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Dear Colleagues,

Welcome to the second issue of the *Journal of Capital Markets Studies (JCMS)*. We are pleased to continue with our efforts to provide scholarly research in the field of economics and finance with a specific focus on capital markets.

The launch of the *JCMS* coincided with the 2nd Capital Markets Summit held in Istanbul in November 2017. At the summit, *JCMS* met with great enthusiasm and excitement that far exceeded our initial expectations. With a rejuvenated dose of eagerness and intensity, we are looking to bring to our audience an ever-increasing breadth of high-quality research.

This second issue includes seven papers dealing with capital markets concerns in several markets. The first paper is titled “Due diligence in capital markets”. In that paper, Mervyn King points out the due diligence only on financials will not be sufficient and suggest that the institutions participating in capital market transactions involving company shares or bonds have to exercise great care in their due diligence before investing their ultimate beneficiaries’ money.

The following paper, Prem Sikka’s “Combating corporate tax avoidance by requiring large companies to file their tax return” concerns tax avoidance and transparency, and recommends policy options by appealing to notions of transparency, public accountability and fair competition. Sikka argues that the public availability of corporate tax returns can help to check tax avoidance emphasizing public filing of the tax returns of large companies.

The next paper titled “Towards a well-functioning stock market in context: critically appreciating issues in interpreting efficient markets research and its regulatory implications”, co-authored by Jim Haslam, Jiao Ji and Hanwen Sun, addresses prices, information and regulation with a focus upon the stock market in context. The paper suggests a pragmatic regulatory policy that should be concerned to improve stock market functioning, including with respect to information, as well as the context of which this is part.

The fourth paper is titled as “Comprehensive evaluation of the financial performance for intermediary institutions based on multi-criteria decision making method”. In this paper, Güler Aras, Nuray Tezcan and Ozlem Kultu Furtuna assess the financial performance of the intermediary institutions that have operated in the Turkish capital markets taking the issue of bank origin and non-bank origin institutions into account. The experimental research provides that the average performances of continuously operating intermediary institutions during the concerned period are above the average performance levels of all intermediaries. The authors argue that the average financial performance of the bank origin intermediary institutions is higher than the average score of non-bank origins.

The fifth paper “Which aspects of CSR predict firm market value?” is an empirical attempt to find robust evidence that corporate social responsibility (CSR) predicts firm. Burcin Yurtoglu and Setavan Bajic’s explore which aspect(s) of CSR drives this result by using a country-benchmarked overall CSR index. With that comprehensive data set, they argue that that firms, in responding to investor pressure for better CSR; and investors, in assessing CSR, would do well to focus on the social aspect of CSR practices.

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In the following paper, Alper Özgün, Hasan Murat Ertuçğul and Yener Coşkun provides insight into house price spillovers exploring the linkage between the USA–UK and London–New York housing markets. They reveal that country-level causality is running from the USA to UK whereas city-level causality is running from London to New York. Additionally, the model outcomes suggest that real estate portfolios involving the US and UK assets require a dynamic risk management perspective.

The seventh and last paper is “Cointegration and causality in capital markets” by Can Inci. He sheds light on energy futures capital markets using intraday data. That paper confirms that oil spot and oil futures markets are tightly linked and shows that most of the reaction is completed within at most half an hour.

We hope you enjoy the second issue of JCMS. Should you have any specific suggestions for future releases, please feel free to contact us. We value your input.

Our e-mail addresses are provided below and JCMS’s website is available at: www.emeraldgrouppublishing.com/services/publishing/jcms/index.htm

Güler Aras
Yıldız Technical University, Turkey

About the Editor-in-Chief
Güler Aras, PhD, CPA, is Professor of Finance and Accounting at Yıldız Technical University, and the Founding Director of Center for Finance, Governance and Sustainability (CFGS) at YTU. Professor Aras is the Founding Chair of the “Integrated Reporting Network Turkey”. She was a Visiting Professor at Georgetown University McDonough School of Business and she is the former Dean of the Faculty of Administrative and Economic Sciences and the former Dean of the Graduate School. Her research focus is on financial economy and financial markets with particular emphasis on the relationship between sustainability, corporate governance, corporate social responsibility and corporate financial performance. She has published more than 25 books and has contributed over 250 articles in academic, business and professional journals. She also edited several book collections and conference proceedings. Her latest books, Sustainable Markets for Sustainable Business: A Global Perspective for Business and Financial Markets (2015) and co-authored books Transforming Governance (2016) and Corporate Behaviour and Sustainability: Doing Well by Being Good (2017) published by Routledge. She is the Editor in Chief of Journal of Capital Market Studies, Editor of Routledge Book Series, Finance, Governance and Sustainability: Challenges to Theory and Practice and the Editor of Routledge book series Corporate Social Responsibility; she has also served as an Editor of Social Responsibility Journal and Emerald Development of Governance and Responsibility book series. Professor Aras has spoken extensively at professional and academic conferences and has served as a Consultant to number of governmental and commercial organizations such as Minister of Development, Undersecretary of Treasury and Minister of Labour and Social Security Employment in Turkey. Professor Aras is working with business closely and she is acting as an independent board member of several institutions and independent board member of “Turkish Capital Market Association (TCMA)”. 
Due diligence in capital markets

Mervyn King

Johannesburg, South Africa

In capital markets long-term debt, equities or securities are bought and sold. Through this mechanism, the money of savers which are held by financial institutions is put to long-term productive use by companies or governments. There are regulators who oversee how these markets are operating and the institutions who are investing their ultimate beneficiaries’ money in these capital markets.

There are both primary and secondary capital markets. In the primary markets, new share issues or bonds are sold to asset owners or institutions holding the money of investors and savers. In the secondary market existing bonds or equities are sold among traders or investors. A secondary market is important because it encourages investments into primary markets. This is so because the initial capital market investor knows that it is able to sell the equities or bonds acquired by it if circumstances call for such disposal.

In the acquisition of shares the members of the capital market will acquire equity in the companies who have issued those shares whereas acquiring a bond issued by a company the capital market investor becomes a creditor of the company.

It will be seen that companies in raising money have to make a decision whether they are going to do so by way of equity or bonds. If by equity then the company’s debt is not increased but if by bonds the company’s debt is increased. From the investor’s perspective, a bond is less risky because it will rank ahead of shares on bankruptcy. On the other hand, the shares could give the investor a higher return by way of an increase in the share price and increasing dividends.

In this paper, I want to focus on the financial institutions in the capital markets acquiring either equity or bonds issued by companies. Usually when a company issues a bond with a particular coupon the financial institutions in the capital market bid for the bond. The successful bidder obviously acquires the bond and becomes a creditor of the company. In acquiring either shares or bonds issued by a company the financial institution in the capital market owes a duty of care to its ultimate beneficiaries to ensure that it does a due diligence on the company and that it is going to not only survive but thrive, at least for the duration of the bond, or in the case of equity it may be an investment by a pension fund and the intention may be to dispose of it in the longer term.

Until towards the end of the twentieth century, a due diligence consisted only of a financial due diligence. This is because the success of the business of a company was seen through a financial lens with the tests being increasing monetary bottom line profit, increased share price and increased dividend payments. There was this focus because of the concept of the primacy of the shareholder. Success as suggested in the UK Companies Act is the success of the business of the company in the best interests of the shareholder while having regard to other environmental, social and governance factors.

There is a realisation in the world that we are in a resource constrained one but with increasing population. At present, we have approximately 7.4bn people on the planet and by
2045 the estimate is that we will have another 2bn people on the planet. It is clear that there will be an increased demand for product but with declining natural assets which have been used faster than nature has been regenerating them. Consequently to carry on business as usual is no longer an option.

The consequence has been to change the mindset of the boards of companies to create a business model which will have a positive impact on the three critical dimensions for sustainable development, namely the economy, society and the environment. These three dimensions are interdependent or integrated, as stated in the preamble to the United Nations Sustainable Development Goals of April 2015.

In 2009 at the UN Headquarters in Geneva, IFAC in a meeting held under Chatham House Rules, said that it is clear that financial reporting although critical is no longer sufficient, because an analysis of the market value of companies listed on major stock exchanges around the world showed that only 20 per cent of the market cap was made up of additives in a balance sheet according to financial reporting standards, the other 80 per cent was intangible assets such as strategy, reputation, sustainability, supply chain issues, legitimacy of operations, etc. In order to report on the balance of the value of market cap sustainability reporting was developed. At that historic meeting, I was the chairman of the Global Reporting Initiative and was able to say that sustainability reporting, without the numbers, was meaningless. But I went further, however, by saying that to report in two silos, financial report and sustainability report, was divorced from reality because companies do not operate on that basis.

They operate on a basis that the sources of value creation, or the six capitals as set out in the framework of the International Integrated Reporting Council (IIRC), together with the relationships between the company and its stakeholders are integrated 24/7.

One of the drivers of an integrated approach to strategy and reporting has been responsible investment. Responsible investment requires institutions to enquire as to whether a company has done an integrated report, if not, why not? Has it done a sustainability report, if not, why not? Has it got a supply chain code of conduct? Has that supply chain been monitored? Does the company know what is happening in its supply chain? The reason for all this is that asset owners have learned that a financial due diligence can be done on a company before investing in its equity or its bonds but something can happen to one of its intangible assets, for example reputation, or in the supply chain, such as the use of child labour, which can destroy up to 60 per cent of value on a stock exchange within a few days. Consequently financial institutions in capital markets, before investing their ultimate beneficiaries’ moneys in either an equity or bond issue by a company today have to do a completely different due diligence. They have to enquire as to the nature of the company’s business model? Is it one that will have a positive impact on the three dimensions for sustainable development? If not what is the value creation strategy of the company to endeavour to eradicate or ameliorate the negative impacts on those three critical dimensions, particularly societal and environmental.

Consequently, a due diligence of companies has become all embracing—diligently studying the additives in the balance sheet, the company’s business model and the intangible assets. A financial due diligence is well-known but a due diligence in the long-term value creation business model of a company has to indicate that it is one which is sustainable in a resource constrained world. It is, in this context, that the IIRC was formed once it was accepted by the great standard setters and reporting institutions that financial reporting alone was not sufficient. It follows that a due diligence on only the financials will not be sufficient.

In conclusion, the institutions participating in capital market transactions involving company shares or bonds have to exercise great care in their due diligence before investing their ultimate beneficiaries’ money. The revolutionary immensity of integrated thinking...
as advocated in the IIRC Framework is in the creation of the company’s business model. It drives the board to think of the six capitals, financial, manufactured, human, natural, intellectual and social which includes the relationships between the company and its stakeholders in creating that business model. In finalising the value creation strategy, the board will also consider the outcomes of its products and not only the activities inside the business model or the output of the company itself, namely its product.

Financial institutions in capital markets may well need people other than auditors to assist them in doing a due diligence which covers all the risks associated with the intangible assets making up 80 per cent of a company’s market value before investing their beneficiaries’ money in the company’s equity or bonds.
Combating corporate tax avoidance by requiring large companies to file their tax returns

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Abstract
Purpose – The purpose of this paper is to develop arguments for a public policy of requiring all large companies to make their tax returns publicly available. It is argued that such a policy would help to check tax avoidance, strengthen public accountability and secure fair competition.
Design/methodology/approach – The policy proposal rests on notions of transparency and public accountability.
Findings – The paper argues that the proposed policy is feasible.
Research limitations/implications – The paper hopes to stimulate debates about the value of public filing of corporate returns and limits of public accountability.
Social implications – The paper extends the range of public policies which might be able to check organised tax avoidance.
Originality/value – It is one of the few papers to call for public filings of large company tax returns.

Keywords
Public accountability, Transparency, Tax avoidance, Large companies, Tax returns

Paper type Viewpoint

Introduction
Tax avoidance is a matter of public concern as it disables the capacity of democratically elected governments to meet policies mandated through the ballot-box, including the mandate to invest in social infrastructure and redistribute income and wealth to secure social stability. Due to secrecy and opacity, the amount of tax avoided/evaded is hard to know. In all, 28 member states of the European Union (EU) are estimated to be losing around one trillion euros each year (Euronews, 2013). It is estimated that between $7.6 and $32 trillion of the world’s wealth is hidden away in low/no tax jurisdictions and escapes tax altogether (Henry, 2012; Zucman, 2015). Various models estimate that global revenue losses due to tax avoidance by corporations could be up to $600 billion each year with approximately $400 billion in developed countries (these are mostly members of the Organisation for Economic Co-operation and Development) and $200 billion elsewhere (Cobham and Janský, 2017; Crivelli et al., 2015; International Monetary Fund, 2015). Revelations such as the Panama Papers (https://panamapapers.icij.org/), Luxembourg leaks (LuxLeaks (www.icij.org/project/luxembourg-leaks)), HSBC leaks (https://projects.icij.org/swiss-leaks/) and the Paradise Papers (www.icij.org/investigations/paradise-papers/) show that corporations are at the forefront of global tax avoidance. A common practice is to use...
complex structures, intragroup and related party transactions to shift profits to low/no tax jurisdictions and reduce corporate tax liabilities.

Corporations are aided by a highly organised tax avoidance industry dominated by major accountancy firms. Some of their personnel have been fined and imprisoned for enabling their clients to evade taxes (Mitchell and Sikka, 2011). In 2005, an internal study by Her Majesty’s Revenue and Customs (HMRC), UK’s tax authority, concluded (The Guardian, 2009) that 50 per cent of the Big Four’s tax fees came from “commercial tax planning” and “artificial avoidance schemes”, which generated fees of around £1 billion a year. In 2013, the tax avoidance business of the big accountancy firms became the subject of a hearing by the UK House of Commons Committee of Public Accounts. Just before the hearing the Committee received evidence from a former senior PricewaterhouseCoopers employee stating that the firm’s policy was that it would sell a tax avoidance scheme which had only a 25 per cent chance of withstanding a legal challenge, or as the Committee chairperson put it “you are offering schemes to your clients – knowingly marketing these schemes – where you have judged there is a 75% risk of it then being deemed unlawful” (UK House of Commons Committee of Public Accounts, 2013a b, Ev4). Partners of Deloitte, KPMG and Ernst & Young admitted to “selling schemes that they consider only have a 50% chance of being upheld in court” (p. 5).

Unsurprisingly, the erosion of tax base and profit shifting has become a major international political issue (International Monetary Fund, 2013a, b; United Nations Finance for Development, 2014). Parliamentary inquiries into corporate tax avoidance in the USA and UK have often been thwarted as corporations, their advisers and tax authorities have sought refuge behind the cloak of confidentiality of tax affairs (Mitchell and Sikka, 2011; Sikka, 2015). This paper argues that secrecy surrounding the tax affairs of corporations should be dissolved and all large corporations subject to tax should be required to make their tax returns and related documents publicly available.

This paper is organised in three further sections. The next or the second section provides details of the proposed policy. The third section provides a rationale for the proposed policy by arguing that it will provide transparency, enhance competition, enable investors to make meaningful assessments of future cash flows and risks and enhance public accountability by empowering parliamentary committees to ask searching questions of tax authorities and corporate indulgence in tax avoidance through complex schemes. The fourth and final section concludes the paper with a summary and discussion.

Policy proposal

This paper calls for the tax returns of all large companies, together with related information, to be made publicly available. Tax returns should be filed with the designated public body at the same time as audited annual accounts. In this context, tax return means the full tax computation for each legal person subject to corporation, capital gains and other taxes. A typical tax computation would show how accounting profits are converted to taxable profits, the reliefs claimed by companies, intragroup and related party transactions and other information that has a bearing on the calculation of tax liability. The tax computation may well be supported by a number of detailed schedules and notes and advice received from accountants and other tax advisers. Indeed, rules can be changed to require companies to disclose whatever is conducive to broader social objectives. It is noted that some jurisdictions (e.g. the Caymans, Bermuda) do not levy corporate taxes and thus entities located therein will not produce a tax return. However, their parent companies (which may be in based in countries that levy corporate taxes) are likely to be party to profit shifting transactions. Hence, the suggestion above is that the tax returns would need to provide detailed information about intragroup and related party transactions. The policy proposed here envisages
public filing of all material information necessary for understanding of corporate tax affairs. The proposal does not require companies to generate any additional information as it requires filing of information that all companies already have. In the era of electronic filings, the cost of filing the tax returns is likely to be negligible and miniscule compared to the amounts that companies spend on public relations campaigns or on the construction of complex tax avoidance schemes. Companies cannot claim to be disadvantaged by additional filings because the proposal would apply to all large companies.

The above proposal is to apply to “large companies” only. Such companies are often defined in corporate legislation. The EU definition, as implemented in the UK Companies Act 2006, distinguishes large companies from others and is shown in Table I.

In most countries, relatively few entities are likely to be classified as large companies/groups and be subjected to the proposed filing. The corporate data relating to the UK, the world’s sixth largest economy, illustrates this point. The data published by the UK Government (www.gov.uk/government/uploads/system/uploads/attachment_data/file/559219/bpe_2016_statistical_release.pdf) show that at the start of 2016 there were about 5.5 million private sector businesses. The split is 3.3 million sole proprietorships (60 per cent of the total), 1.8 million companies (32 per cent), and 421,000 ordinary partnerships (8 per cent). Small businesses accounted for 99.3 per cent of all private sector businesses and 99.9 per cent were small or medium-sized enterprises. Therefore, the proposed policy would not apply to the vast majority of companies. The UK Government data show that 7,200 companies had more than 250 employees and can meet the criteria shown in Table I. These companies employ about 10.5 million people and have a turnover of about £2 trillion, and would be subjected to the proposed policy.

**Rationale for the policy**

**Transparency**

Ever since the inception of limited liability for corporations, there has been a concern that limit on liability, the pursuit of sectional interest (e.g. shareholder wealth maximisation) and high financial rewards for company directors can encourage practices that are detrimental to the welfare of society. In his analysis of early forms of limited liability, Adam Smith, considered to be the father of liberal economics, wrote:

> The directors of such companies, however, being the managers rather of other people’s money than of their own, it cannot well be expected that they should watch over it with the same anxious vigilance with which the partners in a private copartnery frequently watch over their own. Like the stewards of a rich man, they are apt to consider attention to small matters as not for their master’s...
honour, and very easily give themselves a dispensation from having it. Negligence and profusion, therefore, must always prevail, more or less, in the management of the affairs of such a company (Smith, 1776, pp. 606-607).

Indeed, since the dawn of modernity greater information and public accountability have been used as mechanisms for shedding light on dubious practices, fostering democratic governance and possibilities of greater citizen participation in public policymaking (Roberts, 1991). Such discourses have informed state policy and gradually greater transparency and public accountability have become established antidotes to anti-social practices of corporations and their managers. Frequently, in the aftermath of scandals, the state has required companies to publicly file financial statements and additional information (Littleton and Yamey, 1956; Edwards, 1989; Sikka et al., 1998). The constant redrawing of the boundaries between the public and the private spheres of information has sought to dilute the discretion of directors and enabled stakeholders to ask searching questions. The new policies often had to be imposed in the teeth of opposition from those who valued status-quo (Puxty et al., 1994), and arguably helped to restore confidence in capitalism by reassuring the people that capitalism is not corrupt; corporate management is accountable to the public and that the state is willing and able to enact measures to check abusive practices. Such logic applies not only to financial reporting but also to many other walks of life as businesses are required to display information about health and safety, hygiene and many other working practices.

