, 2009, 2010 and 2011, as it is in 2014 and 2015. This frequency underlines the commitment of the company to guarantee safety in the workplace for its employees considering the dangerousness of the company's activities.

Instead, the terms 'social responsibility' and 'stakeholder' are not to be found, notwithstanding the company robustly deals with this issue, just as 'stakeholder' is never mentioned. Therefore, attention of the company, as research matters stand, is more directed towards the development of activities rather than to the disclosure and communication of the same in the financial statements.

As evidence of this, the SCM Group S.p.A. was the winner of the Sodalitas Social Award in 2008 in the category "Best Social Marketing campaign" with the project "International community, human capital, local community, suppliers and environment".

The company, for years, has started on a social responsibility path, training its own employees, collaborating with schools and universities and paying attention to environmental impact reduction during the single production phases.

Besides, thanks to the collaboration with the Figli del Mondo association and the Pope John XXIII Community, it has been possible to realise vocational training centres, teaching the technologies of working wood to the communities of more disadvantaged countries.

It provided economic support through the donation of machinery used in training centres for a refuge community for orphans of parents who died of AIDS in Ndola (Zambia) and in Foz de Iguaçu (Brazil). In 2011, the company went to the finals of Sodalitas Social Award in the category "The Jury's Special Award", an award given over to companies and associations which, via projects, favour youths' entry into the world of work (www.figlidelmondo.org).

The second company that we will look at is Pesaresi Giuseppe S.p.A.

The Pesaresi Giuseppe S.p.A. company was established in 1961, operates in the building industry and is a medium-sized company. Its main activities are in the

construction of roads, motorways and airport runways and in the production of bituminous conglomerates and concrete. At the end of 2016, it numbered 60 employees, turnover of €15,001,266 with gross invested capital of €52,417,577. In **Graph 2**, we show the results of our analysis.

Among the more-used keywords, we can pick out: 'safety' and 'development'.

'Safety' shows an up-hill trend till 2015 where it is repeated up to 20 times.

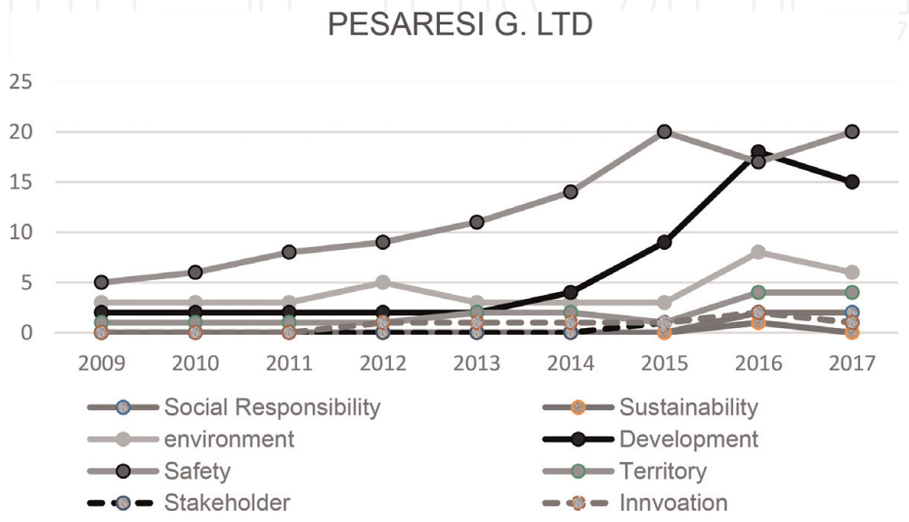
Top management has always been strongly committed to spreading this culture throughout the whole of the company. This culture practised through a team of specialised figures and directed towards the guarantee of an efficient system of safety management which has an impact on, besides the workers, the community with which the company interacts as well.

The word 'development' demonstrates a rise beginning in 2014 till arriving at 2016 where it is repeated at least 18 times. Company development was possible, besides due to the entrepreneurial competences of the founding Pesaresi brothers and the capabilities of company staff members, thanks to the policies of protection of the employees and the environment.

The third most-used word in financial statements is 'environment', showing an almost continuous trend in its use till 2015, excepting 2012, and in the final 2 years there has been an increase, especially in 2016, repeated more than eight times. Company management tries to identify the processes that harm the environment in order to reduce them using appropriate interventions, investments as well as adequate competences.

Pesaresi Giuseppe S.p.A. is concerned with, besides, training and making their employees sensitive to environmental issues, for example through "la promozione della differenziazione nella raccolta e smaltimento dei rifiuti prodotti, sia internamente allo stabilimento che sui cantieri esterni." (www.pesaresi.it) (*the promotion of separate collection and disposal of the produced waste, both internally within the actual factory as well as on external building sites*). Only since year 2016, the two most characteristic words on the topic of CSR, viz. 'social responsibility' and 'sustainability' are used.

Following these observations, we may affirm that the company puts the concept of social responsibility towards people, the environment and the area wherein it operates at the core of its activities. This is to respond to the economic and social needs though it does not show any inclination towards the disclosure of such information in the financial statements.



Graph 2.
Keyword trend of Pesaresi. Source: our elaboration.

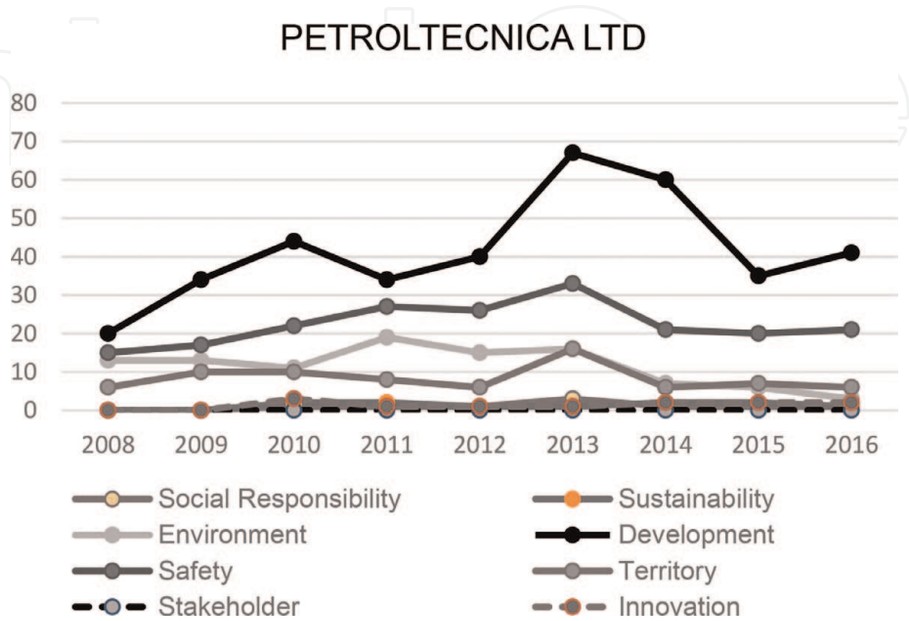
Petroltecnica S.p.A. was established in 1950 and is headquartered in Rimini, but has companies in other Italian cities: Bari, Milan, Cagliari and Priolo Gargallo—in the province of Syracuse in Sicily. The company operates in the sector of "Environmental Ecology" offering a wide range of services: demolition and decontamination of industrial work plants and refineries, recovering of uncontaminated sites, building site services, waste treatment and management, decommissioning of structures containing asbestos, and environment rapid rescue, therefore working in the safeguarding of the soil and waters. At the end of 2016, annual turnover was €59,561,224, gross invested capital equals €60,105,635 and employees numbered 246 among whom are operators, technicians, clerks and management. In **Graph 3**, below, we can see the research results.

The most-used keywords are 'development' and 'safety'. Regarding the word 'development', note a non-continuous use till 2010 though with a later upturn. Petroltecnica S.p.A., over the years, has reached a professional and technological development such that it has consolidated its presence throughout the nation and abroad, as is the case in Taiwan and Turkey.

Particularly, technological development is directed towards strengthening the quality of service offered and worker safety. Indeed, safety is a word we meet increasingly, even if non-continuously. One of the objectives of the company is surely to maintain high safety standards for the operators and for all those who come into contact with the activities of the company, "consapevole dell'importanza di garantire le migliori condizioni di salute e sicurezza negli ambienti di lavoro" (Petroltecnica S.p.A. Code of Ethics) (*aware of the importance of guaranteeing the best health and safety conditions in the workplace*). Visit www.petroltecnica.com.

The company periodically conducts training courses regarding themes connected to safety: for example, in 2016, 248 hours of training were provided for a total number of 984 participants. Another important word is 'environment', seeing as this company makes protection of the eco-system, one of its main aims, also going on to draw up the environmental report.

For this reason, Petroltecnica S.p.A. makes its employees aware of environmental issues while creating greater knowledge on the consequence of operations on the ecosystem.



Graph 3.
Keywords regarding Petroltecnica. Source: our elaboration.

Thus, the company adopts socially responsible behaviours concerning various subjects, particularly as regards the environment, employees, collectivity and local community.

Let us analyse below Focchi S.p.A., established in 1914 and it operates in the sector of metal carpentry. In 1955, the company begins to produce aluminium windows and doors and 20 years later, concentrates on the production of "curtain walls", which is currently its main activity [www.focchi.it/il-gruppo].

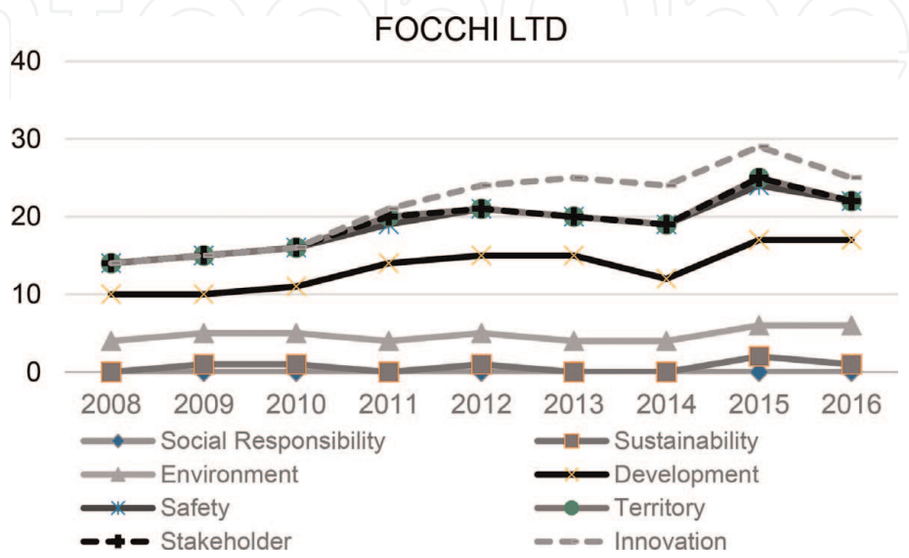
The business has its headquarters in Rimini, London, Singapore and New York. Focchi S.p.A. is an "impresa leader nel settore degli involucri per edifici occupandosi direttamente sia della progettazione, della produzione e della posa in opera" (www.focchi.it/il-gruppo) (*world leader in the sector of building shells directly taking care of design, realisation and assembly*). At the end of 2016, the group had gross invested capital worth €105,412,000, employees numbered 163 and had a turnover of €56,361,000.

Graph 4 summarises the analysis conducted on consolidated financial statements.

Here too, as has already been seen, the keyword used the most is 'development', having been used the same number of times in 2008 and 2010 with 6 words, in 2011 and 2012 with 10 words and, finally, in 2013, 2015 and 2016 with 11 words. Focchi S.p.A. has a study and research office that is strongly committed "allo sviluppo ed alle prove di laboratorio, in modo da ottenere sempre le massime qualità prestazionali ed i prodotti più innovativi del settore." (www.focchi.it/il-gruppo) (*to development and laboratory testing, in such a way as to always obtain optimal quality performance as well as the most innovative products in the sector*).

The word 'safety' is often repeated in financial statements as well. Indeed, the technical staff periodically carry out safety checks in the workplace to get the certificate that allows them to access building sites. The word 'sustainability' is used at least once in the majority of the consolidated financial statements. Focchi S.p.A. chooses to make the concept of sustainability its own, building sustainable façades using innovative technologies. Lastly, the word 'environment' is constantly used in financial statements since it highlights the importance that Focchi S.p.A. places on environmental protection.

Research of sustainability goes hand-in-hand with developing new technologies which may permit the realisation of sustainable structures: since 2011, indeed, the word 'innovation' is starting to be used.



Graph 4.
Keyword trend of Focchi. Source: our elaboration.

In 2009, Focchi S.p.A. was finalist in the Sodalitas Social Awards in the category "Building the best community partnership programme". Management of the company financially sustained the Rimini association: *Cittadinanza Onlus*, "riconoscendone la validità delle iniziative e contribuendo al sostegno e allo sviluppo economico di progetti a favore dei disabili psichici." (www.figlidelmondo.org) (*recognising its initiatives' validity and contributing to sustaining and economically developing projects in favour of the psychologically disabled*). In that year, an international meeting was organised by that association in Rimini, where projects on these issues were discussed in order to implement them in developing countries.

Continuing the work, we will analyse the case of the SGR Group which, compared to those previously analysed, draws up a document separate from the financial statement, wherein it merges social and environmental information.

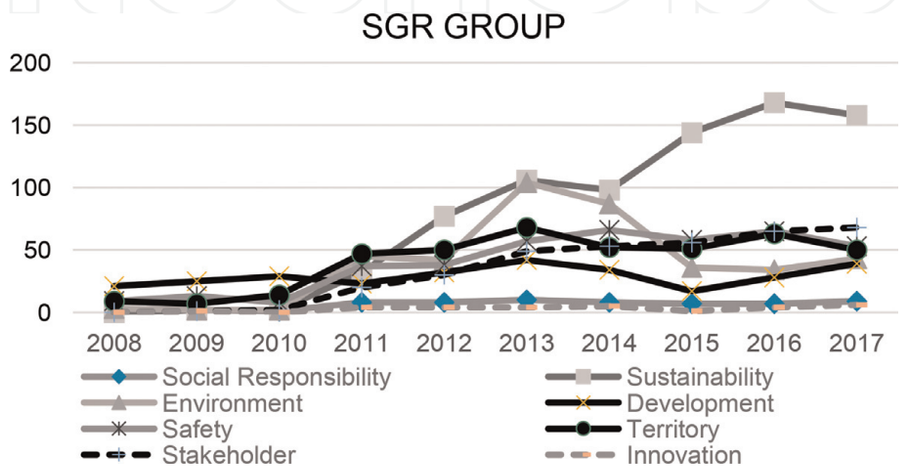
Indeed, the case of the SGR Group is different from the others because since 2011 it regularly draws up a sustainability report [32]. This allows us to make a comparison between keywords, in that the other companies we have previously treated do not draw up, according to specific standards, social, environmental, sustainability and integrated reports.

The SGR Group is a multi-utility and family-owned company founded in 1956, unlisted, based in Italy, made up of several companies, and with a long experience in gas distribution, over 50 years, during which time it has always been a one-family-owned enterprise, and this feature has been able to create a very strong connection with the territory wherein the enterprise is operating.

Its activities are carried out in Italy by SGR Rimini and in Bulgaria by the CityGas Company (Trakia region) [32].

In 2016, the company had 408 workers, a turnover of €290,042,198 and a total of invested capital of €411,820,001. In **Graph 5**, the research results are highlighted.

There being a sustainability report may be noted from the graph, which shows that the use of the word 'sustainability' has started since 2011 and has a growing trend. SGR adheres to the international strategy of the UN 2030 SDGs Agenda, ensuring "l'accesso a sistemi di energia affidabili, sostenibili e moderni, incentivando una crescita economica duratura e inclusiva [...]; ad assicurare salute e benessere per i propri dipendenti e fornire un'educazione di qualità, equa ed inclusiva per la comunità." (www.grupposgr.it/bilancio-di-sostenibilita) (*access to systems of reliable, sustainable and modern energies and incentivating lasting and inclusive economic growth [...], ensuring health and wellbeing for its employees and providing fair and inclusive quality education for the community*).



Graph 5.
Keyword trend of SGR. Source: our elaboration.

The second keyword we find is 'environment', which is fundamental in the strategic and development vision of the company.

Besides, there also feature the words 'stakeholder' and 'territory' which, often, are repeated to the same extent, starting from the sustainability report of 2014 till that of 2017.

SGR promotes innumerable initiatives throughout the territory and for the whole local community which may be of a cultural, sporting or social nature.

We may affirm that the SGR Group, differently from the others we have met, carries out aspects of social responsibility, and it is aware of disclosure, also with fitting documents containing such aspects.

6. Conclusions

In this work, we have wondered how training activities contributed to develop and to spread a culture that includes social responsibility in Rimini territory [31]. This relatively new culture may perhaps influence company management and financial reporting disclosure before and during the innovation in regulation, such as law 254/16.

In order to analyse the Rimini case, we adopted the institutionalist theory and, in particular, that part which may be expressed in terms of social, environmental and sustainable accounting [16]. This has created the theoretical bases, in order to be able to understand, among the various activities, training initiatives that have been started and consolidated over time.

Reading these activities has, on the one hand, validated the theory adopted which has isomorphism as its central point [4, 5], since, throughout the area analysed, the training activities of spreading the culture of CSR have been promoted by a process, the European one, that required alignment to them.

If, from one viewpoint, this might be true, then from another, the training activities in the Rimini area have pushed some of the companies, that we analysed, to become more and more aware of the importance of CSR and, especially, of the keywords through which to translate the same into concrete actions.

Analyses conducted on financial statements and consolidated financial statements demonstrate a positive trend in almost one of the key words used. This trend is one expression of interest of CSR. Even if the company, at the beginning, did not know anything about CSR, such a cultural process influenced the contents of the accounting increasing the attention to the key words, such as sustainability and/or safety and/or environment, etc. even before it became a semi-mandatory process by law.

Therefore, after our analysis, we can reply to the following research question: "How much did the training courses on CSR influence the area of Rimini in order to increase non-financial information contained in company financial statements?"

We formulate an answer, which considers that the training courses on CSR, which had been promoted in the Rimini area, had influence to increase the disclosure of non-financial information in financial statements and consolidated financial statements of some companies here examined. That trend is considered even if there is not an increase of the CSR considered as key word, because the word CSR may be implemented in practice in different ways. The conclusion of this work is partial, because a positive trend of the identified keywords is not always present in the cases analysed. This first result can be a starting point for further analysis through the analysis of other companies.

Another limitation of the work can be found in the initial hypotheses that we implicitly assumed and that is that the diffusion of the culture on CSR could lead to

an influence on the disclosure of non-financial information. This hypothesis was completely verified in particular with the analysis of the SGR case [32] but should be further investigated for the other companies that we analysed.

Besides, it is a pity that the four companies analysed are not yet aware of the importance of drawing up, in an appropriate document, these interesting activities that they have developed over time both externally and internally. Just one has initiated a process of reporting which is mirrored in the high presence, in comparison with the other companies, of the keywords we have chosen for the analysis.

Reading this process with the theory presented here [4, 5] and extracting some inspiration for further research, we may affirm that this does not seem to us to be a purely isomorphic process, because the facets that emerge from this research and from the evolution of the CSR spreading process are multiple and they make this region more than directed towards standardisation, directed towards social innovation and creativity. This is demonstrated by the initiative, called, "Primo Miglio" (www.primomigliostartup.com), which promotes and sustains socially responsible initiatives for start-up enterprises. Of this, we will speak in further research works.

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Chapter

Nonlinear Effect of Financial Development and Foreign Direct Investment in Integration Economies Among ASEAN-5 Countries Following IFRS Adoption

Elya Nabila Abdul Bahri and Nor Hakimah Haji Mohd Nor

Abstract

This chapter examines the role of financial development on foreign direct investment (FDI) inflows in ASEAN-5 countries over the period of 1980–2017. The ASEAN-5 countries include Malaysia, Thailand, Indonesia, Singapore, and the Philippines. The panel cointegration of second generation is used in order to address the existence of economic integration among ASEAN-5 as proven in cross-sectional dependency test. The results from fully modified ordinary least square (FMOLS) and cross-sectional dependency autoregressive distributed lag (CS-ARDL) consistently shows that the financial development has a nonlinear relationship with FDI of U-shape, whereby the financial development will benefit the FDI after it beyond the threshold point at 70% of total GDP. Investors will make decision based on the financial status as shown in the financial accounting report, whereby the quality of financial accounting representing transparent information that leads on reducing asymmetric information between investor and the financial institutions in host countries. In addition, the causality analysis based on panel vector error correction model (VECM) confirms the presence of both long-run relationship and short-run dynamic among FDI, financial development, consumer price index, and real gross domestic product per capita.

Keywords: foreign direct investment, financial development, cross-sectional dependence, nonlinear, financial information quality

1. Introduction

Following the financial liberalization attempted, especially during the 1980s, foreign direct investment (FDI) has being as more important catalyst for accelerating the economic growth. The economic activities are integrated during the transition economies among developing countries as well as ASEAN-5 countries. The formation of ASEAN Economic Community (AEC) at the Ninth ASEAN Summit in

October 2003 represented an important milestone in ASEAN economic cooperation. It stimulates FDI inflows by reducing business costs associated with multinational activities in the ASEAN region that has always been a primary objective of the economic cooperation. Strengthening the financial sector with remaining stable economic condition may establish an attractive business environment for multinational firms to invest in the ASEAN-5 countries.

The trend of FDI inflows in ASEAN-5 countries fluctuate from year 1980 to 2017 as shown in **Figure 1**. There is high volatility in FDI inflows after the Asian financial crisis in 1997–1998 that leads FDI inflows dropped for Singapore, Malaysia and Indonesia, but increased for Philippines and Thailand. While Malaysia and Philippines drop in 2001 in another event of crisis, that is, bubble.com, but the FDI inflows to Singapore, Thailand and Indonesia are increased. The trend of FDI inflows among ASEAN-5 countries are however increases following AEC formation in 2003. The trend of FDI inflows dropped after the global financial crisis in 2007–2008, which affected ASEAN-5 countries, but its effects are delayed for Malaysia and Indonesia. Fluctuation of FDI inflows may reliance on the uncertainty of its enabler such as financial development in ASEAN-5 countries.

To materialize the benefit of FDI, thus, the role of financial development was found as an enabler of the FDI performance. There are five major functions of a financial system: producing information and allocating capital; monitoring firms and implementing corporate governance; meliorating risk; pooling the savings; and easing exchange [1]. These functions contribute to the stimulation of economic growth. Thus, the financial institutions and financial markets can exert a strong influence on economic development, where the incremental of economic growth enabling the FDI to perform better. Financial development is discovered as assistance to the FDI especially in technology transfer that needed more capital to funding the technology expenses.

It is important to consider the effect of financial development on FDI inflows are influenced by the quality of financial information. The investors would review the financial strength via the bank's financial report in the host countries. A quality of financial reporting relies on regulatory accounting standards through the International Financial Reporting Standard (IFRS). In general, ASEAN-5 countries already

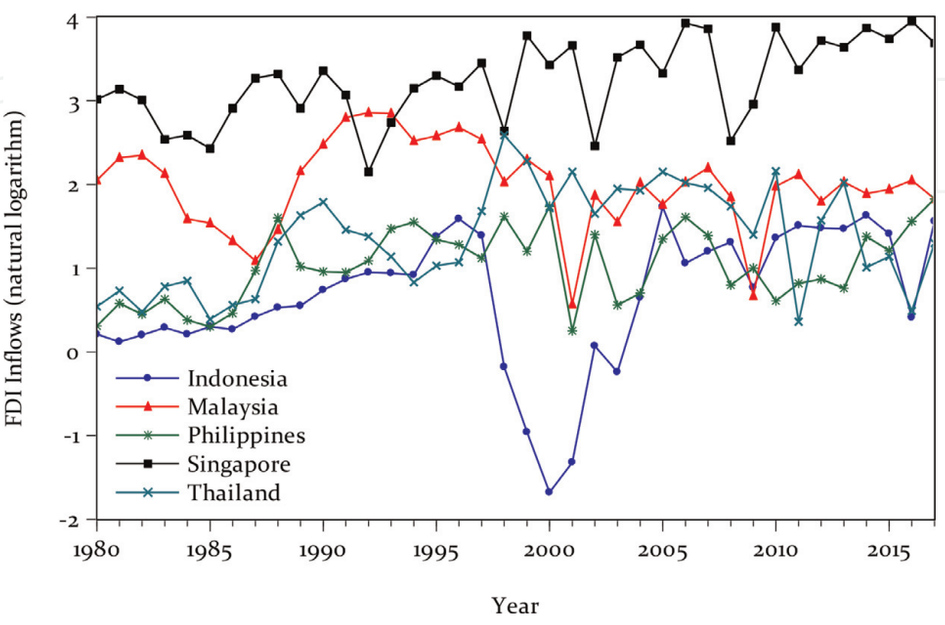

Figure 1.
FDI inflows (% of GDP) in ASEAN-5 countries from 1980 to 2017. Source of data: UNCTAD website (Accessed on 9 March 2019).

complied the regulation starting from 2005 onwards. The effect of regulatory quality is found as an incentive for quality of accounting information that benefited to all stakeholders. Thus, improving the regulatory quality of financial reporting enhances transparency that reducing the asymmetric information between investors and the financial institution in host countries.

2. Literature review

Early theories of the determinants of FDI were encompassed in eclectic approach [2]. The key requirements for FDI as follows: the firm must possess stable specific advantages; the firm must find it beneficial to utilize these advantages directly instead of selling or leasing them (so called as internalization advantages); and the firm must firm must find it profitable to combine these advantages with at least one factor input abroad (so that local production dominates exporting or locational advantages). These advantages include proximity to markets, specialized suppliers, evasion of protective barriers, and factor endowment advantages.

Financial development is found as one of the significant determinants of FDI [3, 4]. The financial markets are measured by the domestic credit provided by banks and domestic credit provided to the private sector as a percentage of GDP [5]. Domestic credit to the private sector refers to the financial resources provided to private sector through loans, purchases of non-equity securities, and trade credits and other receivable accounts. Meanwhile, the domestic credit provided by banks is nonguaranteed long-term commercial bank loans from private banks and other private financial institutions. The other measurement financial development is financial freedom as a catalyst for FDI inflows. Financial freedom is a measurement of banking security as well as independence from government control. The state ownership of banks and other financial institutions is seen as an inefficient burden, and political favoritism has no place in a free capital market [6]. Thus, the financial information quality also affected the investment efficiency because the investors need the information of financial health in the particular host countries [7].

Financial development, as better accounting and disclosure rules and better corporate governance, reduces the spread between domestic and foreign cost of capital [8]. It requires a sound financial reporting system that produces reliable and transparent accounting information for both domestic and foreign investors [9, 10]. Lack of financial reporting systems credibility is likely to have adverse effects on the ability of particular countries to attract foreign investments, because it retards the equity markets development [11]. In fact, the effect of financial development on economic growth, which enhances FDI inflows, is contingent the adoption of financial accounting quality by host countries [12].