The proposal for requiring companies to publicly file their tax returns is based on the logic of greater provision of information for the public. The public filing of tax returns seeks to empower citizens so that they can ask uncomfortable questions about the tax avoidance strategies used by companies. The availability of tax returns will also encourage critical media scrutiny, especially when companies report artificially low tax liabilities. This may alert resource strapped tax authorities to focus on selected companies. The mere availability of public information and possible public opprobrium might dissuade some companies and their directors from indulging in aggressive tax avoidance practices. The availability of tax returns will enhance citizen choices in that those unhappy about particular practices can show their concerns by boycotting corporate goods and services.

The additional filings are necessary because traditional financial statements do not provide information about how companies convert accounting profits to taxable profits, or how profits are shifted to low/no tax jurisdictions. Despite a plethora of accounting standards, companies can select methods which enable them to report high accounting profits but low profits for tax purposes without any explanation. Company accounts are often silent on tax avoidance strategies. Indeed, there is increasing divergence between accounting and taxation practices (Sikka, 2017) and conventional financial statements are often a poor guide to tax practices. Many of the accounting definitions of assets, liabilities, income and expenses are also unacceptable for tax purposes. Traditional financial statements assume that shareholders are owners of corporations and therefore emphasise income, including unrealised gains and seek to shareholders of the possible increase/decrease in their wealth. In contrast, taxes are levied on realised profits on behalf of society in accordance with specific laws rather than professional practices. Corporate taxation practices do not see an organisation through the shareholder lens, rather the corporation is seen as an entity and the taxes levied by the state seek to secure a portion of the value added by the company for the benefit of society as a whole. The recent adoption of country-by-country reporting, if it results in publicly available reports, may provide some information about taxes paid by companies in each country of their operations (Organisation for Economic Co-operation and Development, 2017) but it will
not show how accounting profits are converted to taxable profits or the avoidance strategies used to reduce tax liabilities. Therefore, the public filing of tax returns provides new or additional information.

**Competition**

The public filing of tax returns is also desirable from competition perspective. The tax returns would highlight the discrepancies between the tax advantages enjoyed by large and small and medium-size companies, often local/national businesses, and invite policymakers to respond to distortions of the markets.

For example, tax avoidance strategies give large multinational corporations such as Amazon, Microsoft, Starbucks, Apple and eBay opportunities to devise complex corporate structures and use tax havens, secrecy and opacity to shift profits, avoid corporate taxes and secure additional cash flows. In contrast, local/national businesses cannot easily indulge in the same practices. Many small businesses do not have the resources to hire accountants and lawyers to construct elaborate tax avoidance schemes. For example, Starbucks has used a variety of subsidiaries, affiliates and transfer pricing practices to shift profits to low/no tax jurisdictions to reduce its tax liabilities. Consequently, its contribution to the cost of providing and maintaining the local infrastructure is low (UK House of Commons Committee of Public Accounts, 2012). Local cafés and restaurants compete with Starbucks, but are not in a position to craft complex corporate structures, use tax havens, shift profits and avoid taxes, and are thus economically disadvantaged. Tax avoiding companies can unfairly undercut their normal competitors not necessarily because of some superior products and services, but because of the availability of additional cash flows secured through tax avoidance. They can outbid their normal competitors for goods and services and secure monopolistic control of the market. The additional cash flows enable large companies to indulge in mergers and takeovers to enhance their market dominance. Artificially high cash flows enable large companies to expend greater resources on advertising and influencing policymakers and opinion formers to secure favourable regulations. Tax avoiding companies make full use of social infrastructure to generate profits but avoid making the required contribution. Consequently, smaller and local businesses bear a higher proportion of the cost of providing the social infrastructure. The public filing of tax returns will help to highlight the competition discrepancies and generate pressures for reform.

**Risk management**

In capital markets, rational investors make assessments of future cash flows and risks to enable them to make investment decisions. However, the absence of tax returns and information about tax avoidance strategies obfuscates assessment of future cash flows and risks as investors are unable to distinguish between profits from normal sustainable activities and those arising from contestable tax avoidance practices. Nation states are increasingly resorting to litigation and penalties to secure tax compliance. The litigation and related uncertainty can last for years and secrecy around such events does not enable investors to make good assessments of future cash flows, returns and risks. The eventual settlements with the state also result in unfair wealth transfers. For example, companies may inflate their profits through tax avoidance strategies and pay higher returns to shareholders. However, some years later when as a result of litigation companies face repayments bills and penalties, the burden of this retribution falls on shareholders who did not benefit from the original inflated returns.

Sikka and Willmott (2010) provided a number of examples to show that tax authorities are increasingly taking a robust stance against companies engaged in tax avoidance. US tax authorities have targeted the transfer pricing and royalty payments of some of the largest
corporations, which include, Home Depot, Limited Brands Inc., Kmart Corp., Gap Inc., Sherwin-Williams Inc., Tyson Foods Inc., Circuit City Stores Inc., Stanley Works, Staples Inc., and Burger King Corp. They have sued oil companies such as Shell, Mobil Oil, Oxy USA, Chevron, Conoco, BP Amoco, Texaco, Pennzoil, UPRC, Sun Oil Company, Kerr-McGee, and Exxon for allegedly underpriced energy sales at below-market posted prices and thus recording low royalties, and eventually secured a settlement of $400 million. They have also demanded US$1 billion in back taxes plus interests and penalties from Symantec (maker of the Norton brand of antivirus and security software) for transfer pricing practices in connection with technology licensing agreements. Transfer pricing policies of GlaxoSmithKline, a global pharmaceutical company, have also been scrutinised by the US Government. The tax authorities claim that the rate the company charged for marketing services supplied by its US affiliate from 1989 to 1996 was far too low, and thus understated Glaxo’s US income and avoided around $5.2 billion of US taxes. After some 17 years of protracted litigation and negotiations, Glaxo settled the dispute by making a payment of US $3.1 billion.

Canadian tax authorities have scrutinised the 1980-1989 transfer pricing policies of SmithKline, particularly the prices relating to cimetidine, an active ingredient used in the manufacture of the drug Tagamet. The company purchased its key ingredient at $400 per kilogram from its offshore affiliates located in the Bahamas and Ireland. In the early 1980s, generic forms of the ingredient became available at prices ranging from $50 to $250 per kilogram and this reduced the market price of the drug. SmithKline continued to purchase the ingredients under the pre-existing agreement at $400 per kilogram, resulting in the reporting of lower profits and even losses in Canada. The tax authorities argued that the profits in Canada had been artificially deflated by the company’s transfer prices which ignored the open market prices. Following protracted litigation, a judge concluded that “If this company […] had been paying the international market price for supplies of this drug rather than a higher price to a related corporation [at a non-negotiated price], its operating profits then would have been almost three times as much […] One could readily speculate that the company would still have been in a profitable position had it decided not to purchase the more expensive drug from its sister subsidiary” (cited in McMechan, 2004).

In 2008, the company paid additional taxes of $51.5 million and also paid the tax authority’s legal costs of $3.2 million (Sawyers and Gill, 2015).

Similarly, the UK Government has questioned the transfer pricing policies and related royalty payments by IBM. The investigation centred on the claim that the UK part of the company had increased its royalty payments from 8 to 12 per cent of its income derived from the sale of products and services to IBM Corp, its loss-making American parent company. IBM is alleged to have paid £700 million to the UK tax authorities to settle the case (Sikka and Willmott, 2010).

It is not just nation states, but trading blocs are also taking action against companies for taxes avoided through special tax arrangements in some jurisdictions. In January 2018, the General Court of the EU, the EU’s second-highest court, ordered France (Reuters, 2018) to recover €1.37 billion in state aid, disguised as special tax concessions, from utility group EDF for matters going back to 2003. The European Commission has ordered Luxembourg
to recover €250 million for tax practices from 2003 onwards which enabled Amazon to pay artificially high rates of royalties to companies in low tax jurisdictions and thus reduce taxable profits in EU countries. The Commission said that:

Luxembourg gave illegal tax benefits to Amazon. As a result, almost three quarters of Amazon’s profits were not taxed. In other words, Amazon was allowed to pay four times less tax than other local companies subject to the same national tax rules (European Commission, 2017a).

In 2012, Luxembourg also gave selective tax advantages, i.e. not available to other companies, to Fiat and reduced the companies tax liabilities by €20–€30 million. Similarly, in 2008, the Netherlands gave selective tax advantages to Starbucks to enable the company to shift profits via royalty payments, and also purchase coffee beans from its Swiss affiliate at inflated prices. These practices reduced Starbucks’ tax bill by €20–€30 million. In October 2015, the European Commission ordered (European Commission, 2015b) the Luxembourg and the Dutch governments to collect €20–€30 million of back taxes.

By far the biggest tax settlement may arise from the ongoing litigation relating to state-aid provided by Ireland to Apple, a US technology company. Since 1991 Apple enjoyed special tax concessions from the government of Ireland (European Commission, 2016b). The concessions enabled Apple to create complex structures and record all sales in Ireland rather than in the countries where its products were sold. Through various intragroup transactions profits were effectively shifted to low/no tax jurisdictions even though Apple had virtually no staff or presence in those jurisdictions. The arrangements enabled Apple to avoid tax on almost all profits generated by sales in the EU. In August 2016, the EU concluded the tax arrangements amounted to illegal state-aid. Ireland was ordered to recover the illegal aid of €13 billion. Ireland resisted and in October 2017 the European Commission referred the matter to the European Court of Justice (European Commission, 2017b). In December 2017, it was announced that the Irish Government reached an agreement with Apple to start collecting the €13 billion (The Guardian, 2017) and transfer the money to an escrow account in the first-quarter of 2018, pending the outcome of the EU Commission’s referral of the matter to the European Court of Justice.

The above is a small part of the evidence which shows that litigation relating to tax avoidance can last for years and have material consequences for investor assessment of future cash flows and risks. Some of the uncertainties can be addressed by the public availability of corporate tax returns and related documentations. The information can enable investors to make a more informed assessment of future returns.

Enhancing public accountability

In principle, parliamentary committees can launch inquiries into tax avoidance but their efforts are thwarted because details of corporate tax computations are not known. On occasions, after taking legal advice, tax authorities are known to have reached compromises with corporations to reach settlement of disputes. Such settlements may give rise to new principles of taxation or dispute resolution, but they cannot easily be applied to other companies as the settlements remain secret. In the absence of tax computations and related details it is impossible for parliamentary committees to scrutinise the fairness of such settlements and make an informed assessment of the efficiency of tax authorities. The public availability of tax returns lifts the lid on secret settlements and partisan agreements, and will empower parliamentary committees to call corporations and government officials to account. The public filing of tax returns will enhance democratic accountability.

Google generated $18 billion revenue from its UK operations between 2006 and 2011, but paid UK corporation tax of only $16 million for the same period (UK House of Commons Committee of Public Accounts (2013b, p. 5). The Committee of Public Accounts inquired into
the low rate of taxation but was thwarted as it could not gain access to Google’s tax computation or related information. The Committee considered Google's replies to its questions to be “unconvincing” (p. 4). Google’s tax adviser, Ernst & Young, was also unwilling to share any information as matters relating to tax were considered to be confidential. Similar problems were encountered in the Committee’s questioning of the tax affairs of Starbucks, Shire, Amazon and others (BBC News, 2012) and securing any meaningful information from accountancy firms designing, marketing and implementing tax avoidance schemes (UK House of Commons Committee of Public Accounts (2015).

Following leaks by whistle blowers, an inquiry by the UK House of Commons Committee of Public Accounts (2011) examined special settlements between Vodafone, Goldman Sachs and HMRC. The tax authority confirmed that it had reached a special settlement, but despite repeated requests the chairman of HMRC sheltered behind taxpayer confidentiality and refused to provide any information about the settlement or the amount of taxes involved. The Committee concluded:

We have serious concerns about how the Department handled some cases involving large settlements, where governance arrangements were bypassed or overlooked until it was too late. In some cases the same officials negotiated and approved the settlements, which is clearly unacceptable […] The Department has made matters worse by trying to avoid scrutiny of these settlements and has consistently failed to give straight answers to our questions about specific cases, which has severely hampered our ability to hold it to account for the settlements reached […] The Department has insisted on keeping confidential the details of specific settlements with large companies, even where there have been legitimate concerns about the handling of cases (p. 3).

The Committee went on to add:

It is absurd that we have been forced to rely on information in the media to find out about cases that raise concerns, and of course we only know about cases on which information has been published in the media. The Department was not able to point to an absolute statutory bar on disclosure of information about specific cases. Its withholding of information is in fact a policy decision taken by Commissioners. This approach fails to give proper regard to HMRC’s duty to assist the Public Accounts Committee in examining whether or not the Department is giving best value for money. There is less justification for keeping tax information about large corporations confidential than information about individuals (p. 5).

In another hearing relating to special settlement with Google, the UK House of Commons Committee of Public Accounts (2016) concluded that:

The lack of transparency about tax settlements makes it impossible to judge whether HMRC has settled this case for the right amount of tax. Taxpayers’ legal right to confidentiality means that HMRC cannot explain how it has arrived at this or other settlements, or demonstrate that the rules have been applied correctly […] We are concerned that HMRC appears to have settled for less corporation tax from Google than other countries are willing to accept (p. 5).

Following the above examples, it is reasonable to say that the public availability of corporate tax returns and related information will strengthen public accountability and parliamentary scrutiny of corporate tax affairs, efficiency of tax authorities and ensuring that tax authorities treat all businesses equally. Neither corporations nor tax authorities will be able to shelter behind claims of confidentiality. Any special concessions offered to large companies will need to be offered to other businesses too, thus creating level playing field for all businesses. The proposed filings will check the discretion of civil servants, enhance the rule of law and strengthen public faith in the power of parliament.

Summary and discussion
This paper has sought to argue that the public filing of the tax returns of large companies, together with related information, will help to check tax avoidance. It will strengthen
parliamentary and public scrutiny of corporations and tax authorities. Increased transparency and public accountability would exert pressure on companies to clean up their practices. Public filing of the tax returns of large companies would also improve competition. Still, some opponents would raise the spectre of the cost of public filings, even though they are likely to be minuscule. Such opponents usually neglect the social costs associated with secrecy. In the absence of public filings, companies would continue to indulge in damaging tax avoidance practices and undermine public revenues which would either require citizens to pay higher taxes or forego hard-won social rights, neither of which is conducive to social welfare or long-term social stability.

Corporate elites frequently appeal to the discourse of privacy and confidentiality to obstruct enhanced disclosures and public accountability. For example, discourse of privacy has been unsuccessfully mobilised to oppose obligations for companies to file accounts, prepare consolidated accounts, reveal turnover, profits, audit reports, director remuneration, audit fees, non-audit fees paid to auditors, replacement costs of assets, provisions depreciation and bad debts and much more (Puxty et al., 1994). A key point here is that privacy is applicable to natural persons. A corporation is not a natural person. It a legal person and it only exists because of the policies of the state. A corporation is a creature of the state and on behalf of citizens the state has a democratic mandate and obligation to ensure that corporations operate in the public interest and be made accountable for their practices. That has been a cornerstone of public policy. From such a perspective, the state has imposed numerous obligations on companies (e.g. publish audited accounts, compliance with health and safety laws, equal pay, minimum wage, forbidding gender, age and racial discrimination, etc.). The requirement to file tax returns is part of the policies that seek to check unacceptable and anti-social practices. Some may argue that their international competitors could gain advantage from tax disclosures. However, such claims have little substance. There is no evidence to show that companies in the Bahamas, Jersey, Guernsey, Gibraltar, Bermuda, Belize or Anguilla have gained any competitive advantage because entities in other places publish financial statements. In any case, all large companies will be required to file tax returns. Besides, competitive advantage depends on product innovation, manufacturing processes and research and development, and the proposal here is not asking companies to share details of their scientific processes, secret formulas, details of sensitive products or research and development. For its survival, the state needs to check tax avoidance and the public filing of tax returns is a powerful policy option.

The policy proposed in the paper can be applied unilaterally by any state or a bloc of states (e.g. EU). During the June 2017 general election the manifesto of the UK Labour Party, the main opposition party, contained a “Tax Transparency and Enforcement Programme (http://labour.org.uk/wp-content/uploads/2017/10/Tax-transparency-programme.pdf)”. Amongst other things it pledged the following:

Public filing of large company tax returns. Labour will require all large companies to publicly file their tax returns and related documents at Companies House. This will not only inform the public of novel tax avoidance tactics used by companies but also empower parliamentary committees to ask searching questions of the companies and HMRC. Currently, it is all too easy for companies to avoid this as they hide behind the veil of confidentiality.

Labour Party did not win the UK general election, but contrary to the forecasts of various opinion polls secured a commendable 40 per cent share of the votes cast. The possibilities of checking tax avoidance through public filing of corporate tax returns may well have resonated with some people. Labour’s commitment to the policy was affirmed in a parliament debate on 14 November 2017 when its spokesperson stated that “Labour calls for […] the public filing of large company tax returns” (UK House of Commons Hansard, 2017).
Currently, nation states are considering a number of reforms to check corporate tax avoidance. These include a redesign of the way corporations are conceptualised and taxed (European Commission, 2015a, 2016a) and a piecemeal reform of selected anomalies (Organisation for Economic Co-operation and Development, 2015a, b). This paper has sought to extend policy options by appealing to notions of transparency, public accountability and fair competition and argue that the public availability of corporate tax returns can help to check tax avoidance. Hopefully, the policy of requiring large companies to file their tax returns will become part of the larger armoury in the fight against organised tax avoidance.

References


Further reading

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Towards a well-functioning stock market in context
Critically appreciating issues in interpreting efficient markets research and its regulatory implications
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Abstract
Purpose – The purpose of this paper is to summarise and reflect upon key issues at the interface of prices, information and regulation with a focus upon the stock market in context. Reflecting upon academic research in the area of efficient markets, and regulatory policy, the concern is to discern issues in terms of policy and support for policy. What does the research imply for policy? Is it possible that the research, perhaps given its rhetoric, can be misinterpreted in relation to policy? The study is also concerned to develop avenues for future research based on these considerations.
Design/methodology/approach – The paper is an analytical and critical review and writing.
Findings – The reading of the research suggests a pragmatic regulatory policy that should be concerned to improve stock market functioning, including with respect to information, as well as the context of which this is part. At the same time, the literature may be read as promoting anti-regulatory policy.
Practical implications – On the one hand, these are consistent with the pragmatic policy referred to above. On the other hand, further research is suggested to explore substantively the rhetoric of the research and its interpretation and to explore understandings of the research and its implications amongst key constituencies in practice.
Originality/value – The concern is to bring key insights from the academic literature together with a view to promoting a pragmatic policy orientation, while cautioning in a critical perspective about how this academic literature and research might be interpreted from a policy perspective.
Keywords Pricing, Policy, Regulation, Information, Market, Stock
Paper type Research paper

Introduction
In this paper, the concern is to critically reflect upon academic literature and research in the area of efficient markets and related regulatory policy. We consider what the literature and research imply for policy. We reflect upon whether the meaning of the research may be problematically read and inform problematic policy. We then aim to point to avenues for future research building upon our reflections.
We initially outline the meaning of efficient markets research by comparing and contrasting it with a naïve view expressed by an imaginary character on Wall Street. This concern to articulate the meaning reflects a probing of key texts. We next indicate how
research might be misinterpreted, given aspects of its rhetoric, in terms of its policy implications. In concluding, we reflect further on the implications of the research and point to avenues for future worthwhile research.

Appreciating efficient markets research in relation to policy

We might imagine, on a walk down Wall Street in New York City, a chance encounter with a somewhat wild-eyed man carrying a two-sided placard. As you walk towards him you see that the placard informs you in large letters: “Prices on the Stock Exchange are correct”! As you walk past you turn to read, on the placard’s other side: “No need to regulate them”!

What would those passing by (and also turning to look back) make of this? Perhaps some would be swayed by appearance to see man and messages as somewhat unreliable. But appearances can be deceptive. If such messages were delivered by a smartly dressed leader of an MBA class in Chicago, or by a SEC regulator in the USA, or even by a US judge, would they be seen differently?

Let us take the messages more seriously. What might they mean? Can they be considered valid or justifiable messages? In reflecting on these issues, we can give consideration to key issues of stock market pricing and regulation vis-à-vis the academic literature and policy discourse. We can aim to get a better appreciation of the latter literature and research and the policy implications.

Let us consider initially share price “correctness”. By “correct”, we might interpret our placard holder to mean that share prices on the NYSE reflect perfect foresight of the future. Actually, some presumptions of asset pricing models in abstract finance theory are consistent with such a proposition[1]. But these presumptions are unrealistic. In the real world, the proposition (especially unqualified) that share prices reflect perfect foresight, with all that it entails, given how difficult across the board it is to anticipate everything that can change things in future, would quite properly be dismissed out of hand.

But what might the placard holder more reasonably and realistically mean? One could conceive of prices being “correct” in that they reflect a reasonable interpretation of all the information available today (public and private). This kind of pricing (a best estimate of intrinsic or fundamental value based on all information available) might be seen as at the apex of possibilities in the real world if it is strictly a different (and more realistic) notion to that of prices reflecting perfect foresight.

A dominant strand of Modern Finance Theory, nearer to its purer economic-analytical form and still influential at the very least in the theoretical realm, sees security prices as being determined by a particular theoretical asset pricing model. Academics influenced by mainstream economics reasoning and a particular way of appreciating and measuring risk (which includes a recognition of the possibilities of portfolio diversification) is suggestive of a model by which share prices or the prices of shares invested in should be determined (at least following this main stream economic reasoning). Key to this asset pricing model is the notion of value as the discounted value of future cash flows – these being discounted at a discount rate reflecting the riskiness of the investment given appreciation of the value of portfolio diversification in the marketplace. While this model is somewhat unrealistic, it suggests real-world approximations and we can consider its character as helping to shape the meaning of reasonable in the reference to “reasonable interpretation” in the immediately preceding paragraph.

Tobin’s (1982) view or understanding of “fundamental value” reflects consistent economistic reasoning. It means a share price reflecting the “rational expectations” of the future payments to which the asset to be priced gives title, where those payments include resale value to third parties (see also Copeland and Weston, 1983; Malkiel, 1985).

A perspective claiming share prices to be correct (or accurate, a word more commonly used in the academic literature) might, then, begin to approach realism and reasonableness if it is suggesting that prices are “correct” in terms of something like the above asset pricing
model (to the extent that the model is itself reasonable). This implies a link to information. In the influential abstract theorising, information is somehow assumed to exist, whereas theorising that is a stage more realistic requires costly information to be somehow mobilised and reflected into the prices. Thus, the prices would be “correct” in terms of reflecting a reasonable interpretation of all the information we have today (i.e. at the time of the pricing) consistent with the pricing model[2]. Such pricing requires some active process that inputs information into prices which must be a continuous process in a dynamic context (where new price-sensitive information manifests). And somehow the decisions of the market actors have to be translated into prices that are “correct”/accurate.

Leaving aside for the moment, the desirability of such pricing from a social welfare perspective (and the desirability of moving towards it), we can consider how valid a view it is that prices actually are formed in this sense in practice. How could the proposition that prices are accurate be tested so that it might be given some validity (or otherwise)? One does not have to reflect on this question for too long before concluding that directly testing this proposition is fraught with difficulties (more especially if one is sceptical about the validity of the proposition in the first place – as one properly should be) (see McGoun, 1990). The “information we have today” – all of the public and the private information that is there – is not easy to grasp, more especially given a private realm that values confidentiality/secrecy (Gallhofer and Haslam, 2007). In practice, how is the relevant information content to be assembled? How is this content to be translated into the relevant forecasts of future cash flows? How could the riskiness of these cash flows and in the context of diversification possibilities be determined (and without reference to the actual market prices we are seeking to assess)? And these issues would arise even assuming there are no controversies concerning the asset pricing model itself (e.g. concerning how it measures risk – which has actually been a particularly controversial matter)[3]. Given how difficult the proposition is to test, it is near impossible to be confident about the validity of any stated view that share prices are “correct” in the sense deemed more reasonable above. And as we shall return to later, tests of accuracy in practice are not direct tests but are tests of derived and corollary propositions.

But even as part of an abstract theory (i.e. leaving aside the questions of “testing”), “correctness”/accuracy here strictly implies something unrealistic in at least a pure form, namely the instantaneous translation of any new information into prices[4]. We need to allow into the theory (as many have now done, e.g. Diamond and Verrecchia, 1981; Ippoliti, 1989; Elton et al., 1993; Gordon and Kornhauser, 1985) that information is both costly and has to be actually translated into prices. Regarding this process of translation, in the absence of a public official charged with the task (which would obviously itself not be costless), what would be the motivation for anyone to be active and input the (costly) information? Presumably, the motivation is to trade on the anticipated adjustment and to make a return. With competition to make this return, the average return would tend to fall to one just enough to keep active investors in the market. It is possible to imagine a market of substantively two classes of investors, one that is active and that (in competitive conditions) tends on average to make a “normal” profit from trading and one that just accepts the price (and makes normal returns consistent with an investment strategy based on such an acceptance) (see Copeland and Weston, 1983). But everyone just accepting or taking prices would not make sense – except in the sense and case of a temporary price equilibrium that all happen to agree upon until new information, and information-arbitrage opportunities, come along – how do prices then reflect new information that comes along? These points indicate the impossibility of a pure “correctness” in the above terms even at an abstract theoretical level (once the more realistic assumptions are incorporated), as Stiglitz and others have recognised (see, for instance, Lorie and Hamilton, 1973; Grossman and Stiglitz, 1980; Sorensen, 1983; Wang, 1986; Stigliz, 2000, 2001; McGoun, 1990). And it is the case in the real-world context that significant sums are spent on investment research (see Stanley et al., 1980, for an early appreciation of this).
In respect of the point about the impossibility of pure form “correctness”, one might argue, however, not unreasonably that as seen here it would be a too fussy or demanding normative (or prescriptive) criterion. It is possible to imagine very speedy price adjustments — in the “correct” direction — if not literally instantaneous ones (see McGoun, 1990). The proposition that all prices are “correct”/accurate is too strong on theoretical/analytical grounds. But, theoretically, prices could be at least pretty close to being accurate at any moment in time, or such closeness (in the absence of further new information) would pretty soon manifest.

Let us return, then, to the issue of testing. How are tests on the “correctness”/accuracy (or near “correctness”) proposition actually done in the research literature? Attempts to provide evidence by focusing upon share price volatility and related phenomena (as in the work of Shiller) are acknowledged as approximate (see, e.g. Grossman and Shiller, 1981; Shiller, 1981a, b, 2005, 2014; Shiller et al., 1984; Mankiw et al., 1985). The results of these tests, which focus on properties that ought to follow from the assumption of “efficiency”, and which translate that assumption in the first place for practical purposes are difficult to interpret. Issues include the significance of excluded data, the link between dividend policies and underlying economic realities and presumptions about model validity. Results of these tests are in these ways inconclusive, although they tend to indicate (and have been interpreted as indicating) that share prices have not tended to be accurate (see LeRoy and Porter, 1979; Grossman and Shiller, 1981; Shiller, 1981a, b, 2005, 2014; Shiller et al., 1984; De Bondt and Thaler, 1985; for debate see LeRoy and Porter, 1984; Kleidon, 1986; Marsh and Merton, 1986; MacKinlay, 1995; Fama and French, 1996). The finding, reflecting or consistent with the intuitive position elaborated in Arrow (1982), is consistent with Keynes (1936), who argued that share prices are not only determined by economic fundamentals (see Ackley, 1983; Kosmicke, 1984).

In more recent times, behavioural finance research, emphasising the importance of investor psychology in asset pricing (as Shiller does, see also Hirshleifer, 2001), tends to confirm such a proposition (see Barberis and Thaler, 2003; Shiller, 2003, 2005, 2014; see Fox, 2009). Black (1986) articulates a sense of how far prices might depart from the fundamental value at a given time and suggests quite a wide range around the fundamental value. In more recent times, there has been a view that fundamental value might predict long-term stock price with an acknowledgement that short-term stock price can fluctuate — together with an acknowledgement that it is extremely difficult to prove (or indeed to disprove) such propositions. Many see crashes (such as the 1987 crash, the internet/technology bubble collapse of 1999-2000 and the global financial crisis of 2008) as ex post evidence of mispricing, although not everyone is convinced of this (see, for consideration of various views, Langervoorst, 1992; Ball, 1989, 2009; Siegel, 2009a, b; Shiller, 2014).

Approaches that more indirectly test the correctness proposition by testing corollary propositions thereto (in spite of Samuelson’s warnings about corollary views, see Samuelson, 1965) are more typically advocated and carried out. The most significant corollary proposition is that with respect to the information — and thus by (further) implication any sub-set thereof — it is not possible for anyone to consistently make abnormal returns (returns in excess of the normal), or at least that the “average” person (or investor force) in the marketplace does not consistently make abnormal returns from trading on the information (with the non-average being chance outliers or reflecting a combination of extraordinary skill and speed).

In relation to testing, Wang (1986), following Tobin (1982), makes a distinction between “fundamental-valuation” efficiency (tested albeit, as suggested above, with issues by Shiller and others) and “information-arbitrage” efficiency, a distinction that is rarely highlighted explicitly by researchers. Most research is done on information-arbitrage efficiency (testing is relatively easier) in spite of it being the case that a market might be information-arbitrage efficient but not fundamental-valuation efficient — and the latter being, on the face of it, the more important phenomenon (Summers, 1986; Wang, 1986; see Black, 1986; Shleifer and Summers, 1990; Thaler, 1999). Unsurprisingly, given the difficulty of grasping
the total information set, which includes private information, most tests are done on publicly available information or a sub-set thereof (this argumentation being dependent upon understanding the information set tested in the weak-form tests as a sub-set of publicly available information). We might note here that, where tests are carried out on the rewards to inside information (and already there is a focus here on a particular type of information, rather than anything like the total information set), results have often tended to be particularly inconclusive or to point to inefficiency (Wang, 1986) (Wang, 1986, p. 343 notes that some tests of the strong form – arguably misleading further – have been particularly restrictive in defining the information set, including information that might more reasonably be considered as publicly available[5]).

Fama comes to distinguish between three types of information set: the total information set (which includes private/insider information); publicly available information, i.e. excluding private information (the publicly available information including various types thereof apart from the type referred to immediately next here); and, information in the past prices themselves (this being a particular type of publicly available information – information in trends and past movements of share prices – not included in the immediately aforementioned types) (Fama, 1965, 1970, 1976). These three information sets are associated with strong form, semi-strong form and weak-form tests, respectively.

In these tests, one can point to various issues, including (as Summers, 1986, noted) statistical or econometric issues (e.g. related to sample size), the appropriateness of the model used to determine normal returns and in particular to measure risk – and, following Roll (1977), one must recognise that tests of “informational efficiency” (see below) are always joint tests of the pricing model (see also, Jensen, 1972; Lo and MacKinlay, 1990); further, the models used in testing have moved away from consistency with economic reasoning, see Copeland and Weston, 1983; Fama and French, 1996) – quality of data concerns and the quality of estimates of trading costs made (where it is necessary to estimate them) – trading costs being a real-world feature (see Ball, 1989). Hines (1988) suggests that if researchers want to evidence support for hypotheses in this area they may well be able to do so (see also Lowe et al., 1983; Williams, 1989; McGoun, 1992; Reiter, 1997; Reiter and Williams, 2000). One can perhaps all too easily blame results indicating a lack of efficiency on things such as the model or poor estimates of transactions costs. Usage of the word proof in relation to what is tested by these tests would be very suspect from any reasonable philosophy of method (and, further, findings of a particular time and place may not in any case apply to another time and place). Most (if far from all) of the semi-strong form and weak-form tests have tended to conclude that the information sets focussed upon in these tests do not allow investors (or the average investor) to consistently make abnormal returns from trading upon these information sets (once trading costs are taken into account). And there have been improvements in respect of some of the issues in testing that are referred to above over time (although this context has also seen the rise in behavioural finance, see Kahneman and Tversky, 1979; Tversky and Kahneman, 1986; Shleifer and Vishny, 1997; Barberis and Thaler, 2003; Shiller, 2003, 2005[6]). But what do these findings really mean?

Towards a well-functioning stock market

Towards an appreciation of how efficient markets research might be misread in relation to regulation

The tests discussed here are often articulated as tests of the “efficient market hypothesis” (EMH) (it being at least suspicious that in these terms – there is no reference to information – the hypothesis suggests that much more is at stake, i.e. the “efficiency” of markets in general, than what is actually involved in the hypothesis and then tested). Hence, there are tests of the weak-form, semi-strong and strong form versions of the EMH. The usage or choice of the word efficient here is worth reflecting upon. In the EMH, efficiency is understood positively. There are some who might see efficiency always in positive terms. Who could doubt
something that is efficient? Hopwood (1984) elaborates upon the usage of the word efficiency in relation to public sector discourse and makes this kind of point (see Macey and Miller, 1990). Others might draw from the organisational effectiveness literature (see, for instance, Wilson and Chua, 1983 for a summary account) to point out that you could be very efficient at doing the wrong thing (since efficiency is simply a relationship between inputs and outputs). With the EMH, it is possible that support for it may point to something good in social welfare terms: for instance, it may be part of a more holistic set of findings uncovering information-arbitrage efficiency, fundamental-valuation efficiency, economic efficiency and social welfare (or social well-being). But it is also possible, for instance, at nearer to the other end of the scale, that it indicates only that it is difficult to consistently make abnormal profits from trading in securities that are priced by what are actually very irrational processes yielding prices that are poorly related to economic reality and somewhat dysfunctional from a social welfare perspective (see Bozeman, 2002; cf. Bator, 1958; Stout, 1988; Dow and Gorton, 1997).

Declarations that the EMH (in whatever form) is supported have often been, it is reasonable to argue, made with something of a rhetorical flourish. It appears to be the case that the finding of support is seen as the finding of support for a good thing. This good thing has sometimes been articulated, even explicitly, as suggesting that prices on the stock market do reflect fundamental (or intrinsic) value (or at least are very quickly corrected to this value where they depart therefrom) (see Fama, 1965, 1970, 1976; Malkiel, 2003; Schuster, 2006). Moreover, including in finance textbooks, the case for support has often tended to be overstated, while the case for doubt has been understated, even heavily suppressed. This is the sort of usage of language that writers like McCloskey (1981, 1985) and Klammer (1985, 1987) analyse and highlight (see Simons, 1990; Fischer and Forester, 1993; see also Ball, 1992; Thaler, 1999; Mackenzie, 2006; cf. Alback, 1995). It appears to be the case, then, that not only is the finding of support seen as the finding of support for a good thing but that the very finding of support is seen as a good thing too (see Tinker et al., 1982; Hines, 1988; Shubik, 1988; Tinker, 1988; Williams, 1989; Langervoorst, 1992; McGoun, 1995; Reiter, 1997; Gallhofer et al., 2001; Mackenzie, 2006; Frankfurter, 2007; Thomas Goodnight and Green, 2010; Chabrak, 2012).

We have cast doubt on the finding of support. But even if there were no issues such as the statistical issues, the weak-form and semi-strong tests (and indeed in practice, as we have suggested, the strong form tests) while not without meaning (and worthwhile doing) are somewhat partial and limited. Take the weak-form tests – it would be surprising in a competitive market if it was possible (for anyone) to consistently make abnormal profits from what amount to forms of technical analysis based on very particular information sets (assuming that the strategies investigated are easily operationalized[7]). So, the surprising thing here are the “anomalies” as they are often called (the language again has a problematic rhetorical aspect) where the EMH is not so well supported. It would be stretching things considerably to argue on the basis of such findings that the proposition that market prices are “correct” or reasonably close thereto (a proposition that could be considered as underlying the corollary hypothesis tested) was substantiated. The tests, more generally (outwith, in principle, tests of the strong form hypothesis – but in practice those tests also are more indirect tests or tests of corollary propositions), do not suggest (even where findings are very supportive of the EMH) that you cannot improve pricing by having better information input into prices (Whittington, 1987, 1993) – a point that has come to be widely acknowledged (indeed, Ball, 2009, indicates that beyond the strong fundamental value efficiency positions, efficient markets research does point to the importance of adequate public disclosure; see Fox, 2004, for a more expansive elaboration[8]). While the weak-form tests provide a good case to illustrate these points, they apply (to a significant, even if lesser, degree) in the case of the other tests.

Yet maybe the rhetorical flourish could mislead. Maybe it is meant to or it all too easily fits with and bolsters the hegemonic discourse (see Hines, 1988). And here we should note that promotions of the EMH (as a validated hypothesis) have been linked to promotions of a
neoliberal project that not only stresses how well markets (in general) work but that point to the case for taking the State out of the economy as much as possible (see Arnold, 2009). Here, we can consider the other side of the placard. The expression indicating that there is no need to regulate the prices might be considered as capturing the neoliberal view as we have characterised it[9].

Interpreting regulatory implications. Let us first note that the view seems to at least threaten to ignore the pervasive nature of regulation. In socio-economic theory, forces of the state and the market (as well as other things that might be called the “community”, including e.g. civil society) interact together to “regulate”. Polanyi’s (1994) analysis indicates how state regulatory infrastructure is required for a well-functioning marketplace (see Shubik, 1988; Kay, 2003; cf. North, 1991). Actually, Friedman (1962) acknowledges the point about the need for some basic infrastructure for markets to function. Polanyi (1994) traces out how the constructing of the market system in Britain was accompanied with a massive extension of the state regulatory infrastructure. The general point of relevance here is that there has never been a market system in history functioning without at least basic legal and regulatory support. In this sense, at the very least, the view that there is no need to regulate markets is an eccentric one indeed. Perhaps our placard holder is suggesting that there is no need to further regulate markets in a particular way or he is opposing a particular regulation that might have been proposed. But we have seen that the results of actual tests on the EMH do not provide very strong evidence against the view that pricing could be improved by some sort of state-like regulation, e.g. intervention for better quality (including more informative) information (and this has been taken up by a current in the literature that has had some impact on policy, see Coffee, 1984). And rhetorically such statements as those of the placard holder might encourage deregulatory programmes: ironically perhaps, since any “correctness” in prices may be linked to existing regulations.