The application of IFRS in host countries is considered a way to attract the FDI [13, 14]. IFRS leads to higher earnings quality and more foreign investment [15]. Furthermore, the short-run and long-run causality existed between IFRS adoption and FDI inflows [16]. The quality of financial reporting according to IFRS has potential to enhance transparency that reduces asymmetric information and cost for foreign investors [17]. IFRS adoption requires strong governance and internal controls within a bank to give confidence to the investors resulting in the quality financial information. The effect of regulatory quality is found as an incentive for quality of accounting information and compliance to the IFRS by firms. Hence, the financial statement act as organization's resume that indicate the strength of finance by banks in host countries. Quality of financial statement among bans in host countries will build good reputation that leads the confidence of decision maker from foreign firms. The information of financial development, that is, credit

market, through the financial reporting can reduce the asymmetric information that attracts the FDI inflows into the host countries.

The development of strong financial market can increase an economy's ability to absorb and efficiently manage FDI inflows and take advantage of potential FDI benefits [18]. Although recent studies discover that financial development influences FDI performance to be realized, the long run relationship between the variables including FDI, financial development and macroeconomic variables need adequately addressed in the field of study. This study is therefore attempting to contribute to the existing literature in the dimensions of nonlinearity and cross-sectional dependency dimensions. The investigation on the effects of financial development on the FDI inflows employs both linear and quadratic models in the estimations. Incorporating the cross-sectional dependency due to economic integration, financial openness, economic freedom and spillover effects among ASEAN-5 countries over the period 1980–2017, the panel cointegration for second generation is used and the long-run coefficient estimated by considering the cross-sectional dependence in this study.

3. Econometric model and data description

The effect of the financial development on foreign direct investment is investigated by using ASEAN-5 countries panel data with the econometric model specified as follows:

$$FDI_{it} = \beta_0 + \beta_1 FinDev_{it} + \beta' X_{it} + \omega_i + \varepsilon_{it} \quad (1)$$

where, the *FDI* in Eq. (1) represents foreign direct investment, and *FinDev* indicating financial development. The domestic credit of private sector, liquid liabilities and private sector credit to deposit money are used as a proxy for financial development. Parameter X comprises with the vector of control variables: real gross domestic product per capita (*RGDPPC*) and consumer price index (*CPI*). The cross-sections are denoted by subscript i (i = 1, 2, ..., N), the time period by subscript t (t = 1, 2, ..., T), ω_i is the country fixed effect and ε is the stochastic random term.

Incorporating the nonlinear effect of financial development on FDI, Eq. (1) has been extended by using a quadratic specification as expressed in Eq. (2):

$$FDI_{it} = \alpha_0 + \alpha_1 FinDev_{it} + \alpha_2 FinDev_{it}^2 + \alpha' X_{it} + \theta_i + \mu_{it} \quad (2)$$

where $FinDev_{it}^2$ is a square term for financial development that indicates the nonlinearity of the relationship between financial development and FDI inflows. The focal parameters in the quadratic model in Eq. (2) are α_1 and α_2. If there exists a nonlinear relationship between financial development and FDI, an anti-Kuznets curve is anticipated since higher the financial development indicating the financial health that can assist the foreign entrepreneur and thus attracting the FDI inflows in ASEAN-5 countries. The anti-Kuznets curve is verified by significantly negative sign in parameter α_1 and significantly positive in α_2. The threshold level is computed by first order derivation ($\delta FDI/\delta FinDev$). Based on the quadratic model in Eq. (2), the turning point of financial development can be calculated as $-\alpha_1/2\alpha_2$.

This study uses FDI inflows as the percentage of GDP. Real GDP per capita in constant of US dollar (US$) is used to measure economic development. Domestic credit to private sector by banks as a percentage share of GDP (*DCPS*), liquid liabilities as a percentage of GDP (*LL*) and private credit to deposit money (*PCDM*) are used as proxies for financial development. Five countries have been selected

among the ASEAN countries including Malaysia, Thailand, Indonesia, Singapore, and the Philippines. The study covers 38 years for the period of 1980–2017. The sources of the data are World Development Indicators, UNCTAD Database and Financial Structure Dataset.

The last few decades, the ASEAN-5 economies have witnessed an increasing economic freedom and financial integration implies a strong interdependence between these countries. To measure the existence of economic integration among ASEAN-5 countries, the cross-sectional dependency (CD) test is used for all variables [9]. The existence of cross-sectional dependency among ASEAN-5 countries are proven in **Table 1** indicated by the p-value of CD statistics which are lower than 0.01 for all variables that against the null hypotheses of cross-sectional independence among countries, CD $\sim$ N(0,1). Consumer price index is the highest absolute correlation among ASEAN-5 countries at 0.976, means the changes of price of one country closely affected price the other countries. Meanwhile, liquid liabilities are the highest absolute correlation in ASEAN-5 region among other proxies for financial development. This may involve the integrated economic process especially when the countries are neighbors. Furthermore, the cross-sectional dependence can arise for several reasons, such as spatial spillovers, financial contagion, and socioeconomic interactions [19].

Table 2 shows the descriptive statistics of the variables. Jarque-Bera for normality test shows that all variables are not normally distributed. The median for

Variable	CD test	Breusch-Pagan LM test	Absolute correlation
Foreign direct investment inflows	2.833***	17.103*	0.193
Domestic credit to private sector	10.776***	134.678***	0.553
Liquid liabilities	15.234***	239.532***	0.781
Private credit by deposit money	11.116***	146.326***	0.570
Real GDP per capita	17.571***	313.179***	0.901
Consumer Price Index	19.020***	361.854***	0.976

*** *Significant at 1% level.*
* *Significant at 10% level.*

Table 1.
Result of cross-sectional dependency test for ASEAN-5 countries.

	FDI	DCPS	LL	PCDM	RGDPPC	CPI
Minimum	−2.583	9.681	10.400	6.490	1230.840	5.554
25% quantile	0.979	34.884	39.500	33.940	1880.193	46.614
Median	2.269	75.908	72.295	74.725	3571.915	71.617
75% quantile	5.058	106.363	105.290	102.210	8635.566	95.117
Maximum	26.084	166.504	136.63	163.210	55,235.500	142.182
St. deviation	5.841	40.852	35.270	40.304	13,085.87	32.874
Skewness	1.997	0.230	0.062	0.193	2.066	−0.248
Kurtosis	6.389	1.875	1.733	1.782	6.224	2.237
Jarque-Bera	217.175	11.701	12.827	12.924	217.441	6.566
Probability	0.000	0.003	0.002	0.002	0.000	0.038

Table 2.
Descriptive statistics of variables.

Variables	FDI	DCPS	LL	PCDM	RGDPPC	CPI
FDI	1.000					
DCPS	0.622***	1.000				
LL	0.620***	0.889***	1.000			
PCDM	0.651***	0.981***	0.901***	1.00		
RGDPPC	0.839***	0.665***	0.687***	0.700***	1.00	
CPI	0.489***	0.568***	0.764***	0.613***	0.551***	1.00

***Significant at 1% level.*

Table 3.
Correlations of variables.

DCPS, *LL* and *PCDM* is 76, 72 and 75%, respectively indicating the small differences between all proxies. The kurtosis of FDI is the highest at 6.389 indicating the fluctuation of FDI as compared to other variables. The correlation matrix presented in **Table 3** reveals that the variables are positive correlated among other with more than 0.5. The highest correlation between *DCPS* and *PCDM* is at 0.981 since both variables are the proxies of same variable of financial development.

Table 4 presents the mean of all variables of each country in the ASEAN-5 economies. As shown in this table, there is a considerable variation in RGDPPC across these countries, ranging from as low as US$2332.82 for Indonesia to as high as US$32,385.13 for Singapore. The mean of financial development demonstrates that Malaysia is consistently the highest for DCPS and LL, but Singapore is the highest in PCDM.

Each country in ASEAN-5 region has different starting date on complying IFRS in accordance with IFRS Foundation's Jurisdictional Profiles as shown in **Table 5**. Philippines is the earliest country adopting IFRS since 2005, while Malaysia is most recent among others. In addition, **Table 6** shows the different scores for each

Country	FDI	DCPS	LL	PCDM	RGDPPC	CPI
Malaysia	4.08	106.60	107.67	95.93	6757.70	77.30
Indonesia	0.86	32.42	31.07	25.53	2332.82	51.41
Thailand	2.18	102.20	83.29	97.29	3566.14	72.54
Singapore	14.20	95.26	95.80	99.92	32,385.13	84.84
Philippines	1.34	31.72	44.63	31.88	1801.00	59.97

Table 4.
Mean of variables over 1980–2017 for each country.

ASEAN-5 countries	Year of IFRS adoption
Malaysia	2012
Indonesia	Has not adopted (public commitment in support of moving towards IFRS from 2012)
Thailand	2011
Singapore	2010
Philippines	2005

Source: Yousefinejad et al. [16].

Table 5.
The IFRS adoption date of ASEAN countries.

Score	Characteristics of IFRS adoption	Malaysia	Indonesia	Thailand	Singapore	Philippines
1	Has the jurisdiction made a public commitment in support of moving towards a single set of high-quality global accounting standards?	1	1	1	1	1
2	Has the jurisdiction made a public commitment towards IFRS Standards as that single set of high-quality global accounting standards?	1	1	1	1	1
3	For domestic companies are IFRS Standards required or permitted?	1	0	0	1	1
4	Are IFRS Standards also required or permitted for more than the consolidated financial statements of companies whose securities trade in a public market?	1	0	0	1	1
5	Are all or some foreign companies whose securities trade in a public market either required or permitted to use IFRS Standards in their consolidated financial statements?	1	0	1	1	1
6	Are IFRS Standards incorporated into law or regulations?	1	0	0	0	1
7	Has the jurisdiction adopted the IFRS for SMEs Standard for at least some SMEs?	1	0	0	1	1
Total		7	2	3	6	7

Source: Yousefinejad et al. [16].

Table 6.
IFRS adoption scores.

country. The score was constructed based on IFRS Foundation's Jurisdictional Profiles. Malaysia and the Philippines achieved full scores based on the characteristics that has been constructed. Although Indonesia has not adopted IFRS, however, this country has a score of 2 because it has made a public commitment in support of moving towards a set of high-quality global accounting. Hence, ASEAN-5 countries have financial information quality following IFRS on presenting the financial position for each country. The quality of financial reporting and financial development soundness would lead better decision among foreign investors.

4. Methodology

The flow of methodology started with the panel unit root test with cross-sectional dependency to ensure the variables are integrated at first difference before proceed with cointegration test of panel cointegration second-generation. Since the existence of cross-sectional dependency among ASEAN-5 countries, hence, this study considers the using Westerlund's cointegration test as the second-generation of panel cointegration. In addition, the fully modifies ordinary least square

(FMOLS) and cross-sectional dependency autoregressive distributed lag (CS-ARDL) are used to estimate the long run coefficient in the specification. FMOLS estimator is used to overcome the endogeneity and heterogeneity problem. Meanwhile, the cross-sectional dependency needs to take into account in the estimation by using CS-ARDL. The causality test by using panel vector error correction model (VECM) is used to investigate the direction of causality among the variables.

4.1 Panel unit root test

The panel unit root test of second-generation in used in order to incorporating the cross-sectional dependency. For the case of ASEAN-5 countries, the common stochastic trends may occur due to global developments and strong relationships between economies. The heterogenous panel unit root test with cross-sectional dependence is employed for clarity [20]. The standard Dickey-Fuller (DF) or augmented Dickey-Fuller (ADF) regressions are augmented with the cross-section averages of lagged levels (x_{it-1}) and first-differences (Δx_{it-1}) of the individual series to eliminate cross-sectional dependence. Hence, the cross-sectional dependence ADF (CADF) test [20] expressed as follows:

$$\Delta x_{it} = \alpha_i + \rho x_{it-1} + v_{it} \tag{3}$$

where, $v_{it} = g_i\theta_t + \mu_{it}.\theta_t$ is a common factor and is white noise.

The CADF model is given by, without the autocorrelation of μ_{it} can be written as follows:

$$\Delta x_{it} = \alpha_i + \rho x_{it} + c_i\overline{x}_{t-1} + d_i\Delta\overline{x}_{t-1} + \varepsilon_{it} \tag{4}$$

The cross-sectionally augmented Im, Pesaran and Shin (IPS) or CIPS [20] is given by:

$$CIPS\ (N,T) = \frac{1}{N}\sum_{i=1}^{q} t_i(N,T) \tag{5}$$

where t_i indicates the statistics from each CADF model for each individual i of the panel and significance level based on the critical value (see [20]). If the p-value of CIPS statistics is lower than 0.05 indicating the null hypothesis of non-stationary of the variables is rejected.

4.2 Panel cointegration test

The second-generation panel cointegration test with cross-sectional dependence has four error-correction-based tests, which allows for large degree of heterogeneity in both long-run cointegration and short-run dynamics [21]. The presence of cointegration is tested by determining whether or not the existence of error-correction for individual panel of also the panel as a whole. Transforming Eq. (1) to the error-correction model can be expressed as follows:

$$\begin{aligned}\Delta \ln FDI_{it} = {} & c_{1j} + \varphi_{i1}\sum_{j=1}^{p}\Delta \ln FDI_{it-j} + \varphi_{i2}\sum_{j=0}^{p}\Delta \ln FinDev_{it-j} + \varphi'_i\sum_{j=0}^{p}\Delta X_{it-j} \\ & + \theta_i[\beta_{1i}(\ln FDI_{it-1}) - \beta_{2i}(\ln FinDev_{it-1}) - \beta'_i(X_{it-1}) + \varepsilon_{it}\end{aligned} \tag{6}$$

where θ_i measures the speed of error-correction towards the long-run equilibrium, $FDI_{it} = -(\varphi_i/\theta_i) \times x_{it}$ for the series i. The null hypothesis, $H_0 : \theta_i = 0$ for all i

versus H_1: $\theta_i < 0$ for at least one i for the G_α and G_τ statistic tests. If H_0 is rejected, it means that cointegration exists for at least one of the cross-sectional units. Meanwhile, the P_α and P_τ test statistics pooled the information over all the cross-sectional units to test $H_0 : \theta_i = 0$ for all i versus $H_1 : \theta_i < 0$ for all i. The rejection of H_0 indicating the evidence of cointegration for the panel as a whole.

4.3 Long-run estimation

The long-run coefficient estimation is proceeded if the evidence of cointegration among the variables is proven. Fully modified ordinary least square (FMOLS) estimator is used to estimate the long-run coefficient for financial development and FDI inflows relationship. The long-run coefficients are further estimates by using cross-sectional dependency autoregressive distributed lag (CS-ARDL) in order to considering the element of cross-sectional dependency among ASEAN-5 countries for robustness.

4.3.1 Fully modified ordinary least square (FMOLS)

The FMOLS estimator allows for cross-sectional heterogeneity in the alternative hypothesis. The endogeneity and serial correlation problems are allowing in the FMOLS long-run coefficients estimation in order to obtain consistent and asymptotically unbiased estimates of the cointegrating vectors [22, 23]. The definition of in FMOLS estimator can be expressed as follows:

$$\hat{\beta} = N^{-1} \sum_{i=1}^{N} \left[\sum_{t=1}^{T} \left(X_{it} - \overline{X}_1 \right)^2 \right]^{-1} \left[\sum_{t=1}^{T} \left(X_{it} - \overline{X}_1 \right) Y_{it}^{*} - T\hat{\tau}_i \right] \tag{7}$$

where, $Y_{it}^{*} = \left(Y_{it} - \overline{Y} \right) - \frac{\hat{L}_{21i}}{\hat{L}_{22i}} \Delta X_{it}$, $\hat{\tau}_i \equiv \hat{\Gamma}_{21i} + \hat{\Omega}_{21i}^{0} - \frac{\hat{L}_{21i}}{\hat{L}_{22i}} \left(\hat{\Gamma}_{22i} + \hat{\Omega}_{22i}^{0} \right)$ and $\hat{L}_i$ is a lower triangular decomposition of $\hat{\Omega}_i$. The associated t-statistic is assumed to be normally distributed and given by:

$$t_{\hat{\beta}^*} = N^{-1/2} \sum_{i=1}^{N} t_{\hat{\beta}^*, i}; \text{where } t_{\hat{\beta}^*, i} = \left(\hat{\beta}_i^{*} - \beta_0 \right) \left[\hat{\Omega}_{11i}^{-1} \sum_{t=1}^{T} \left(X_{it} - \overline{X} \right)^2 \right]^{1/2} \tag{8}$$

The long-run relationship between financial development and FDI inflows is measured by the coefficient $(\hat{\beta})$ from FMOLS estimator.

4.3.2 Cross-sectional dependency autoregressive distributed lag (CS-ARDL)

Cross-sectional dependency autoregressive distributed lag (CS-ARDL) estimator is used for robustness that allows for cross-sectional dependency among ASEAN-5 countries in the alternative hypothesis. The dataset shows cross-sectional dependency existed for all variables (refer to **Table 1**), which might be due to integrational economies among neighbor countries in ASEAN-5. This element needs to consider in estimating the long-run coefficient by using CS-ARDL estimator [24]. The baseline model for generic ARDL (p,q) can be expressed as follows:

$$\overline{y}_{i,t} = \sum_{k=1}^{p} \varphi_{i,k} \overline{y}_{i,t-k} + \sum_{l=0}^{q} \beta'_{i,l} \overline{x}_{i,t-1} + u_{i,t} \tag{9}$$

while its cointegrating form would be:

$$y_{i,t} = \theta_i x_{i,t} + \alpha_i'(L)\Delta x_{it} + \widetilde{u}_{i,t} \tag{10}$$

In CS-ARDL, Eq. (9), the errors (u) is postulated a common unobserved factor structure for the errors. It can be written as:

$$u_{i,t} = \gamma'_i F_t + \varepsilon_{i,t} \tag{11}$$

CS-ARDL is an augmented model from generic ARDL (p,q) by averaging cross-sectional of the dependent and explanatory variables, as well as their lags, which are supposed to proxy for the unobserved common factors.

4.4 Panel vector error-correction model

The panel Granger causality in the framework of the panel VECM is employed to analyze the direction of the causal effect among FDI, financial development and the control variables, CPI and GDP per capita. The long-run model specified in Eq. (1) is estimated by using FMOLS to obtain the estimated residual, followed by Granger causality model estimation based on the error-correction model as follows:

$$\begin{aligned}\Delta\ln FDI_{it} = \alpha_{1i} &+ \sum_{k=1}^{m} \lambda_{11ik}\Delta\ln FDI_{i,t-k} + \sum_{k=1}^{m} \lambda_{12ik}\Delta\ln FinDev_{i,t-k} \\ &+ \sum_{k=1}^{m} \lambda_{13ik}\Delta\ln RGDPPC_{i,t-k} + \sum_{k=1}^{m} \lambda_{14ik}\Delta\ln CPI_{i,t-k} + \phi_{1i}EC_{i,t-1} + \mu_{1it}\end{aligned} \tag{12}$$

$$\begin{aligned}\Delta\ln FinDev_{it} = \alpha_{2i} &+ \sum_{k=1}^{m} \lambda_{21ik}\Delta\ln FinDev_{i,t-k} + \sum_{k=1}^{m} \lambda_{22ik}\Delta\ln FDI_{i,t-k} \\ &+ \sum_{k=1}^{m} \lambda_{23ik}\Delta\ln RGDPPC_{i,t-k} + \sum_{k=1}^{m} \lambda_{24ik}\Delta\ln CPI_{i,t-k} + \phi_{2i}EC_{i,t-1} + \mu_{2it}\end{aligned} \tag{13}$$

$$\begin{aligned}\Delta\ln RGDPPC_{it} = \alpha_{3i} &+ \sum_{k=1}^{m} \lambda_{31ik}\Delta\ln RGDPPC_{i,t-k} + \sum_{k=1}^{m} \lambda_{32ik}\Delta\ln FinDev_{i,t-k} \\ &+ \sum_{k=1}^{m} \lambda_{33ik}\Delta\ln FDI_{i,t-k} + \sum_{k=1}^{m} \lambda_{34ik}\Delta\ln CPI_{i,t-k} + \phi_{3i}EC_{i,t-1} + \mu_{3it}\end{aligned} \tag{14}$$

$$\begin{aligned}\Delta\ln CPI_{it} = \alpha_{4i} &+ \sum_{k=1}^{m} \lambda_{41ik}\Delta\ln CPI_{i,t-k} + \sum_{k=1}^{m} \lambda_{42ik}\Delta\ln FinDev_{i,t-k} \\ &+ \sum_{k=1}^{m} \lambda_{43ik}\Delta\ln RGDPPC_{i,t-k} + \sum_{k=1}^{m} \lambda_{44ik}\Delta\ln FDI_{i,t-k} + \phi_{4i}EC_{i,t-1} + \mu_{4it}\end{aligned} \tag{15}$$

where, EC is error-correction term comes from the FMOLS estimation, and m is the lag length. The short-run causality is determined by the statistical significance of the F-statistic associated with the corresponding right hand side variables. The presence or absence of long-run causality can be established by examining the significance of the t-statistic on the coefficient ϕ, in Eqs. (12)–(15).

5. Empirical findings

The result of the second-generation panel unit root for the option of with and without trend are presented in **Table 7**. The panel unit root of CIPS using one lag order due to parsimony principle. The null hypothesis of non-stationary is fail to rejected in level in lag 1 (q = 1) for both variables option without trend (Z_α) and with trend (Z_τ), but rejected in first difference indicating that all series are integrated of order one or $I(1)$ for the panel of ASEAN-5 countries.

Variable	Level				First difference			
	Z_α		Z_τ		Z_α		Z_τ	
	$q = 0$	$q = 1$	$q = 0$	$q = 1$	$q = 0$	$q = 1$	$q = 0$	$q = 1$
FDI	−4.0*	−1.5	−4.3*	−1.4	−10.0*	−8.3*	−9.7*	−7.5*
DCPS	−1.0	−1.0	0.6	0.5	−8.5*	−5.0*	−8.0*	−4.4*
LL	0.8	−0.8	0.9	−1.5	−4.6*	−5.1*	−3.6*	−4.3*
PCDM	−0.2	−2.0	1.9	−0.3	−3.7*	−4.0*	−3.7*	−3.4*
RGDPPC	2.2	1.0	4.4	3.1	−3.5*	−3.1*	−3.8*	−4.2*
CPI	1.0	−0.8	1.0	0.0	−5.5*	−3.7*	−4.7*	−3.2*

*Significant at 1% level.

Table 7.
Second-generation panel unit root test of CIPS.

	Model 1: FinDev = DCPS		Model 2: FinDev = LL		Model 3: FinDev = PCDM	
	Statistics	*p*-value	Statistics	*p*-value	Statistics	*p*-value
G_τ	−2.975***	0.003	−3.054***	0.002	−3.398***	0.000
G_α	−8.162	0.450	−9.576	0.264	−8.249	0.438
P_τ	−5.701**	0.018	−5.240**	0.040	−6.038***	0.009
P_α	−6.939	0.172	−7.178	0.152	−7.051	0.162

***Significant at 1% level.
**Significant at 5% level.

Table 8.
Second-generation panel cointegration results.

Since all variables are integrated of order one, the panel cointegration test is employed to measure the existence of long-run relationship in Eq. (1). The results of second-generation of panel cointegration presented in **Table 8**. The panel cointegration test shows that P_α and P_τ test statistics reject the null hypothesis of no cointegration at 1, 5 and 10% significance level for both models using DCPS and PCDM, for the specification without trend. The P_α and P_τ test statistics have the highest power and are the most robust to cross-sectional correlation [21]. Thus, the evidence from the second-generation panel cointegration test supports the presence of a cointegrating relationship among FDI, financial development, price and economic development in ASEAN-5 countries.

Due to the existence of cointegration among variables in the region, the FMOLS estimator is used to estimate the long-run equilibrium. **Table 9** reports that Model 1–3 estimates the linear and nonlinear relationship between financial development and FDI in the long-run, by using DCPS, LL and PCDM as a proxy for financial development, respectively. Long-run covariance estimates pre-whitening with lag 1, where the automatic bandwidth selection is based on Newey-West fixed bandwidth and Bartlett kernel. In the linear specification, the relationship between financial development and FDI are not significant in all models. However, in contrast, there is significant of nonlinear relationship between financial development and FDI. The nonlinear relationship between these variables is anti-Kuznets or U-shape curve, where α_1 the coefficient of financial development and α_2 the financial development square coefficient (Eq. (2)) is negative and positive,

	Linear model			Quadratic model		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
FinDev	0.21	0.07	0.03	−7.98*	−3.78	−8.46*
FinDev^2	—	—	—	0.93*	0.34	0.93*
RGDPPC	2.38***	1.92***	2.44***	2.57***	1.84***	2.69***
CPI	−2.22***	−1.58***	−2.11***	−2.80***	−2.05***	−2.29***
Threshold value (% of GDP)				73.00	—	94.48

DCPS is used as a proxy in Model 1, while PCDM in Model 2.
****Significant at 1% level.*
**denotes significant at 10% level.*

Table 9.
Panel FMOLS long-run estimation (dependent variable: FDI).

respectively. The U-shape curve indicating that the financial development exceeded the threshold level, its incremental will attract more FDI inflows.

The result show that the negative effect of low level of financial development below the threshold level, in general at 70% of GDP that portrays the financial illness in host country. Initially, the negative relationship associated with the underdeveloped financial sector that may discourage the investor's decision to invest to the host country for those investors who are preferring on resource-seeking and market-seeking. Low level in credit market will reduce the purchasing power of parity among the citizens, and as a result, the innovative products produced by foreign firms may become unmarketable or over-supplied in the host country.

In the other hand, the high financial development reflects high financial strength that might attracts the inflows of FDI that related to assist them to set-up new business in host country and survival in their day-to-day business. When the level of financial development that above the 70% of GDP threshold point, it influences the positive impact on FDI inflows. Specifically, based on the quadratic specification of Model 1 in **Table 7**, the financial development threshold point is 73% of GDP (−7.98/(0.93(2))), and Model 3 is 94.48% of GDP (−8.46/(0.93(2))). The result showed that the DCPS surpassed the threshold point at median value to accelerate inflows of FDI, while PCDM should beyond the 75% quantile. The nonlinear relationship between financial development and FDI in this study is however differed from those of previous studies which examined the linear relationship (see [25–27]). The U-shape curve commensurate with the argument that well-developed financial market benefited FDI in host country [28].

The result from FMOLS is however not considering the cross-sectional dependency among ASEAN-5 countries. The long-run coefficients are further estimated by using CS-ARDL for robustness check as shown in **Table 10**. Similar with **Table 9** previously, the relationship between financial development on FDI inflows are not significant by using linear specification for all models in short-run and long-run estimations as shown in **Table 10**. The relationship between financial development and FDI inflows is however absence in the short-run estimation. But the relationship is existed in quadratic model specification, but result shows that only Model 2 has significant U-shape relationship between LL and FDI inflows in the long-run. The relationship is significant only in the long-run due to time lag effect in materializing the benefit of FDI inflows influenced by financial development. The U-shape relationship indicates by the negative coefficient for $\hat{\alpha}_1$, and positive coefficient for $\hat{\alpha}_2$ (refer to Eq. (2)), which both coefficients are significant at 1% level. It means, when the level of liquid liabilities as a percentage of GDP beyond the

	Linear model			Quadratic model		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Short-run estimation						
FinDev	0.61	0.32	−0.11	10.36	−3.42	9.20
$FinDev^2$	—	—	—	−1.34	0.54	−1.27
RGDPPC	7.11***	5.39***	5.86***	10.02	5.73	4.89
CPI	2.69	2.85	2.98*	2.16	1.88	1.76
Long-run estimation						
FDI	−0.96***	−1.00***	−0.96***	−1.04***	−1.12***	−1.16***
FinDev	−0.05	−0.07	−0.53	1.33	−29.34***	−4.16
$FinDev^2$	—	—	—	−0.21	3.46***	0.38
RGDPPC	4.66**	2.37	3.93**	8.90	4.92	6.55
CPI	1.85	2.03	1.07	2.00	0.66	−0.73**
R^2	0.64	0.65	0.65	0.74	0.72	0.76
CD statistic	−3.91	−3.86	−3.60	−3.55	−3.91	−3.80
p-value	0.00	0.00	0.00	0.00	0.00	0.00
RMSE	0.37	0.36	0.36	0.33	0.34	0.31
Threshold value (% of GDP)				—	69.66	—

DCPS is used as a proxy in Model 1, while LL and PCDM in Model 2 and Model 3, respectively.
****denotes significant at 1% level.*
***denotes significant at 5% level.*

Table 10.
Cross-sectional dependence ARDL (CS-ARDL) estimation (dependent variable: FDI).

threshold point at median level, it will attract the FDI inflows to ASEAN-5 countries. Specifically, by considering the cross-sectional dependency among ASEAN-5 countries the liquid liabilities threshold point is 70% of GDP (−29.34/(3.46(2))) in long-run.

Although the more financial development can attract the FDI inflows, but the quality of financial reporting is important channel of its information for investors, since the ASEAN-5 countries are committed in complying IFRS rules. The information in financial reporting provided by firms and financial institution in host countries as a canal on presenting it financial position that leads better decision for foreign investors. The foreign investors may unable to make decision of lacking information on financial condition in host countries. A superior financial reporting system lowers the cost of capital and improves capital allocation efficiency [29]. The quality of financial reporting would lead to transparent and clear information that reducing asymmetric information between foreign investors and financial institutions in ASEAN-5 countries.

In further investigation, the causality between variables are tested by using Granger causality test based on VECM model as shown in **Table 11**. The lag length is based on Akaike information criterion. All models shown the negatively significant of error-correction term for the FDI equation, that suggesting the existence of long-run relationship when the FDI is dependent variable. Similarly, there are exists the long-run causality when financial development and CPI as a dependent variable for all models. The causality between financial development and FDI inflows is however occurred only in the long-run. As shown in **Table 11**, there is a unidirectional causal effect running from real GDP per capita to DCPS and PCDM, CPI to FDI, CPI

Dependent variable	Independent variables				ECT_{t-1}
	ΔFDI	*ΔFinDev*	*ΔRGDPPC*	*ΔCPI*	Coefficient (*t*-statistic)
	Wald F-statistics				
Model 1: FinDev = DCPS					
ΔFDI	—	2.106	0.935	2.201	−0.136*** (−4.292)
ΔFinDev	0.052	—	0.345	3.213	−0.016*** (−2.375)
ΔRGDPPC	2.263	24.223***	—	0.902	−0.001 (−0.55)
ΔCPI	17.821***	23.688***	4.793*	—	−0.012*** (−4.064)
Model 2: FinDev = LL					
ΔFDI	—	0.331	1.021	1.871	−0.081*** (−3.921)
ΔFinDev	4.542	—	0.726	0.996	−0.005* (−1.923)
ΔRGDPPC	2.929	3.101	—	1.827	−6.947 (−0.047)
ΔCPI	17.615***	1.287	3.332	—	−0.010*** (−5.375)
Model 3: FinDev = PCDM					
ΔFDI	—	2.210	1.029	2.224	−0.084*** (−3.588)
ΔFinDev	1.300	—	0.254	1.420	−0.011*** (−3.489)
ΔRGDPPC	2.000	44.048***	—	2.940	−0.001 (−0.342)
ΔCPI	14.846***	9.414***	4.079	—	−0.011*** (−5.106)

ECT is error-correction term.
****Significant at 1% level.*
**Significant at 10% level.*

Table 11.
Granger causality based on panel VECM estimation.

to DCPS and PCDM and CPI to real GDP per capita. The linkage is however broken between financial development-FDI nexus in short term. The error-correction terms presented in the last column of all models demonstrated that the burden of the short-run endogenous adjustment (in long-run trend) to bring the system back to its long-run equilibrium borne by the FDI, financial development and CPI equations.

6. Conclusion

The financial development, FDI, CPI and real GDP per capita is cointegrated by considering cross-sectional dependence. The relationship between the financial development and FDI in ASEAN-5 countries is found nonlinear of U-shape over the period from 1980 to 2017. Based on the findings from the quadratic model, financial development contributed towards promoting FDI after surpassed the threshold level at 70% of GDP or median score. It is important to understand how the financial development affects FDI. The results demonstrated that there exists cross-sectional dependence among ASEAN-5 countries which this supports the argument of geographic influence on financial integration as well as FDI inflows. Economic integration has a direct effect on internationalization by reducing transaction costs and partial information costs [30].

Financial integration among the ASEAN-5 countries strengthened financial development as well as ease transaction activities among the regional players [31]. The integration in the AEC Blueprint 2015 towards strengthening the financial institutions, enhance commitment in implementation and in monitoring and evaluation of finance. Since all ASEAN-5 countries are complying the financial accounting standards of IFRS (including Indonesia who committed to comply the IFRS), the quality of financial information is needed in order to monitor and evaluate the financial position. In addition, ASEAN seeks to achieve a well-integrated and smoothly functioning ASEAN region financial system, as well as the IFRS accounting standard, that characterized by more liberalized capital account regime and inter-linked capital markets. Strengthening financial integration as well as financial market infrastructure with the quality of financial reporting are therefore aimed at facilitating intra-ASEAN trade and investment by increasing the role of ASEAN indigenous banks. It also augmenting the integrated insurance and capital markets that leading to safe, cost-efficient and more connected regional economy. The attraction of FDI inflows is an important goal of the AEC and largely conditional to the success of the ASEAN-5 economies efforts.

Conflict of interest

This chapter has been declared as no conflict of interest.

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Chapter

The Roles of Accounting Valuations and Earnings Management in the Survivorship of Technology Firms during the Global Financial Crisis

Oliver Neoh and Matthias Nnadi

Abstract

This study examines the survivorship of technology firms listed on the NASDAQ market during the immediate and post-2008 global financial crisis period. Underpinned by contingency theory, this study demonstrates the varying roles of accounting valuation and earnings management metrics in the technology industry. Findings in this chapter show during the global financial crisis periods, technology firms have greater survivorships when they are undervalued, and possess a lesser degree of discretionary earnings (DA). The DA factor is a double-edged sword for technology firms since it has positive and negative effects on the returns and survivorships, respectively. The research and development (R&D) variable remains a positive component for both returns and survivorships of these firms.

Keywords: accounting valuation, earnings management, technology, prediction, performance, survivorship

1. Introduction

The technology sector has rapidly gained importance in the past two decades. The NASDAQ Composite, which measures all the stocks on the tech-heavy NASDAQ market, surpassed its dotcom high in 2015.[1] Valuations are also close to the general market today, in sharp contrast to the extreme valuation gap seen in 2000.[2] Firms within the technology sector possess distinct aspects relative to non-technology firms, examples being: innovation and technical advancement leading to high economic growth, opaque information causing moral hazard, longer investment horizon required for technology innovations, greater uncertainties in cash

[1] The transformation of the industry over the past 17 years has been significant. Technology companies are expected to generate more than 25% of the S&P 500's overall earnings in the fourth quarter of this year, compared with 15% at the index's peak in 2000. At that time, tech stocks accounted for more than a third of the benchmark S&P 500. Today that figure has fallen closer to 23%.

[2] Tech stocks trade at 19.4 times 2017 full-year earnings, while the S&P 500 is at 19 times. As per Bloomberg data, in the first quarter of 2000, S&P 500 technology groups traded at 73 times earnings.

flows and growth potentials. It is further asserted that greater litigation risk arises from information asymmetry [1]. Therefore, our goal is to analyse the reasons behind the rapid performance growth and change in survivorship in technology sector during of financial turmoil and its initial recovery of our 2008 global financial crisis. We evaluate the impact of accounting valuation and earnings management indicators considering special aspects of technology firms and our lesson from the technology bubble in 2000.

Currently there exists a gap in the academic discourse comparing the state of the technology sector during the crisis of 2008. Our study fills the present gap by re-evaluating the sector in the aftermath of the most recent crisis and reflects on the findings drawn from preceding crisis of 2000. The current study seeks to evaluate whether the same findings drawn from the earlier crisis literature, referring to [2], are still relevant for capital providers and participants in the post-crisis period. Accordingly, our study sets a considerable contribution to current studies on the effects of valuation measures in the technology sector on the financial crisis, and whether these effects vary over the various periods of the crisis.

Secondly, previous studies limit their scope to analysing performance of stock returns [3, 4]. This chapter however focuses on examining both future performance and the survivorship of firms within the technology-sector. This is linked to our base understanding that accounting valuation and earnings management variables play a much greater role in determining future survivorship within this particular sector that has developed with large strides since the late twentieth century. Moreover, given the uniqueness of the technology sector, such as the larger existence of intangible assets, we anticipate that our evaluation encompassing linked variables such as discretionary accruals (DA) and research and development (R&D) expenditure will be a valuable contribution to the current technology sector literature. We examine how these effects are contingent on different time horizons, short and long run, and morality (ETHICS) of these technology firms' behaviours.

This chapter contributes to ongoing discussion in relation to the determining the effects of accounting valuation and earnings management variables in the performance and survivorship of technology firms during the financial crisis. The three core objectives of the study linked particularly towards future performance and survivorship are:

I. to determine the level of explanatory power of valuation and accounting metrics in determining the short- to long-term performance of securities within the technology sector throughout the most recent global financial crisis (GFC) period;

II. to examine whether valuation and accounting metrics hold predictive power in explaining the future survivorship or failure of technology firms in the immediate and post-crisis period; and

III. to investigate how the technology firms' moral hazard (i.e. opportunistic behaviour) affect their future returns and survivorships during and after the GFC period.

We find that our accounting valuation and earnings management techniques including R&D, market capitalization (MktCap), earnings to price ratio (EP), book to market ratio (BM), and discretionary accruals (DA) have stronger positive effects on longer term performance of the technology firms. In other words, undervaluation, larger firm size, and more discretionary earnings and R&D lead to higher returns which increase more with longer terms. On the other hand, undervaluation,

large firm size (MktCap), more R&D but with less discretionary earnings (DA) increase the survivorships of these firms. We confirm that practising earnings management introduces a double-edged sword for the technology firms since DA has positive and negative effects on the returns and survivorships, respectively particularly during the global financial crisis. R&D mostly increases both the returns and survivorships although the significance may vary. Furthermore, the moral hazard (ETHICS) within the technology firms tends to reduce their future returns while not significantly affecting their survivorships.

1.1 Development of the research hypothesis

The underlying research question for this chapter considers whether in times of financial crisis, capital providers, including investors, equity providers, and debt holders could use accounting valuation, and earnings management variables in predicting the future performance and survivorship/failure of technology-firms. To investigate the research question, we consider the contingency theory as a fitting framework as it suggests that an optimal course is contingent on the circumstance or environment confronting the phenomenon being examined. This is because our study seeks to provide an explanation to phenomena that are dependent upon times of crisis.

Keystone works utilising this contingency approach explore a diverse range of subjects, such as the usefulness of virtual learning environments in education amongst different sectors or groups [5–7], or the optimal conditions in organisations where certain IT implementations will be beneficial [8]. The same framework is applied to our investigation as we seek to identify which accounting valuation, and earnings management techniques are useful in explaining future performance and probability of failure contingent on times of crisis and periodic outlooks. Accordingly, we propose two hypotheses directly relevant to the issues for equity-holders on future performance, and creditors on future probability of failure:

H_1: *Accounting* valuation *and earnings management metrics will be significant at different times of crises in explaining short- to long-term performance, and where they are significant they should follow the conventional relationship these measures have with future returns.*

H_2: *Accounting* valuation*, earnings management, and past performance variables will be significant at different times of crises in explaining future firm failure, and when they do, they adhere to conventional relationships.*

For equity providers and investors of stock markets, this issue of being able to predict the performance of the firm is highly relevant as these groups typically seek to invest in businesses that are set for future success. If the investment is successful, they are rewarded with stock price returns. For debt holders, it is important that they are able to determine the probability of future failure and to assess whether the recipient of the loan would be able to pay-back or risk defaulting on their loan. For accurate prediction of these outcomes, a more robust risk-assessment of lending agreements is essential.

The rest of the chapter is structured as follows: Section 2 is the literature review, Section 3 is the data and research design, Section 4 is the results and discussion of findings and Section 5 is the conclusion, implication of study and limitations.

2. Review of literature

Arguably, since the late twentieth century the technology sector has increased its presence within society in every aspect. Its continued rise is now imminent and a

robust understanding of the sector is well in demand. Alongside the sector's rise, a myriad of listed technology companies have also grown in presence and influence in capital markets since its origins. Throughout its history, these high-technology investments have at times showcased behaviours of high-growth characteristics [9]. To understand the issues that the chapter aims to address, we provide the four core areas covered in the existing literature, consisting of the technology sector, financial crises, financial measures, and earnings management.

2.1 The technology sector

Technology stocks have increased immensely in both presence and importance to global financial markets. For instance, from 1990 to 2000, technology firms have emerged from barely being existent to occupying six of the ten largest firms in the US, in terms of market capitalisation [10]. The National Association of Securities Dealers Automated Quotations (NASDAQ) index which is heavily weighted by technology stocks has grown over 29 times to reach a total market capitalisation of $8.4tn.[3] Moreover, the largest stocks in today's financial markets are concentrated to the largest of the technology pioneer companies, namely Apple, Alphabet, and Microsoft. This is testament to the prominence of technology in today's world. Technology firms arguably have adopted increasingly important roles in today's capital market [11].

Nevertheless, technology stocks have faced significant challenges. Particularly, in consequence of the technology bubble and crash of late-1999 to Spring 2000, the world experienced a monumental downturn in the technology sector that sent ripples of distress throughout international financial markets. The next crisis following this was the most recent sub-mortgage crash in 2008, which similarly sent devastating effects to global markets. As such, the periodic context that coincided with the growth of the technology sector was significantly more volatile than its preceding bull-run of the 1950s to 80s.

The explanations that have arisen behind the crisis in 2000 is critical for our study, and its objective of examining the technology sector's reaction to the most recent global financial crisis (GFC) that erupted in 2008. The causes of this credit crunch and its huge impact is explored by many scholars in the field, refer to [3, 12, 13]. The crisis is a prime foundation behind this study which explores the varying dynamics of the financial crises. Close to 8 years after, this presents an opportune moment to look into the consequent shaping of the technology sector and investigate the determinants behind the performance and survivorship in this post-crisis period.

2.2 Financial crises

The cause of financial crisis is a recurring subject in economic history. Referring to the earlier 2000 technology-bubble, much discussion in the academic landscape has evolved in this field where its origins are commonly pointed to the over-optimistic behaviours expressed in the market towards the rise of Internet stocks. For example, some scholars advocate that the absence of traditional valuation metrics proved to be evidence for collective investor irrationality during the initial crash of the tech-sector [4]. As a result of this downturn, there has been a vast array of studies in the financial literature which has examined causes and impacts of the bubble. Two key areas of study have observed technology stocks in: (1) the valuation space, and how traditional metrics may not be as applicable to tech-stocks; and (2) the investment perspective looking at the various co-movements of technology

[3] Data from Bloomberg Terminal.

stocks in comparison to other sectors as well as the behaviour of different investment clienteles.

To exemplify the scale of destruction that crises like the GFC produces, there has been examination of nine crisis episodes, including the GFC and the technology bubble, and their implications on equity markets and the incidence of contagion [3]. They identify the GFC as a global crisis having contagion effects in all the channels tested. Tests on the technology bubble show that it possess normal interdependencies as a result of the downturn. Our research will therefore seek to further evaluate the effects of the GFC specifically towards the technological sector.

2.3 Accounting and valuation metrics

There has been ongoing discussion on the predictive power that accounting and valuation metrics serve in explaining future performance and survivorship of listed technology firms [2, 4, 14]. Due to the nature of tech-firms' wide-ranging business operations, they tend not to have the same drivers of business growth or failure as other sector firms. Within technology remit, the general nature of operations may be heavily service-oriented when referring to the likes of software providers, or more product-driven such as those companies specialising in computer hardware. A lot of these companies may be travelling through their early growth stages, meaning investments and capital expenditure do not necessarily translate to earnings until much later on in their life-cycle.

Furthermore, investment behaviour towards the sector has a track-record of being over-optimistic, as argued in the sector's early development and in the emergence of the 2000 technology-bubble [14]. The chapter recognises this thinking as a reflection based on the origins of the past tech-bubble, however our chapter seeks to enhance understanding in the contemporary links and similarities that the market expressed in the most recent crisis of 2008, and the key implications for equity holders and creditors active within the sector.

2.4 Earnings management

There has also been a wide-ranging scope of literature examining the phenomenon of companies practising earnings management. There has been explanations that earnings management occurs when managers use judgement in financial reporting and in structuring transactions to alter financial reports to either mislead some stakeholders about the underlying economic performance of the company or to influence contractual outcomes that depend on reported accounting practices [15]. The academic discussion on this topic explores the possibility that earnings management may imply on the immediate and future performance of tech companies during financial crisis. There is further evidence showing that firms are likely to manipulate earnings in order to report small profits instead of losses during periods of financial distress [16].

Earnings management generally refers to the management of items such as increasing accruals, as well as cutting discretionary expenditure, such as advertising, selling, general and administrative expenses, and research and development (R&D). This is particularly relevant when looking at how companies manage earnings in preparation for reporting season and meeting analyst expectations. Certain findings indicate high-tech firms are more likely to use discretionary accruals to reward CEOs to meet their earnings expectations compared to low-tech firms [17]. Moreover, some studies make conclusions that firms who show higher levels of earnings management to beat forecasts typically outperform firms who do not engage in this practise as much [18].

3. Data and research design

To explain the sample selection of technology-firms from the NASDAQ market index, we firstly used the COMPUSTAT database to generate a list of firms that were active on the NASDAQ market as of January 2007. The rationale behind selecting the NASDAQ market is that its constituent members are heavily weighted towards the technology sector, a decision similarly applied in reference to [4]. As we identify the pinnacle of the GFC to be the latter half of 2008, we generate a shortlist which comprises of firms which were active as of January 2007 to ensure that each firm within our final sample have been active for at least a year. We also ensure that all firms within our final sample were active as of third quarter of 2008.

After generating the shortlist of firms, we further break down our sample into defined Industry Classification Benchmark (ICB) codes within the NASDAQ index to arrive at a total of 350 firms. These represent the chapter's scope in evaluating technology firms. The earliest starting point of our data is selected as the year-ending 2007 so that we may calculate figures which require a year-on-year change, such as the calculation of yearly sales growth. In other words, if the financial data involves a year-on-year change, the earliest data point used to calculate this change figure will be the 2007 value. All financial and valuation data are generated from the financial year end of 2008, which is December. This is the same for 2009 and 2010.

In addition, we collect the overall firms' ethical behaviour scores (ETHICS) in US from The Global Competitiveness Report (2008–2010). This variable measures the effect of ethical behaviour of the technology firms to their returns and bankruptcies in our further analysis. The descriptions of the accounting valuation and earnings management metrics used in the study are detailed in **Table 1**.

In terms of their data extraction, we use yearly data where it refers to an accounting reported figure (Sales_g, EBITDA, RD, and calculation of DA) and quarterly data for valuation metrics (EP, BM, PS and MktCap) from the Bloomberg Terminal ranging from 2007 to 2015. Where the variables are extracted on an annual basis, we use the base year figures 2008, 2009, and 2010. Where the variables are quarterly, we use the Q4 data from the base years, 2008, 2009, 2010 to form the independent variable pool as this aligns with the financial year-end figures of our accounting data.

All accounting items required to conduct the DA procedures are extracted using yearly data from the Bloomberg database for each year, 2008–2010. The 2007 figures are also generated considering that some items require a calculation to measure the change. The *non-discretionary accruals using the Jones Model* is express as:

$$NDA_t = a_1\left(\frac{1}{A_{t-1}}\right) + a_2(\Delta REV_t) + a_3(PPE_t) \tag{1}$$

The total accruals using the Jones Model is express as:

$$TA_t = a_1\left(\frac{1}{A_{t-1}}\right) + a_2(\Delta REV_t) + a_3(PPE_t) + \vartheta_1 \tag{2}$$

where ΔREV_t = revenues in year t less revenues in year $t-1$ scaled by total assets at $t-1$; PPE_t = gross property plant and equipment in year t scaled by total assets at $t-1$; A_{t-1} = total assets at $t-1$; $a_1a_2a_3$ = firm-specific parameters; TA_t = total accruals scaled by lagged total assets; income before extraordinary items—CF from continuing operations.

Type	Variables	Description
Valuation	Earnings to price ratio (EP)	Also known as the earnings yield, the EP ratio is the inverse of the PE ratio measuring the earnings per share of a company divided by the share price of the company. Generally, the higher an EP ratio gets, the company can either be seen by the market with low confidence in its earnings, or is currently undervalued
	Book to market ratio (BM)	The book to market ratio is a ratio that calculates the book value of a firm relative to its market value. This ratio is also used in valuation practices to identify undervalued, typically over 1.00, or overvalued securities, if less than 1.00
	Price to sales ratio (PS)	Another ratio that divides a company's stock price by its revenues. It is used to indicate the value attached to each dollar of a company's sales or revenues. Lower values tend to suggest undervaluation while higher values may indicate overvalued stocks or those with higher confidence assigned by the market
Accounting	Market capitalisation (MktCap)	Market capitalisation is derived by calculating the company's shares outstanding multiplied by the current market price. It is used as a close proxy for size of the firm, and typically larger firms tend to survive crises
	Sales growth ($Sales_g$)	Sales growth in our study is defined as the growth in sales revenue year on year in Q4 of a particular year. Those with higher growth are assumed to enjoy greater return prospects and lower likelihood of failure
	Earnings before interest, taxes, depreciation, and amortisation (EBITDA)	An accounting item that acts as a strong indicator of a company's financial performance. It is useful in displaying the earning potential of a business as well as a gauge to analyse profitability that eliminates the effects of financing and accounting decisions
	R&D expenditure (R&D)	Refers to expenses linked to the research and development of a company's goods or services. Importantly, the technology sector is amongst the highest users of RD and the level may be viewed by market participants as either an expense or investment initiative, a key part to our study
	3m, 6m, 1y, 3y, 5y	These are the firm's 3-month, 6-month, 1-year, 3-year, and 5-year performance measured by stock returns. These explain the firm's performance from the short to long term
	Failed_6m, Failed_1y, Failed_3y, Failed_5y	These are the dummy variables assigned 1 if the firm fails and 0 if otherwise in 6-month, 1-year, 3-year, and 5-year
Earnings management	Discretionary accruals (DA)	Along with non-discretionary accruals, they make up the total accruals practiced by the company. Discretionary accrual is associated with management choices whereas non-discretionary accruals originate from business conditions. DA is a good proxy for earnings quality and our study employs the Jones and Modified Jones Model for its calculation
Qualitative data	ETHICS	The scores of firm's ethical behaviour in US collected from The Global Competitiveness Report (2008–2010)

The table shows the description of the variables we use. It shows the description for our valuation (EP, BM, PS), accounting (MktCap, $Sales_g$, EBITDA, R&D, (3m, 6m, 1y, 3y, 5y) returns, (Failed_6m, Failed_1y, Failed_3y, Failed_5y) failures, DA, and ETHICS).

Table 1.
Variable description.

We also compute the non-discretionary accruals using the Modified Jones Model which is express as:

$$NDA_t = a_1\left(\frac{1}{A_{t-1}}\right) + a_2(\Delta REV_t - \Delta REC_t) + a_3(PPE_t) \quad (3)$$

where ΔREC_t = net receivables in year t less net receivables in year $t-1$ scaled by total assets at $t-1$; NDA_t = non-discretionary accruals scaled by total assets of prior year.

Once we have calculated the discretionary accruals value for each firm in their MJDA and JDA forms, we then measure each firm's value relative to the sample median in percentage terms similar to the methodology adopted by past studies, refer to [18]. Consequently, a positive value refers to a firm who has greater discretionary accruals for that particular year relative to its peer group. The descriptive statistics of our overall data is shown in the following **Table 2**.

3.1 Research design

The core methodologies used for our research include the linear regression and logistic regression models. In our linear regression section investigating H_1, we conduct OLS regressions for each base year measuring 3-month, 6-month, 1-year, 3-year, and 5-year performance as the dependant variable. In addressing H_2,

	3m	6m	1y	3y	5y	EP	BM	PS	MktCap	$Sales_g$
Average	7.95	21.59	35.16	59.73	80.14	0.06	0.74	2.28	2.66	0.08
Median	7.06	11.53	20.84	33.86	37.94	0.05	0.55	1.69	2.65	0.01
Min	−59.69	−100.00	−100.00	−100.00	−100.00	0.00	0.02	0.05	0.27	−4.21
Max	103.87	314.04	1358.18	1089.90	2880.31	0.84	11.01	27.98	5.47	9.07
Std.	20.44	48.84	85.65	148.61	231.81	0.07	0.79	2.21	0.86	0.49
10th per	−16.59	−18.92	−34.44	−100.00	−100.00	0.01	0.23	0.43	1.57	−0.06
90th per	32.29	70.69	117.39	214.18	290.98	0.12	1.30	4.44	3.74	0.28
N	866	866	866	866	866	866	866	866	866	866
	EBITDA	**Failed_6m**	**Failed_1y**	**Failed _3y**	**Failed _5y**	**MJDA**	**JDA**	**R&D**	**ETHICS**	
Average	1.16	0.01	0.04	0.15	0.26	0.43	0.39	0.10	5.36	
Median	0.00	0	0	0	0	0	0	0.09	5.40	
Min	−29.32	0	0	0	0	−16.37	−15.71	0.00	5.20	
Max	350.67	1	1	1	1	35.87	34.33	0.54	5.50	
Std.	13.00	0.11	0.19	0.35	0.44	3.82	3.70	0.07	0.12	
10th per	−0.05	0	0	0	0	−2.41	−2.39	0.02	5.20	
90th per	0.59	0	0	1	1	3.26	3.10	0.18	5.50	
N	866	866	866	866	866	866	866	866	866	

The table shows the descriptive statistics of the data set we used. We show the average, median, minimum (min), maximum (max), standard deviation (Std.), 10th percentile (10th per), 90th percentile (90th per), and the total number of sample (N) for our overall data. Our overall data include 3m, 6m, 1y, 3y, 5y, EP, BM, PS, MktCap, $Sales_g$, EBITDA, Failed_6m, Failed_1y, Failed_3y, Failed_5y, MJDA, JDA, R&D, and ETHICS from 2008 to 2010.

Table 2.
Descriptive statistics.

we conduct logistics regression using 3-models for each base year measuring 1-year failure, 3-year failure, and 5-year failure. One year is chosen as the earliest measure of failure as any earlier, such as 6-months, would consist of an insignificant number of firms that have failed. Logistic regression results earlier than 1-year, in our case, are limited in their validity.