There have been a number of suggestions that an anti-regulatory drive combined with a neo-classical economics reasoning in the accounting realm (around the construct “fair value”, see Zhang and Andrew, 2014; Cooper, 2015) is and actually was contributory to financial crisis (see Boyer, 2007; Cooper, 2008; Shiller, 2008, 2012, 2013; Arnold, 2009; Fox, 2009; Soros, 2009; Akerlof and Shiller, 2010; Baker, 2010; Hoarau, 2014; Cooper, 2015; cf. the different views in Siegel, 2009b; it is interesting to read Merino and Neimark, 1982, for historical perspective here[10]. Baker (2010) elaborates on an “intellectual capture” of regulation in the banking sphere, suggesting that the EMH strongly shaped the BASEL II accord and regulatory orientation more generally (including the G7’s round of meetings between finance ministers and central bank governors) – although captures of banking regulation more generally have a long history (see Calomiris and Haber, 2014). Reflecting on the 2008 crisis, Crotty (2009, p. 577) argues that: “Efficient financial theory must be replaced as the guide to policy making by the more realistic theories associated with Keynes and Minsky […] most elected officials responsible for overseeing US financial markets have been strongly influenced by efficient markets ideology[11].” Fox (2009) suggests that the EMH spawned overconfidence in markets and paved the way for deregulation and laissez-faire policy.

Readings of EMH research as suggesting that prices are in effect near “correct” in fundamental value terms (there is rarely a distinction between information-arbitrage and fundamental-valuation efficiency) have impacted – including in the realm of information-related matters – upon policy discourse, policy and legal deliberation (see, e.g. Saari, 1977; Kripke, 1979; Barry, 1981; Fischel, 1982; Pickholz and Horaham, 1982; Easterbrook and Fischel, 1984; Wolfson, 1984; Schulte, 1985; Seligman, 1985; see the elaboration in Wang, 1986; see Langervoort, 1992). This is in spite of one commentator on legal theory suggesting that the “efficiency” of the market scarcely mattered to the law (Levmore, 1984). Sometime before the 2008 financial crisis, Gilson and Kraakman (1984) argued that the EMH had become the context in which policy discussion
concerning the securities markets takes place. Here, we must acknowledge substantively two key currents of regulatory implications. Along with the generic ideological tendency against state and quasi-state regulation, there is, drawing especially upon the semi-strong test results, the perspective that it is important to buttress the quality of public information and disclosure. Yet, as we return to below, policy in respect to information has nevertheless been weak in practice, while only focusing on information may be considered not enough.

A more holistic as well as economistic view. In any case, is it a good thing for prices to be “correct” in the sense considered? Fundamental value pricing is only one aspect of what is relevant from a holistic perspective. So, one might argue in response to this question that it all depends. Prices on the stock market might be “correct” (or fair, as Fama put it) but the producers of goods and services in the marketplace might operate in conditions of oligopolistic or monopolistic competition. This means you cannot conclude on the basis of one well-functioning and competitive market that all markets are equally well-functioning and competitive (see Bator, 1958; Bozeman, 2002; cf. Stout, 1988). But, further, let us consider the implications of the analysis of Lipsey and Lancaster (1956). They argue that where a market is characterised by imperfections in more than one dimension, just improving one of the dimensions has unclear or ambivalent consequences. Thus, improving the “correctness” of prices in the stock market could even be negative in terms of the overall impact on economic welfare (see Laughlin and Puzyt, 1983; Gallhofer and Haslam, 2007; cf. Ng, 1975; Jacklin and Bhattacharya, 1988; Dranove et al., 2003). For instance, consistent with Cournot (see Touffut, 2007), more openness might allow oligopolies and monopolies to more easily collude over pricing. Further, given that confidentiality/secrecy adds to the profitability of research and development, too much openness or transparency about that might reduce the effective motivation to invest in research and development activity, consistent with Arrow’s reflections (see Arrow, 1984, 1996; see Hirshleifer, 1971). By implication, reversing the logic, if prices are “correct” on the stock market, perhaps it would be better if they were not (in the sense of not reflecting everything of the information, given what that would imply for other dimensions of the economy) (see also considerations such as those discussed by Levin, 2001, drawing on Akerlof, 1970).

Beyond the conventional economics focus. Beyond mainstream economics, one could clearly envisage situations where in social and environmental terms we have serious problems even where the stock market prices were near “correct” and markets generally were well-functioning (see Cooper and Sherer, 1984; Tinker, 1984; Reiter, 1988; Gray, 2002; Frankfurter, 2006). So, again, this accuracy would need to be supported by a wider regulatory policy attending to social and environmental dimensions if social welfare or well-being is to be properly attended to (see Frankfurter, 2006).

Concluding comments
A review of key aspects of the literature on information, pricing, social well-being and regulation suggests a pragmatic policy. More meaningful notions of efficient markets (with respect to information) are extremely difficult to validate in practice (they are difficult to refute with evidence too, given all the things that can be blamed when ostensible refutation manifests – and basically given the difficulty of testing). Rhetoric, with a scientific reference, is fashioned in relation to prevailing hegemony. It is important to interpret empirical work cautiously and with a great suspicion of the language in which it is framed. Not being able as a midstream investor to consistently make abnormal profit from various strategies using information available (public and/or private) does not necessarily mean prices are very close to fundamental value (no strong argument against improving regulation is entailed by the former finding). If prices were near “correct” in the fundamental value terms articulated then if we could isolate the stock market from everything else that would suggest that the particular regulatory mix (State-market-other) was working ok (it would not suggest that we can do without any regulation). But we cannot
isolate the stock market in this way. Although analytical reasoning is suggestive of the positive potentialities of markets, well-functioning stock markets do not imply that other markets function well and do not imply that other aspects of the context function well. The impacts on social well-being of the stock market are dependent on the character of other markets and more generally on the social and environmental context. A regulator concerned about well-being is concerned about improvement in all these dimensions, which can be so difficult to achieve in practice (and things may well vary between contexts – countries and cultures for instance – while there are also similarities and contexts may learn from each other). If seeking to improve things is not costless, from the evidence and contextual analysis, it would be somewhat wild to conclude against trying to improve stock market regulation, including with respect to information, as well as trying to improve other contextual dimensions. We have suggested the case for pragmatic regulation. This includes being concerned to intervene to improve the quality of information. It also includes being concerned to intervene to improve the wider economic, social and environmental context. Detailed suggestions in the financial regulatory sphere can be found in the literature (see, for instance, Crotty, 2009; Crotty and Epstein, 2009; Baker, 2010; see Frankfurter, 2006, 2007; Thaler and Cunstein, 2009; Shiller, 2012). Here we have given emphasis to taking (more) seriously the need to improve information and as a regulatory device in relation to pricing[12]. It cannot be currently argued that enough is done currently in relation to the quality of information. For instance, to give just one idea, in the sphere of stock market pricing the case for the monitoring of prices through a kind of audit function, while not straightforward, could be a corrective to “irrational exuberance” (notwithstanding that this may clearly not be a perfect process)[13]. A pragmatic concern to progress well-being should be suspicious of approaches suggesting that there is nothing else to do except leave things to markets, particular or general, even while valuing the positive actualities and possibilities thereof. In our current context, many see at least the positive potential of quality pricing in terms of an allocative function (see Coffee, 1984). And the phenomenon of stock market crashes (which can be exacerbated in the combination of modern trading with fraud and market manipulation, see Easley et al., 2011), which most see as at least ex post evidence of manifestations of poor quality pricing, is for many linked to very negative outcomes. Even given some doubt about pricing in this context, a regulator concerned about social well-being should seek to do something to intervene. The issue then would be to do so at some reasonable level of cost. In our view, our reflections are suggestive of avenues for future research. For instance, building upon the work done on problematic rhetoric including very detailed analysis of key texts is here suggested. And exploring the understandings and interpretations of efficient markets research by key constituencies throughout the world, including in developed as well as emerging markets, would be useful research.

Notes
1. And some attempts to test fundamental or intrinsic value “efficiency” – which struggle at a macro level (and at a more micro level focused on laboratory-type experiments with individual decision-makers) to grasp directly the relevant empirics – go back in time and relate past prices/movements therein to subsequent and actual dividends, e.g. in some variance-bounds studies, referring to the construct “perfect foresight” in this context (see Shiller, 2014) (later in the text we shall see that Shiller supports argumentation that the prices actually reflect behavioural factors and investor psychology).
2. It should be pointed out that the word “correct” is used in some academic texts in effect with this meaning, although in most texts the word “accurate” is used.
3. It is not here denied that (descriptive) theoretical models are always approximations of the real world. Nevertheless, there may be different levels of abstraction that potentially impact (see Hines, 1988).
4. Fundamental valuation efficiency at a given moment logically implies informational efficiency (see later in the text).

5. One distinction here is between pre- and post-analysed information. The analysis of information may improve its quality. But both may be seen as being in the same category of information, e.g. as publicly available information in the case where the pre-analysed information is publicly available.

6. Earlier studies especially tended to find support. Over time there has accumulated more evidence against efficiency (e.g. post-earnings drift, short term momentum, long-term price reversals, day of the week effect). Some of these later studies have suggested behavioural bias.

7. Here we should note that there are clearly far too many strategies to test of course and some of them are mathematically very complex. One of the authors recalls knowing a self-proclaimed technical analyst (or “chartist”) and inviting him to give a lecture on a module he was running at the London School of Economics. His lecture did not of course give away his particular method. He was then coming towards the end of his career and had been employed by a city firm for many years as their resident technical analyst. He was, it appears, successful enough to keep his position but not knowing his method it is difficult to comment further. The explanation of finance theory for successful and widely replicable technical analysis would be chance.

8. If publicly available information is being reflected in prices speedily then providing better information could improve pricing.

9. This paragraph is pointing to a rhetorical current that had influence. It is de-emphasising potential regulatory implications of the efficient markets research (more particularly the semi-strong form) – implications, particularly for bettering information disclosure, that some have stressed. Nevertheless, consistent with our discussion here and the work we have drawn upon, we are reasonable in pointing to the influence at this same time of this rhetorical current, which was promoting market functioning over state and quasi-state regulation. Note that the authors are not here seeking to get rid of market processes (and see, in this regard, Rodrik, 2017).

10. It might be argued that the IASB’s promotion of fair value has only marginally impacted actual accounting practice (although some of the works cited suggest that in some cases the impacts are more significant). But it may have its impacts through the changed philosophical perspective supporting it and consequently how accounting comes to be seen.

11. On Minsky, see Prychitko (2009).

12. A focus on information/pricing is of course not enough. Regulators should have questioned the high returns consistently earned by some large financial institutions. The regulators could have looked more closely at the leverage and risk-taking positions of Lehman brothers. Another weakness of the EMH hinted at above is its silence about the return distributions and how they evolve over time. There is considerable evidence that risk is non-stationary. This is another reason for regulators to control risk, especially the extreme event. In the wider discourse of economics there is of course substantial discussion on state and quasi-state regulation (see Buchanan and Vanberg, 1988; Stiglitz, 1989; Besley, 1994) and we should acknowledge that some fear state regulation in relation to market failings as making things worse (see discussion in Datta-Chaudhuri, 1990; Acemoglu and Verdier, 2000). While, on the latter, there is a Panglossian hue (see Tinker, 1988) and a problematic (and selective) lack of trust, such views indicate the need for a pragmatic balance.

13. One of the authors recalls raising the possibilities of the same to David Tweedie, then Chair of the IASB. Tweedie was, it appeared to this author, positive about this possibility as an idea that should be explored in the future. It is an idea that is consistent with distrusting markets in practice in order to realise better the benefits of their functioning.

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Towards a well-functioning stock market


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Further reading


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Comprehensive evaluation of the financial performance for intermediary institutions based on multi-criteria decision making method

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Abstract
Purpose – The purpose of this paper is to assess the financial performance of the intermediary institutions that have operated in the Turkish capital markets taking the issue of bank-origin and non-bank-origin institutions into account.
Design/methodology/approach – Financial performance of the intermediary institutions has been measured by the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method between the years 2005 and 2016. In order to implement the TOPSIS method, the relative importance of financial performance indicators has been determined by Entropy, survey results and considering equal weights approaches.
Findings – Empirical findings indicate that the average performances of continuously operating intermediary institutions during the concerned period are above the average performance levels of all intermediaries. Additionally, the average rank of bank-origin intermediary institutions have been found higher than the non-bank origins for all years. This reveals that the average financial performance of the bank-origin intermediary institutions is higher than the average score of non-bank origins during the related years.
Originality/value – This study is unique in terms of evaluating the performance of intermediary institutions in Turkish capital markets with a comprehensive framework. Determining the relative importance of financial performance indicators according to entropy, survey results and equal-weight approaches and revealing the average financial performance ranking methodology for bank-origin and non-bank-origin intermediary institutions have added value.
Keywords Survey, Financial performance, TOPSIS, Entropy, Capital markets, Intermediary institutions
Paper type Research paper

1. Introduction and literature
Financial intermediaries play a crucial and sensitive role in securities market as well as in the economy. Levine (1997) stated that the financial functions of these intermediaries are as follows: mobilizing savings, allocating resources, exerting corporate control, facilitating risk
management and easing trading of goods and services. Moreover, Levine et al. (2000) revealed that the exogenous component of financial intermediary development has been positively associated with economic growth.

The overall size of the financial intermediaries, the conduction level of commercial banking institutions with the intermediation and the extent to which financial institutions transfer credit to private sector activities provide information about financial intermediary development (Levine et al., 2000). Diamond (1984) emphasized that financial intermediaries also have another crucial role in reducing the information asymmetries that lead to adverse selection problems. Rising economic development in countries has spawned the need for investment and capital, and this has led to a growth in supply and demand of intermediary institutions in financial markets (Aras and Muslimov, 2003).

Exploring the performance of financial institutions has been so significant, since the well-performing financial institutions ensure a fundamental guarantee of healthy growth of the real sector. At the beginning of the 2008 global financial crisis, financial institutions and managers, who are the main actors of the system, have to take excessive risks by acting with short-term financial targets. This fact has led to a large financial cost that the entire economy has to undergo (Aras and Yobaş, 2013). In the financial system, which is based on trust, the decrease of trust also negatively affects the functioning of the financial intermediation system (Aras, 2018). Effective corporate governance practices are an indispensable element in increasing the robustness of the financial intermediation system and reducing financial risk, which is a major step in the proper functioning of the financial markets and the economy as a whole (Aras and Crowther, 2013).

There are several decision making methods and tools that are available to measure performance ranks of intermediary institutions. Tunay and Akhisar (2015) evaluated the financial performance of private banks according to their Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) scores during the years 2009 and 2013. They have found that the higher the capital adequacy ratio, the higher the level of protection available to depositors. Başç (2016) studied the financial performance and ranked Turkish private banks using AHP and TOPSIS, taking into account their branch capability. He reveals that there are some way to reduce branch cost.

For Turkish intermediary firms, the number of studies are very limited. Okay and Köse (2015) evaluated the financial performance of five listed brokerage companies according to ten financial ratios using TOPSIS between the years 2011 and 2014. They determined that the fluctuation of profitability ratios, in particular, had an impact on financial performance in the related years. Moreover, Günay and Kaya (2017) also studied five brokerage houses for 2014 and 2015 using 11 financial ratios. They compared the financial performance of the listed firms using ELECTRE, ORESTE and TOPSIS methods. For 2014, they found similar ranking for all the models for the related firms and notated that for 2015, they have different rankings.

After giving the significance of this sector for financial markets and providing literature review, the following section contains the current status of intermediary institutions in Turkey. The third section discusses the methodology of TOPSIS, which was used to determine the financial performance of these institutions. That section also includes the data set used for the study, the steps taken in the analysis, and the final research findings. The conclusion of the study contains the significance of the findings for the Turkish intermediary institutions.

2. Financial intermediaries in Turkey

Intermediary Institutions have an essential role in financial markets with the effective transfer of funds needed in these markets to those demanding these funds, particularly through securitizations. Therefore, it is vital for examining the performance of the institutions and assess their performance with the development of Turkish capital markets.
Turkish Capital Markets Board’s (CMB) Communiqué, Number 46 is the main regulation regarding the establishment and activities of intermediary institutions. Financial intermediaries have to be required to obtain a license from the CMB in order to be able to offer services. CMB also determines minimum requirements for application and examines each application in detail before issuing a license. According to the communiqué, intermediary institutions licenses are listed as securities trading, public offering, portfolio management, investment consultancy, repo/reverse repo agreements, margin trading, derivatives trading and securities lending and short-selling. Capital Market Law describes investment firms as banks and intermediary institutions. While intermediary institutions can operate in the equity, fixed income and derivatives markets, and in leveraged transactions, banks are prohibited to operate in the equity market directly and cannot engage in equity-linked derivatives or leveraged transactions.

Turkish Capital Markets Association (TCMA) is a self-regulatory organization that sets professional rules and monitors the members to provide a fair and orderly capital market. Financial intermediaries, banks that are authorized for capital market operations, asset management companies and investment trusts, should become members of the TCMA (Turkish Capital Markets Association, 2018).

In channelizing funds from savers to investors, intermediary institutions play a significant role. At the end of 2016, 71 brokerage firms were registered in the industry. CMB has defined the intermediary institutions that have 50 percent of their shares or up owned by a bank, either directly or indirectly as bank origin and other intermediary institutions as non-bank origin (TCMA, 2018 Report, p. 83). As at the end of 2016, there were 29 bank-origin and 42 non-bank-origin intermediary institutions in operation.

Table I gives the total number of Turkish intermediary institutions in terms of private, public and bank origin and non-bank origin during the years 2005 and 2016. After 2013, there has been a decreasing trend in the number of institutions.

Table II gives the fundamental financials of Turkish intermediary institutions. At the end of 2016, total assets were increased by 38.31 percent and reached approximately 21 billion TL. This increase was heavily depended on the increase in the current assets (41.20 percent). Intermediary institutions had almost 17 billion total liabilities and short-term financial liabilities made up 16 billion TL of this amount, while 412 million TL belonged to long-term liabilities as of 2016.

Related table also exhibits that intermediary institutions generated 164 billion revenue with a decrease of 11.29 percent at the end of 2016. Furthermore, net profit of those institutions increased by 12 percent and reached 483 million TL, and 75 million TL of this sum was generated by firms trading mainly in the foreign exchange market.

There is no doubt that specifically for emerging countries, the growth of the capital market depends upon the active role of market intermediaries. During the last decade, there have been substantial regulatory, structural, institutional and operational changes in Turkish securities market.

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</table>

Source: Aras et al. (2018a)
3. Methodology

3.1 Data, sample and analysis process

The main objective of the research is to assess the performance of the intermediary institutions that have operated in the Turkish capital markets between the years 2005 and 2016 using the TOPSIS method. While the number of intermediary institutions was 100 at the beginning of the period, in 2016, there were only 71 firms in Turkish capital markets. During the observation period, the number of firms have been 55 that operated consistently. Financial data of these institutions are obtained from TCMA, Capital Markets Board of Turkey and corporate web-sites of the intermediary institutions.

Primarily in the research, a comprehensive survey was conducted to high-level executives of intermediary institutions during the December 2017−March 2018 period in order to determine the main indicators for the financial performance. For further survey detail see Aras et al. (2018b). Also, the literature review has been considered. Table III gives the abbreviations and formula of financial performance indicators employed in the study.