Our linear regression model for determining future performance is express as:

$$r_{a_t} = a + b_1EP + b_2BM + b_3PS + b_4MktCap + b_5EBITDA + b_6Sales_g + b_7MJDA + b_8RD \tag{4}$$

And our logistic regression model for determining future failure is express as:

$$Failed\ firmt = a + b_1EP + b_2BM + b_3PS + b_4Sales_g + b_5MJDA + b_6RD + b_7MktCap + b_8EBITDA + b_91y... + b_{11}5y \tag{5}$$

In Eq. (4), the methodology for the linear regression involves a similar framework used in reference to [4], examining the market value of securities in the tech sector during the tech-bubble of 2000. In our case, the dependent variable is selected as the percentage return over the prescribed period (3m, 6m, 1 y, 3 y, and 5 y) from the end of the selected base-years (2008, 2009, and 2010). The independent variables include our valuation, accounting, and earnings management variables of each underlying security in the sample, as described in **Table 1**. A positive significant coefficient would imply a positive relationship between the indicator and future returns.

Our linear regression model for determining future performance using our overall data including ETHICS is express as:

$$r_{a_t} = a + b_1EP + b_2BM + b_3PS + b_4MktCap + b_5EBITDA + b_6Sales_g + b_7MJDA + b_8RD + b_9ETHICS \tag{6}$$

Furthermore, our logistic regression model for determining future failure using our overall data including ETHICS is express as:

$$Failed\ firmt = a + b_1EP + b_2BM + b_3PS + b_4Sales_g + b_5MJDA + b_6RD + b_7MktCap + b_8EBITDA + b_9ETHICS + b_{10}6m... + b_{13}5y \tag{7}$$

Then the corresponding null and alternative hypotheses for linear (Eq. (6)) and logistic regressions (Eq. (7)) are coefficients equal zero and non-zero, respectively, as before.

4. Results and discussion of findings

4.1 Future performance

Table 3 is the result of the multivariate analyses using the Jones Model and shows that the R&D is significant[4], and follows the traditional relationship with

[4] In this paper, we mostly discuss the results that show significantly strong results (i.e., p-values ≤ 0.05). Weakly significant results (i.e., $0.05 < p$-values < 0.10) are sometimes aligned with the strongly significant results, but we do not actively discuss these.

	3m	6m	1y	3y	5y	EP	BM	PS	MktCap	$Sales_g$	EBITDA	Failed_6m	Failed_1y	Failed_3y	Failed_5y
3m	1***														
6m	0.3***	1***													
1y	0.21***	0.67***	1***												
3y	0.14***	0.42***	0.49***	1***											
5y	0.03	0.26***	0.3***	0.62***	1***										
EP	-0.08**	0.19***	0.23***	0.15***	0.13***	1***									
BM	-0.09***	0.29***	0.28***	0.18***	0.11***	0.42***	1***								
PS	0.02	-0.15***	-0.11***	-0.09***	-0.08**	-0.27***	-0.37***	1***							
MktCap	0.05	-0.14***	-0.14***	-0.09**	-0.03	-0.19***	-0.43***	0.48***	1***						
$Sales_g$	0.02	0.01	-0.03	-0.02	-0.05	0.06*	-0.01	-0.03	-0.09***	1***					
EBITDA	-0.04	-0.05	-0.04	-0.02	0	-0.01	0	-0.04	-0.06*	0.01	1***				
Failed_6m	0.05	-0.28***	-0.17***	-0.12***	-0.09**	-0.05	-0.02	0.01	-0.02	-0.1***	0.06*	1***			
Failed_1y	0	-0.12***	-0.32***	-0.22***	-0.16***	-0.05	-0.04	-0.04	-0.02	-0.04	0.03	0.51***	1***		
Failed_3y	-0.05	-0.08**	-0.17***	-0.45***	-0.32***	-0.07*	0.01	-0.09	-0.12***	-0.02	0.01	0.24***	0.49***	1***	
Failed_5y	-0.04	-0.03	-0.12***	-0.32***	-0.46***	-0.06*	0.07**	-0.08**	-0.18***	0.04	-0.01	0.17***	0.34***	0.71***	1***

The table shows the correlation matrix of our data set we used. It uses a Pearson correlation calculation.
**Significance at 10% level.*
***Significance at 5% level.*
****Significance at 1% level.*

Table 3.
Correlation Table

both survivorship and future performance of tech-firms. Across two of the three years in the study, namely 2008 and 2009, the longer the returns are, the stronger the positive effects from BM, MktCap, MJDA, and R&D become. R&D acts a good predictor of future performance with significant coefficients of 155.73 in 6 months, 265 in 1 year and 335.09 in 3 years respectively in 2008 model. In the 2009 model, the R&D results remain significant at 56.41 and 286.02 respectively.

Sales growth is negatively significant to the medium-term returns (1y) in 2010 with a coefficient of −16.35 (**Table 3**). This suggests that firms who reported increased growth in year-on-year sales did not necessarily enjoy corresponding positive returns in medium-term. This finding corroborates with past literature suggesting there is a significant association between three-day market returns and Internet firm revenue announcements [19]. This finding and the PS results shed valuable insights into the characterisation of tech stock returns in the crisis periods. Our discretionary accruals (MJDA) variable also exhibits significant linkage to the explanation of increased short- to medium-term returns from 2008. As shown in **Table 3** the variable possesses positive coefficients of 1.23 and 4.25 in 2008s 6-month and 3-year outlook respectively which indicates a positive linkage to future returns. Therefore, discretionary accruals is a positive element for the returns which amplifies with longer returns.

As a whole, the accounting variables such as BM, MktCap, MJDA, and R&D have stronger positive effects on the longer-term performances in 2008 and 2009. In general, the large firm size (MktCap), undervaluation (EP and BM), more discretionary accruals and R&D are positive drivers for the returns of the technology firms. The negative effects from sales growth occur in 2010 sometime after the crisis. The overvaluation measured by PS seemed to positively affect the long-term returns but this effect fades out as time goes by.

4.2 Future survivorship

For future survivorship, **Table 4** shows that the R&D variable plays a significant role in a firm's 1-year outlook over the three crises years with negative coefficients of −88.16, −95.25, and −64 across 2008–2010. This reveals key points about the practice of R&D expenditure in the technology sector and why firms who practice higher levels tend to experience positive future returns and a higher likelihood of survivorship.

Furthermore, our findings suggest that firms with higher MktCap tend to survive and are more likely to outperform in the longer-term. With negative coefficients ranging from −2.17 and −0.48 in 2008, and −0.86 and −0.91 in 2010, the explanatory power for future failure is in line with the argument that undercapitalisation is a core reason to every technology business failure evaluated [20]. The R&D is significantly negative which highlights the importance of R&D expenditure in the technology sector as an investment rather than an asset. Support for this expenditure figure in providing a 'truer measure of a company's value because this spending often turns out to be money in an investor's pocket in the future' is also advocated in reference to [21]. This implies that expenditure in the technology industry leads to improved efficiency, increased sales, and ultimately increasing company value.

The level of discretionary accruals (MJDA) practiced by firms is also a good predictor of future failure in the medium- to long-term in 2008 and 2010. In predicting future failure in **Table 4**, the coefficients suggest that higher levels of discretionary accruals translate to greater likelihood of failure with positive coefficients of 0.18 in 2008; 0.36 and 0.27 respectively in 2010. Importantly, this conforms closely with our expectation that practising earnings management introduces

$MODEL: r_{a_{t+p}} = a + b_1EP + b_2BM + b_3PS + b_4MktCap + b_5EBITDA + b_6Sales_g + b_7MJDA + b_8R\&D$

	Years								
	2008				2009		2010		
	3m	6m	1y	3y	3m	1y	3m	1y	5y
Const	−4.45 (−0.76)	4.57 (0.31)	2.99 (0.11)	22.78 (0.51)	9.43 (1.56)	2.61 (0.13)	**14.33**** **(2.24)**	−1.6 (−0.13)	**−76.04*** **(−1.82)**
EP	−9.82 (−0.67)	47.8 (1.29)	**252.49***** **(3.85)**	**220.46*** **(1.95)**	−28.34 (−1.26)	−117.87 (−1.52)	−44.66 (−1.43)	14.96 (0.24)	23.24 (0.11)
BM	−0.59 (−0.42)	**12.85***** **(3.66)**	**19.83***** **(3.18)**	**23.41**** **(2.18)**	**6.37*** **(1.89)**	**22.56*** **(1.93)**	−0.61 (−0.13)	−5.36 (−0.57)	−2.03 (−0.07)
PS	0.44 (0.4)	0.54 (0.19)	1.77 (0.36)	**19.93**** **(2.35)**	0.42 (0.69)	**5.15**** **(2.46)**	−0.54 (−1.12)	0.63 (0.67)	−5.09 (−1.63)
MktCap	**4.72**** **(2.5)**	3.53 (0.74)	−1.31 (−0.16)	−5.51 (−0.38)	**−2.84*** **(−1.69)**	−5.57 (−0.96)	−0.8 (−0.47)	−2.96 (−0.89)	**33.94***** **(3.08)**
EBITDA	−0.27 (−1.1)	−0.63 (−1.01)	−0.72 (−0.64)	−2.6 (−1.35)	−0.07 (−0.46)	−0.41 (−0.8)	−0.04 (−0.75)	−0.08 (−0.79)	0.22 (0.64)
$Sales_g$	2.2 (1.08)	−3.84 (−0.75)	−6.07 (−0.67)	−0.1 (−0.01)	1.2 (0.4)	0.92 (0.09)	**6.23*** **(1.66)**	**−16.35**** **(−2.21)**	−16.96 (−0.69)
MJDA	0.32 (1.34)	**1.23**** **(2.07)**	0.93 (0.88)	**4.25**** **(2.34)**	−0.25 (−0.52)	0.9 (0.55)	−1.08 (−1.27)	2 (1.19)	−2.84 (−0.51)
R&D	−5.25 (−0.29)	**155.73***** **(3.36)**	**265***** **(3.22)**	**335.09**** **(2.37)**	**56.41***** **(3.15)**	**286.02***** **(4.61)**	4.55 (0.29)	30.75 (0.98)	127.85 (1.24)
F-test	**2.55*****	**4.81*****	**6.27*****	**3.46*****	**2.47****	**3.80*****	1.36	1.16	**1.96***
Adjusted R^2	0.03	0.08	0.11	0.05	0.05	0.09	0.01	0.00	0.03
N	350	350	350	350	241	241	275	275	275

The table shows the valuation and accounting variables' effect on the technology firms' returns from 2008 to 2010. The dependent variables are 3 months (3m), 6 months (6m), 1 year (1y), and 3 years (3y) returns of the technology firms. Then we use the earnings to price ratio (EP), book to market ratio (BM), price to sales ratio (PS), market capitalization (MktCap), EBITDA, sales growth ($Sales_g$), modified Jones for discretionary accruals (MJDA), and research and development (R&D) as our independent variables. The values in parentheses are the t*-values to the corresponding coefficients.*

**Significance at 10% level.*

***Significance at 5% level.*

****Significance at 1% level.*

Table 4.
Multivariate analysis of periodic returns of NASDAQ technology firms—using modified Jones model for discretionary accruals (MJDA).

a double-edged sword. On one hand, firms practising greater degrees of earnings management tend to enjoy greater returns up to a certain point as seen in our analysis on future returns, however at the same time high levels of discretionary accruals damages their earnings quality and heightens risk of potential failure.

4.3 Ethical behaviour of the firms

Furthermore, the earnings managements can be related with the opportunistic behaviour of the firm. We investigate this issue by analysing the effect of ethical behaviour of the firms using ETHICS variable on their future returns and future survivorship. Since the ETHICS is an annual value identical within a year while different across the years, we include this in our overall sample including all periods

Model : Failed firmt $= a + b_1EP + b_2BM + b_3PS + b_4MktCap + b_5EBITDA + b_6Sales_g + b_7MJDA + b_8R\&D + b_91y... + b_{11}5y$

	Years							
	2008		2009			2010		
	1y	5y	1y	3y	5y	1y	3y	5y
Const	**5.54* (1.66)**	0.77 (1.1)	3.29 (0.96)	1.24 (0.91)	−0.34 (−0.3)	1.12 (0.46)	1.35 (0.94)	1.77 (1.57)
EP	−16.07 (−1.01)	**−5.86** (−2.37)**	−7.98 (−0.56)	**−13.27* (−1.73)**	−4.81 (−1.07)	−4.52 (−0.47)	**−12.41** (−2.08)**	0.41 (0.1)
BM	−1.66 (−1.32)	0.19 (1.09)	−1.17 (−0.84)	0.18 (0.31)	0.47 (0.85)	−1.14 (−0.74)	−0.36 (−0.37)	−0.45 (−0.58)
PS	0.4 (0.78)	−0.21 (−1.18)	−0.28 (−0.65)	−0.27 (−1.35)	0.03 (0.27)	−0.34 (−1.29)	−0.06 (−0.53)	0.01 (0.12)
MktCap	**−2.17* (−1.81)**	**−0.48* (−1.89)**	−0.77 (−0.84)	−0.53 (−1.38)	−0.43 (−1.3)	−0.02 (−0.03)	**−0.86** (−2.29)**	**−0.91*** (−3.07)**
EBITDA	0.08 (1.44)	−0.01 (−0.58)	−0.05 (−0.52)	−0.01 (−0.26)	−0.01 (−0.4)	−0.09 (−0.29)	−0.04 (−0.31)	−0.01 (−0.36)
$Sales_g$	**−4.3* (−1.85)**	0.15 (0.78)	−1.43 (−1.23)	0.51 (0.99)	0.01 (0.02)	−1.06 (−0.65)	−0.05 (−0.1)	−0.82 (−1.63)
MJDA	**0.18* (1.85)**	0.03 (1.14)	−0.06 (−0.32)	0.14 (1.38)	−0.04 (−0.45)	0.19 (0.97)	**0.36*** (2.78)**	**0.27* (1.67)**
R&D	**−88.16*** (−3.04)**	0.4 (0.18)	**−95.25*** (−3.09)**	−3.4 (−0.84)	−2.49 (−0.78)	**−64*** (−3.92)**	−2.4 (−0.91)	−0.01 (0)
3m	0.05 (1.57)	−0.01 (−0.78)	0.02 (0.68)	**0.02* (1.92)**	**0.03*** (2.72)**	0.03 (1.51)	0 (−0.45)	0 (0.29)
6m	0 (−0.27)	0 (1.35)	**−0.04** (−2.02)**	0.01 (1.15)	0 (0.33)	−0.01 (−0.95)	0.01 (0.65)	0 (0.45)
1y		0 (0.28)		**−0.03*** (−4.2)**	0 (−0.35)		**−0.03*** (−4.52)**	0 (0)
3y		**−0.01*** (−5.85)**			**−0.02*** (−5.61)**			**−0.02*** (−5.26)**
χ^2	**38.78*****	**78.62*****	**60.26*****	**52.54*****	**77.59*****	**57.14*****	**49.95*****	**78.30*****
Pseudo R^2	0.57	0.20	0.63	0.26	0.29	0.49	0.21	0.24
N	350	350	241	241	241	275	275	275

The table shows the valuation and accounting variables' effect on the technology firms' returns from 2008 to 2010. The dependent variables are dummy variables indicating 1 if the technology firm fails in 1 year (1y), and 3 years (3y), and 5 year (5y) and 0 otherwise. Then we use the earnings to price ratio (EP), book to market ratio (BM), price to sales ratio (PS), market capitalization (MktCap), EBITDA, sales growth ($Sales_g$), modified Jones for discretionary accruals (MJDA), and research and development (R&D) as our independent variables. The values in parentheses are the t*-values to the corresponding coefficients.*

*Significance at 10% level.

**Significance at 5% level.

***Significance at 1% level.

Table 5.
Logistic analysis of failed NASDAQ firms using modified Jones model for discretionary accruals (MJDA).

$MODEL: r_{a_{t+p}} = a + b_1EP + b_2BM + b_3PS + b_4MktCap + b_5EBITDA + b_6Sales_g + b_7MJDA + b_8R\&D + b_9ETHICS$

	3m	6m	1y	3y	5y
Const	−5.69 (−0.18)	**−147.8** (−2.05)**	**−971.81*** (−7.98)**	−263.65 (−1.16)	**−1137.59*** (−3.18)**
EP	−17.02 (−1.58)	**49.28** (2.03)**	**174.69*** (4.26)**	**179.28** (2.35)**	**327.49*** (2.72)**
BM	−1.63 (−1.5)	**15.35*** (6.26)**	**23.33*** (5.64)**	**25.51*** (3.31)**	**21.78* (1.79)**
PS	−0.27 (−0.73)	−0.58 (−0.7)	1.58 (1.12)	−0.07 (−0.03)	−3.83 (−0.92)
MktCap	0.55 (0.55)	−0.71 (−0.32)	−2.08 (−0.55)	−4.01 (−0.57)	13.44 (1.21)
EBITDA	−0.06 (−1.07)	−0.16 (−1.29)	−0.16 (−0.77)	−0.2 (−0.52)	0.12 (0.21)
$Sales_g$	1.18 (0.83)	0.52 (0.16)	−2.97 (−0.55)	−7.71 (−0.76)	−20.39 (−1.28)
MJDA	0.2 (1.07)	**1.3*** (3.1)**	**1.42** (2.01)**	**4.21*** (3.19)**	0.32 (0.15)
R&D	8.64 (0.84)	**90.11*** (3.9)**	**205.73*** (5.27)**	**231.66*** (3.19)**	**200.81* (1.75)**
ETHICS	2.64 (0.45)	**27.78** (2.09)**	**179.05*** (7.97)**	52.32 (1.25)	**211.71*** (3.2)**
F-test	1.49	**13.43*****	**21.88*****	**6.69*****	**4.01*****
Adjusted R^2	0.01	0.11	0.18	0.06	0.03
N	866	866	866	866	866

The table shows the valuation and accounting variables' effect on the technology firms' returns from 2008 to 2010. The dependent variables are 3 months (3m), 6 months (6m), 1 year (1y), 3 years (3y), and 5 years (5y) returns of the technology firms. Then we use the earnings to price ratio (EP), book to market ratio (BM), price to sales ratio (PS), market capitalization (MktCap), EBITDA, sales growth ($Sales_g$), modified Jones for discretionary accruals (MJDA), research and development (R&D), and firm's ethical behaviour score (ETHICS) as our independent variables. The values in parentheses are the t*-values to the corresponding coefficients.*

**Significance at 10% level.*

***Significance at 5% level.*

****Significance at 1% level.*

Table 6.

Full multivariate analysis of periodic returns of NASDAQ technology firms—using modified Jones model for discretionary accruals (MJDA).

(2008, 2009, and 2010) and run linear and logistic regressions as in our Sections 4.2 and 4.3. The results for the future returns and future survivorships are shown in **Tables 5** and **6**, respectively.

In **Table 5**, we do find highly similar relationship of EP, BM, MJDA and R&D with the future returns as in our **Table 3**. However, using the overall sample in **Table 5** shows more significant effects of these variables on the future returns. Then we find that the ETHICS has positive effect on the future returns in technology firms. In other words, the ethical behaviour of the technology firms tend to increase the future returns. Thus, the opportunistic behaviour of the technology firms is likely to decrease their future returns.

The similar relationship of EP, BM, PS, MktCap, Salesg, MJDA, and R&D on future survivorships are also found between **Tables 4** and **6** while the latter one using overall data tend to show more significant relationships. However, in this case, we do not find highly significant effect of ETHICS on the future survivorships of the technology firms. Therefore, the opportunistic behaviour of the technology

firms are more likely to reduce their future returns while leaving their future survivorships not significantly affected.

4.4 Robustness check

To provide a robustness check on the results obtained, we have compare the output generated when running our returns and survivorship analyses using the Modified Jones Discretionary Accruals (MJDA) method. As shown in **Table 7**, there is no difference between the two results.

From **Table 7**, we can deduce that our results in evaluating predictors of future performance are robust in being replicated across the MJDA and JDA procedures. Each regression model provides the same significance and similar explanatory power through their R-squared. All variables across the two methods possess the same signage of coefficients and remain within the statistical significance zone. In testing the robustness of our results in finding predictors of the survivorship of tech-firms, we find similar result using the JDA as presented in **Table 8**. All models remain significant just as in the MJDA results and the variables hold the same meaning within the outputs. These confirm that our results are consistent with the initial findings. We further perform our robustness check on the results from **Tables 7** and **8** where we used our overall data including ETHICS.

$$Model: Failed\ firmt = a + b_1EP + b_2BM + b_3PS + b_4MktCap + b_5EBITDA + b_6Sales_g + b_7MJDA + b_8R\&D + b_9ETHICS + b_{10}6m... + b_{13}5y$$

	6m	1y	3y	5y
Const	−4.75 (−0.33)	9.48 (1.02)	6.25 (1.37)	**7.22* (1.94)**
EP	**−26.86** (−2.33)**	**−12.62** (−2.17)**	**−7.12*** (−2.81)**	**−5.29*** (−3.14)**
BM	−0.54 (−0.57)	**−1.22* (−1.91)**	−0.27 (−1.4)	0.06 (0.54)
PS	0.01 (0.06)	−0.21 (−1.41)	−0.16** (−2.15)	−0.02 (−0.42)
MktCap	0.06 (0.11)	−0.44 (−1.25)	**−0.49*** (−3.08)**	**−0.61*** (−4.73)**
EBITDA	0.01 (0.72)	0 (0.08)	0 (−0.41)	−0.01 (−0.64)
$Sales_g$	**−2.32*** (−3.42)**	−0.97 (−1.33)	−0.12 (−0.61)	0.08 (0.58)
MJDA	**0.13* (1.77)**	**0.09* (1.71)**	0.03 (1.08)	0.02 (1.1)
R&D	**−53.67*** (−3.8)**	**−73.42*** (−6.29)**	**−5.84*** (−3.49)**	−1.23 (−1.03)
ETHICS	0.69 (0.26)	−1.3 (−0.76)	−0.99 (−1.17)	**−1.18* (−1.71)**
χ^2	**44.69*****	**138.67*****	**44.01*****	**48.06*****
Pseudo R^2	0.38	0.48	0.06	0.05
N	866	866	866	866

The table shows the valuation and accounting variables' effect on the technology firms' returns from 2008 to 2010. The dependent variables are dummy variables indicating 1 if the technology firm fails in 6 months (6m), 1 year (1y), and 3 years (3y), and 5 year (5y) and 0 otherwise. Then we use the earnings to price ratio (EP), book to market ratio (BM), price to sales ratio (PS), market capitalization (MktCap), EBITDA, sales growth ($Sales_g$), Modified Jones for discretionary accruals (MJDA), research and development (R&D), and firm's ethical behaviour score (ETHICS) as our independent variables. The values in parentheses are the t*-values to the corresponding coefficients.*
**Significance at 10% level.*
***Significance at 5% level.*
****Significance at 1% level.*

Table 7.
Full logistic analysis of failed NASDAQ firms using modified Jones model for discretionary accruals (MJDA).

$MODEL: r_{a_{t+p}} = a + b_1EP + b_2BM + b_3PS + b_4MktCap + b_5EBITDA + b_6Sales_g + b_7JDA + b_8R\&D.$

	Years								
	2008				2009		2010		
	3m	6m	1y	3y	3m	1y	3m	1y	5y
Const	−4.46 (−0.76)	4.44 (0.3)	2.35 (0.09)	22.85 (0.51)	9.43 (1.56)	2.63 (0.13)	**14.36**** **(2.24)**	−1.73 (−0.14)	**−76*** **(−1.82)**
EP	−9.76 (−0.67)	48.08 (1.3)	**253.12***** **(3.86)**	**221.03*** **(1.96)**	−28.35 (−1.27)	−117.9 (−1.52)	−44.95 (−1.44)	15.39 (0.25)	22.41 (0.11)
BM	−0.59 (−0.42)	**12.86***** **(3.66)**	**19.89***** **(3.19)**	**23.38**** **(2.18)**	**6.37*** **(1.89)**	**22.56*** **(1.93)**	−0.6 (−0.13)	−5.35 (−0.57)	−1.98 (−0.06)
PS	0.44 (0.4)	0.53 (0.19)	1.74 (0.35)	**19.95**** **(2.36)**	0.42 (0.69)	**5.15**** **(2.46)**	−0.54 (−1.12)	0.63 (0.66)	−5.09 (−1.63)
MktCap	**4.74**** **(2.51)**	3.6 (0.76)	−1.08 (−0.13)	−5.44 (−0.38)	**−2.84*** **(−1.69)**	−5.58 (−0.96)	−0.8 (−0.47)	−2.94 (−0.88)	**33.93***** **(3.07)**
EBITDA	−0.27 (−1.1)	−0.63 (−1.01)	−0.71 (−0.64)	−2.61 (−1.36)	−0.07 (−0.46)	−0.41 (−0.8)	−0.04 (−0.76)	−0.08 (−0.79)	0.22 (0.64)
$Sales_g$	2.23 (1.1)	−3.71 (−0.73)	−5.91 (−0.65)	0.31 (0.02)	1.2 (0.4)	0.93 (0.09)	6.17 (1.64)	**−16.22**** **(−2.19)**	−17.08 (−0.7)
JDA	0.33 (1.34)	**1.27**** **(2.05)**	0.86 (0.78)	**4.46**** **(2.36)**	−0.24 (−0.52)	0.9 (0.56)	−1.07 (−1.27)	2.08 (1.26)	−2.77 (−0.51)
R&D	−5.25 (−0.29)	**155.82***** **(3.36)**	**266.04***** **(3.23)**	**334.49**** **(2.36)**	**56.41***** **(3.15)**	**286.01***** **(4.61)**	4.51 (0.29)	30.96 (0.99)	127.8 (1.24)
F-test	**2.55****	**4.80*****	**6.25*****	**3.48*****	**2.47****	**3.80*****	1.36	1.18	**1.95***
Adjusted R^2	0.03	0.08	0.11	0.05	0.05	0.09	0.01	0.01	0.03
N	350	350	350	350	241	241	275	275	275

The table shows the valuation and accounting variables' effect on the technology firms' returns from 2008 to 2010. The dependent variables are 3 months (3m), 6 months (6m), 1 year (1y), and 3 years (3y) returns of the technology firms. Then we use the earnings to price ratio (EP), book to market ratio (BM), price to sales ratio (PS), market capitalization (MktCap), EBITDA, sales growth ($Sales_g$), Jones for discretionary accruals (JDA), and research and development (R&D) as our independent variables. The values in parentheses are the t*-values to the corresponding coefficients.*

*Significance at 10% level.

**Significance at 5% level.

***Significance at 1% level.

Table 8.
Multivariate analysis on periodic returns of NASDAQ technology firms—using Jones model for discretionary accruals (JDA).

5. Conclusion and implication of study

We find that, during the global financial crisis periods, the technology firms have larger returns with undervaluation, larger firm size, and more discretionary earnings and R&D which increases more with longer terms. On the other hand, these firms have greater survivorships when they are undervalued, larger in size, have more R&D but with less discretionary earnings (DA). DA is a double-edged sword for the technology firms since it has positive and negative effects on the returns and survivorships, respectively. R&D is a positive component for both returns and survivorships of these firms. The moral hazard (ETHICS) tend to reduce the returns of these firms but do not have significant effect on their survivorships.

The key implications for investors, equity holders and creditors derived from our results and analyses are threefold. Firstly, the alignment of our results and underlying expectation that certain variables should demonstrate significant explanatory power at various times of crisis illustrates the strong relevance of contingency theory in evaluating the phenomenon of tech firms during periods of financial turmoil. Secondly, through our analysis of results, we reiterate that traditional relationships of accounting valuation and earnings management measures may not always hold especially during crisis periods. Thirdly, from a general perspective, the results indicate that the variables employed in this study demonstrate greater predictive power in determining the phenomena of future tech-firm failure than performance.

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Chapter

Banks Financial State Analysis and Bankruptcy Risk Forecasting with Application of Fuzzy Neural Networks

Yuriy Zaychenko, Michael Zgurovsky and Galib Hamidov

Abstract

The problem of banks bankruptcy risk forecasting under uncertainty is considered. For its solution, the application of computational intelligence methods fuzzy neural networks ANFIS and TSK and inductive modeling method FGMDH was suggested and explored. Experimental investigations were carried out and estimation of the efficiency of the suggested methods was performed at the problems of bankruptcy risk forecasting for Ukrainian and leading European banks. The efficiency comparison with classic statistical methods such as ARMA, logit, and probit models was fulfilled. The comparative experiments with rating system CAMELS and matrix method were carried out. In general, the comparative analysis had shown that fuzzy forecasting methods and techniques give better results than conventional crisp methods for forecasting bankruptcy risk. On the whole, the conclusions of experiments with European banks completely confirmed the conclusions of experiments with Ukrainian banks. But at the same time, the crisp methods are more simple in implementation and demand less time for their adjustment. The set of informative bank financial factors for bankruptcy risk forecasting was determined and estimated.

Keywords: banks bankruptcy risk, forecasting, FNN, FGMDH, ARMA, logit, probit model, rating system CAMELS

1. Introduction

The problems of banks financial state analysis and bankruptcy risk forecasting are of great importance. The opportune discovery of coming bankruptcy allows top bank managers to make urgent decisions for preventing the bankruptcy. Nowadays, there are a lot of methods and techniques of banks state analysis and determination of bank rating—WEB Money, CAMEL [1], Moody's S&P, etc. But their common drawback is that all of them work with complete and reliable data and cannot give correct results in case of incomplete and unreliable input data. This is especially actual for the Ukrainian banking system where bank managers often provide the incorrect reports about bank financial state to obtain new credits and loans.

Therefore, it is very important to create new methods for banks bankruptcy risk forecasting under uncertainty. The main goal of present investigation is to consider

and estimate novel methods of bank financial state analysis and bankruptcy risk forecasting under uncertainty and compare with classical methods. The implementation and assessment of the efficiency of the suggested methods are performed at the problems of bankruptcy risk forecasting for Ukrainian and European banks.

2. Bankruptcy risk forecasting of Ukrainian banks

2.1 Problem statement

As it is well known, the year 2008 was the crucial year for the bank system of Ukraine. If the first three quarters were periods of fast growth and expansion, the last quarter became the period of collapse in the financial sphere. A lot of Ukrainian banks faced the danger of coming default.

For this research, the quarterly accountancy bank reports used were obtained from National bank of Ukraine site. For analysis, the financial indices of 170 Ukrainian banks were taken up to the date January 01, 2008 and July 01, 2009, that is, about two years before crises and just before the start of crises [2].

The important problem that occurred before the start of the investigations is which financial indices are to be used for better forecasting of possible bankruptcy. Thus, another goal of this exploration was to detect the most relevant financial indicators for obtaining maximal accuracy of forecasting.

For analysis, the following indicators of banks accountancy were considered:

assets, capital, financial means, and their equivalents; and

physical person's entities, juridical person's entities, liabilities, and net incomes (losses).

The collected indicators were used for analysis by fuzzy neural networks as well as classic statistical methods. As output data of models for Ukrainian banks were two values:

1, if the significant worsening of bank financial state is not expected in the nearest future

−1, if the bank bankruptcy is expected in the nearest future.

2.2 FNN TSK model and hybrid training algorithm

For forecasting of banks bankruptcy risk, the application of fuzzy neural networks (FNN) ANFIS and TSK was suggested [3]. The application of FNN is determined by following reasons:

the capability to work with incomplete and unreliable information under uncertainty; and

the capability to use expert information in the form of fuzzy inference rules.

Let us consider the mathematical model and training algorithm of a fuzzy neural network TSK (Takagi, Sugeno, Kang'a), which is generalization of the neural network ANFIS. The rule base of FNN TSK with M rules and N variables can be written as follows [3]:

$$R_1 : if\ x_1 \in A_1^{(1)}, x_2 \in A_2^{(1)}, ..., x_n \in A_n^{(1)}\ \text{then}\ y_1 = p_{10} + \sum_{j=1}^{N} p_{1j} x_j;$$

$$R_M : if\ x_1 \in A_1^{(M)}, x_2 \in A_2^{(M)}, ..., x_n \in A_n^{(M)}\ \text{then}\ y_M = p_{M0} + \sum_{j=1}^{N} p_{Mj} x_j,$$

where $A_i^{(k)}$ is the value of linguistic variable x_i for the rule R_k with membership function (MF) of the form

$$\mu_A^{(k)}(x_i) = \frac{1}{1 + \left(\frac{x_i - c_i^{(k)}}{\sigma_i^{(k)}}\right)^{2b_i^{(k)}}} \tag{1}$$
$$i = \overline{1, N}; k = \overline{1, M}.$$

At the intersection of the TSK network rule conditions, R_k MF is defined as a product

$$\mu_A^{(k)}(x) = \prod_{j=1}^{N} \left[\frac{1}{1 + \left(\frac{x_j - c_j^{(k)}}{\sigma_j^{(k)}}\right)^{2b_j^{(k)}}} \right]. \tag{2}$$

With M inference rules, the general output of FNN TSK is determined by the following formula:

$$y(x) = \frac{\sum_{k=1}^{M} w_k y_k(x)}{\sum_{k=1}^{M} w_k}, \tag{3}$$

where $y_k(x) = p_{k0} + \sum_{j=1}^{N} p_{kj} x_j$. The weights in this expression are interpreted as the degrees of fulfillment of rule antecedents (conditions): $w_k = \mu_A^{(k)}(x)$, which are given by (2).

The fuzzy neural network TSK, which implements the output in accordance with (3), represents a multilayer network whose structure is shown in **Figure 1**.

This network has five layers with the following functions:

1. The first layer performs fuzzification separately for each variable $x_i, i = 1, 2, ..., N,$ defining for each rule the k value MF $\mu_A^{(k)}(x_i)$ in accordance with the fuzzification function, which is described, for example, by Gaussian or bell-wise function. This is a parametric layer with parameters $c_j^{(k)}, \sigma_j^{(k)}, b_j^{(k)}$, which are subject to adjustment in the learning process.

2. The second layer performs the aggregation of individual variables x_i, determining the resulting degree of membership $w_k = \mu_A^{(k)}(x)$ for the vector x. This is not a parametric layer.

3. The third layer is a function generator TSK, wherein the output values are calculated $y_k(x) = p_{k0} + \sum_{j=1}^{N} p_{kj} x_j$. At this layer, also functions formed in the previous layer $y_k(x)$ on w_k are multiplied. This is a parametric layer, wherein the adaptation of linear parameters (weight) p_{k0}, p_{kj} for $j = \overline{1, N}, k = \overline{1, M},$ is carried out determining the rules output functions.

4. The fourth layer consists of two summing neurons, one of which calculates the weighted sum of the signals $y_k(x)$, and the second one calculates the sum of the weights $\sum_{k=1}^{M} w_k$.

5. The fifth layer is composed of a single output neuron. In it, weight normalizing is performed and the output signal determined in accordance with the expression:

$$y(x) = \frac{f_1}{f_2} = \frac{\sum_{k=1}^{M} w_k y_k(x)}{\sum_{k=1}^{M} w_k} \tag{4}$$

This is also nonparametric layer.

From this description follows that TSK fuzzy network contains only two parametric layers: first and third, the parameters of which are determined in the training process. Parameters of the first layer $\left(c_j^{(k)}, \sigma_j^{(k)}, b_j^{(k)}\right)$, we call nonlinear, and the parameters of the third layer $\left\{p_{kj}\right\}$—linear weights. The general expression for the functional dependence (4) for the network TSK is defined as follows:

$$y(x) = \frac{1}{\sum_{k=1}^{M}\prod_{j=1}^{M}\mu_A^{(k)}(x_j)} \sum_{k=1}^{M}\left(p_{k0} + \sum_{j=1}^{N} p_{kj} x_j\right)\prod_{j=1}^{N}\mu_A^{(k)}(x_j)$$

If we assume that at any given time moment, the nonlinear parameters are fixed, then the function $y(x)$ would be linear with respect to the variable x_j.

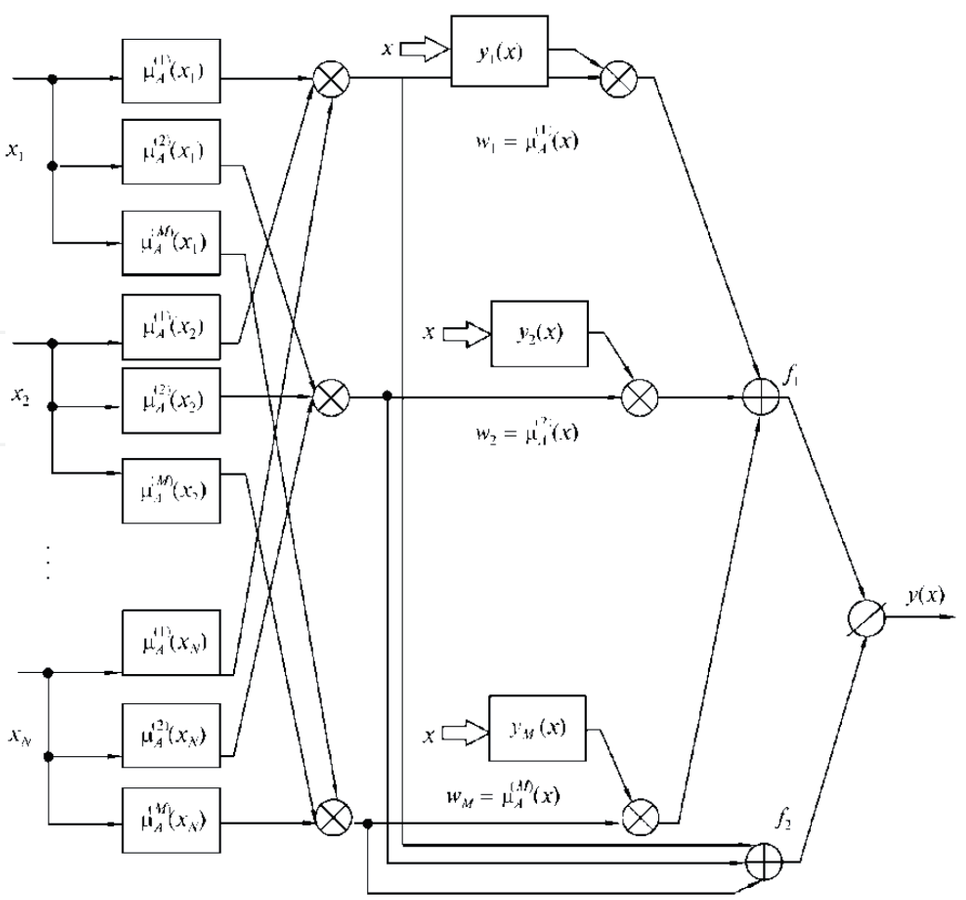

Figure 1.
The structure of TSK fuzzy neural network.

In the presence of N input variables, each rule R_k formulates $(N+1)$ variable $p_j^{(k)}$ of linear dependence $y_k(x)$. If M inference rules are present, then $M(N+1)$ linear network parameters are obtained. In turn, each MF uses three parameters (c, σ, b), which are subject to adjustment. With M inference rules, three MN nonlinear parameters are obtained. In total, this gives $M(4N+1)$ linear and nonlinear parameters that must be determined in the learning process. This is a very large value. In order to reduce the number of parameters for adaptation, we operate with fewer number of MF. In particular, it can be assumed that some of the parameters of one function MF $\mu_A^{(k)}(x_j)$ are fixed, e.g., $\sigma_j^{(k)}$ and $b_j^{(k)}$.

2.2.1 Hybrid learning algorithm for fuzzy neural networks

Considering a hybrid learning algorithm which is used for FNN TSK, all parameters can be divided into two groups. The first group includes linear parameters p_{kj} of the third layer, and the second group includes nonlinear parameters (MF) of the first layer. Adaptation occurs in two stages.

In the first stage after fixing the individual parameters of the membership function by solving a system of linear equations, linear parameters of polynomial p_{kj} are calculated. With the known values of MF dependence, input-output can be represented as a linear form with respect to the parameters p_{kj}:

$$y_k(x) = \sum_{k=1}^{M} w'_k \left(p_{k0} + \sum_{j=1}^{N} p_{kj} x_j. \right) \tag{6}$$

where

$$w'_k = \frac{\prod_{j=1}^{N} \mu_A^{(k)}(x_j)}{\sum_{r=1}^{M} \prod_{j=1}^{N} \mu_A^{(r)}(x_j)}, k = \overline{1, M}. \tag{7}$$

With the dimension L of training sample $\left(x^{(l)}, d^{(l)}\right)$, $(l = 1, 2, ..., L)$ and replacement of the network output by expected value $d^{(l)}$, we get a system of L linear equations of the form

$$\begin{bmatrix} w'_{11} & w'_{11}x_1^{(1)} \ldots & w'_{11}x_N^{(1)} \ldots. & w'_{1M}\, w'_{1M}x_1^{(1)} \ldots & w'_{1M}x_N^{(1)} \\ w'_{21} & w'_{21}x_1^{(2)} \ldots & w'_{21}x_N^{(2)} \ldots & w'_{2M}\, w'_{2M}x_1^{(2)} \ldots & w'_{2M}x_N^{(2)} \\ \ldots & \ldots & \ldots & \ldots \quad \ldots & \ldots \\ w'_{L1} & w'_{L1}x_1^{(L)} & w'_L x_N^{(L)} & w'_{LM}\, w'_{LM}x_1^{(L)} & w'_{LM}x_N^{(L)} \end{bmatrix} \times \begin{bmatrix} p_{10} \\ p_{11} \\ \ldots \\ p_{1N} \\ \ldots \\ p_{M0} \\ p_{M1} \\ \ldots \\ p_{MN} \end{bmatrix} = \begin{bmatrix} d^{(1)} \\ d^{(2)} \\ \ldots \\ d^{(L)} \end{bmatrix} \tag{8}$$

where $w'_{\ell i}$ means normalized weight of the i-th rule at presentation of ℓ-th input vector x^{ℓ}. This expression can be written in matrix form:

$$Ap = d.$$

Matrix A dimension is equal to $L(N+1)M$. By thus, a number of rows L usually is much greater than a number of columns $(N+1)M$. The solution of this equations system may be obtained by conventional methods as well as using pseudoinverse matrix A at one step:

$$p = A^{+}d,$$

where A^{+} is a pseudoinverse matrix for matrix A.

In the second stage, after fixing the values of linear parameters p_{kj}, the actual output signals $y^{(\ell)}$, $\ell = 1, 2, ..., L$ are determined using a linear equations system:

$$y^{(L)} = Ap. \tag{9}$$

Then, the error vector $\varepsilon = (y - d)$ and the criterion E are calculated:

$$E = \frac{1}{2}\sum_{\ell=1}^{L}\left(y\left(x^{(\ell)}\right) - d^{(\ell)}\right)^2. \tag{10}$$

The error signals are sent through the network backward according to the method of back propagation until the first layer, at which gradient vector components of the objective function with respect to parameters $\left(c_j^{(k)}, \sigma_j^{(k)}, b_j^{(k)}\right)$ are calculated.

After calculating the gradient vector, a step of gradient descent method is made. The corresponding formulas (for the simplest method of the steepest descent) are the following:

$$c_j^{(k)}(n+1) = c_j^{(k)}(n) - \eta_c \frac{\partial E(n)}{\partial c_j^{(k)}} \tag{11}$$

$$\sigma_j^{(k)}(n+1) = \sigma_j^{(k)}(n) - \eta_\sigma \frac{\partial E(n)}{\partial \sigma_j^{(k)}} \tag{12}$$

$$b_j^{(k)}(n+1) = b_j^{(k)}(n) - \eta_b \frac{\partial E(n)}{\partial b_j^{(k)}} \tag{13}$$

where n is a number of iterations.

After verifying the nonlinear parameters, the process of adaptation of linear parameters TSK (first phase) restarts and nonlinear parameters are further adapted (second stage). This cycle continues until all the parameters will be stabilized.

Formulas (11)–(13) require the calculation of the gradient of the objective function with respect to the parameters of the MF. The final form of these formulas depends on the type of MF. For example, if using the generalized bell-wise functions:

$$\mu_A(x) = \frac{1}{1 + \left(\frac{x-c}{\sigma}\right)^{2b}}$$

the corresponding formulas for gradient of the objective function for one pair of data (x, d) take the form [3]:

$$\frac{\partial E}{\partial c_j^{(k)}} = (y(x) - d) \sum_{r=1}^{M} \left(p_{r0} + \sum_{j=1}^{N} p_{rj} x_j \right) \cdot \frac{\partial w'_r}{\partial c_j^{(k)}} \tag{14}$$

$$\frac{\partial E}{\partial \sigma_j^{(k)}} = (y(x) - d) \sum_{r=1}^{M} \left(p_{r0} + \sum_{j=1}^{N} p_{rj} x_j \right) \cdot \frac{\partial w'_r}{\partial \sigma_j^{(k)}} \tag{15}$$

$$\frac{\partial E}{\partial b_j^{(k)}} = (y(x) - d) \sum_{r=1}^{M} \left(p_{r0} + \sum_{j=1}^{N} p_{rj} x_j \right) \cdot \frac{\partial w'_r}{\partial b_j^{(k)}} \tag{16}$$

In the practice of the hybrid learning method implementation, the dominant factor in adaptation is considered to be the first stage in which weights p_{kj} are determined using pseudoinverse in one step. To balance its impact, the second stage should be repeated many times in each cycle.

It is worth to note that the described hybrid algorithm is one of the most effective ways of training fuzzy neural networks. Its principal feature is the division of the process into two stages separated in time. Since the computational complexity of each nonlinear optimization algorithm depends nonlinearly on the number of parameters subject to optimization, the reduction in the dimensions of optimization significantly reduces the total amount of calculations and increases the speed of convergence of the algorithm. Due to this, hybrid algorithm is one of the most efficient in comparison with conventional gradient-based methods.

3. The application of fuzzy neural networks for financial state forecasting

A special software kit was developed for FNN ANFIS and TSK application in bankruptcy risk forecasting problems. As input data, the financial indicators of Ukrainian banks in financial accountant reports were used in the period of 2008–2009 [2] . As the output values were used +1, for bank nonbankrupt and −1, for bank bankrupt. In the investigations, various financial indicators were analyzed, and different number of rules for FNN and the analysis of data collection period influence on forecasting accuracy were performed.

The results of experimental investigations of FNN application for bankruptcy risk forecasting are presented below.

In the first series of experiments, input data at the period of January 2008 were used (that is for two years before possible bankruptcy) and possible banks bankruptcy was forecasted at the beginning of 2010.

Experiment No. 1:

Training sample—120 Ukrainian banks, test sample—50 banks.

Number of rules = 5.

Input data—financial indices (taken from bank accountant reports):

assets, capital, cash (liquid assets), households deposits, liabilities.

The results of application of FNN TSK are presented in **Table 1**.

Results	
Total amount of errors	5
% of errors	10
First type of errors	0
Second type of errors	5

Table 1.
Results of FNN TSK forecasting.

The similar experiments were carried out with FNN ANFIS.

Experiment No. 2:

The goal of the next experiment was to find out the dependence of rule number on predicting accuracy. Input data—the same financial indices as in experiment 1.

The results of application of FNN TSK are presented in **Table 2**.

Results	
Total amount of errors	6
% of errors	12
First type of errors	1
Second type of errors	5

Table 2.
Results of FNN TSK forecasting.

The similar experiments were carried out with FNN ANFIS.

Experiment No. 3:

The comparative analysis of forecasting results versus the number of rules is presented in **Table 3** [4].

Network/number of rules	Total number of errors	% of errors	Number of first type errors	Number of second type errors
ANFIS 5	6	12	0	6
ANFIS 10	7	14	1	6
TSK 5	5	10	0	5
TSK 10	6	12	1	5

Table 3.
Comparative analysis of FNN ANFIS and TSK in dependence on rules number.

Comparing the results in **Table 3**, one may conclude FNN TSK has better accuracy than FNN ANFIS.

The goal of the next experiments was to explore the influence of training and test samples size on accuracy of forecasting.

Experiment No. 4:

Training sample—120 Ukrainian banks, test sample—50 banks, and number of rules = 10.

Input data—financial indicators:

assets, entity, cash (liquid assets), household deposits, and liabilities.

Results	
Total number of errors	7
% of errors	10
First type of errors	1
Second type of errors	6

Table 4.
Results of FNN TSK forecasting.

The results for FNN TSK are presented in **Table 4**.
The similar experiments were carried out with FNN ANFIS.
After analysis of the experimental results the following conclusions were made:

FNN TSK ensures the higher accuracy of risk forecasting than FNN ANFIS;

the variation of the number of rules in the training and test samples makes slight influence on the accuracy of forecasting; and

the goal of the next series of experiments was to determine the optimal input data (financial indicators) for bankruptcy risk forecasting. The period of input data was January 2008.

Experiment No. 5:

Number of banks and rules were the same as in previous experiment 4.

Input data—financial indicators (taken from banks financial accountant reports):

profit of current year, net percentage income, net commission income; and

net expense on reserves and net bank profit/losses.

The results of FNN TSK application are presented in **Table 5**.

Experiment No. 6:

Number of banks and rules were the same as in the previous experiment 5.

Results	
Total number of errors	13
% of errors	19
First type of errors	6
Second type of errors	7

Table 5.
Results of FNN TSK forecasting.

Input data—the financial indicators (taken from banks financial accountant reports):

general reliability factor (own capital/assets);

instant liquidity factor (liquid assets/liabilities);

cross coefficient (total liabilities/working assets);

general liquidity coefficient (liquid assets + defended capital + capitals in reserve fund/total liabilities); and

coefficient of profit fund capitalization (own capital/charter fund).

The results for FNN TSK are presented in **Table 6**.

It is worth to note that these financial indicators are also used as input data in Kromonov's method of banks bankruptcy [5–7], whose results are presented below.

Results	
Total number of errors	7
% of errors	10
First type of errors	1
Second type of errors	6

Table 6.
Results of FNN TSK forecasting.

Experiment No. 7:

Training sample—120 Ukrainian banks and test sample—70 banks.

Number of rules = 5.

Input data—following financial indicators (other than in experiments 5 and 6):

ROE—return on entity (financial results/entity);

ROA—return on assets (financial results/assets);

CIN—incomes-expenses ratio (income/expense);

NIM—net percentage margin; and

NI—net income.

The results of application of FNN TSK for forecasting with these input indicators are presented in **Table 7**.

It should be noted that these indicators are used as input in the method of Euro Money [1].

Results:	
Total number of errors	12
% of errors	17
First type of errors	5
Second type of errors	7

Table 7.
Results of FNN TSK forecasting.

Experiment No. 8:

Training sample—120 Ukrainian banks and test sample—70 banks.

Number of rules = 5.

Input data—financial indicators (banks financial accountant reports):

general reliability factor (own capital/assets);

instant liquidity factor (liquid assets/liabilities);

cross coefficient (total liabilities/working assets);

general liquidity coefficient (liquid assets + defended capital + capitals in reserve fund/total liabilities);

coefficient of profit fund capitalization (own capital/charter fund); and

coefficient entity security (secured entity/own entity).

The results of FNN TSK application with these financial indicators are presented in **Table 8**.

The comparative analysis of forecasting results using different sets of financial indicators are presented in **Table 9**.

Next experiment was aimed on finding the influence of data collection period on the forecasting results. It was suggested to consider two periods: January of 2008 (about 1.5 year before the crisis) and July of 2009 (just before the start of crisis).

Experiment No. 9:

Training sample—120 Ukrainian banks and test sample—70 banks.

Number of rules = 10.

Results	
Total amount of errors	8
% of errors	13
First type of errors	1
Second type of errors	7

Table 8.
Results of FNN TSK forecasting.

Experiment	**Total number of errors**	**% of errors**	**First type of errors**	**Second type of errors**
Experiment 5	13	19	6	7
Experiment 6	7	10	1	6
Experiment 7	12	17	5	7
Experiment 8	8	13	1	7

Table 9.
The dependence of forecasting accuracy on sets of input financial indices.

Experiment/number rules	Total number of errors	First type of errors	Second type of errors	Total % of errors
January 1, 2008 5 rules	7	0	7	10
July 1, 2009 5 rules	5	0	5	7
July 1, 2009 10 rules	7	3	4	10

Table 10.
Accuracy of forecasting in dependence on data collection period.

Input data—financial indices, the same as in experiment 8.

In **Table 10**, the comparative results of forecasting versus period of input data are presented.

3.1 The application of fuzzy GMDH for financial state forecasting

In the process of investigations, fuzzy group method of data handling (FGMDH) was also suggested for financial state of Ukrainian banks forecasting [3]. GMDH is the inductive modeling method that enables to construct a model automatically by experimental data [3]. As input data, the same indices were used as in the experiments with FNN TSK.

In **Table 11**, the forecasting accuracy of FGMDH is presented in dependence on input data collection period.

If we compare the results of FGMDH with the results of FNN TSK, one can see that FNN TSK gives better results for short-term risk forecasting (one year before possible bankruptcy) while FGMDH has better accuracy using older input data and so it has advantages in long-term forecasting (2 or more years).

3.2 The generalized analysis of crisp and fuzzy forecasting methods

In the concluding experiments, the comparative analysis of application of all the considered methods was carried out. The following methods were considered [4]:

fuzzy neural network ANFIS;

fuzzy neural network TSK; and

crisp forecasting methods: Kromonov's method and Byelorussian bank association method.

Input data period	Total error number	% of errors	First type of errors	Second type of errors
2004	10	14	3	7
2005	9	13	3	6
2006	8	11.4	3	5
2007	7	10	2	5
2008	6	8.5	1	5
2009	6	8.5	2	4

Table 11.
Comparative results of forecasting using method FGMDH in dependence on period of input data collection.

Method/period	Total amount of errors	% of errors	First type of errors	Second type of errors
ANFIS	7	10	1	6
TSK	5	7	0	5
GMDH	6	8.5	1	5
Kromonov's method	10	15	5	5
BBA method	10	15	2	8

Table 12.
Comparative results analysis of various forecasting methods.

As input data, the financial indices of Ukrainian banks on July 2007 year were used. The results of application of all methods for bankruptcy risk analysis are presented in **Table 12**.