<table>
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<tr>
<th>Year</th>
<th>2014</th>
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<th>2016</th>
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<td>14,242</td>
<td>20,109</td>
<td>41.20</td>
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<td>15,132</td>
<td>15,312</td>
<td>21,178</td>
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<td>11,180</td>
<td>16,430</td>
<td>46.96</td>
</tr>
<tr>
<td>Long-term liabilities</td>
<td>78</td>
<td>122</td>
<td>412</td>
<td>237.70</td>
</tr>
<tr>
<td>Equity</td>
<td>3,659</td>
<td>4,010</td>
<td>4,336</td>
<td>8.13</td>
</tr>
<tr>
<td>Net sales</td>
<td>192,296</td>
<td>185,113</td>
<td>164,222</td>
<td>−11.29</td>
</tr>
<tr>
<td>EBIT profit</td>
<td>281</td>
<td>301</td>
<td>332</td>
<td>10.30</td>
</tr>
<tr>
<td>Net profit</td>
<td>372</td>
<td>433</td>
<td>483</td>
<td>11.55</td>
</tr>
</tbody>
</table>

Sources: TCMA (2017), Turkish capital markets 2016 annual review

Table II.
Fundamental financials of Turkish intermediary institutions (million TL)

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Indicator</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>Asset size</td>
<td>Ln asset</td>
</tr>
<tr>
<td>S2</td>
<td>Equity size</td>
<td>Ln equity</td>
</tr>
<tr>
<td>S3</td>
<td>Net sales level</td>
<td>Net revenue</td>
</tr>
<tr>
<td>L1</td>
<td>Liquidity ratio</td>
<td>Current assets/short-term liabilities</td>
</tr>
<tr>
<td>L2</td>
<td>Cash ratio</td>
<td>Cash and cash equivalents/short-term liabilities</td>
</tr>
<tr>
<td>L3</td>
<td>Networking capital</td>
<td>(Current assets-short term liabilities)/total assets</td>
</tr>
<tr>
<td>L4</td>
<td>Equity financing level</td>
<td>Equity/tangibles</td>
</tr>
<tr>
<td>D1</td>
<td>Debt level</td>
<td>Total debt/total assets</td>
</tr>
<tr>
<td>D2</td>
<td>Financial leverage</td>
<td>Total debt/total equity</td>
</tr>
<tr>
<td>P1</td>
<td>EBIT margin</td>
<td>EBIT/net sales</td>
</tr>
<tr>
<td>P2</td>
<td>Net profit margin</td>
<td>Net profit/net sales</td>
</tr>
<tr>
<td>P3</td>
<td>Asset turnover ratio</td>
<td>Net sales/net sales</td>
</tr>
<tr>
<td>P4</td>
<td>Equity turnover ratio</td>
<td>Net sales/equity</td>
</tr>
<tr>
<td>P5</td>
<td>Operating profit</td>
<td>Operating expense/net sales</td>
</tr>
<tr>
<td>P6</td>
<td>Tangibles financing level</td>
<td>Net sales/tangibles</td>
</tr>
<tr>
<td>P7</td>
<td>Assets operating profit</td>
<td>EBIT/total assets</td>
</tr>
<tr>
<td>P8</td>
<td>ROA</td>
<td>Net profit/total assets</td>
</tr>
<tr>
<td>P9</td>
<td>ROE</td>
<td>Net profit/equity</td>
</tr>
</tbody>
</table>

Table III.
Financial performance indicators employed

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>Asset growth rate</td>
</tr>
<tr>
<td>G2</td>
<td>Equity growth rate</td>
</tr>
</tbody>
</table>
After determining indicators, the weights of the primary indicators, representing the financial performance, have been calculated. For this purpose, entropy, survey and equal-weight approaches have been used and performance scores obtained from the TOPSIS method are compared.

3.2 Method

In this study, the financial performance of the intermediary institutions has been measured by the TOPSIS method. The TOPSIS method was developed by Hwang and Yoon (1981) and it is a classical multi-criteria decision making (MCDM) method that ranks alternatives according to their distance from the so-called positive ideal solution and negative ideal solution. In addition, after applying this method, a performance score that lies between 0 and 1 is obtained. Thus, alternatives can be ranked from the best to the worst using these scores. Moreover, this method does not assume that each criterion has equal importance. Therefore, it requires a set of weights from the decision maker.

In literature, objective or subjective methods can be used for determining the relative importance of each indicator. Subjective method has some disadvantages when the total number of indicator is large. Moreover, this kind of weighing process can be unstable, suboptimal and arbitrary (Zeleny, 1974). In addition, a number of indicator can lead to conflict with each other. From this point, the entropy method is preferred to evaluate the weights of the indicators as objective method. Entropy was introduced by Shannon and Weaver (1949) with the theory of communication and it has been widely used in information theory in the course of time. Entropy can be defined as a measure of observational variety or actual diversity and it does not assume anything about the nature of the frequency or probability distribution, and therefore it is accepted as a nonparametric measure of variety (Krippendorff, 1986).

TOPSIS has consecutively six steps as follows:

- Step 1: construct the decision matrix.
  
  Supposing there are $m$ alternatives ($A = \{A_i|i = 1, 2, \ldots, m\}$) and $n$ criteria ($C = \{C_j|j = 1, 2, \ldots, n\}$) in a MCDM problem, decision matrix $D$ can be expressed as follows:

$$
D = 
\begin{bmatrix}
C_1 & C_2 & \ldots & C_j & \ldots & C_n \\
[x_{11} & x_{12} & \ldots & x_{1j} & \ldots & x_{1n}] & A_1 \\
[x_{21} & x_{22} & \ldots & x_{2j} & \ldots & x_{2n}] & A_2 \\
\vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\
[x_{m1} & x_{m2} & \ldots & x_{mj} & \ldots & x_{mn}] & A_m
\end{bmatrix}
$$

- Step 2: calculate the normalized decision matrix.
  
  The decision matrix needs to be normalized for each criterion $C_j$ ($j = 1, 2, \ldots, n$) to gain the projection value of each criterion $r_{ij}$. By doing this, Matrix $R = [r_{ij}]$ can be obtained:

$$
r_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}} (i = 1, 2, \ldots, m \text{ and } j = 1, 2, \ldots, n)
$$
Step 3: calculate the weighted normalized decision matrix.

Elements in each column of matrix $R$ are multiplied with the relevant $w_j$ value and matrix $V$ is created. Matrix $V$ is as follow:

$$V = \begin{bmatrix}
w_1r_{11} & w_2r_{12} & \ldots & w_nr_{1n} \\w_1r_{21} & w_2r_{22} & \ldots & w_nr_{2n} \\
\vdots & \vdots & \ddots & \vdots \\
w_1r_{m1} & w_2r_{m2} & \ldots & w_nr_{mn}
\end{bmatrix}$$

$$V = \begin{bmatrix}
v_{11} & v_{12} & \ldots & v_{1j} & \ldots & v_{1n} \\
v_{21} & v_{22} & \ldots & v_{2j} & \ldots & v_{2n} \\
\vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\
v_{1j} & v_{2j} & \ldots & v_{ij} & \ldots & v_{in} \\
v_{1m} & v_{2m} & \ldots & v_{mj} & \ldots & v_{mn}
\end{bmatrix}$$

Step 4: determine ideal and negative ideal solutions.

In this step, maximum and minimum values in each column of weighted matrix are determined as follows.

Positive ideal solution: $A^+ = (v_1^+, v_2^+, \ldots, v_n^+)$

$$v_j^+ = \begin{cases} 
\max_{i \in N} v_{ij}, j \in N i = 1, 2, \ldots, m & \text{for benefit criteria} \\
\min_{i \in N} v_{ij}, j \in N i = 1, 2, \ldots, m & \text{for cost criteria}
\end{cases}$$

Negative ideal solution: $A^- = (v_1^-, v_2^-, \ldots, v_n^-)$

$$v_j^- = \begin{cases} 
\min_{i \in N} v_{ij}, j \in N i = 1, 2, \ldots, m & \text{for benefit criteria} \\
\max_{i \in N} v_{ij}, j \in N i = 1, 2, \ldots, m & \text{for cost criteria}
\end{cases}$$

Step 5: calculate the distance from the positive ideal solution and the negative ideal solution.

The distance of each alternative from positive ideal solution and negative ideal solution is calculated as given in the following equations:

$$S_i^+ = \sqrt{\left( v_{ij} - v_j^+ \right)^2}, i = 1, 2, \ldots, m; j = 1, 2, \ldots, n$$

$$S_i^- = \sqrt{\left( v_{ij} - v_j^- \right)^2}, i = 1, 2, \ldots, m; j = 1, 2, \ldots, n$$

Step 6: Calculate the closeness coefficient.

In this step, the closeness coefficient $C_i^*(0 \leq C_i^* \leq 1)$ of each alternative is calculated and ranked in descending order, as given in the following equation. The alternative with higher closeness coefficient value will be the best choice:

$$C_i^* = \frac{S_i^-}{S_i^- + S_i^+}$$
3.3 Empirical results

In order to implement the TOPSIS method, the relative importance (weights) of these indicators has to be determined. The relative importance of these indicators has been determined by Entropy method, survey results and considering equal weights consecutively.

Empirical results have been categorized into three phases. In the first phase, the relative importance (weights) of financial performance indicators according to Entropy, survey results and equal weights has been determined. In the second phase, the TOPSIS method has been employed according to Entropy results. In that phase, financial performance, financial performance developments, and the performance development of the top intermediary institutions have been evaluated on a yearly basis.

Phase I: determining the relative importance (weights) of financial performance indicators according to entropy, survey results and equal-weight approaches. First, the individual completing survey was asked to indicate the degree of importance of the related financial performance indicators in terms of a five-point Likert scale (1-Low, 2-Average, 3-Good, 4-Very Good, 5-Excellent). A total of 76 responses were received from the 55 intermediary institutions. Second, entropy method is applied in order to determine weights using 55 institutions. By doing this, weights that represent the whole intermediary institution sector are obtained, and discrepancies between the institutions are removed using common values. In this way, it is possible to ensure an objective comparison for all institutions. Last, each indicator has equal weight that is 0.05.

Table IV exhibits the degree of importance of financial performance indicators based on three approaches. The italic values give the most important indicators and the last column shows the average values of all these related methods. According to Entropy results, operating profit has been found as the most important indicator affecting the financial performance among all indicators, while based on survey results, net sales level has become the most significant indicator.

According to the both survey results and entropy results, operating profit, total net sales, equity growth rate, total assets, asset growth rate and total equity indicators have found to be the common financial performance indicators in the top ten indicators.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Entropy</th>
<th>Survey result</th>
<th>Equal-weight</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>0.0780</td>
<td>0.0586</td>
<td>0.0500</td>
<td>0.0589</td>
</tr>
<tr>
<td>S2</td>
<td>0.0290</td>
<td>0.0552</td>
<td>0.0500</td>
<td>0.0481</td>
</tr>
<tr>
<td>S3</td>
<td>0.0333</td>
<td>0.0563</td>
<td>0.0500</td>
<td>0.0465</td>
</tr>
<tr>
<td>L1</td>
<td>0.0653</td>
<td>0.0504</td>
<td>0.0500</td>
<td>0.0552</td>
</tr>
<tr>
<td>L2</td>
<td>0.0855</td>
<td>0.0499</td>
<td>0.0500</td>
<td>0.0618</td>
</tr>
<tr>
<td>L3</td>
<td>0.0037</td>
<td>0.0494</td>
<td>0.0500</td>
<td>0.0344</td>
</tr>
<tr>
<td>L4</td>
<td>0.1631</td>
<td>0.0470</td>
<td>0.0500</td>
<td>0.0867</td>
</tr>
<tr>
<td>D1</td>
<td>0.0889</td>
<td>0.0480</td>
<td>0.0500</td>
<td>0.0356</td>
</tr>
<tr>
<td>D2</td>
<td>0.0283</td>
<td>0.0496</td>
<td>0.0500</td>
<td>0.0426</td>
</tr>
<tr>
<td>P1</td>
<td>0.0001</td>
<td>0.0519</td>
<td>0.0500</td>
<td>0.0340</td>
</tr>
<tr>
<td>P2</td>
<td>0.0001</td>
<td>0.0541</td>
<td>0.0500</td>
<td>0.0347</td>
</tr>
<tr>
<td>P3</td>
<td>0.0026</td>
<td>0.0444</td>
<td>0.0500</td>
<td>0.0323</td>
</tr>
<tr>
<td>P4</td>
<td>0.0036</td>
<td>0.0492</td>
<td>0.0500</td>
<td>0.0343</td>
</tr>
<tr>
<td>P5</td>
<td>0.2352</td>
<td>0.0554</td>
<td>0.0500</td>
<td>0.1135</td>
</tr>
<tr>
<td>P6</td>
<td>0.1589</td>
<td>0.0422</td>
<td>0.0500</td>
<td>0.0857</td>
</tr>
<tr>
<td>P7</td>
<td>0.0001</td>
<td>0.0450</td>
<td>0.0500</td>
<td>0.0317</td>
</tr>
<tr>
<td>P8</td>
<td>0.0001</td>
<td>0.0459</td>
<td>0.0500</td>
<td>0.0320</td>
</tr>
<tr>
<td>P9</td>
<td>0.0002</td>
<td>0.0557</td>
<td>0.0500</td>
<td>0.0333</td>
</tr>
<tr>
<td>G1</td>
<td>0.0453</td>
<td>0.0482</td>
<td>0.0500</td>
<td>0.0478</td>
</tr>
<tr>
<td>G2</td>
<td>0.0488</td>
<td>0.0538</td>
<td>0.0500</td>
<td>0.0509</td>
</tr>
</tbody>
</table>

Table IV. The degree of importance of financial performance indicators based on three approaches.
These three approaches state that substantial differences occur while determining the degree of importance of financial performance indicators during these years.

Phase II. Employing TOPSIS method. After determining the relative importance (weights) of financial performance indicators according to three approaches, financial performance scores of 55 intermediary institutions have been calculated on a yearly basis and average values are calculated for research period. Additionally, based on average weight, financial performance scores are obtained and all results are compared.

Table V represents the average rank of bank-origin and non-bank origin intermediary institutions in top ten and bottom ten according to entropy, survey results, equal-weight and average-weight approaches.

The table also represents that there is substantial differences in average performance scores of intermediary institutions according to four approaches. This indicates that using objective or subjective methods for determining weights does not significantly affect the results. Another finding that has to be noted is that seven of the intermediary institutions in top ten ranking are bank-origin, and except one, the others have been in non-bank origin intermediary institutions in top bottom rankings. This fact also states that bank-origin intermediary institutions have the highest financial performance.

While employing objective or subjective methods for determining weights does not significantly affect the results, entropy method is preferred due to its objectivity in the following part of the research. Based on common Entropy results, performance scores for all intermediary institutions and 55 intermediary institutions that operated consistently throughout the research period are calculated.

Figure 1 gives the average performance score of all intermediary institutions, 55 intermediary institutions continuously operating between the years 2005 and 2016 and top ten institutions during the related years. Findings reveal that the average performances of continuously operating intermediary institutions during the concerned period are above the average performance levels of all intermediaries operating in this period. Likewise, the performances of the best ten performing institutions seem to differ significantly from the others. This is an important indicator of a possible oligopolistic structure and the high concentration in the Turkish intermediary institutions.

The disruptions that arise in the unsoundly structured financial systems matter for both the development of the existing system and for the parties involved in the market, i.e. savings account holders, investors and issuers/borrowers. The situation can ultimately render the functionality of the intermediary mechanism between the financial sector and the real sector. The fulfillment of the intermediary function in the financial system in order to meet the requirements of the institutions and investors is of great importance in terms of the confidence in the capital markets and the sustainability of the market development. In the related figure, the effects of the 2008 global financial crisis are seen in all three groups. Depending on these supports and precautions, the recovery that began in the second half of 2009 continued in 2010 as well. It is seen that the performances of the institutions have increased, especially since the second half of 2011.

Figure 2 states the bank-origin and non-bank origin differentiation of top 20 intermediary institutions according to financial performance scores. Results reveal that the majority of 20 intermediary institutions with the highest scorer are bank originated.

The financial performance scores have also been calculated for bank-origin and non-bank-origin intermediary institutions during these years. Figure 3 states the average rank of these two group intermediaries during the related years. For all years, the average rank of bank origin intermediary institutions has been found higher than the non-bank origins. This reveals that the average financial performance of the bank-origin intermediary institutions is higher than the average score of non-bank origins for all years.
<table>
<thead>
<tr>
<th>Intermediary institution</th>
<th>Entropy Average rank</th>
<th>Origin</th>
<th>Intermediary institution</th>
<th>Survey result Average rank</th>
<th>Origin</th>
<th>Intermediary institution</th>
<th>Equal-weight Average rank</th>
<th>Origin</th>
<th>Intermediary institution</th>
<th>Average-weight Average rank</th>
<th>Origin</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Top ten</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FI32</td>
<td>1.00</td>
<td>Bank origin</td>
<td>FI32</td>
<td>1.00</td>
<td>Bank origin</td>
<td>FI32</td>
<td>1.00</td>
<td>Bank origin</td>
<td>FI32</td>
<td>1.00</td>
<td>Bank origin</td>
</tr>
<tr>
<td>FI53</td>
<td>2.08</td>
<td>Bank origin</td>
<td>FI53</td>
<td>2.00</td>
<td>Bank origin</td>
<td>FI53</td>
<td>2.00</td>
<td>Bank origin</td>
<td>FI53</td>
<td>2.03</td>
<td>Bank origin</td>
</tr>
<tr>
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<td>Bank origin</td>
<td>FI3</td>
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<td>Bank origin</td>
<td>FI3</td>
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<td>Bank origin</td>
<td>FI3</td>
<td>3.28</td>
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</tr>
<tr>
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<td>FI4</td>
<td>5.08</td>
<td>Bank origin</td>
<td>FI4</td>
<td>4.92</td>
<td>Bank origin</td>
<td>FI4</td>
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<td>Bank origin</td>
</tr>
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<td>FI20</td>
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<td>FI20</td>
<td>5.67</td>
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</tr>
<tr>
<td>FI36</td>
<td>8.33</td>
<td>Non-bank origin</td>
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<td>Non-bank origin</td>
<td>FI36</td>
<td>9.17</td>
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<td>FI36</td>
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<td>Non-bank origin</td>
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<td>Non-bank origin</td>
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<td>FI23</td>
<td>9.33</td>
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<td>FI46</td>
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<td>11.08</td>
<td>Bank origin</td>
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<tr>
<td>FI13</td>
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<td>Bank Origin</td>
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<td>11.50</td>
<td>Non-bank Origin</td>
<td>FI23</td>
<td>11.33</td>
<td>Non-bank Origin</td>
<td>FI23</td>
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</tr>
<tr>
<td><strong>Bottom Ten</strong></td>
<td></td>
<td></td>
<td></td>
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<td>Non-bank Origin</td>
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<td>Non-bank origin</td>
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<td>Non-bank Origin</td>
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<td>44.67</td>
<td>Non-bank origin</td>
</tr>
<tr>
<td>FI4</td>
<td>45.25</td>
<td>Non-bank origin</td>
<td>FI19</td>
<td>44.92</td>
<td>Bank origin</td>
<td>FI19</td>
<td>44.75</td>
<td>Bank origin</td>
<td>FI19</td>
<td>44.97</td>
<td>Non-bank origin</td>
</tr>
<tr>
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<td>46.25</td>
<td>Non-bank origin</td>
<td>FI1</td>
<td>45.58</td>
<td>Non-bank origin</td>
<td>FI1</td>
<td>45.67</td>
<td>Non-bank origin</td>
<td>FI1</td>
<td>45.83</td>
<td>Non-bank origin</td>
</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th>Intermediary institution</th>
<th>Entropy</th>
<th>Average rank</th>
<th>Origin</th>
<th>Survey result</th>
<th>Average rank</th>
<th>Origin</th>
<th>Equal-weight</th>
<th>Average rank</th>
<th>Origin</th>
<th>Average-weight</th>
<th>Average rank</th>
<th>Origin</th>
</tr>
</thead>
<tbody>
<tr>
<td>FI40</td>
<td>47.58</td>
<td></td>
<td>Non-bank origin</td>
<td>FI21</td>
<td>48.08</td>
<td>Non-bank origin</td>
<td>FI21</td>
<td>48.00</td>
<td>Non-bank origin</td>
<td>FI21</td>
<td>47.89</td>
<td>Non-bank origin</td>
</tr>
<tr>
<td>FI21</td>
<td>47.67</td>
<td></td>
<td>Non-bank origin</td>
<td>FI5</td>
<td>48.33</td>
<td>Non-bank origin</td>
<td>FI5</td>
<td>48.50</td>
<td>Non-bank origin</td>
<td>FI5</td>
<td>48.17</td>
<td>Non-bank origin</td>
</tr>
<tr>
<td>FI5</td>
<td>48.83</td>
<td></td>
<td>Non-bank origin</td>
<td>FI40</td>
<td>48.75</td>
<td>Non-bank origin</td>
<td>FI40</td>
<td>48.75</td>
<td>Non-bank origin</td>
<td>FI40</td>
<td>48.78</td>
<td>Non-bank origin</td>
</tr>
<tr>
<td>FI39</td>
<td>49.50</td>
<td></td>
<td>Non-bank origin</td>
<td>FI39</td>
<td>48.92</td>
<td>Non-bank origin</td>
<td>FI39</td>
<td>48.83</td>
<td>Non-bank origin</td>
<td>FI39</td>
<td>49.08</td>
<td>Non-bank origin</td>
</tr>
<tr>
<td>FI9</td>
<td>53.50</td>
<td></td>
<td>Non-bank origin</td>
<td>FI9</td>
<td>53.67</td>
<td>Non-bank origin</td>
<td>FI9</td>
<td>53.67</td>
<td>Non-bank origin</td>
<td>FI9</td>
<td>53.61</td>
<td>Non-bank origin</td>
</tr>
</tbody>
</table>