3.3 Application of rating system CAMEL for assessment of financial state of Ukrainian banks

The most widely used approach of banks financial state analysis and bankruptcy risk forecasting is based on the application of rating systems. The determination of bank rating is one of the methods that enables to obtain complex financial assessment of bank financial state and compare them. There are various private and official banks rating systems. The most known of them are systems developed by world leaders in this sphere-rating companies Fitch, Standard & Poor's, Moody's, etc. Officially recognized banks rating system that is widely used in the world is system CAMELS. It's American rating system was developed and implemented by Federal reserve System (FRS) and Federal Deposit Insurance Corporation (FDIC) in 1978 [1].

Supervision over banks activity based on risk estimation by system CAMELS lies in determination of general bank state using the common criteria that defines all aspects and spheres of bank activity. This system is also widely used in Ukraine by National Bank of Ukraine (NBU) according to developed "Statement of order of rating estimates determination by rating system 'CAMELS'."

Rating system CAMELS allows NBU to estimate general financial state and stability of banking system of Ukraine. Such assessment enables to obtain information for priority determination in banking supervision activity and necessary materials and financial resources for performing adequate control over banking system.

At the same time, system CAMELS envisages the detail supervision and analysis of bank state. Such analysis may be performed only while complex inspecting checking of bank activity, which enables to determine how the top managers analyze and control bank risks.

The base of rating system, CAMELS, is risk assessment and determination of rating estimates by each component of the system: capital adequacy, assets quality, management, liquidity, and sensitivity.

Due to rating system, each bank obtain digital rating by all six components, and integral (complex) rating estimate is determined on the base of rating estimates of all components. Components of rating system are estimated by 5 balls scale in which estimate 1 is the highest, and estimate 5 is the lowest one. Integral estimate is also determined by 5 balls scale. Banks that obtained integral rating estimate 1 or 2 are considered reliable by all the factors capable to overcome economic depression and its management believed to be qualified.

Banks that got integral estimate 3 have substantial drawbacks, which may lead to serious problems with liquidity and solvency if these drawbacks won't be corrected

in proper time. In this case, bank's supervision system should give recommendations to managers how to overcome existing problems.

Banks that got rating estimate 4 or 5 have serious problems, which demand strict supervision and special urgent actions to prevent possible bankruptcy (see **Table 13**).

3.3.1 Comparative experimental investigations of efficiency of bankruptcy risk forecasting by systems CAMEL and FNN TSK

For bankruptcy risk forecasting in banking sphere of Ukraine, a special data set was collected consisting of 160 Ukrainian banks in the period 2012–2014 . It was divided into training and test subsamples in ratio 70/30 for FNN TSK, i.e., training samples consisted of 110 banks and test samples of 50 banks. The experiments were carried out, and the following results were obtained for FNN TSK (in average, 20 experiments were performed for each year and rules number), which are presented in **Table 2**. The data were collected in the year indicated in the first column, and the forecasting was made for next year, e.g., 2012-5—means bankruptcy risk forecasting in 2013 with use of 5 rules in FNN TSK by data of 2012. Two types of experiments were carried out with fixed parameters of membership functions (MF) and with training MF parameters. In **Table 14**, forecasting results for FNN TSK with adaptation of parameters are presented and in **Table 15** with fixed parameters values.

In **Table 16**, forecasting results for FNN TSK with triangular MF are presented, while in **Table 17** with trapezoidal MF.

	Bank integral rating				
	"1"	**"2"**	**"3"**	**"4"**	**"5"**
Bank financial state	Bank is stable, reliable, and has skilled management		Bank has substantial drawbacks, which may lead to serious problems in future.	Bank faces very serious problems, which may lead to bankruptcy.	
Control from banks supervision service			Bank supervision service should give clear instructions to overcome existing problems.	Banks need urgent actions to prevent possible bankruptcy.	
Application of special actions			Proper influence actions are performed over bank due to demands of existing regulation laws of NBU.		

Table 13.
Comparative results analysis of various forecasting methods.

Year and number of rules	**General number of errors**	**% of errors**	**Number of first type errors**	**Number of second type errors**
2012—5	6	12	0	6
2013—5	9	18	0	9
2014—5	8	16	1	7
2012—10	7	14	2	5
2013—10	5	10	0	5
2014—10	10	20	4	6

Table 14.
Forecasting results for FNN TSK with FM parameters' adaptation.

Year and number of rules	General number of errors	% of errors	Number of first type errors	Number of second type errors
2012—5	8	16	1	7
2013—5	8	16	0	8
2014—5	9	18	1	8
2012—10	9	18	3	6
2013—10	7	14	1	6
2014—10	11	22	4	7

Table 15.
Forecasting results for FNN TSK with fixed parameters.

Year and number of rules	General number of errors	% of errors	Number of first type errors	Number of second type errors
2012—5	9	18	1	8
2013—5	7	14	1	6
2014—5	9	18	0	9
2012—10	11	22	4	7
2013—10	10	18	2	8
2014—10	13	26	4	9

Table 16.
Forecasting results for FNN TSK with triangular MF.

Year and number of rules	General number of errors	% of errors	Number of first type errors	Number of second type errors
2012—5	7	14	1	8
2013—5	8	16	1	6
2014—5	5	10	0	9
2012—10	9	18	4	7
2013—10	12	24	2	8
2014—10	11	22	4	9

Table 17.
Forecasting results for FNN TSK with trapezoidal MF.

The application of well-known matrix method by Nedosekin [11, 12] with level (threshold) of cut 0.7 gave the following results presented in **Table 18.**

Results obtained by rating system CAMEL are presented in **Table 19** (threshold of 4).

Year and number of rules	General number of errors	% of errors	Number of first type errors	Number of second type errors
2012—0,7	14	28	8	6
2013—0,7	11	22	3	8
2014—0,7	16	32	9	7

Table 18.
Forecasting results of matrix method by Nedosekin.

Year and number of rules	General number of errors	% of errors	Number of first type errors	Number of second type errors
2012—4	12	24	7	5
2013—4	14	28	5	9
2014—4	9	18	5	4

Table 19.
Forecasting results of rating system CAMEL.

In **Figure 2**, the probability of error for different forecasting methods and various MF is presented.

In **Figure 3**, dependence of error probability versus number of rules in FNN TSK is presented.

Analyzing the performed experiments, the following conclusions may be made.

1. The experimental investigations of efficiency of different forecasting methods FNN TSK, matrix method of Nedosekin, and rating system CAMELS were carried out for the problem of bankruptcy risk forecasting of Ukrainian banks.

2. Results obtained by FNN TSK are the best (min error%). Mean forecasting accuracy by TSK with Gaussian MF is equal to 85%, with trapezoidal MF mean accuracy is 82%, triangular MF gives 79%, matrix method of Nedosekin –70%, while standard rating system CAMELS has 75% accuracy.

3. With the increase of rules, number error probability first decreases, then attains minimum and then begins to raise.

3.4 General conclusions of investigations for Ukrainian banks

Various methods for Ukrainian banks financial state forecasting were considered and analyzed. The following methods were considered [3, 4]: fuzzy neural network

Figure 2.
Bankruptcy risk forecasting results for different methods.

Figure 3.
Error probability for different rules number in FNN.

ANFIS, fuzzy neural network TSK, Kromonov's method, Byelorussian bank association method, rating system CAMELS, and matrix method (Nedosekin).

As the input data, the financial indices of Ukrainian banks were considered.

While experiments with the adequate financial indicators were detected using which the best forecasting results for Ukrainian banks were obtained:

general reliability factor (own capital/assets);

instant liquidity factor (liquid assets/liabilities);

cross coefficient (total liabilities/working assets);

general liquidity coefficient (liquid assets + defended capital + capitals in reserve fund/total liabilities); and

coefficient of profit fund capitalization.

1. It was established that FNN TSK gives much more accurate results than FNN ANFIS. With increase of rules, number error probability first decreases, then attains minimum and then begins to raise.

2. The fuzzy GMDH gives better results using older data that is, more preferable for long-term forecasting (two or more years).

3. The comparison of FNN TSK with standard rating system CAMELS has shown that TSK enables to obtain more accurate bankruptcy risk forecasting.

4. In general, the comparative analysis had shown that fuzzy forecasting methods and techniques give better results than the conventional crisp and rating methods for forecasting bankruptcy risk. But at the same time, the crisp methods are more simple in implementation and demand less time for their adjustment.

4. Comparative analysis of bankruptcy risk forecasting methods for European banks under uncertainty

4.1 Introduction

The results of successful application of fuzzy methods for bankruptcy risk forecasting of Ukrainian banks under uncertainty stimulated the further investigations of these methods application for financial state analysis of European leading banks.

The main goal of this exploration was to investigate novel methods of European banks bankruptcy risk forecasting, which may work under uncertainty with incomplete and unreliable data.

Besides, the other goal of this investigation was to determine which factors (indicators) are to be used in forecasting models to obtain results close to real data. Therefore, we used a set of financial indicators (factors) of European banks according to the International accountant standard IFRS. The annual financial indicators of about 300 European banks were collected in 2004–2008, preceding the start of crisis of bank system in Europe in 2009. The data source is the information system Bloomberg [8]. The resulting sample included the reports only from the largest European banks as system Bloomberg contains the financial reports only from such banks. For correct utilization, input data were normalized in interval [0,1].

4.2 Application of fuzzy neural networks for European banks bankruptcy risk forecasting

The period for which the data were collected was 2004–2008. The possible bankruptcy was analyzed in 2009. The indicators of 165 banks were considered among which more than 20 banks displayed the worsening of the financial state in that year. Fuzzy neural networks and Fuzzy Group Method of Data Handling (FGMDH) were used for bank financial state forecasting.

In accordance with the above stated goal, the investigations were carried out for detecting the most informative indicators (factors) for financial state analysis and bankruptcy forecasting. Taking into account incompleteness and unreliability of input data, FNN ANFIS and TSK were suggested for bankruptcy risk forecasting.

After performing a number of experiments, the data set of financial indicators was found using which FNN made the best forecast. These indicators are the following:

debt/assets = (short-term debt + long-term debt)/total assets;

loans to deposits ratio;

net interest margin (NIM) = net interest income/earning assets;

return on equity (ROE) = net income/stockholder equity;

return on assets (ROA) = net income/assets equity;

cost/income = operating expenses/operating income; and

equity/assets = total equity/total assets.

A series of experiments was carried out for determining the influence of the number of rules and period of data collection on forecasting results.

In the first series of experiments, FNN TSK was used for forecasting.

Experiment Nos. 1–5:

Training sample = 115 banks of Europe, testing sample = 50 banks, and number of rules = 5.

Input data period = 2004 (experiment 1), 2005 (experiment 2), 2006 (experiment 3), 2007 (experiment 4), and 2007 (experiment 5).

The total results of application FNN TSK for different rules number and data collection period are presented in **Table 20**.

Furthermore, the similar experiments were performed with FNN ANFIS, while the period of data collection varied since 2004–2007. The corresponding results for FNN ANFIS are presented in **Table 21** showing the influence of data collection period on forecasting accuracy.

After analysis of these results, the *following conclusions* were made:

1. FNN TSK has better forecasting accuracy than FNN ANFIS;

2. the best input variables (indicators) for European banks bankruptcy risk forecasting are the following:

Experiment/number of rules	Total errors number	% of errors	Number of first type errors	Number of second type errors
2004—5	8	16	0	8
2005—5	7	14	0	7
2006—5	5	10	0	5
2007—5	1	2	0	1
2004—10	8	16	0	8
2005—10	8	16	1	7
2006—10	11	22	7	4
2007—10	4	8	0	4

Table 20.
Forecasting results for FNN TSK versus number of rules and data period.

Experiment/number of rules	Total errors number	%% of errors	Number of first type errors	Number of second type errors
2004—5	8	16%	0	8
2005—5	8	16%	1	7
2006—5	8	16%	4	4
2007—5	4	8%	0	4

Table 21.
Forecasting results for FNN ANFIS versus number of rules and data period.

debt/assets = (short-term debt + long-term debt)/total assets;

loans to deposits;

net interest margin (NIM) = net interest income/earning assets;

return on equity (ROE) = net income/stockholder equity;

return on assets (ROA) = net income/assets equity;

cost/income = operating expenses/operating income; and

equity/assets = total equity/total assets.

Input data collection period (forecasting interval) makes influence on forecasting results.

4.3 The application of fuzzy GMDH for bank financial state forecasting

In next experiments, Fuzzy Group Method of Data Handling (FGMDH) was applied for European banks financial state forecasting. Fuzzy GMDH enables to construct forecasting models using experimental data automatically without expert [3]. The additional advantage of FGMDH is possibility to work with the fuzzy information.

As the input data in these experiments, the same indicators as in experiments with FNN TSK were used. In **Table 22**, forecasting results are presented in dependence on input data period collection for FGMDH

Input data period	Total number of errors	% of errors	Number of first type errors	Number of second type errors
2004	7	14	0	7
2005	6	12	1	5
2006	4	8	1	3
2007	2	4	0	2

Table 22.
Comparative analysis of forecasting results for FGMDH.

Method (period)	Total number of errors	% of errors	Number of first type errors	Number of second type errors
ANFIS (1 year)	4	8	0	4
TSK (1 year)	1	2	0	1
FGMDH (1 year)	2	4	0	2
ANFIS (2 years)	8	16	4	4
TSK (2 years)	5	10	0	5
FGMDH (2 years)	4	8	1	3

Table 23.
Forecasting results of different fuzzy methods.

If to compare the results of FGMDH with the results of FNN TSK, one can see that neural network has better accuracy at the short forecasting interval (1 year), while fuzzy GMDH has better accuracy at the greater intervals (2 or more years). This conclusion coincides with similar conclusion for Ukrainian banks.

In **Table 23,** the comparative results of application of different methods for bankruptcy risk forecasting are presented

4.4 Application of linear regression and probabilistic models

4.4.1 Regression models

For estimation of fuzzy methods' efficiency at the problem of bankruptcy risk forecasting the comparison with crisp method, the regression analysis of linear models was performed. As input data, the same indicators were used, which were found optimal for FNN. Additionally, the index net financial result was also included in the input set. This index makes great impact on forecasting results. Thus, input data in these experiments were eight financial indicators of 256 European banks according to their reports:

debt/assets—X1;

loans/deposits—X2;

net interest margin—X3;

ROE (return on equity)—X4;

ROA (return on assets)—X5;

cost/income—X6;

equity/assets—X7; and

net financial result—X8.

The input data were normalized before the application. The experiments were carried out with full regression ARMA model, which used eight variables and shortened models with six and four variables.

Each obtained model was checked on testing sample consisting of 50 banks. The comparative forecasting results for all ARMA models are presented in **Table 24**.

As one may see in **Table 24**, the application of all types of linear regression models gives the same error of 18%, which is much worse than application of fuzzy neural networks.

4.4.2 Logit models

Furthermore, the experiments were performed using logit models for bankruptcy forecasting [9, 10]. The training sample consisted of 165 banks and the testing sample of 50 banks.

The first one was constructed, linear logit model, using all the input variables. It has the following form (estimating and forecasting equations):

$$I_Y = C(1) + C(2) * X_1 + C(3) * X_2 + C(4) * X_3 + C(5) * X_4 + C(6) * X_5 + C(7) * X_6 + C(8) * X_7 + C(9) * X_8$$

$$Y = 1 - @CLOGISTIC(-(C(1) + C(2) * X_1 + C(3) * X_2 + C(4) * X_3 + C(5) * X_4 + C(6) * X_5 + C(7) * X_6 + C(8) * X_7 + C(9) * X_8))$$

The next constructed model was a linear probabilistic logit model with six independent variables. The final table including the forecasting results of all the logit models is presented below (**Table 25**)

Input data	Testing sample	First type of errors	Second type of errors	Total number of errors	% of errors
All variables (eight)	50	5	4	9	18
Six variables	50	5	4	9	18
Four variables	50	5	4	9	18

Table 24.
Comparative analysis of ARMA models.

Input data	Testing sample	First type of errors	Second type of errors	Total number of errors	% of errors
All variables (eight)	50	6	2	8	16
Six variables	50	6	2	8	16

Table 25.
Comparative analysis of logit models.

4.4.3 Probit models

The next experiments were carried out with probit models [9, 10]. The first constructed model was the linear probit model based on 206 banks using all the input variables. It has the following form:

$$I_Y = C(1) + C(2) * X_1 + C(3) * X_2 + C(4) * X_3 + C(5) * X_4 + C(6) * X_5 + C(7) * X_6 + C(8) * X_7 + C(9) * X_8$$

$$Y = 1 - @CLOGISTIC(-(C(1) + C(2) * X_1 + C(3) * X_2 + C(4) * X_3 + C(5) * X_4 + C(6) * X_5 + C(7) * X_6 + C(8) * X_7 + C(9) * X_8))$$

As the experiments had shown that the inputs net interest margin (X_3) and net financial result (X_8) very weakly influence on the forecasting accuracy, they were excluded in the next experiments. The next probit model included six variables.

Furthermore, in this model insignificant variables debt/assets (X_1) and loans/deposits (X_2) were excluded, and as a result, linear probit model with four variables was obtained.

Each of the constructed probit models was checked on the test sample of 50 banks. The results of application of all probit models are presented in **Table 26**.

As one may see from **Table 26**, the application of all the probit models gives relative error 14–18%, which is much worse than results obtained by fuzzy neural networks. It is worth to mention the decrease of model forecasting quality after exclusion of insignificant variables.

4.5 Concluding experiments

In the final series of experiments, investigations and detailed analysis of various methods for forecasting bankruptcy risk were performed. The following methods were investigated: FNN ANFIS, FNN TSK, FGMDH, regression models, logit models, and probit models.

Period of input data was 2007 (1 year before possible bankruptcy).

Comparative analysis of all the forecasting methods is presented in **Table 27**.

As one may see from this table, fuzzy methods and models show much better results than crisp methods: ARMA, logit models, and probit models. When forecasting by one year prior to current date, fuzzy neural network TSK shows better results than FGMDH. But when forecasting for longer intervals (several years), FGMDH is the best method.

In a whole, the conclusions of experiments with European banks completely confirmed the conclusions of experiments with Ukrainian banks.

Input data	Testing sample	First type of errors	Second type of errors	Total number of errors	% of errors
All variables (eight)	50	5	2	7	14
Six variables	50	5	2	7	14
Four variables	50	6	3	9	18

Table 26.
Forecasting results of probit models.

Method	Total number of errors	% of errors	First type of errors	Second type of errors
ANFIS	4	8	0	4
TSK	1	2	0	1
FGMDH	2	4	0	2
ARMA	9	18	4	5
Logit	8	16	2	6
Probit	7	14	2	5

Table 27.
Comparative analysis of methods for banks bankruptcy forecasting.

5. Conclusions

The problem of banks bankruptcy risk forecasting under uncertainty was considered.

For its solution, the application of novel methods of computational intelligence, fuzzy neural networks ANFIS and TSK and fuzzy GMDH, was suggested.

1. The experimental investigation of FNN TSK, ANFIS, and GMDH application in the problem of bankruptcy risk forecasting was carried out for Ukrainian and European banks.

2. The comparison of forecasting efficiency of FNN TSK and ANFIS with Fuzzy GMDH and conventional statistical methods ARMA, logit, and probit models was performed.

3. The experimental results show that FNN and FGMDH have much better accuracy than statistical methods. When forecasting by one year prior to current date, fuzzy neural network TSK shows better results than FGMDH. But when forecasting for longer intervals (several years), FGMDH is the best method.

4. While in experimental investigations, the best sets of financial indicators for bankruptcy forecasting were found for Ukrainian and European banks as well.

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Chapter

The Colombian Banking Sector: Analysis from Relative Efficiency

Gloria Rodriguez-Lozano

Abstract

The banking sector is that sector of the modern economy that is primarily called upon to play the important role of intermediation between the surplus agents and the deficit agents. Based on this fact, this research presents and analyzes the behavior of banks in Colombia since 2002 and up to 2016 (15 years) through the application of data envelopment analysis, a nonparametric methodology of advanced linear programming, which generates a single efficiency indicator for each unit studied in each period, optimizing multiple resources (inputs) and multiple products (outputs). One aspect of the results shows that for the year 2014, 71% of the banks were efficient, this being the highest result within the period studied.

Keywords: Colombian banking sector, banking efficiency, data envelopment analysis, efficiency measurement, relative efficiency

1. Introduction

In the development of any economy, the banking sector plays a key role, since it is primarily that sector that advances the task of intermediation between the so-called surplus agents (they do not spend the total of their monetary resources, the savers) and the so-called deficit agents (require additional monetary resources); this is one of the reasons why banks exist in all countries. Additionally, because they transmit to the population in general, monetary and credit policies issued by central banks and/or governments in such a way that they become one of the key sectors in every economy since an important part of savings, investment and financing goes through their intermediation. Otherwise, banks play a preponderant role in determining living standards within modern economies, so much so that [1] banks have the ability to stimulate and collect the savings of a society and distribute them among companies and sectors that need capital as an input for their economic activities.

Banks are important within any financial system; for example, in the United States in mid-2017, there were 7,836 member banks of the Federal Deposit Insurance Corporation. According to [2], within the European Union as of November 2016, there were 127 larger banking groups and according to [3], in Latin America, there are 23 banks in Chile; according to [4], in Mexico, there were 47 institutions of multiple banking as of December 2016 and in Colombia 25 banks as of December 2016.

According to [5], within the Colombian financial system, banks are part of the credit facilities supervised by the Superintendencia Financiera de Colombia (SFC), along with financial corporations, traditional financing companies, leasing specialized finance companies, and financial cooperatives. According to [6], the credit institutions are financial institutions whose main function is to capture

legal currency resources from the public, either in sight deposits (savings accounts and current accounts) or in term deposits (CDT and CDAT'S), to place them again through loans, discounts, advances, or other active credit operations. According to [7], being watched by the SFC means that there is an institution that authorizes and monitors the activity carried out by entities that receive monies from the public, where you save, invest your capital, and have a loan, insurance, or your pension. According to Decree 663 of April 2, 1993, published in the Official Gazette No. 40, 820, Organic Statute of the Financial System [8], in its Article 2 it is made explicit that the main function of banking establishments is the capture of resources in bank current account, as well as the collection of other sight or term deposits, with the primary objective of making active credit operations.

Given the importance of the banking sector worldwide, this research analyzes the behavior of the Colombian banking sector during the last 15 years, using the nonparametric methodology data envelopment analysis (DEA) to generate relative efficiency indicators for each of the banks and for every year throughout the study period; questions are answered: are there efficient banks throughout the period? What are the average efficiency levels of the sector for each year? In what year or years were there better results of relative efficiency?

2. Colombian banking sector

In 1923 and through Law 25, the Banco de la República was created, the second central bank created in the region, a year before that had been created in Peru. According to [9], between the years 1922 and 1950, 17 central banks were created in the region under the guidance of Edwin Walter Kemmerer. Along with the approval of Law 25 of 1923, which established the organic status of the Banco de la República, Law 45 was approved, which regulated private banks and established the Banking Superintendency, seeking to allow the stable functioning of the Colombian financial sector [10]. In the nineties, the transition to a universal banking system began, with an emphasis on commercial banks. In [11], a scheme of subsidiaries and matrices was standardized, the structure of the sector and its services was redefined, and the entry and exit of markets were liberalized.

The financial crises of the twentieth century resulted in the closure of entities and processes of internal mergers and acquisitions, which consolidated the system in the early twenty-first century transforming the financial sector. According to [12], the period from 2002 to 2009 was characterized by an environment of economic recovery, by the high flows of foreign capital and by the increase in the services provided by the banks. During these years, the transformations led to a reduction in the number of financial institutions, which went from more than forty banks between mortgages and commercials, in the mid-1990s, to less than twenty in 2009. The same is true for [13], those between 1995 and 2009, the financial sector had a consolidation process.

In such a way that the competition for the market resumed, always with two big banks at the head, Bancolombia and Grupo Aval. But Banco Davivienda bought Bancafé and it became the third bank; Granahorrar was bought by BBVA, positioning itself as the fourth bank in the country. For the year 2008, 72% of the Colombian banking market was distributed as follows, in importance: Aval, Bancolombia, Davivienda, and BBVA.

For the last few years, and in global terms, it is observed that the Colombian financial sector is monopolized by a few financial groups, which through their business conglomerates offer an extensive portfolio of banking services, securities administration, insurance, investment fund management, layoffs, and pensions, among others. According to [14], for 2014, only 10 of the 33 most representative

companies in the sector accounted for 68% of total investments: Bancolombia, Porvenir, Banco de Bogotá, Davivienda, Protección, BBVA, Banco de Occidente, Corpbanca, Banco Agrario, and Colpatria; of these 10, eight are banks. Regarding income, 61% of the total was concentrated in ten entities: 7 banks, 2 insurers, and one administrator of pension and severance funds: Bancolombia, Banco Agrario, Banco de Bogotá, Banco de Occidente, Davivienda, Protección, BBVA and Banco Corpbanca, insurer Suramericana, insurer Positiva, and Porvenir administrator. In relation to profits only 8 concentrated 66% of the total profits of the sector; among these are Bancolombia, Banco Agrario, Banco de Bogota, Banco de Occidente, Davivienda, Banco Colpatria, Banco Popular, and Suramericana Vida.

For the year 2016, in Colombia, there are four important national financial groups with international operations: Grupo Aval, Grupo Bancolombia, Grupo Bolívar, and Grupo Colpatria.

According to [15], the Aval Group is one of the most important financial groups in Colombia; even on its website, it calls itself "Colombia's largest financial group". Specifically, it is the largest financial conglomerate in Colombia and through of BAC Credomatic is the largest and most profitable regional group in Central America. It has four banks: Banco de Bogotá, Banco de Occidente, Banco Popular, and Banco AV Villas. Banco de Bogotá: it is the financial institution with the longest history in the country (founded in 1870), the second largest bank in Colombia by size of assets, and the largest company in the Aval Group due to its level of assets, deposits, and profits. Banco de Occidente: it is the fifth largest bank in Colombia by asset level and portfolio and the third largest bank in current accounts. Banco Popular: is a pioneer in the promissory note market and provides financial solutions for government entities in Colombia. AV Villas Bank: it has gone from being exclusively focused on housing loans, to be a consumer-oriented universal bank; it is the group's most active bank, in the use of nontraditional channels: mobile banking, nonbank correspondents, and virtual branches.

Another of the important groups is the Grupo Bancolombia, which denotes that 142 years have passed since its birth [16]; this group originated from the merger of the Bank of Colombia and the Industrial Colombiano Bank, later merged with Conavi (2005) and Confisura. Bancolombia is the largest private bank in the country due to the size of its equity and assets [17].

The Grupo Empresarial Bolívar is a conglomerate of companies that are coordinated and controlled through Sociedades Bolívar. Banco Davivienda belongs to this group, which originated in the Colombian Savings and Housing Corporation, Coldeahorro (founded in 1972) and the Superior Banks (merger in 2005) and Granbanco-Bancafe [18]. In mid-2017 and according to the information on its website [19], it is consistently positioned among the first three banks in the country, with a record number of customers for 2016 of 7,714,552 and 593 offices.

The Grupo Colpatria—Red Multibanca has a banking unit (bank and fiduciary), a construction unit, an investment unit, and Colfondos. In October 2011, Colpatria, the group's holding, announced the Bank's new partner: the multinational Scotiabank, with whom they signed a long-term strategic alliance; this multinational institution is one of the main financial institutions in North America and Canada [20].