*Note: FI represents financial intermediaries*
4. Conclusions
Transmitting the savings into the financial system via financial instruments and enabling the borrowers to access the funds, it is required to have the specialized financial intermediaries. These intermediary institutions play a major role in the development of the capital markets by carrying out intermediary activities in line with the demands and expectations of the investors. Therefore, it is necessary that the securities market provides a well-developed, efficiently administered and properly regulated market system specifically for emerging capital markets.
This study has employed several financial indicators to assess the performance of intermediary institutions in Turkish capital markets with a comprehensive framework. Operating profit has been found as the most important indicator affecting the financial performance among all indicators, while based on survey results, net sales level has become the most significant indicator. This reveals the fact that raising operating profit and net sales is relatively more significant than raising other financial performance indicators. Additionally, operating profit, total net sales, equity growth rate, total assets, asset growth rate and total equity indicators have found to be the common financial performance indicators in the top ten financial performance indicators. Moreover, findings reveal that the average performances of continuously operating intermediary institutions during the concerned period are above the average performance levels of all intermediaries operating in this period. Likewise, the performances of the best ten performing institutions seem to differ significantly from the others. This is a significant indicator of an oligopolistic structure and the high concentration in the Turkish intermediary institutions.

For all years, the average rank of bank-origin intermediary institutions has been found higher than the non-bank origins. This reveals that the average financial performance of the bank-origin intermediary institutions is higher than the average score of non-bank origins for all years.

The role of the intermediary institutions in ensuring an atmosphere of confidence and stability in the capital markets emphasizes the management and performance of the institutions in the sector. It deems necessary to take the steps parallel to the findings regarding the current situation for the sake of a sound development of the intermediary sector.

References


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Which aspects of CSR predict firm market value?

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Abstract

Purpose – There is evidence that corporate social responsibility (CSR) practices predict higher firm value, but little evidence on which specific aspects of CSR drive this relationship. The purpose of this paper is to study this question in a sample drawn from 35 countries over 2003-2016.

Design/methodology/approach – The authors employ a research design that analyzes observational data with panel data methods including ordinary least squares, firm-random effects, and firm-fixed effects.

Findings – The authors find in a sample drawn from 35 countries over 2003-2016 an economically significant relationship between an overall CSR measure and firm value. The overall CSR score builds on data from Asset4 and is comprised of three indices for environmental, social, and corporate governance aspects of CSR. The authors find that the social index consistently predicts higher market value. The authors also show that the use of particular elements of CSR can lead to substantial omitted variables bias when predicting firm value. The results also suggest a similar bias in studies that focus on a single index, which captures a specific aspect of CSR, but omits the remaining aspects.

Research limitations/implications – The study is subject to limitations common to observational studies.

Practical implications – The authors find robust evidence that CSR predicts market value using a country-benchmarked overall CSR index. The power to predict firm value comes solely from the social dimension of this measure, which captures firm-level practices related to treatment of employees and stakeholder relations including those with customers and the broader community. Three elements drive the social index: customer/product responsibility, human rights, and employment quality. None of the remaining 12 elements significantly predicts firm value in an empirical setting with firm-FE and extensive covariates. The authors also show that omitted aspects of CSR can easily lead to an omitted variable bias and that the magnitude of this bias is potentially greater with an OLS specification.

Social implications – Among the many dimensions of CSR, only a subset drives firm value. Policies that target to improve the CSR performance of firms adopt a broader definition of CSR.

Originality/value – The authors provide first-hand evidence on which specific aspects of CSR drive firm market value.

Keywords Corporate governance, Social performance, Corporate social responsibility, Firm value, Environmental performance, Omitted variables bias

Paper type Research paper

1. Introduction

The last decade has witnessed that corporate social responsibility (CSR) has become a significant theme in strategic business decisions (The Economist, 2008). In PwC’s (2014) 17th Annual Global CEO Survey, 75 percent of CEOs suggest that satisfying societal needs, beyond those of investors, customers and employees, and protecting the interests of future generations is important. A similar view emerges from the Edelman Trust Barometer (2014) suggesting that 84 percent of responding consumers believe that business can pursue its self-interest while doing good work for society. While the emphasis on CSR is shaping the relationship between companies and their stakeholders, there is a lack of agreement on the antecedents and consequences of CSR, and perhaps more importantly, a unified
CSR is a complex and multifaceted concept and comprises a broad range of activities of the firm with its various stakeholders. While for some companies, the social dimension of CSR (e.g. the treatment of employees) is important, other companies may care more about their relationship with suppliers and expect them to meet certain standards. Still for some others, environmental aspects (e.g. control of emissions) may be more relevant. Such CSR activities involve that companies go beyond country-level statutory requirements in the provision of goods and services with a public character and in internalizing the externalities they create. CSR can benefit firms through various channels. CSR may improve, for example, brand value, and enhance reputational effects (Baron, 2001). Some CSR activities can make the firm more attractive to employees (Turban and Greening, 1997), increase productivity (McGuire et al., 1988; Waddock and Graves, 1997), contribute to smoother relationships with regulators, and help the firm meet the standards and expectations of its customers and thereby increase revenues (Teraji, 2009). Better CSR performance is also related to better stakeholder engagement and thereby reduce information asymmetries, agency problems, and other types of transaction costs. CSR can also be an insurance mechanism against reputational risks (Godfrey et al., 2009; Koh et al., 2014) and create intangible assets (Gardberg and Fombrun, 2006). This suggests that contracting with stakeholders takes place based on mutual trust and cooperation (Jones, 1995). However, some of these issues can be costly (Palmer et al., 1995), both in terms of direct costs (e.g. when expenditures for charitable donations or environmental protection increase) and so reduce profits. CSR activities can also reduce firms’ flexibility by introducing additional constraints and thereby lead to lower operating efficiency, which contributes indirectly to the costs of the CSR activities ( Claessens and Yurtoglu, 2013).

This paper builds on our previous work (Bajic and Yurtoglu, 2018) and suggests that observational CSR studies of whether CSR predicts higher shareholder value can be subject to omitted variable bias (OVB), which poses an important challenge to identification. While OVB is ubiquitous virtually in all studies that use observational research designs, its specific consequences in CSR research have not been studied extensively. Many studies of CSR use a single, specific CSR construct which is either not available (e.g. environmental disclosure) or not meaningful for firms in other industries (e.g. hazardous waste reduction). In their influential meta-analysis including 251 studies, Margolis et al. (2009) show that a substantial fraction of these studies use a specific CSR construct, which measures only a limited number of CSR practices. However, different aspects of CSR are often correlated. Firms with superior performance in one of these aspects, e.g., in reducing emissions, are likely to perform well also on other dimensions, e.g., reducing resources. A study, which analyzes the impact of only one of these aspects in isolation from other aspects may document a relationship between the included aspect and a measure of performance, however, the true driver of superior performance can be an omitted dimension of CSR. This raises concerns both for studies that use a broad measure of CSR and for studies that employ a specific measure. Using a broad measure of CSR raises the concern that the true driver(s) would remain hidden in the definition of the broad measure and using a specific measure might suggest a link between this measure and firm value due its correlation with other aspects omitted from the analysis. Both approaches can potentially deliver misleading policy recommendations.

We deal with this problem by using ESG measures of three different granularities. We first employ a broad measure of CSR, using data from ASSET4, reflecting firm-level choices and activities in dealing with ESG issues. One major advantage of using this broad index is that it captures the differences across many countries, but has sufficient commonality across countries to allow for generalization. Using this measure, we assess
whether CSR affects firm market value (proxied by Tobin’s q) and how estimates from firm fixed effects (FE) or random effects (RE) with extensive covariates differ from pooled OLS results. In the second step, we analyze whether the components of this broad measure, comprised of environmental (E), social (S), and governance (G) indices matter for firm value. Then, in a third step, we employ 15 specific elements of these three ESG aspects using the same empirical setting. With the use of these three types of measures with increasing granularity, we document the following empirical regularities:

1. the broad $ESG$ measure captures an economically and statistically significant impact of CSR on firm value;
2. the social aspect of this measure drives the relationship between CSR and firm value; and
3. only a small subset of the 15 specific elements of the broad CSR measure predict firm value.

In the next part, we present a brief literature review of the relationship between CSR and firm value. Section 3 describes our data sources and details the definitions of the employed variables. Section 4 develops our empirical strategy. Section 5 presents our results. Section 6 concludes.

2. The relationship between CSR and corporate financial performance (CFP)

The empirical literature on CSR, especially in the US corporate context is vast. Three influential papers survey this literature (Margolis and Walsh, 2003; Orlitzky et al., 2003; and Margolis et al., 2009) and report a significantly positive, albeit quite small effect of CSR on CFP[1]. A large fraction of these studies use measures of CSR that specifically focus on environmental performance and self-reported social performance. With third-party audits used to assess CSR, one obtains usually a weaker association between CSR and corporate performance. The studies included in the above-mentioned surveys use substantially different empirical strategies. Earlier studies (e.g. Spicer, 1978; Aupperle et al., 1985; Spencer and Taylor, 1987) report pure associations of various measures of CSR and CFP. Other studies use a regression framework with limited controls for firm characteristics. These studies usually rely on cross-sectional data or cross-sectional methods (e.g. Waddock and Graves, 1997; Hillman and Keim, 2001) which gives rise to endogeneity concerns, including the potential for both reverse causation and OVB. Novel exceptions include Dowell et al. (2000) who analyze the environmental standards in a sample of US multinational companies using a RE specification. They report that adopting a single stringent environmental standard globally is associated with higher market valuations than adhering to local or US environmental standards. Berman et al. (1999) adopt a two-step GLS approach and identify which aspects of CSP matter for the firms in their sample. Garcia-Castro et al. (2010) employ panel data models using KLD data on US firms and show that CSR predicts higher performance in OLS equations, but not in FE specifications.

Sharfman and Fernando (2008) and El Ghoul et al. (2011) show that firms which display higher levels of CSR enjoy lower costs of equity capital. This findings is consistent with the notion that CSR performance can affect firm value by decreasing financial risk (Kim et al., 2014; Orlitzky and Benjamin, 2001). Cheng et al. (2014) document that firms with better CSR performance face significantly lower capital constraints and have easier access to finance. More recently, Liang and Renneboog (2018) report a positive relationship between CSR and firm value in a sample of 4,700 large, public companies. A positive relationship between CSR and firm value is also reported by Lins et al. (2017) who study the 2008-2009 financial crisis period.

We provide a brief overview of studies that focus on the relationship between CSR and firm value, but not covered in the above-mentioned surveys, in Table I.
<table>
<thead>
<tr>
<th>Study</th>
<th>Sample period</th>
<th>Dependent variable</th>
<th>Measure of CSR</th>
<th>Overview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuquerque et al. (2014)</td>
<td>2003-2011</td>
<td>Firm value, firm risk, Tobin’s q</td>
<td>+</td>
<td>Overall Social Environmental</td>
</tr>
<tr>
<td>Dhalial et al. (2014)</td>
<td>1992-2007</td>
<td>Implied cost of equity</td>
<td>+^a</td>
<td>+</td>
</tr>
<tr>
<td>Dimson et al. (2015)</td>
<td>1999-2009</td>
<td>Firm value, Tobin’s q</td>
<td>+ + +</td>
<td>+</td>
</tr>
<tr>
<td>Flammer (2015)</td>
<td>1997-2012</td>
<td>Firm value</td>
<td>+^a</td>
<td>+</td>
</tr>
</tbody>
</table>

CSR is considered as an investment in customer loyalty. Empirically, CSR reduces systematic risk on average and more strongly for firms producing differentiated goods and when consumers’ expenditure share on CSR goods is small.

Firm risk for S&P500 index constituents is positively affected by employee, diversity, and governance concerns. Community (Diversity) strengths negatively (positively) affect firm risk. As to non-S&P500 members, firm risk is positively affected by employee concerns and diversity strengths. However, firm risk of non-S&P500 members is negatively affected by Environment strengths.

Investors demand significantly higher expected returns on stocks with environmental concerns compared to firms without such concerns. Lenders charge a significantly higher interest rate on bank loans issued to firms with these environmental concerns.

Negative association between CSR disclosure and the cost of equity capital; this relationship is more pronounced in stakeholder-oriented countries. There is also evidence that financial and CSR disclosures act as substitutes for each other in reducing the cost of equity capital.

Successful CSR engagements with US public companies experience positive abnormal returns. Firms with reputational concerns and higher capacity to implement changes are more likely to experience positive abnormal returns.

Firms with better CSR rankings enjoy cheaper equity financing. Investment in improving CSR rating contributes substantially to reducing cost of equity.

Participation in two “sin” industries, tobacco and nuclear power, increases firms’ cost of equity.

One of the few papers using a quasi-natural experiment design (regression discontinuity design). The passage of “close-call” CSR-related shareholder proposals is similar to a random assignment of CSR to companies and leads to positive announcement returns and better accounting performance. The channels are higher labor productivity and sales growth.

(continued)
CSR performance is higher when dividends are high, leverage is high, cash flows and cash holdings are low, and when there is a high managerial pay-for-performance sensitivity. There is a positive relation between CSR investments and Tobin’s q (with instrumental variables) suggesting a causal link between good governance and high CSR and Tobin’s q. During the 2008-2009 financial crisis, firms with high CSR intensity had stock returns that were four to seven percentage points higher than firms with low social capital. High-CSR firms also experienced higher profitability, growth, and sales per employee relative to low-CSR firms, and they raised more debt. The evidence suggests that the trust between a firm and both its stakeholders and investors pays off when the overall level of trust in corporations and markets suffers a negative shock.

CSR has a small, negative impact on market value for firms with low advertising intensity, and a positive impact for firms with high advertising intensity. There is no effect with a firm fixed effects specification.

Firms benefit from better environmental risk management through a reduction in their cost of equity capital, a shift from equity to debt financing, and higher tax benefits which come with the ability to add more debt.

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample period</th>
<th>Dependent variable</th>
<th>Measure of CSR</th>
<th>Overall</th>
<th>Social</th>
<th>Environmental</th>
<th>Overview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liang and Renneboog (2018)</td>
<td>2002-2013</td>
<td>Tobin’s q</td>
<td>+^a</td>
<td>+^a</td>
<td>+^a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Servaes and Tamayo (2013)</td>
<td>1991-2005</td>
<td>Firm value, Tobin’s q</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: This table presents an overview of selected papers on the relationship between CSR and firm value, including the authors, the sample period, the independent variable, and the CSR data used. The two most widely recognized ESG data sets are KLD and Asset4. All studies use KLD data, except * indicates the use of other sources of CSR data.
The analysis of the validity of constructs used to proxy for CSR practices in prior research is limited. Waddock and Graves (1997) criticize a wide range of CSR constructs used in prior research (see the references therein) and suggest that one needs a multidimensional measure of CSR which should be meaningful for a wide range of companies. Dowell et al. (2000) and Margolis et al. (2009) express similar concerns on the validity of CSR measures. Bajic and Yurtoglu (2018) study the validity of CSR constructs based on Asset4 data. To the best of our knowledge, no other paper studies the extent to which the use of specific CSR constructs can lead to a bias in predicting firm value.

3. Data sources and ESG scores

3.1 Data

We use the following data sources. CSR data is from Thomson Reuters ASSET4, which is specialized in disseminating socially responsible investment analysis. Financial data come from the WRDS Compustat North America and Compustat Global databases. We substitute missing financial data from Datastream. Information on cross-listed firms, including the foreign exchange(s) they are listed and listing level comes from databases maintained at the Bank of New York (www.adrbny.com) and JP Morgan (www.adr.com). We translate the variables into US dollars using the exchange rates obtained from Bloomberg at the fiscal year end.

3.2 ESG scores

Environmental, social and governance scores are from the ASSET4 database of Thomson Reuters[2]. ASSET4 specializes in providing systematic ESG information to professional investors who integrate ESG data into their investment analysis. Economist (2013) estimates that investors representing more than $3.3 trillion assets under management make use of ASSET4 data. ASSET4 transforms more than 900 evaluation points per firm into 250 key performance indicators. These indicators are organized into 18 categories within four pillars: environmental performance, social performance, corporate governance and economic performance. In a year $t$, firms receive a $z$-score for each of the four pillars, based on all the information available in fiscal $t−1$. Therefore, by construction, ESG scores are lagged by one year. A firm’s performance in a pillar is benchmarked with all of the remaining firms, with the firms in the same country, or with the firms in the same business sector.

Environmental scores have three elements reflecting firm-level efforts to reduce resources and emissions as well as to increase performance in product innovation. Social scores use eight elements such as employment quality, health and safety, training and development, diversity, human rights, community, and product responsibility. Governance scores have five elements (board structure and functions, compensation policy, shareholder rights, and the firm’s vision and strategy). Table II details these individual elements and reports descriptive statistics.

We use the annual environmental, social and corporate governance scores to construct a composite CSR measure for every year and each firm. We follow the convention established by previous studies and assign equal weights to each of the scores[3]. We call this overall CSR measure ESG. Since disclosure requirements as well as the strength and quality of institutions vary across countries, we benchmark the CSR measures with the firms in the same country.

Table III shows that the resulting sample is an unbalanced panel of 23,803 firm-years with CSR data during 2003-2016 from 35 countries. The majority of the observations (10,748) are from the USA, Japan, and the UK, however, we also have a large sample from European countries (5,155). On average, we have slightly less than seven observations per firm. For our empirical analysis, we exclude all firms in financial and regulated industries, because they are likely to be subject to different rules and regulations. The majority of firms in our sample is active in manufacturing industries, about 20 percent are from energy and basic materials, 13 percent from IT, and the remaining ones are in healthcare and telecommunications.
<table>
<thead>
<tr>
<th>ESG measure</th>
<th>Description</th>
<th>Definition</th>
<th>Mean</th>
<th>SD</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ESG</strong></td>
<td>Overall CSR index</td>
<td>Equally weighted average of the environmental, social, and corporate governance indices</td>
<td>0.526</td>
<td>0.242</td>
<td>0.003</td>
<td>1</td>
</tr>
<tr>
<td><strong>E</strong></td>
<td>Subindex: environment</td>
<td>Equally weighted average of the three elements comprising the environment index</td>
<td>0.546</td>
<td>0.304</td>
<td>0.003</td>
<td>1</td>
</tr>
<tr>
<td><strong>S</strong></td>
<td>Subindex: social</td>
<td>Equally weighted average of the seven elements comprising the social index</td>
<td>0.550</td>
<td>0.302</td>
<td>0.003</td>
<td>1</td>
</tr>
<tr>
<td><strong>G</strong></td>
<td>Subindex: corporate governance (CG)</td>
<td>Equally weighted average of the five elements comprising the CG index</td>
<td>0.501</td>
<td>0.300</td>
<td>0.000</td>
<td>1</td>
</tr>
<tr>
<td>Resource reduction</td>
<td>Element 1: environment index</td>
<td>Measures a company's management commitment and effectiveness toward achieving an efficient use of natural resources in the production process and reflects the capacity to reduce the use of materials, energy or water, and to find more eco-efficient solutions by improving supply chain management</td>
<td>0.549</td>
<td>0.304</td>
<td>0.001</td>
<td>1</td>
</tr>
<tr>
<td>Emission reduction</td>
<td>Element 2: environment index</td>
<td>Measures a company’s management commitment and effectiveness toward reducing environmental emission in the production and operational processes. It reflects a company’s capacity to reduce air emissions (greenhouse gases, F-gases, ozone-depleting substances, NOx and SOx, etc.), waste, hazardous waste, water discharges, spills or its impacts on biodiversity and to partner with environmental organizations to reduce the environmental impact of the company in the local or broader community</td>
<td>0.546</td>
<td>0.307</td>
<td>0.003</td>
<td>1</td>
</tr>
<tr>
<td>Product innovation</td>
<td>Element 3: environment index</td>
<td>Measures a company’s management commitment and effectiveness toward supporting the research and development of eco-efficient products or services. It reflects a company’s capacity to reduce the environmental costs and burdens for its customers, and thereby creating new market opportunities through new environmental technologies and processes or eco-designed, dematerialized products with extended durability</td>
<td>0.516</td>
<td>0.306</td>
<td>0.028</td>
<td>1</td>
</tr>
<tr>
<td>Employment quality</td>
<td>Element 1: social index</td>
<td>Measures a company’s management commitment and effectiveness toward providing high-quality employment benefits and job conditions. It reflects a company’s capacity to increase its workforce loyalty and productivity by distributing rewarding and fair employment benefits, and by focusing on long-term employment growth and stability by promoting from within, avoiding layoffs and maintaining relations with trade unions</td>
<td>0.530</td>
<td>0.300</td>
<td>0.000</td>
<td>1</td>
</tr>
<tr>
<td>Health and safety</td>
<td>Element 2: social index</td>
<td>Measures a company’s management commitment and effectiveness toward providing a healthy and safe workplace. It reflects a company’s capacity to increase its workforce loyalty and productivity by integrating into its day-to-day operations a concern for the physical and mental health, well-being and stress level of all employees</td>
<td>0.525</td>
<td>0.299</td>
<td>0.007</td>
<td>1</td>
</tr>
<tr>
<td>Training and development</td>
<td>Element 3: social index</td>
<td>Measures a company’s management commitment and effectiveness toward providing training and development (education) for its workforce. It reflects a company’s capacity to increase its intellectual capital, workforce</td>
<td>0.558</td>
<td>0.300</td>
<td>0.002</td>
<td>1</td>
</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th>ESG measure</th>
<th>Description</th>
<th>Definition</th>
<th>Mean</th>
<th>SD</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diversity and opportunity</td>
<td>Element 4: social index</td>
<td>Measures a company’s management commitment and effectiveness toward maintaining diversity and equal opportunities in its workforce. It reflects a company’s capacity to increase its workforce loyalty and productivity by promoting an effective life-work balance, a family friendly environment and equal opportunities regardless of gender, age, ethnicity, religion or sexual orientation.</td>
<td>0.523</td>
<td>0.310</td>
<td>0.009</td>
<td>1</td>
</tr>
<tr>
<td>Human rights</td>
<td>Element 5: social index</td>
<td>Measures a company’s management commitment and effectiveness toward respecting the fundamental human rights conventions. It reflects a company’s capacity to maintain its license to operate by guaranteeing the freedom of association and excluding child, forced or compulsory labor.</td>
<td>0.503</td>
<td>0.302</td>
<td>0.000</td>
<td>1</td>
</tr>
<tr>
<td>Community</td>
<td>Element 6: social index</td>
<td>Measures a company’s management commitment and effectiveness toward maintaining the company’s reputation within the general community (local, national and global). It reflects a company’s capacity to maintain its license to operate by being a good citizen (donations of cash, goods or staff time, etc.), protecting public health (avoidance of industrial accidents, etc.) and respecting business ethics (avoiding bribery and corruption, etc.)</td>
<td>0.550</td>
<td>0.300</td>
<td>0.001</td>
<td>1</td>
</tr>
<tr>
<td>Customer/Product responsibility</td>
<td>Element 7: social index</td>
<td>Measures a company’s management commitment and effectiveness toward creating value-added products and services upholding the customer’s security. It reflects a company’s capacity to maintain its license to operate by producing quality goods and services integrating the customer’s health and safety, and preserving its integrity and privacy also through accurate product information and labeling</td>
<td>0.537</td>
<td>0.307</td>
<td>0.001</td>
<td>1</td>
</tr>
<tr>
<td>Board structure</td>
<td>Element 1: CG index</td>
<td>Measures a company’s management commitment and effectiveness toward following best practice corporate governance principles related to a well-balanced membership of the board. It reflects a company’s capacity to ensure a critical exchange of ideas and an independent decision-making process through an experienced, diverse and independent board.</td>
<td>0.474</td>
<td>0.294</td>
<td>0.000</td>
<td>1</td>
</tr>
<tr>
<td>Compensation policy</td>
<td>Element 2: CG index</td>
<td>Measures a company’s management commitment and effectiveness toward following best practice corporate governance principles related to competitive and proportionate management compensation. It reflects a company’s capacity to attract and retain executives and board members with the necessary skills by linking their compensation to individual or company-wide financial or extra-financial targets.</td>
<td>0.478</td>
<td>0.300</td>
<td>0.000</td>
<td>1</td>
</tr>
<tr>
<td>Board functions</td>
<td>Element 3: CG index</td>
<td>Measures a company’s management commitment and effectiveness toward following best practice corporate governance principles related to board activities and functions. It reflects a company’s capacity to have an effective board by setting up the essential board committees with allocated tasks and responsibilities</td>
<td>0.478</td>
<td>0.287</td>
<td>0.000</td>
<td>1</td>
</tr>
<tr>
<td>ESG measure</td>
<td>Description</td>
<td>Definition</td>
<td>Mean</td>
<td>SD</td>
<td>Min.</td>
<td>Max.</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------</td>
<td>-----</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>Shareholder rights</td>
<td>Element 4: CG index</td>
<td>Measures a company’s management commitment and effectiveness toward following best practice corporate governance principles related to a shareholder policy and equal treatment of shareholders. It reflects a company’s capacity to be attractive to minority shareholders by ensuring equal rights and privileges and by limiting the use of anti-takeover devices.</td>
<td>0.507</td>
<td>0.297</td>
<td>0.000</td>
<td>1</td>
</tr>
<tr>
<td>Vision and strategy</td>
<td>Element 5: CG index</td>
<td>Measures a company’s management commitment and effectiveness toward the creation of an overarching vision and strategy integrating financial and extra-financial aspects. It reflects a company’s capacity to convincingly show and communicate that it integrates the economic (financial), social and environmental dimensions into its day-to-day decision-making processes.</td>
<td>0.551</td>
<td>0.305</td>
<td>0.007</td>
<td>1</td>
</tr>
</tbody>
</table>

**Notes:** This table shows summary statistics and definitions of the overall CSR measure (ESG), its indices (Environmental, Social and Corporate Governance), and the index elements from Asset 4.
4. Methodology

Next section details our empirical methods and Section 4.2 details control variables.

4.1 Empirical models

The natural logarithm of Tobin’s $q$ is our primary dependent variable. We take logs to reduce the influence of high-$q$ outlier firms. In our base specification, all variables are winsorized at 1-99 percentiles. We use two different econometric models. The first model, pooled OLS, has the following specification:

$$\ln q_{i,t} = \beta_0 + \beta_1 \times X_{i,t} + \beta_2 \times ESG_{i,t} + g_{i,t} + e_{i,t}$$  \hspace{1cm} (1)$$

where $\ln q_{i,t}$ is the natural logarithm of Tobin’s $q$ for firm $i$ at time $t$, $X_{i,t}$ a vector of firm characteristics; $ESG_{i,t}$ the ESG score; $g_{i,t}$ a vector of year dummies; and $e_{i,t}$ is an error term.

---

Table III.

<table>
<thead>
<tr>
<th>Period</th>
<th>$N$</th>
<th>Mean $q$</th>
<th>Median $q$</th>
<th>SD $q$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>2003-2016</td>
<td>1.397</td>
<td>0.508</td>
<td>0.483</td>
</tr>
<tr>
<td>Austria</td>
<td>2003-2016</td>
<td>169</td>
<td>0.552</td>
<td>0.551</td>
</tr>
<tr>
<td>Belgium</td>
<td>2003-2016</td>
<td>232</td>
<td>0.516</td>
<td>0.543</td>
</tr>
<tr>
<td>Bermuda</td>
<td>2003-2016</td>
<td>117</td>
<td>0.474</td>
<td>0.451</td>
</tr>
<tr>
<td>Brazil</td>
<td>2008-2016</td>
<td>408</td>
<td>0.559</td>
<td>0.571</td>
</tr>
<tr>
<td>Canada</td>
<td>2003-2016</td>
<td>1,039</td>
<td>0.516</td>
<td>0.487</td>
</tr>
<tr>
<td>Cayman Islands</td>
<td>2005-2016</td>
<td>82</td>
<td>0.400</td>
<td>0.316</td>
</tr>
<tr>
<td>China</td>
<td>2009-2016</td>
<td>485</td>
<td>0.397</td>
<td>0.382</td>
</tr>
<tr>
<td>Denmark</td>
<td>2003-2016</td>
<td>227</td>
<td>0.554</td>
<td>0.573</td>
</tr>
<tr>
<td>Finland</td>
<td>2003-2016</td>
<td>282</td>
<td>0.538</td>
<td>0.560</td>
</tr>
<tr>
<td>France</td>
<td>2003-2016</td>
<td>889</td>
<td>0.590</td>
<td>0.644</td>
</tr>
<tr>
<td>Germany</td>
<td>2003-2016</td>
<td>800</td>
<td>0.563</td>
<td>0.604</td>
</tr>
<tr>
<td>Greece</td>
<td>2003-2016</td>
<td>163</td>
<td>0.536</td>
<td>0.524</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>2003-2016</td>
<td>845</td>
<td>0.441</td>
<td>0.411</td>
</tr>
<tr>
<td>India</td>
<td>2008-2016</td>
<td>506</td>
<td>0.536</td>
<td>0.523</td>
</tr>
<tr>
<td>Ireland</td>
<td>2003-2016</td>
<td>141</td>
<td>0.501</td>
<td>0.480</td>
</tr>
<tr>
<td>Israel</td>
<td>2003-2016</td>
<td>90</td>
<td>0.496</td>
<td>0.543</td>
</tr>
<tr>
<td>Italy</td>
<td>2003-2016</td>
<td>391</td>
<td>0.552</td>
<td>0.588</td>
</tr>
<tr>
<td>Japan</td>
<td>2003-2016</td>
<td>3,072</td>
<td>0.533</td>
<td>0.562</td>
</tr>
<tr>
<td>Jersey</td>
<td>2005-2016</td>
<td>32</td>
<td>0.656</td>
<td>0.739</td>
</tr>
<tr>
<td>Korea</td>
<td>2005-2016</td>
<td>416</td>
<td>0.538</td>
<td>0.616</td>
</tr>
<tr>
<td>Malaysia</td>
<td>2009-2016</td>
<td>280</td>
<td>0.489</td>
<td>0.499</td>
</tr>
<tr>
<td>Mexico</td>
<td>2003-2016</td>
<td>154</td>
<td>0.471</td>
<td>0.498</td>
</tr>
<tr>
<td>Netherlands</td>
<td>2003-2016</td>
<td>325</td>
<td>0.559</td>
<td>0.589</td>
</tr>
<tr>
<td>New Zealand</td>
<td>2005-2016</td>
<td>165</td>
<td>0.451</td>
<td>0.408</td>
</tr>
<tr>
<td>Norway</td>
<td>2003-2016</td>
<td>203</td>
<td>0.554</td>
<td>0.579</td>
</tr>
<tr>
<td>Portugal</td>
<td>2003-2016</td>
<td>101</td>
<td>0.560</td>
<td>0.623</td>
</tr>
<tr>
<td>Singapore</td>
<td>2005-2016</td>
<td>353</td>
<td>0.483</td>
<td>0.461</td>
</tr>
<tr>
<td>South Africa</td>
<td>2009-2016</td>
<td>603</td>
<td>0.548</td>
<td>0.563</td>
</tr>
<tr>
<td>Spain</td>
<td>2003-2016</td>
<td>423</td>
<td>0.698</td>
<td>0.660</td>
</tr>
<tr>
<td>Sweden</td>
<td>2003-2016</td>
<td>430</td>
<td>0.571</td>
<td>0.610</td>
</tr>
<tr>
<td>Switzerland</td>
<td>2003-2016</td>
<td>602</td>
<td>0.540</td>
<td>0.535</td>
</tr>
<tr>
<td>Taiwan</td>
<td>2003-2016</td>
<td>725</td>
<td>0.463</td>
<td>0.450</td>
</tr>
<tr>
<td>The UK</td>
<td>2003-2016</td>
<td>2,158</td>
<td>0.535</td>
<td>0.545</td>
</tr>
<tr>
<td>The USA</td>
<td>2003-2016</td>
<td>5,518</td>
<td>0.528</td>
<td>0.466</td>
</tr>
<tr>
<td>Total</td>
<td>2003-2016</td>
<td>23,803</td>
<td>0.526</td>
<td>0.525</td>
</tr>
</tbody>
</table>

Notes: This table presents the composition of the sample and the means, medians, and standard deviations of the overall ESG score and its Environmental, Social, and Governance components.

CSR data by country
The second model, RE specification, adds $f_i$, firm-RE to Model (1). In the FE specification, the firm effects are assumed to be fixed instead of random:

$$\ln q_{i,t} = \beta_0 + \beta_1 X_i + \beta_2 ESG_i + g_i + f_i + e_{i,t}$$  \hspace{1cm} (2)$$

The FE model provides unbiased estimates even if the firm effects are correlated with other covariates, but imposes a cost because many aspects of ESG scores are sticky. With FE, we can study only aspects with substantial within-firm time variation.

We also employ models where we replace ESG with its indices ($E$, $S$, and $G$) included separately:

$$\ln q_{i,t} = \beta_0 + \beta_1 X_i + \beta_2 Sub_E^i + g_i + f_i + e_{i,t}$$  \hspace{1cm} (3a)$$

where subscripts are indexed by superscript $j$ ($j = E, S, and G$).

Similarly, we also estimate models that replace the $E$, $S$, and $G$ aspects with 15 individual elements that constitute them:

$$\ln q_{i,t} = \beta_0 + \beta_1 X_i + \beta_2 Element^i + g_i + f_i + e_{i,t}$$  \hspace{1cm} (3b)$$

where the individual elements (see Table II) are indexed by superscript $k$ ($k = 1, 2, \ldots, 15$).

In studies which focus on a single aspect, the coefficient on an index (or more often an element in this index) using variants of Model (3a or 3b) can reflect the effect of another omitted index (or also other neglected elements) and can potentially lead to OVB. Therefore, while it is appropriate to use Models (1) and (2) to estimate the relationship between a broad ESG measure and firm value, Models (3a) and (3b) are likely to yield biased coefficients when assessing which aspect(s) of ESG matters. To account for this potential bias, we employ two additional models in which we consider all indices (4a) and elements (4b) together:

$$\ln q_{i,t} = \beta_0 + \beta_1 X_i + \sum_{k=1}^{15} \beta_{2,k} Element^i_k + g_i + f_i + e_{i,t}$$  \hspace{1cm} (4a)$$

$$\ln q_{i,t} = \beta_0 + \beta_1 X_i + \sum_{k=1}^{15} \beta_{2,k} Element^i_k + + f_i + g_i + e_{i,t}$$  \hspace{1cm} (4b)$$

4.2 Control variables

Many firm characteristics are potentially associated with both $q$ and ESG. We therefore include the following extensive set of covariates to minimize OVB concerns. Firm size: $\ln$ (assets). Leverage: total debt/assets, because leverage can influence Tobin’s $q$ by providing tax benefits, affecting bankruptcy risk and reducing free cash flow problems. Leverage is also mechanically related to $q$, since both variables use the same denominator; Growth prospects: we control for growth prospects using three year geometric growth rate of sales (or two-year growth if the three year growth rate is missing). Firms with attractive opportunities to innovate are likely to spend more on R&D than other companies, and earn monopoly rents from their innovations. These firms will have relatively high returns on capital that will be reflected in higher $qs$. Since some countries in our sample do not require the disclosure of R&D expenditures, we employ a dummy variable for firms with positive R&D expenditures and obtain similar results with the R&D/Sales ratio\(^4\). We control for profitability using EBIT/Sales. Capital intensity: we use the ratio of capital expenditures (Capex) to property, plant and equipment (PPE) and the ratio of PPE to sales (PPE/Sales); Liquidity: we include share turnover (annual average of daily shares traded over shares outstanding), the fraction of freely trading shares (Free float) as measures of share liquidity, since share prices may be higher for firms with more liquid shares. Risk: we use
the standard deviation of monthly stock returns in year $t$ as a measure of the total risk of the firm (Volatility). Cross-listing dummy: cross-listings may enhance liquidity, foreign investor interest, and also proxy for otherwise unobserved growth opportunities and governance effects (Doidge et al., 2007). To control for these effects we include a dummy for firms cross-listed in US (at any level). We employ a dummy for firms, which report negative equity, because firms with negative equity are close to bankruptcy, show signs of financial distress, and are usually excluded from samples in empirical work. Industry and country: factors such as asset structure, accounting practices, government regulation, and industry concentration may vary across industries and countries. They may affect both ESG practices and firm valuation. To account for these differences, we include a set of industry dummies defined at the 2-digit SIC level and country dummies. Industry and country dummies drop out in the FE specification, but they are relevant for OLS and RE specifications.