The international financial groups with presence in Colombia are: BBVA, Citibank, GNB Sudameris, and Corpbanca.

Grupo BBVA: is composed of a Spanish banking entity with over a century and a half of experience, which after mergers and acquisitions both nationally and internationally, is currently the Grupo BBVA. According to [21], in 1996, it made a presence in Colombia through the purchase of 40% of Banco Ganadero; in 2004, it was renamed BBVA Colombia, and in 2006, it merged with Banco Granahorrar.

Grupo Citibank: the history of Citibank in the world began in the United States in 1812, when the City Bank of New York (today Citibank) was founded [22]. Citibank Colombia is a Citigroup franchise. The group is composed of the controlling company, Citibank Colombia S.A. and the subordinates [23]. According to [24], Citi in Colombia opened the first branch in 1916; since 1986, it has organized according to the model of Consumer Banking and Corporate Banking.

Grupo GNB Sudameris: in 1920, the bank was born as a Colombian mercantile company; after acquisitions and sales in 2004 Banco Sudameris acquires the majority shareholding of Banco Tequendama and Servibanca. At the beginning of 2014, the incorporation of the HSBC operation was formalized. The group currently consists of the Banco GNB Sudameris and 7 companies [25].

Grupo Corpbanca: Banco CorpBanca was created in 1997 from the merger of Banco Concepción Chileno and Banco Corp Group. Since then, it has positioned itself in the Chilean market as the fourth most important bank. For [26], in 2012 arrived at the Colombian market. Currently, Banco Corpbanca Colombia has four subsidiary companies.

Otherwise, at the December 2016 cutoff and using the SFC as an information source, it can be seen that within the Colombian financial system, there are 25 banks that represent 11% of the total of the entities in the sector, but in terms of participation in assets, banks represent 93%. For example, savings and housing cooperatives have a 78% stake in the entities, but only 2.1% participation in the sector's assets. Within the aforementioned 25 banks, there are 14 national (including the two cooperatives owned), 10 foreign, and one public.

According to [27], the banking sector closed in 2016 with total assets of $ 548 billion, an increase of 8.6% over the previous year and 126% in relation to the result for 2010, with an increasing trend in this period; the entities with the greatest assets at the end of 2016 are the Bancolombia, the Banco de Bogotá and Davivienda.

With respect to the gross portfolio, 2016 closed with $ 394 billion, representing an increase of 12% with respect to 2015 and 148% with respect to 2010, with an ever-increasing trend. By the end of 2016, the commercial portfolio of the banking sector participates with 58%, while the consumer portfolio with 27%, housing with 13%, and microcredit with only 3%; these shares are very similar to those of the immediately previous year.

Looking at the behavior of the liability, it is established that at the end of 2016, it is 475 billion with a growth of 9% for this last year, and between the years 2010 and 2016 with a growth of 125% with an ever-increasing trend. The ratio between the granted portfolio and the deposits of the public (savings, CDT, and current accounts) for the sector is 0.92, which represents that the sector for each peso that captures places only 0.92 pesos.

3. Methodology

3.1 Data envelopment analysis (DEA)

It is a nonparametric methodology of advanced linear programming, in which a double process of optimization is carried out, establishing the relative efficiency of Decision Making Unit—DMU, for [28] specify that this is done by generating an efficient frontier that locates the individual relative indices without having prior knowledge of the production function. More specifically, according to [29], DEA is used to evaluate the relative efficiency of a set of n DMUs, by posing linear programming problems for each unit according to the data of resource utilization or inputs and product or output generation. More broadly, according to [30], the

efficiency of each DMU is defined as the relationship between weighted outputs and weighted inputs, so that it is obtained by solving a double problem of linear programming in order to determine the optimum set of weights that maximizes.

DEA has experienced a dynamic development, for [31] it gradually becoming a set of concepts and methodologies, which have materialized in a series of models. The first DEA model to be developed was the CRS (constant returns to scale) model that results in the categorical classification of each DMU [32]; after a few years, the VRS (variable returns to scale) model appears, through which not only constant returns can be worked [33], but also as [34] clarifies these returns can be incremental and decremental.

3.2 CRS model

Consider a set composed of n DMU denoted as DMU_j (j = 1, ..., n), which uses resources x_{ij} (i = 1, ..., m) and generate s outputs y_{rj} (r = 1, ..., s), part of that the multipliers v_i, u_r associated with i inputs and r outputs respectively are known. So, specifically, if the DMU_0 is under study, this model is giving the solution to the problem of fractional programming for the measure of efficiency of that DMU_0 as well [31]:

$$e_0 = \max \sum_r u_r y_{ro} / \sum_i v_i x_{io} \tag{1}$$

Subject to:

$$\sum_r u_r y_{rj} - \sum_i v_i x_{ij} \leq 0, \text{for all } j$$

$$u_r, v_i \geq \varepsilon, \text{for all } r, i$$

where ε is a nonarquimidian value designated strictly positive.

The theory of fractional programming expressed in [35] is applied and the following changes of variables are made:

$$\mu_r = t u_r y, v_i = t v_i$$

where:

$$t = \left(\sum_i v_i x_{i0}\right)^{-1}.$$

The initial problem can be transformed into the following linear programming model:

$$e_0 = \max \sum_r \mu_r y_{ro} \tag{2}$$

Subject to:

$$\sum_i v_i x_{i0} = 1$$

$$\sum_r \mu_r y_{rj} - \sum_i v_i x_{ij} \leq 0, \text{for all } j$$

$$\mu_r, v_i \geq \varepsilon, \text{for all } r, i$$

3.3 VRS model

According to [31] and all the above parameters, for this model we have a mathematical approach:

$$e_0^* = \max\left[\sum_r u_r y_{r0} - u_o\right] / \sum_i v_i x_{i0} \quad (3)$$

Subject to:

$$\sum_r u_r y_{rj} - u_o - \sum_i v_i x_{ij} \le 0 \; j = 1, \ldots, n$$

$$u_r \ge \varepsilon, v_i \ge \varepsilon, \text{for all } i, r$$

u_o not restricted in sign

With its equivalent in linear programming:

$$e_0^* = \max \sum_r \mu_r y_{ro} - \mu_o \quad (4)$$

Subject to:

$$\sum_i v_i x_{io} = 1$$

$$\sum_r \mu_r y_{rj} - \mu_o - \sum_i v_i x_{ij} \le 0, j = 1, \ldots, n$$

$$\mu_r \ge \varepsilon, v_i \ge \varepsilon, \text{for all } i, r$$

μ_o, unrestricted

The conventional measurement of DEA is based on the hypothesis that resources or inputs should be minimized, and products or outputs should be maximized according to [36]. Additionally, for each of these basic models, there is the orientation to the entrances and the orientation to the exits, depending on whether you want to prioritize the maximum decrease of the inputs keeping the outputs constant or the total maximization of the outputs with the constant inputs. One of the strengths of DEA is that a single efficiency result (%) is obtained for each unit, in a multi-input and multi-output context.

4. Review of current literature

The study of relative efficiency through DEA applied to banks is one of the most recurrent issues, so that some of the most recently published research is presented below. Ref. [37] measured the efficiency of the offices of a state bank in India by applying a DEA model based on slack. The diffuse DEA models are used in those

occasions in which it is considered that the accuracy of the data is not the best; for this reason, [38] used this type of model to analyze the banking sector in India.

The CRS and VRS models were used by [39] in their research to measure the efficiency of commercial banks in Slovenia, Poland, Austria, Hungary, Slovenia, and Czech Republic. These two models were also applied by [40] to study the banks of Côte d'Ivoire in West Africa, for the period 2008–2010. The VRS model was also used by [41] to study 79 bank branches in Canada, only this time they used the orientation to the inputs.

Islamic banks were studied by [42] comparing them with traditional banks using the Meta-Frontier Analysis (MFA) model. The Nash negotiation game model was combined with the centralized two-stage DEA model for [43] to study banks in China. Through an additive efficiency decomposition approach in DEA [44] evaluated the management and investment efficiencies of ICTs in Taiwan's banks for the 2007–2011 period. The Iranian banks were studied by [45] through the CRS model with output orientation. The research of [46] proposes a model with a multi-stage procedure that integrates robust methods, cluster analysis, and DEA to identify and study the efficiency of management in the different branches of the banks.

The main banks in Cambodia were studied by [47] through the DEA panel model for 13 years. [48] studied Taiwanese banks developing a new model based on DEA gaps to decompose their different components. Research from [49] focused on measuring the efficiency of marketing as a measure of performance after the merger, and this was investigated through DEA applied to 20 merger and acquisition agreements within the US commercial banking.

[50] studied the relative efficiency of 23 Colombian commercial banks for a period of 10 years, with the CRS and VRS models oriented to inputs and outputs. [51] investigated the efficiency of Colombian banking from the year 2000 until 2012; they applied the VRS model with orientation to the outputs. On the other hand, [52] compared the relative efficiency of the real sector with that of the financial sector of the Colombian economy for 2014 using the VRS model oriented to the outputs.

5. Specific methodological design

Information source: Superintendencia Financiera de Colombia.

Delimitation of the DMU: given that the Colombian banking sector is studied, the DMUs are the banks that year after year, and from 2002 and until 2016, reported their financial statements to the SFC. Reaffirming the statement by [53], DEA is generally interpreted using the notion of production technology generated by the set of observed units. For the study period, 5 government banks reported to the SFC, because they were from the government; they withdrew from the database, accepting what was expressed by [54] as to which institutions of the Government alone are comparable to each other. Additionally, a private bank that was liquidated in 1999 also reported its financial statements, but because it was not comparable, because it was not fully operational, it was also removed from the database. **Table 1** shows the number of banks that are part of the investigation for each year.

Determining the specific DEA model, as recommended by [55], since there is no evidence of constant returns to scale, we choose to use the DEA VRS model, and having a particular interest to evaluate how to obtain best results, we work with orientation to the outputs.

Delimitation of inputs and outputs: given that DEA is a nonparametric boundary model, in which it is not necessary to previously establish the production function, and that the determinant variables of the model are the resources used (inputs) and

Year	# of banks
2002	24
2003	24
2004	24
2005	19
2006	15
2007	15
2008	17
2009	17
2010	18
2011	22
2012	22
2013	23
2014	21
2015	24
2016	24

Source: self-made.

Table 1.
Number of banks that are part of the study.

Inputs	Outputs
Current assets	Operating income
Property, plant & equipment	Net income
Noncurrent liabilities	
Equity	

Source: self-made.

Table 2.
Input and output variables.

what is obtained from the process of transformation of them (outputs), the variables used in this investigation are shown in **Table 2**.

Taking into account the inputs and outputs chosen for this model and going to [56], it can be established that this model is what they call an intermediation model, which consists in measuring how the entity operates based on the monetary assets it gathers (inputs), making loans and investments (outputs).

These same input and output variables have been used by [52] and by (Rodríguez-Lozano) [57] to study the insurance brokerage companies in the Colombian financial environment through DEA indicators, and also by [58] to determine relative efficiency in two subsectors of the Colombian economy from 1993 to 2002 and [59] to determine the measurement of relative efficiency in three subsectors of the Colombian economy from 1993 to 1999.

6. Results

Table 3 shows the result of the efficient units, in percentage terms, for each year.
Table 4 shows the average efficiency levels for each year.

Year	# Units	%
2002	6	25%
2003	9	38%
2004	9	38%
2005	8	42%
2006	9	60%
2007	10	67%
2008	11	65%
2009	10	59%
2010	11	61%
2011	11	50%
2012	14	64%
2013	14	61%
2014	15	71%
2015	13	54%
2016	15	63%

Source: self-made.

Table 3.
Efficient units per year.

The study period begins with the lowest index, as previously stated is a period of recovery of the Colombian financial sector after its crisis; the highest index is in 2007, which coincides with the time before it started the first global financial crisis of this century; as of 2014 (with the second best average), the consequences of the global economic recession begin to be evident.

Year	Average efficiency (%)
2002	70
2003	79
2004	78
2005	88
2006	89
2007	95
2008	87
2009	88
2010	89
2011	90
2012	92
2013	89
2014	92
2015	86
2016	86

Source: self-made.

Table 4.
Average efficiency levels per year.

Figure 1 shows the behavior of the units, by efficiency range for the entire study period.

The results show that between the years 2002 and 2007, the percentage of efficient banks was in a clear rise, an increase of 42% points, despite the fact that the number of banks decreased; even 2007 was the year in which there were fewer banks for the 15 years studied. This confirms that since 2002, the sector experienced improvements. Additionally, in 2005, 79% of the banks were between 100 and 80% efficiency, ratifying the good results.

In 2007, the first financial crisis of the twenty-first century began and the impact of this crisis is evident from the results of 2008 and until 2011; there is a decrease of 17% points for efficient banks. At the same time, the efficiency range between 79.9 and 60 increased until reaching its maximum level in 2010 (33%). These results are consistent with those found by [60], in the sense that global financial crises impact the behavior of banks. As of 2011, a slow recovery process begins for the efficient, until 2014.

The Colombian economy ended 2015 with a rate slightly above 3%, despite the stagnation experienced in Latin America and the low global growth [61]; for the financial sector, the growth was 4.3% and according to [62], the balance of the banking sector was satisfactory. In terms of relative efficiency, it can be established that the share of the efficiency decreased at the same time as the holdings of the banks with low ranks increased. The efficient banking institutions had a fall of 17% points in a single year and for this same year the ranges 99.9–60% and lower to 40% increased their participation by 11 and 8% points, respectively. This means that more banks were unconcerned about managing their resources efficiently prioritizing other types of behavior as a process of deceleration of the beginning of world economy.

For the year 2016, in spite of continuing the deceleration of the economy, the Colombian banking sector reported good results, for example increased profits by 17% over the immediately previous year. In the same way, the participation of efficient banks improved to 63%, and the rest of the ranks were concentrated around a 10% share; leaving in this way very clear the difference of participation between the efficient banks and those that are not, a difference that began to take shape from the year 2006 and that from 2014 is stabilized by the grouping of the inefficient in participations below 20%.

6.1 Analysis by groups

Figure 2 shows the behavior in terms of relative efficiency of the 8 financial groups mentioned previously.

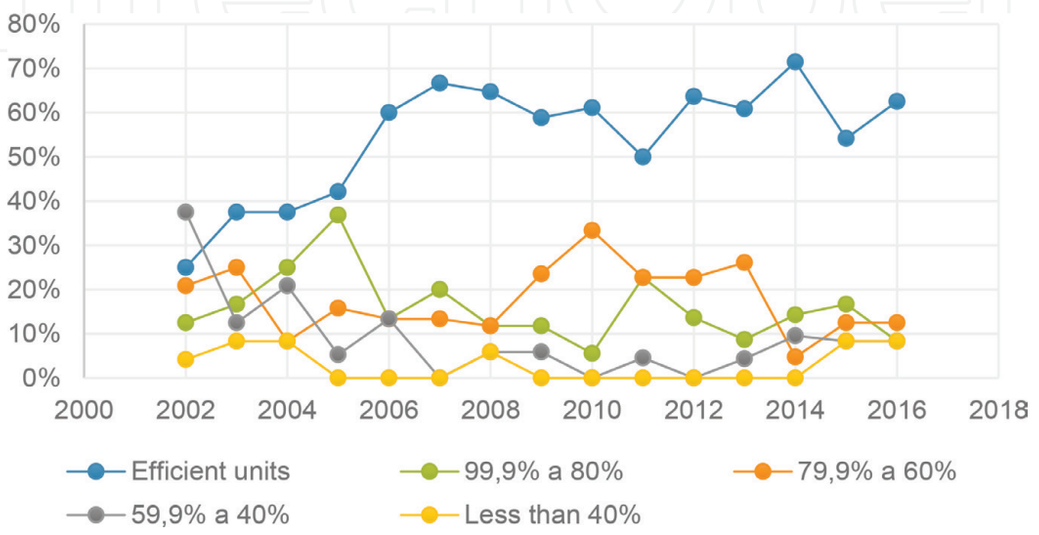

Figure 1.
Units by efficiency range. Source: self-made.

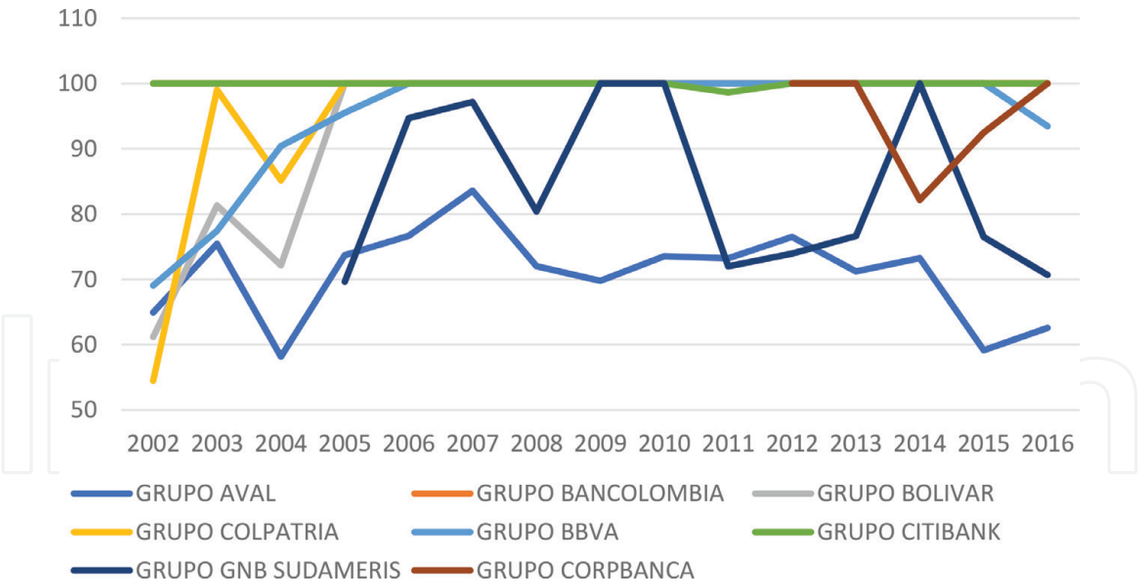

Figure 2.
Efficiency (%) of financial groups. Source: self-made.

The one that is considered the largest financial group in Colombia, Grupo Aval, is definitely the most inefficient. On the other hand, the only efficient group in all 15 years of the study is Grupo Bancolombia. Both the Grupo Bolívar (Banco Davivienda) and the Grupo Colpatria (Banco Colpatria) began the study period with relatively low rates (61 and 54% respectively) but they were improving to the point that since 2005 they are efficient and they maintained the same until 2016.

Regarding international groups, Citibank is the one with the best results, because only in 2011, it is not efficient, but its index is 99%. The behavior of the Grupo BBVA is very similar to that of the Grupo Bolívar and Grupo Colpatria, but this group is not efficient for 2016; although it is very close, its index is 93%. The Grupo Corbanca in the 5 years of presence has rates above 80% and even in 3 years it is efficient. The Grupo GNB started in 2005 with an index of 70%, improved for the next 2 years, fell, and then became efficient, and from 2011 it repeats the cycle ending in 2016 with an indicator close to 70%. The Grupo CorpBanca Group shows better results, since in three of the 5 years of presence it is efficient, and its inefficiency is not more than 20% since the indexes of those 2 years are higher than 80%.

In **Figure 3**, the behavior of the 4 banks of the Grupo AVAL is presented; there it is evident that although the one of Banco de Bogota has indexes above 80% and is efficient in 9 of the 15 years of the study, this is not enough because the remaining three banks mark downwards since they have rates that are around 60% and in the last 3 years the Banco Popular and the Banco AV Villas have very low rates.

Figure 4 shows the behavior of efficient banks according to whether they are national or not.

Foreign banks have a greater participation in 90% of the years; only for 2016, the participation of efficient national banks exceeds the participation of foreigners, although by very little.

Now, of all the banks that are part of the study, only 24% are efficient during all the years that each of them is present in the study period: Bancolombia: 15 years, Procredit: 9 years, Finandina: 6 years, Santander de Negocios: 4 years, Bankboston: 3 years, Megabaco: 4 years, Mundo Mujer: 2 years, Multibank: 2 years, and Standard Chartered: 3 years. They are not within this group because only in 1 year they were not efficient, although this indicator is above 95%: Coomeva, WWB, Bancompartir, and Citibank.

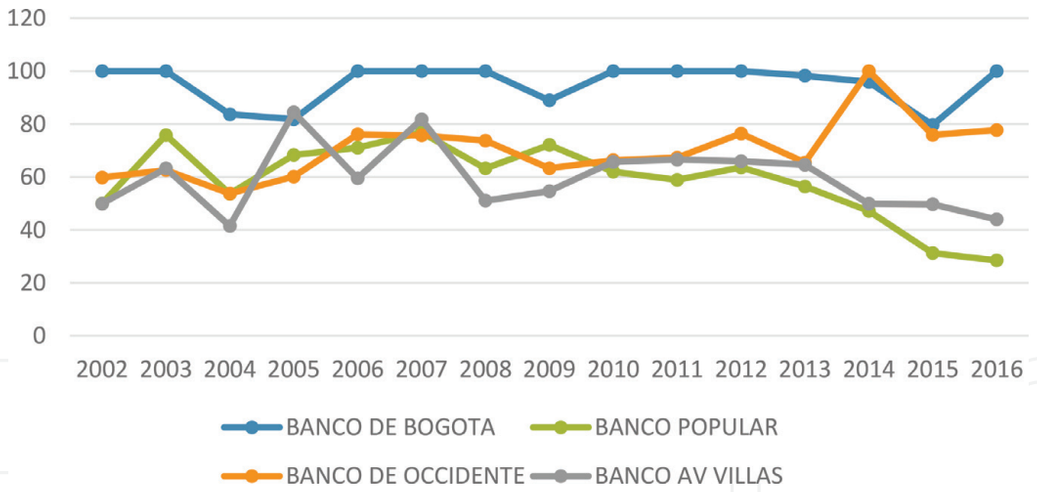

Figure 3.
Efficiency (%) of banks of the grupo aval. Source: self-made.

Figure 4.
Behavior of efficient banks. Source: self-made.

7. Conclusions

The financial sector is important in any economy, since it is the one that brings together those agents that have monetary resources to spare with the agents that need those resources. In Colombia, this sector is one of those that have marked the growth of the economy for several years; even more, at a time of global economic slowdown, it is the one that has definitely had very good profits. An example of this is the year 2016 in which despite the global recession this sector obtained an increase of 24.8% in its profits.

The Colombian banking sector emerges from the crises of the twentieth century, preparing itself to tackle the twenty-first century, through an organization that prioritizes the formation of financial groups of both national and foreign origin; this means that purchases and mergers have been the order of the day. In the last 15 years, the period of time of this investigation, there has been a great movement regarding the number of banks in the sector in each year. Although this period began with 24 banks in 2002, discounting the banks owned by the government and closing 2016 with this same number of banks do not mean that there was no movement in the intervening years.

The Santander Colombia, Scotiabank, HSBC Colombia, Helm, Union Colombiano, Tequendama, Bansuperior, Megabanco, Granahorrar, Colmena, and Conavi banks disappeared from the sector, either because they were purchased or because they merged. The Standard Chartered bank closed voluntarily and the bank Bankboston also settled voluntarily. The following banks entered: Corpbanca, Procredit Colombia, Bancamia, WWB, Coomeva, Finandina, Falabella, Pichincha Coopcentral, Santander de Negocios, Mundo Mujer, Multibank, and Bancompartir.

To study this sector, the DEA methodology is perfectly adjusted since it is not necessary to predetermine the production function and a set of multiple entries and multiple outputs can be worked out to obtain a single indicator per bank and per period studied.

Within this investigation, it has been possible to establish that of the 13 banks that entered the sector during the study period, and that were previously mentioned, 62% have obtained such good results that at least 90% of the years of existence have been efficient and when they are not, the indicator is above 90%.

Overall, it can be determined that the average relative efficiency over the last 15 years of the Colombian banking sector is 86%, despite having raffled the first global financial crisis of this century and living a severe economic recession worldwide.

The highest percentage of efficient banks is in 2014 (71%), for 2016 37% of banks are inefficient.

It was also established that one does not need to be the most important bank, nor the largest one in terms of assets, nor have they obtained the most voluminous profits, nor belong to the most powerful financial group, and nor have years of evolution, to be efficient. Additionally, not being a bank that is part of a very important financial group, it is efficient. Otherwise, so be a robust financial group, this does not mean that as a group, be efficient.

The results also show that there is a large gap between the percentage of efficient and inefficient banks. This gap began in 2006 with 47% points of difference, which increases for 2008 and ends in the last year of the study with more than 50% points.

On the other hand, the foreign banks have been more representative in the total of efficiency than the national banks; this situation only has a very slight change for the year 2016.

8. Recommendations

This research was carried out using public information to which there is free access, but it is evident that for a better approximation to the measurement of relative efficiency it would be very good to have access to information that in Colombia is considered as private. In other words, the directors of the different banks agree to provide the information required to improve this study.

On the other hand, bank managers should take advantage of the conclusions reached to improve their performance, and if that were the case, the performance of the whole group.

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Chapter

Sustainability in Indebtedness: A Proposal for a Treaty-Based Framework in Sovereign Debt Restructuring

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Abstract

The debate concerning reforms in sovereign debt restructuring (SDR) ranges from those which maximize flexibility (e.g. adoption of clauses in debt contracts) to those which maximize uniformity and predictability (e.g. enacting a fixed framework similar to a domestic bankruptcy regime). This paper proposes that the principles of SDR in the United Nations General Assembly Resolution 69/319 be broadly codified into a treaty. This includes the principle of sustainability which emphasizes "inclusive growth and sustainable development" of stakeholders in SDR. In the current unsystematized regime of SDR, this proposal seeks to bridge the value of flexibility in *ex post* negotiations and the values of uniformity and predictability in *ex ante* rules under fixed bankruptcy regimes.

Keywords: sovereign debt, bankruptcy, sustainability, inclusive growth, reform, resolution, restructuring

1. Introduction

The challenge of resolving a sovereign debt crisis becomes problematic when it has international dimensions. A State with purely domestic indebtedness has the flexibility to enact measures to address a debt problem that is entirely within its jurisdiction. It can, for example, enact laws that reduce the face value of its debts or lengthen their maturities to prevent the possibility of default. In this case, the State's creditors would normally be without any recourse because debt contracts are created, operationalized and sustained within the legal framework of the Debtor State.

Thus, the restructuring measure enacted by the State to preserve its fiscal health and the general well-being of the country would prevail over the creditors' rights to receive the "full value" of the debt. In short, a purely domestic sovereign debt would permit unilateral restructuring by the Debtor State. In the positivistic language of Justice Oliver Wendell Holmes, "there can be no legal right as against the authority that makes the law on which the right depends..." [1]. In economic terms, however, the creditors' lack of legal recourse is effectively part of sharing the burden (like everyone else) to address the collective problem of a sovereign debt crisis.

Once sovereign debt has international dimensions, the Debtor State has to contend with legal systems other than its own. Access to international debt markets

made the resolution of sovereign debt crises an international affair. For their protection, creditors often demand that debt contracts contain provisions that introduce elements of foreign legal systems to them—e.g. provisions on governing law and the choice of a tribunal other than the domestic courts of the Debtor State. As in the Argentinian crisis that started in the early 2000s, Argentina had to contend with creditor holdouts carrying injunctions secured from New York courts (see generally [2]).

Thus, in the case of sovereign debt crises with international dimensions, their resolution involves the interaction between at least two legal systems. The protection given by a foreign legal system has a deterrent effect on unilateral debt restructuring by the concerned State. However, this situation also creates the opportunity for delays and holdout behavior by giving creditors protection contractually drawn from a legal system outside that of the Debtor State. This becomes a collective action problem that ultimately hinders the resolution of a sovereign debt crisis. The International Monetary Fund (IMF) has long acknowledged that "While private creditors as a group may recognize that support for rapid restructuring is in their own interest, they may hesitate to agree to a restructuring out of concern that other creditors may hold out and press for full payment on the original terms after the agreement has been reached" ([3], p. 12).

Proposals for a collective and multilateral proceeding for the resolution of sovereign debt crises have been fairly widespread in the literature (see [4], p. 87). These proposals usually draw from domestic bankruptcy rules which, among others, support a global stay on debt collection efforts, the application of the automatic acceleration principle, priority rules and variants of creditor equality treatments [4, 5]. However, the resolution of a sovereign debt crisis would not be as simple as, to paraphrase the legal positivist H.L.A. Hart, a "bankruptcy regime writ large."[1] [6, 7]. There are significant characteristics of sovereign debt restructuring (SDR) that are not found in domestic bankruptcy regimes such as the non-availability of an option to liquidate the Debtor State and the critical role of macroeconomic policy and economic growth in the restructuring process.

Given that the current resolution efforts primarily occur within a conflict of law regime, this paper argues that a minimum level of multilateralization is needed to universalize broad norms that channel collective behavior during a sovereign debt crisis. These norms should consider "inclusive economic growth and sustainable development" within the Debtor State as rational and viable strategy in SDR.

More concretely, this paper proposes that efforts should be exerted so that the principles of sovereignty, good faith, transparency, impartiality, equitable treatment, sovereign immunity, legitimacy, majority structuring and sustainability under the United Nations (UN) General Assembly Resolution 69/319 adopted on 10 September 2015 ("Basic Principles on Sovereign Debt Restructuring Processes") may be broadly codified into a treaty. Such codification may include changes in the articulation of these principles to accommodate the positions of States such as those in the European Union (EU) (see [8]). Significantly, the principle of sustainability should emphasize the concept of "inclusive growth and sustainable development" within the Debtor State as part of the SDR framework. This proposal is being made in the context of the lack of support from countries which have the "major financial centers from which most of the sovereign debt has been issued" ([9], p. 47).

While certainly not an easy feat, the foregoing follows the so-called Incremental Approach that "complement, rather than replace, existing mechanisms, including contractual approaches and the activities of the International Financial Institutions

[1] In criticizing John Austin's Command Theory of law, H.L.A. Hart described it as a "gunman situation writ large."

or the Paris Club, and guide their operation" ([10], p. 38). The thrust of this proposal is to broadly formalize the norms in UN General Assembly Resolution 69/319 that would give States the flexibility to negotiate and adopt specific measures in resolving a sovereign debt crisis. As such, this would not involve an unqualified "surrender of sovereignty" which has been part of the reason for States' reluctance to enter into a "hard law" approach in SDR.

In what follows, Part II of this essay describes the current conflicts of law regime where SDR occurs. Part III sets out the proposal to codify the principles embodied in UN General Assembly Resolution 69/319 into a treaty. Part IV discusses the principle of sustainability which emphasizes the concept of "inclusive growth and sustainable development" as a rational and viable strategy of SDR. Part V concludes.

2. The conflict of law regime of sovereign debt restructuring

The international dimension of SDR does not arise primarily from international law as set out in Article 38 of the Statute of the International Court of Justice, but by contractual provisions that incorporate laws other than the legal system of the Debtor State. In general, there are no "top-down" international norms that govern SDR in the form of treaties, custom or principles. Instead, there is a "bottom-up" normative system that arises from the number of debt contracts issued by Debtor States that contain provisions which introduce elements of a foreign legal system to them. While there are international laws that may apply to SDR such as the principle of sovereign immunity or the Hague Convention on the Recognition and Enforcement of Foreign Judgments [11], these international norms are limited to the extent that they do not dictate how SDR is implemented as a whole.

The legal environment where SDR presently operates is a regime of "conflict of laws" or "private international law." Conflict of laws does not principally concern itself with international law. Rather, it is the application of domestic law whenever a particular jurisdiction is "faced with a claim that contains a foreign element" ([12], p. 2). In other words, a conflict of law approach does not depend on the application of international law among States. Instead, it entails the operation of a particular domestic law in cases involving the interaction between at least two legal systems. Thus, "[t]he *raison d'être* of private international law is the existence in the world of a number of separate municipal systems of law—a number of separate legal units—that differ...from each other in the rules by which they regulate the various legal relations arising in daily life" ([12], p. 4).

As in the current regime of SDR, the rules that generally govern SDR are strictly not international law, but a State's domestic rules that apply when foreign laws that are incorporated in a debt contracts. The practice of SDR is therefore situated within a conflict of laws regime which recognizes that while a State may enact rules in the treatment of foreign laws, "[a] sovereign is supreme within [its] own territory...[It] can, if [it] chooses, refuse to consider any law but [its] own" ([12], p. 4). As discussed below, while the principle of State sovereignty is conceded in theory, its practical application in SDR is qualified by the set of debt contracts that a State has entered into in accessing capital.

The provisions that are often stipulated to introduce elements of a foreign legal system in debt contracts are (a) dispute settlement clauses that confer jurisdiction to a tribunal other than the domestic courts of the Debtor State; and (b) governing law clauses (see [13]). Incidentally, these contractual provisions mirror the scope of private international law which is "always concerned one or more of three questions, namely," (a) the jurisdiction of the domestic court; (b) recognition and

enforcement of foreign judgments; and (c) the choice of law ([12], p. 7). Governing law clauses in a debt instrument may include the specific choice of law provision designating, for instance, New York or English or Japanese Law; or a provision that references an international norm such as a particular treaty or the principle of State sovereignty. Moreover, the adjudicatory body constituted by the debt instrument applies the choice of law or the referenced international norm pursuant to the contract.

During a sovereign debt crisis, the Debtor State may unilaterally restructure its debts pursuant to its sovereign right to set its own macroeconomic policy. In this context, foreign creditors demand that such clauses be contained in debt instruments to effectively act as restraints against unilateral restructuring by a Debtor State. These clauses therefore imply a waiver of the Debtor State's sovereignty. By introducing elements of foreign laws in debt instruments, these clauses "internationalize" what would otherwise be purely domestic contracts that may be amended by the Debtor State. It has been said that "[m]any countries do not regard foreign creditors with great sympathy, especially when the country is bankrupt and the citizens are throwing stones in the street" ([13], p. 4). Thus, for instance, New York or English Law "continue to dominate sovereign and quasi-sovereign lending in large parts of the world[,] including many emerging markets" [14]. New York and English Law are often the choices of law in debt instruments because of their "insulating effect" against "legislative changes in the borrower's country" ([13], p. 4). It is also a factor that the United States and the United Kingdom are often the home States of creditors who hold sovereign bonds. On the other hand, Debtor States normally agree to these clauses in order to access capital from foreign creditors.

The present regime of SDR has also been described as "contractual" given that debt contracts are the primary sources of rights and obligations with respect to sovereign debt. In the case of purely domestic indebtedness, a State has wide leeway in dealing with its debts using its own legal system. However, when a State borrows capital from foreign markets, debt contracts trigger the interaction between two legal systems and, to a more limited extent, between the Debtor State's legal system and international law. This precisely characterizes a conflict of law regime which is principally concerned with the "existence in the world of a number of separate municipal systems of law" ([12], p. 4). As a consequence, without an overarching framework, SDR is necessarily based on the Debtor State's *ad hoc* negotiations with its creditors based on those contracts. The *ad hoc* nature of these negotiations is reinforced by the fact that the distressed Debtor State has to deal with a diverse set of creditors including hedge funds and institutional investors.

Thus, the myriad of sovereign debt contracts is the core operational legal framework in the resolution of a sovereign debt crisis. The application of the international principle of State sovereignty is, to a large extent, determined through the State's express and implied waivers of such principle contained in the debt contracts. In most cases, international law is applied in SDR if it is incorporated in these contracts. While sovereign debt contracts may be covered by an investment treaty as in *Abaclat v. Argentina* [15], this has not evolved into a consistent international norm in SDR. In the first place, whether debt contracts are considered protected under an investment treaty would depend on the specific definition of "investment" under such treaty. Second, such expansive interpretation of "investment" has been criticized as a departure from the common understanding of "investment" as long-term commitment of capital that contributes to the economic development of the host State (see [16], pp. 515–517). In any event, there are currently more than 3000 investment treaties in the world with varying definitions of investment [17]. This situation in international investment law is hardly one that reflects a consistent international norm in SDR.

According to Guzman and Stiglitz, the contractual regime of SDR is essentially a "*non-system*...characterized by bargaining based on decentralized and non-binding market-based instruments centered on collective action clauses and competing codes of conduct" ([18], p. 3). There is widespread literature which strongly criticizes this contractual regime as "disorderly, inefficient, and overly costly" especially with respect to creditor collective action problems, in particular debt runs, holdouts and litigation (Citations omitted. [14], p. 88). Thus, there have been calls for a "hard law" approach or a multilateral legal framework to address these problems (for an overview, see [14], pp. 87–96). On the other hand, there are those skeptical of these proposals because of fears of rigidity of rules and "regulatory overkill" ([14], p. 88). Thus, an *ex ante* SDR framework consisting of mandatory rules carries the risk of stifling the flexibility that is present in *ex post* negotiations. Thus, "[i]nstead of creating a statutory framework 'top-down,' it could suffice to alter the documentation of bond and loan contracts to regulate the restructuring process in a more efficient way" ([14], p. 88). This would be the contractual regime of SDR where the prevailing norms of conduct are based on the terms and conditions stipulated in contracts entered into by the parties.

As discussed below, one way to bridge these opposing views is to formalize norms that are broad enough to allow parties the flexibility to adopt certain measures in the resolution of sovereign debt crises. At the same time, the formalization of these norms should be effective enough to influence collective behavior in SDR. The next part will discuss this proposal through a treaty-based codification of the norms contained in UN General Assembly Resolution 69/319.

3. Establishing a treaty-based normative framework

When UN General Assembly Resolution 69/319 ("Basic Principles on Sovereign Debt Restructuring Processes") was adopted 10 September 2015, 136 States voted in favor, six States voted against, and 41 States abstained ([18], p. 4; [10], p. 37). Among those which opposed the resolution were the US and the UK, "the two major jurisdictions for sovereign debt issuances by emerging economies, as well as Canada, Germany, Israel and Japan" ([18], p. 4).

UN General Assembly Resolution 69/319 articulates nine principles in SDR:

1. The *principle of State sovereignty* which is the Debtor State's right "to design its macroeconomic policy, including restructuring its sovereign debt..."

2. *Good faith* which is the "engagement in a constructive sovereign debt restructuring workout negotiations and other stages..."

3. *Transparency* which is "accountability of the actors concerned..."

4. *Impartiality* which means "independence" and the prevention of "undue influence" and "conflicts of interest."

5. *Equitable treatment* which is a State duty to refrain from arbitrary discrimination among its creditors.

6. *Sovereign immunity* of States from jurisdiction and execution which includes courts' obligation to "restrictively interpret" it in favor of State immunity.

7. *Legitimacy* entails "inclusiveness and the rule of law" in SDR "at all levels."

8. *Sustainability* "implies that sovereign debt restructuring workouts are completed in a timely and efficient manner and lead to a stable debt situation in the debtor State..."

9. *Majority restructuring* "implies that sovereign debt restructuring agreements that are approved by a qualified majority of the creditors of a State are not to be...impeded by other States or a non-representative minority of creditors..."

The thrust of this paper's proposal to codify UN General Assembly Resolution 69/319 into a treaty is to formalize the foregoing principles without necessarily adopting the resolution *in toto*. Its main objective is to introduce these norms as a multilateral framework in SDR without, at the moment, imposing any specific measure to implement them. If the voting of UN General Assembly Resolution 69/319 is any indication, only the 136 States which voted in favor of the resolution would probably regard its codification in a positive light. Thus, to improve chances of success, a proposal for codification should court the "no" and "abstain" votes by introducing changes that accommodate their positions.

It is not surprising that the influential developed economies voted against UN General Assembly Resolution 69/319 given that their citizens are mostly the creditors of distressed Debtor States and that they have an interest in protecting the sovereign debt market within their jurisdictions. One of their declared principal objections is that "the IMF as the primary forum to discuss sovereign debt restructuring issues" instead of the UN General Assembly [8]. Equally important are their objections against the specific manner by which the nine principles in SDR were articulated in the resolution.

The European Union, for instance, has declared its objections to a number of statements in the resolution:

> *Paragraph 4 requests "all institutions and actors involved in sovereign debt restructuring," including "at regional level," to "refrain from exercising any undue influence over the process and other stakeholders or engaging in actions that would give rise to conflicts of interest." Such a statement fits poorly with both the EU institutional setting and its practical situation, where possible discussions related to the stock of debt of a Member State take place primarily at regional level, against a background in which the Member States themselves are often the main creditors (directly or via the financial assistance mechanisms that they have established).*
>
> *Paragraph 5 states that "creditors have the right to receive the same proportionate treatment in accordance with their credit and its characteristics" and that "no creditors or creditor groups should be excluded ex ante from the sovereign debt restructuring process." Such a statement denies the customary preferred creditor status recognized to the International Financial Institutions (IMF, ESM...) when lending to a Sovereign in distress, with possible major negative implications on their ability to fulfill their primary mission.*
>
> *Paragraph 9 states that "sovereign debt restructuring agreements that are approved by a qualified majority of the creditors of a State are not to be affected, jeopardized or otherwise impeded by other States." This statement is very problematic for issuances under foreign jurisdiction (the overwhelmingly dominant case for developing and emerging countries). Issuing under a foreign jurisdiction does, by definition, involve accepting the competence of the courts of another State. This is a point of major importance for the EU, as a very large part of the world's sovereign issuances under foreign jurisdiction are made under the jurisdiction of one of its Member States (UK) [19].*

In codifying the SDR principles into a treaty, it is worthwhile to consider these objections which relate to the specific wording of UN General Assembly Resolution 69/319. In general, it is easier to accommodate concerns about specific wordings than the more fundamental objections premised on the market-based approach to SDR. This is driven by a pragmatic consideration of securing State support by postponing the imposition of concrete SDR measures and, at the same time, advancing the main objective of introducing a multilateral normative framework for SDR.

The broad codification of the norms contained in UN General Assembly Resolution 69/319 would be a compromise between a "soft law" approach (usually in the form of guidelines that may be adopted by States) and a "hard law" approach in the form of enforceable specific SDR measures. While the proposal takes the form of a treaty, the SDR norms to be articulated therein should be deliberately broad to give States the flexibility to implement them within specific contexts. As such, this would not be an unqualified "surrender of sovereignty" on the part of State parties that may be part of their reluctance towards UN General Assembly Resolution 69/319 (consider, for instance, the 41 abstaining votes). A degree of flexibility is needed in SDR especially in view of the rapidly changing nature of the sovereign debt market (see generally [20]).

This proposal is preliminary: it is designed to set the grounds for more concrete and "hard law" SDR measures in the future. It follows the so-called Incremental Approach that "complement, rather than replace, existing mechanisms, including contractual approaches and the activities of the International Financial Institutions or the Paris Club, and guide their operation" ([10], p. 38). Despite not codifying concrete SDR measures, a treaty-based multilateral normative framework would hopefully exert a "compliance pull" on the current SDR regime towards a shared understanding of these norms. A multilateral normative framework in SDR would reinforce the "use [of] the interpretive space between the factual and the normative, between apology and utopia, in order to highlight and strengthen trends in current practice that support debt sustainability" ([10], pp. 38–39).

The broad codification of the norms in UN General Assembly Resolution 69/319 would be a significant advancement in itself towards establishing a multilateral normative framework in SDR. Even from the perspective of market-based proponents, the efficiency and equity problems in the present regime of SDR is serious enough to warrant reform. It is the kind of reforms needed that is the subject of intense debate which straddles between, on one hand, the value of uniform and predetermined rules and, on the other, that of flexibility. This paper's proposal seeks to bridge those values by supporting a predetermined normative framework in SDR while retaining the flexibility needed to undertake the restructuring process.

As a political matter, there is no doubt that the support of influential developed countries like the US and the UK would considerably help the success of the proposed treaty. However, even if there are limited States which become parties to the treaty, it cannot be discounted that some actors might prefer to deal with States with a reasonably predictable SDR framework as forwarded by the proposal.

A treaty-based normative framework in SDR would also mean that domestic courts of State parties would be obligated to apply the norms embodied in the treaty. Howse observes that even with international arbitration, "domestic courts are the ultimate mechanism [in SDR], as is illustrated by international investment law." ([21], p. 244). This is because it is often the case that most of the Debtor State's assets are located within its jurisdiction. Moreover, it is not unlikely for treaty-based SDR norms to influence international arbitration (based on debt contracts) given that State parties to the arbitration now have a treaty obligation to follow the SDR norms. Thus, while treaty-based SDR norms are deliberately broad, there will be some measure of enforcement of those norms especially at the domestic level.

In sum, this treaty-based normative framework in SDR may set the course for a series of actions which may lead to more concrete and enforceable measures in SDR. This is the import of the Incremental Approach that "highlight[s] and strengthen[s] trends in current [and future] practice" ([10], p. 38) and which is designed to continuously build upon the broad normative framework set out at the start.

4. The principle of sustainability

The principles or norms provided in UN General Assembly Resolution 69/319 may be seen as addressing two aspects of SDR: first is the conduct of the relevant actors in the restructuring process; and second is the objective of the restructuring process itself. The principles of sovereignty, good faith, transparency, impartiality, equitable treatment, sovereign immunity, legitimacy and majority structuring primarily relate to the behavior of States, creditors, tribunals and other relevant actors. These principles are meant to address the collective action problem in SDR—that is, the failure to coordinate among the Debtor State and its creditors even if all would be better off if they coordinate.

For instance, the end of Argentina's 15-year stand-off with the majority of its holdout creditors in April 2016 has been attributed to "good faith negotiations" ([22], p. 1). In lifting the injunction against Argentina's payment of its restructured bonds, the New York court judgment "indicated…that the election of Argentina's new government with its willingness to negotiate in good faith…was pivotal in [the] decision…" ([22], p. 2; [23]). In this case, "good faith" was used to characterize the conduct of negotiations between Argentina and its holdout creditors in reaching a settlement that allowed the recovery of 75% of the creditors' original claim. This would be an example of an application of the principle of good faith to address a collective action problem in SDR. Moreover, the principles of sovereignty, transparency, impartiality, equitable treatment, sovereign immunity, legitimacy and majority structuring would have, in varying degrees, played a part in reaching the Argentine settlement as it is often necessary that these principles operate in concert to address a collective action problem.

On the other hand, the principle of sustainability would relate more to the objective of SDR. Guzman and Stiglitz, for instance, stated that "[t]he ultimate goal of sovereign debt restructuring is to restore the sustainability of public debt *with high probability*" ([18], p. 3). The articulation of the principle of sustainability in UN General Assembly Resolution 69/319, however, is noteworthy for its progressiveness:

> *Sustainability implies that sovereign debt restructuring workouts are completed in a timely and efficient manner and lead to a stable debt situation in the debtor State, preserving at the outset creditors' rights while promoting sustained and inclusive economic growth and sustainable development, minimizing economic and social costs, warranting the stability of the international financial system and respecting human rights.*

The foregoing is not only concerned with the debt sustainability within the Debtor State, but also "inclusive economic growth and sustainable development… [which] respect[] human rights." This particular articulation is holistic in the sense that it considers the long-term social and economic welfare of the Debtor State which may very include the well-being of its citizens. Significantly, the mention of "human rights" may make SDR resonate with other international norms such as those embodied in the Universal Declaration of Human Rights [24] and the International Covenant on Civil and Political Rights [25].

The IMF has defined debt sustainability "as a situation in which a borrower is expected to be able to continue servicing its debts without an unrealistically large future correction to the balance of income and expenditure" ([26], p. 4). Compared to the UN General Assembly Resolution 69/319, the IMF's definition of "debt sustainability" has been described as being "in purely financial terms" ([10], p. 25).

The IMF's definition consists of two components: (1) that the Debtor State "cannot indefinitely accumulate debt faster than [its] capacity to service these debts" ([14], p. 71); and (2) that the service of debts should not require "an unrealistically large future correction to the balance of income and expenditure." The first relates to a financial aspect of sustainability whose objective is to prevent an unbounded accumulation of debts. On the other hand, the second component "implies that there are social and political limits to adjustment[s]" ([14], p. 71) needed to achieve debt sustainability. Thus, "[n]ot all fiscal adjustment paths are realistic, because political and other constraints will influence a country's willingness to pay (as opposed to ability to pay)" ([14], p. 71).

The recognition by the IMF of social and political limits to adjustment policies in SDR may be seen as going beyond a purely financial framework of sustainability. Although this recognition may be limited insofar as it affects a State's willingness to pay its debts, the IMF's definition is significant to the extent that it implies an assessment of the social and political situation of the debtor State in the context of a sovereign debt crisis. Thus, it may not be entirely accurate to say that the IMF's definition of "debt sustainability" is incompatible with the principle of sustainability in UN General Assembly Resolution 69/319. The IMF's willingness to recognize the social and political aspects of SDR has some kinship with UN General Assembly Resolution 69/319 in its emphasis on "inclusive economic growth and sustainable development." In fact, recent debt sustainability analysis of the IMF factors economic growth within the Debtor State as a contributing variable in assessing sustainability ([14], p. 75).

In short, there may be possible points of contact between the IMF's definition of "debt sustainability" and the principle of sustainability in UN General Assembly Resolution 69/319. These points of contact in the understanding of sustainability may play a role in gathering support for a proposal to include "inclusive economic growth and sustainable development" as part of a codified principle of sustainability. Indeed, there is significance in going beyond a purely financial assessment of whether a State's payment of its existing debts may lead to an unbounded accumulation of future debts.

Fostering "inclusive economic growth" within the Debtor State should be seen as rational and viable strategy in SDR because it addresses the following characteristics that is not found in domestic bankruptcy regimes:

1. Unlike corporations that are the subject of bankruptcy proceedings, there is no option of liquidation or dissolution of a Debtor State because the likelihood of such an event happening as result of a debt crisis is minimal. As such, the debt crisis is necessarily temporary. In most instances, the question to be addressed is not the survival of the State but the duration of the crisis given the measures that may be implemented to resolve it.

2. The assets of the Debtor State that may be used to service its debts are dynamic given a functioning economy that utilizes fiscal policies like raising revenue through taxation.

3. A distressed Debtor State is also accountable to its citizens who are beneficiaries of its social welfare programs such as "pensioners, those depending on the

> government for health benefits or education, etc." ([27], p. 9). Guzman and Stiglitz have called these beneficiaries as the State's informal creditors whose "benefits are part of the social contract" ([27], p. 9).

The lack of an option for "State dissolution" should shift an SDR framework towards economic growth rather than the common pool of assets (see [28]) problem in bankruptcy cases. This is a paradigm shift from a static understanding of a limited pool of assets in domestic bankruptcy proceedings to a dynamic one which accounts for the possibility of growth (or conversely, diminution) based on the macroeconomic conditions of the Debtor State. Thus, "inclusive economic growth" within the Debtor State shortens the duration of a sovereign debt crisis and expands the available pool of State assets that may be used to service its debts. The expansion of the State's asset base also prevents the unbounded accumulation of future debts.

Such endogenous growth implies a multiplier effect in the economy that increases a Debtor State's tax revenues, consumption, investments and expenditures. In the context of SDR, "inclusive economic growth" ultimately means the increased likelihood of the Debtor State to pay its debts. In this way, it benefits everyone: the Debtor State, the creditors and other stakeholders especially those who derive benefit from the Debtor State's social contract.

The project of fostering "inclusive economic growth" within the Debtor State would be seen in contradistinction to the imposition of austerity measures purportedly to set aside money to pay the State's creditors. Guzman and Stiglitz observes that "austerity policies are normally counterproductive *even from a creditors' perspective*" ([27], p. 8). Austerity measures may, in fact, decrease the State's ability to pay its debts by preventing it from spending money domestically to fix its economy.

There is also a question of social justice involved in prioritizing foreign creditors over the Debtor State's social welfare beneficiaries. Limited State assets are being used to pay wealthy investors (which include the so-called "vulture funds") over the State's citizens who may be invoking rights more closely related to value of human life—*e.g.* rights to public health and a sustainable environment. This arrangement in effect violates a hierarchy of values in international law which upholds the primacy of human life over property. Thus, the U.N. Commission on Human Rights issued a Resolution which "affirms that the exercise of the basic rights of the people of debtor countries to food, housing, clothing, employment, education, health services and a healthy environment cannot be subordinated to the implementation of structural adjustment policies and economic reforms arising from the debt" [29].

The treaty codification of "inclusive economic growth and sustainable development" as part of the principle of sustainability helps SDR move beyond a purely financial framework of sustainability. While it may be desirable to adopt more targeted measures to improve the human rights situation in SDR, an emphasis on the Debtor State's endogenous economic growth also addresses this aspect by improving the collective welfare of the relevant actors involved. In particular, an improved economic situation helps the Debtor State fulfill its social contract with its citizens through an increased ability to pay.

5. Conclusion

As shown above, there are not only efficiency and equity problems in the present regime of SDR but also fundamental questions of social justice. These problems are serious enough to be simply ignored. The literature in SDR reveals that there is hardly any dispute that reforms are needed to address these problems. There is dispute, however, in the *kind of reforms* needed in SDR which ranges from the

adoption of clauses in debt contracts (to maximize flexibility) to enacting a fixed framework similar to a domestic bankruptcy regime (to maximize uniformity and predictability). If anything, a pragmatic approach to reform in SDR would have to be between these two ends.

This paper's proposal to establish a treaty-based normative framework in SDR seeks to bridge the flexibility in *ex post* negotiations and the uniformity in *ex ante* rules. This proposal is not as ambitious as it sounds. By broadly codifying the norms in UN General Assembly Resolution 69/319, the proposal follows the Incremental Approach for reforms in SDR in the way it is *backward-looking*, because it builds on existing "soft law" approaches and other mechanisms and practices in SDR (for instance, it recognizes the role of *ad hoc* negotiations); and *forward-looking*, because it hopes to set the ground for more concrete and effective SDR measures in the future. As a whole, the approach of the proposal is to complement and improve the current conflicts of law regime of SDR.

Despite the proposal's declared strategy to accommodate the various positions of States, one thing that stands out is its call to codify the principle of sustainability that emphasizes "inclusive economic growth and sustainable development." This comes from the recognition that the articulation and implementation of this principle is a more effective way of undertaking SDR than a purely financial framework of preventing the State's unbounded accumulation of debts. It is premised on the idea that while there are no systematized rules, SDR is nevertheless situated in an international order that upholds a complexus of norms which includes human rights. Thus, this proposal is a call for a movement from SDR's current focus on the protection of debt markets to the broader economic, social and political context of the international order.

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