Table IV reports the descriptive statistics of Tobin’s $q$ and other covariates. Tobin’s $q$ for the full sample is 1.35 with a standard deviation of 1.61. The average company has a growth rate of around 6.3 percent, a mean leverage of 21.8 percent, and Capex in the order of 15.3 percent of fixed assets. The sample consists of large and highly traded companies, which have a large investor base (mean free float = 72.5 percent) and visible (~34 percent of them have a cross-listing in the USA). 45.5 percent of firms report R&D expenditures and a small fraction of them report negative equity. Overall, these statistics suggest that our sample contains mostly large, visible and liquid firms.

5. ESG scores and firm value

5.1 The impact of overall ESG scores on firm value

In Table V, we examine whether the overall ESG measure predicts Tobin’s $q$. Columns 1-3 report the coefficients from OLS, firm-RE, and firm-FE specifications of ln (Tobin’s $q$) on ESG. In columns 4-9 we study whether the environmental, social and governance indices predict firm value. In even (odd-)numbered columns, we regress these three indices together (separately) on $q$. All regressions use the full set of firm-level covariates, time, industry and country dummies (dropped for FE). The $t$-statistics use standard errors clustered on firm.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Mean</th>
<th>SD</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ln (Tobin’s $q$)</td>
<td>Natural logarithm of ((BV debt+MV of common stock)/BV of assets)</td>
<td>0.030</td>
<td>0.722</td>
<td>−3.926</td>
<td>4.523</td>
</tr>
<tr>
<td>Size</td>
<td>Natural logarithm of total assets</td>
<td>12.425</td>
<td>3.735</td>
<td>2.392</td>
<td>21.926</td>
</tr>
<tr>
<td>Leverage</td>
<td>Total debt/Total assets</td>
<td>0.218</td>
<td>0.167</td>
<td>0.000</td>
<td>0.998</td>
</tr>
<tr>
<td>Sales growth</td>
<td>Sales growth rate (3 or 2-year growth rate (if 3 year missing))</td>
<td>0.063</td>
<td>0.264</td>
<td>−0.942</td>
<td>1.967</td>
</tr>
<tr>
<td>EBIT/Sales</td>
<td>EBIT/Sales</td>
<td>0.643</td>
<td>2.321</td>
<td>−1.697</td>
<td>39.213</td>
</tr>
<tr>
<td>Capex/PPE</td>
<td>Capital Expenditures/(gross) fixed assets</td>
<td>0.153</td>
<td>0.130</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Share turnover</td>
<td>Annual average shares traded (daily) over outstanding</td>
<td>1.558</td>
<td>0.987</td>
<td>0.000</td>
<td>5.294</td>
</tr>
<tr>
<td>PPE/Sales</td>
<td>PPE/Sales</td>
<td>2.730</td>
<td>7.309</td>
<td>−0.036</td>
<td>49.995</td>
</tr>
<tr>
<td>Stock volatility</td>
<td>SD of monthly stock returns in year $t$ (annualized)</td>
<td>0.300</td>
<td>0.142</td>
<td>0.010</td>
<td>1.500</td>
</tr>
<tr>
<td>Free float</td>
<td>Fraction of shares excluding locked-in shares such as those held by insiders, or governments</td>
<td>0.225</td>
<td>0.236</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Cross-listing dummy</td>
<td>Dummy, 1 if firm has a US cross-listing, 0 otherwise</td>
<td>0.342</td>
<td>0.474</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>R&amp;D dummy</td>
<td>Dummy, 1 if firm reports R&amp;D expenditures, 0 otherwise</td>
<td>0.455</td>
<td>0.498</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Negative equity dummy</td>
<td>Dummy, 1 if firm reports negative equity, 0 otherwise</td>
<td>0.037</td>
<td>0.189</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: This table provides definitions of the covariates and descriptive statistics for the samples used in Tables V and VI.
Table V: Overall ESG.

<table>
<thead>
<tr>
<th></th>
<th>OLS</th>
<th>RE (f)</th>
<th>FE (f)</th>
<th>Separate</th>
<th>OLS</th>
<th>Together</th>
<th>Separate</th>
<th>RE (f)</th>
<th>FE (f)</th>
<th>Separate</th>
<th>OLS</th>
<th>Together</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESG</td>
<td>0.346***</td>
<td>0.107***</td>
<td>0.064***</td>
<td>0.186***</td>
<td>0.160***</td>
<td>0.130***</td>
<td>0.068***</td>
<td>0.100***</td>
<td>0.073***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social index</td>
<td></td>
<td></td>
<td></td>
<td>0.197***</td>
<td>0.165***</td>
<td>0.130***</td>
<td>0.068***</td>
<td>0.100***</td>
<td>0.073***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental index</td>
<td></td>
<td></td>
<td></td>
<td>0.145***</td>
<td>0.115***</td>
<td>0.051*</td>
<td>0.050*</td>
<td>0.057*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corporate governance</td>
<td></td>
<td></td>
<td></td>
<td>0.141***</td>
<td>0.077***</td>
<td>0.048***</td>
<td>0.002 (0.11)</td>
<td>0.015 (0.73)</td>
<td>-0.003 (0.87)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firm size</td>
<td>-0.172***</td>
<td>-0.159***</td>
<td>-0.159***</td>
<td>-0.172***</td>
<td>-0.172***</td>
<td>-0.182***</td>
<td>-0.182***</td>
<td>-0.193***</td>
<td>-0.193***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leverage</td>
<td>0.333***</td>
<td>0.284***</td>
<td>0.272***</td>
<td>0.323***</td>
<td>0.229***</td>
<td>0.198***</td>
<td>0.289***</td>
<td>0.289***</td>
<td>0.289***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales growth</td>
<td>0.323***</td>
<td>0.234***</td>
<td>0.250***</td>
<td>0.335***</td>
<td>0.237***</td>
<td>0.249***</td>
<td>0.197***</td>
<td>0.269***</td>
<td>0.260***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EBIT/Sale</td>
<td>0.001 (0.56)</td>
<td>-0.000 (0.23)</td>
<td>-0.000 (0.17)</td>
<td>0.000 (0.50)</td>
<td>0.000 (0.49)</td>
<td>-0.000 (0.31)</td>
<td>-0.000 (0.30)</td>
<td>-0.000 (0.19)</td>
<td>-0.000 (0.19)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CapEx/PPE</td>
<td>0.052***</td>
<td>0.142***</td>
<td>0.410***</td>
<td>0.357***</td>
<td>0.090***</td>
<td>0.145***</td>
<td>0.512***</td>
<td>0.423***</td>
<td>0.419***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turnover</td>
<td>0.029***</td>
<td>0.004 (1.22)</td>
<td>-0.001 (0.03)</td>
<td>0.029***</td>
<td>0.029***</td>
<td>0.004 (1.24)</td>
<td>-0.001 (0.30)</td>
<td>-0.001 (0.27)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPE/Sale</td>
<td>-0.031***</td>
<td>-0.002***</td>
<td>-0.001 (0.00)</td>
<td>-0.001 (0.01)</td>
<td>-0.001 (0.01)</td>
<td>-0.001 (0.01)</td>
<td>-0.001 (0.01)</td>
<td>-0.001 (0.01)</td>
<td>-0.001 (0.01)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volatility</td>
<td>-0.001***</td>
<td>-0.023***</td>
<td>-0.052***</td>
<td>-0.021***</td>
<td>-0.022***</td>
<td>-0.023***</td>
<td>-0.024***</td>
<td>-0.025***</td>
<td>-0.025***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free float</td>
<td>-0.250***</td>
<td>-0.678***</td>
<td>-0.025 (0.96)</td>
<td>-0.217***</td>
<td>-0.233***</td>
<td>-0.232***</td>
<td>-0.234***</td>
<td>-0.235***</td>
<td>-0.235***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cross-listing</td>
<td>0.119***</td>
<td>0.002***</td>
<td>-0.001 (0.04)</td>
<td>0.115***</td>
<td>0.118***</td>
<td>0.022 (1.68)</td>
<td>0.021 (1.67)</td>
<td>-0.000 (0.05)</td>
<td>-0.000 (0.05)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age R&amp;D</td>
<td>0.060***</td>
<td>0.061***</td>
<td>0.030 (1.10)</td>
<td>0.067***</td>
<td>0.077***</td>
<td>0.002 (1.11)</td>
<td>0.010 (1.06)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stock Market</td>
<td>0.060***</td>
<td>0.061***</td>
<td>0.030 (1.10)</td>
<td>0.067***</td>
<td>0.077***</td>
<td>0.002 (1.11)</td>
<td>0.010 (1.06)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>County dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R² (fitted)</td>
<td>0.456</td>
<td>0.604</td>
<td>0.604</td>
<td>0.456</td>
<td>0.456</td>
<td>0.456</td>
<td>0.460</td>
<td>0.460</td>
<td>0.201</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: OLS, firm random effects (RE), and firm fixed effects (FE) regressions of ln (Tobin’s q) on ESG (its subindices) and control variables for 2003-2016. All variables are winsorized at 1 percent and 99 percent. Significance results (at 5 percent level or better) are in italic. **Significant at 5 percent level, respectively (suppressed for constant term).
Most firm-level covariates capture significant coefficients with a sign consistent with theoretical considerations. Size has a highly significant negative coefficient in OLS, RE and FE specifications. The coefficient on Leverage is consistently positive and significant. Firms growing (Sales growth) and investing at higher rates (Capex/PPE) have higher \( q \). The measure of total firm risk (volatility) is negatively associated with \( q \). The PPE/sales ratio captures a small and negative coefficient. The remaining covariates tend to capture significant coefficients in the OLS and firm-RE specifications, but not with firm-FE.

We obtain a positive and highly significant coefficient on the overall ESG score \( (\beta_2 = 0.246) \) with OLS. With RE, ESG significantly predicts \( q \) \( (\beta_2 = 0.107) \). (Untabulated) Breusch-Pagan tests strongly reject the absence of firm effects and imply that pooled OLS coefficients will be biased. At the same time Hausman tests strongly reject the equivalence of RE and FE models[6]. Thus, if the FE specification is correct, RE results will be biased. The median RE \( \lambda \), indicating whether RE results are closer to pooled OLS \( (\lambda = 0) \) or to FE \( (\lambda = 1) \) is relatively high \( (\lambda \approx 0.75) \). With firm-FE, the coefficient on overall ESG drops to 0.064 and remains significant at the 5 percent level. Tobin’s \( q \) equations use 23,352 observations from 3,844 firms and explain 20 percent of the variation in \( q \) in the FE specification[7]. The coefficients have economically meaningful magnitudes. The coefficient on ESG in the FE specification implies that a one standard deviation increase in ESG predicts 6.6 percent higher Tobin’s \( q \).

5.2 The impact of environmental, social, and governance scores on firm value
In columns (4)-(9) of Table V we focus on the three indices of the overall ESG measure. As noted before, different aspects of CSR correlate. Therefore, separate estimates of their effect on firm value can be biased due to omitting other aspects of CSR. To address this bias, we use two different approaches. We first estimate separate coefficients on the ESG indices, then we include all subindices together in a single regression. In this specification, the coefficient on each index indicates the contribution of the part of each index that is orthogonal to the other indices. We start with OLS equations and regress the social (S), environmental (E), and governance indices (G) separately on \( q \) (reported in even numbered columns) and then regress them together on \( q \) (reported in odd-numbered columns). When we regress the \( E, S, \) and \( G \) indices separately on \( q \), we obtain highly significant coefficients on all of them (except for the G index in the firm-FE specification reported in column 8). In the OLS specification (column 4) all three aspects are highly significant and their coefficients are relatively large: the social index captures a coefficient of 0.188 \( (t\text{-value} = 6.68) \), the coefficient on the environmental index is 0.145 \( (t\text{-value} = 4.82) \), and the coefficient on the governance index is 0.141 \( (t\text{-value} = 5.77) \). When we include all three aspects together in a single regression (column 5), the environmental aspect becomes insignificant, and the coefficients on the \( S \) and \( G \) indices drop in magnitude and lose some significance. In the remaining columns, we repeat the same exercise using firm-RE and firm-FE specifications and obtain qualitatively similar results. All three indices capture statistically and economically significant coefficients when regressed on firm value in isolation from other indices, but with the exception of the social aspect, fail to do so in the presence of the other indices.

The only aspect, which matters for firm value is the social aspect of the overall CSR measure. The other indices capturing environmental and governance aspects have no consistent predictive value. With OLS, RE or FE, none of the coefficients on these indices are significant, and the signs on the coefficients are mixed. This comparison suggests that omitting relevant aspects of CSR can lead to severe OVB bias and can falsely suggest that a specific aspect matters for firm value, while in fact, the significance is due to the omission of a relevant aspect of CSR.
5.3 The impact of specific CSR elements on firm value

In this section, we examine which individual elements that we used to define the E, S, and G indices predict firm value. These individual elements represent a much higher granularity than the indices they jointly form and accordingly capture much more specific dimensions of CSR. The environmental index has three elements, the social index has seven and the governance index consists of five different elements.

As noted before, there is a potential concern of OVB when a study focuses on one or few such aspects and omits the others. To show the consequences of omitting relevant aspects of CSR, we start focusing on a single element at a time and estimate separate coefficients on each of these elements. Then we include all elements together in a single regression. Table VI reports the results of this exercise. We report in columns 1, 3, and 5 the regression results when the elements are used separately\[8\] and in columns 2, 4, and 6, when all 15 elements are included together.

When we use the elements separately to predict Tobin’s \( q \), 13 out of 15 elements are highly significant in the OLS specification (column 1). When they are included together, the number of significant elements drops to 5 and we observe a substantial decrease in the magnitudes of the coefficient estimates. Importantly, some of the coefficients capture negatively significant coefficients. For example, the “Product Innovation” element which is part of the environment index captures a coefficient of 0.040 (\( t \)-value = 1.41) when included in isolation from the remaining elements (column 1). When it is regressed on Tobin’s \( q \) together with the remaining 14 elements, the coefficient estimate becomes -0.071 (significant at the 5 percent level). Similarly, the “Health and Safety” element that is part of the social index, has a coefficient of 0.092 (\( t \)-value = 3.43) when used in isolation. This coefficient predicts higher Tobin’s \( q \) in the order of 9.6 percent for a one standard deviation increase. However, when we control for the remaining elements (column 2), the estimated coefficients drops to an insignificantly negative 0.044. These examples demonstrate that omitting the remaining aspects of CSR can overstate the importance of a specific CSR practice and can lead to misleading policy implications.

The remaining columns in Table V demonstrate similar effects with firm-RE and firm-FE specifications. We note the following differences to OLS results. Only 9 of the 15 elements are significant predictors of firm value when we use a firm-FE specification where each element is estimated in isolation from the remaining elements, suggesting the importance of controlling for unobserved but fixed firm-level characteristics. When all 15 elements are included together, only 4 of them remain significant, 1 of them capturing a significantly negative coefficient (Shareholder rights). All of the three significantly positive elements are part of the social index. With the firm-RE specification, 11 of the 15 elements capture significant coefficients when they are estimated separately. The number of significant elements drops to four when they are estimated together in a single firm-RE regression (one of these elements captures a negative coefficient). The three elements, which capture significantly positive coefficients belong to the social index and they also coincide with the significant elements from the firm-FE specification in column 6. We conclude that the use firm-RE and firm-FE specifications reduce but do not eliminate the potential for OVB when one focuses on a single CSR element.

These results highlight the need to use a broadly defined CSR measure to assess the importance of CSR, and to control for the rest of this overall index when assessing a particular aspect. Studies, which focus on a specific aspect of CSR may find an association between this aspect (say employee treatment or emission reduction) and firm value, but it is important to note that exclusion of other aspects of CSR can lead to misleading inferences. The results in Table V suggest that even firm-RE and firm-FE specification can fail to reduce this source of OVB. The findings of predictive value for a single dimension of CSR can be the observed as consequence of this bias.
<table>
<thead>
<tr>
<th>Social index</th>
<th>OLS Separate (1)</th>
<th>Together (2)</th>
<th>RE Separate (3)</th>
<th>Together (4)</th>
<th>FE Separate (5)</th>
<th>Together (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training and development</td>
<td>0.154*** (6.01)</td>
<td>0.033 (1.00)</td>
<td>0.069*** (3.56)</td>
<td>-0.014 (-0.61)</td>
<td>0.036* (1.82)</td>
<td>-0.022 (-0.92)</td>
</tr>
<tr>
<td>Customer/Product responsibility</td>
<td>0.075*** (3.03)</td>
<td>-0.005 (-0.17)</td>
<td>0.083*** (4.99)</td>
<td>0.049*** (2.78)</td>
<td>0.031** (4.41)</td>
<td>0.057*** (3.03)</td>
</tr>
<tr>
<td>Human rights</td>
<td>0.171*** (6.82)</td>
<td>0.116*** (4.05)</td>
<td>0.102*** (3.40)</td>
<td>0.064*** (3.24)</td>
<td>0.074*** (3.54)</td>
<td>0.045*** (2.13)</td>
</tr>
<tr>
<td>Health and safety</td>
<td>0.092*** (3.43)</td>
<td>-0.044 (-1.41)</td>
<td>0.019 (1.06)</td>
<td>-0.059*** (-2.55)</td>
<td>-0.004 (-0.22)</td>
<td>-0.053** (-2.56)</td>
</tr>
<tr>
<td>Employment quality</td>
<td>0.182*** (7.66)</td>
<td>0.130*** (4.89)</td>
<td>0.114*** (7.04)</td>
<td>0.089*** (5.21)</td>
<td>0.092*** (5.23)</td>
<td>0.076*** (4.19)</td>
</tr>
<tr>
<td>Diversity and opportunity</td>
<td>0.111*** (4.34)</td>
<td>-0.020 (-0.63)</td>
<td>0.075*** (3.94)</td>
<td>0.007 (0.32)</td>
<td>0.050*** (2.31)</td>
<td>-0.002 (-0.07)</td>
</tr>
<tr>
<td>Community</td>
<td>0.116*** (4.49)</td>
<td>-0.002 (-0.06)</td>
<td>0.067*** (3.66)</td>
<td>0.004 (0.18)</td>
<td>0.048*** (2.55)</td>
<td>0.008 (0.40)</td>
</tr>
<tr>
<td>Environmental index</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resource reduction</td>
<td>0.189*** (6.77)</td>
<td>0.191*** (4.57)</td>
<td>0.110*** (5.19)</td>
<td>0.043 (1.46)</td>
<td>0.081*** (3.34)</td>
<td>0.019 (0.64)</td>
</tr>
<tr>
<td>Product innovation</td>
<td>0.040 (1.41)</td>
<td>-0.071** (-2.22)</td>
<td>0.048** (2.49)</td>
<td>-0.019 (-0.86)</td>
<td>0.044** (2.08)</td>
<td>-0.007 (-0.29)</td>
</tr>
<tr>
<td>Emission reduction</td>
<td>0.126*** (4.42)</td>
<td>-0.085* (-1.94)</td>
<td>0.115*** (5.16)</td>
<td>0.034 (1.16)</td>
<td>0.103*** (4.05)</td>
<td>0.054* (1.76)</td>
</tr>
<tr>
<td>Corporate governance index</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shareholder rights</td>
<td>0.119*** (5.24)</td>
<td>0.087*** (3.60)</td>
<td>-0.005 (-0.31)</td>
<td>-0.016 (-1.02)</td>
<td>-0.036*** (-2.19)</td>
<td>-0.042** (-2.47)</td>
</tr>
<tr>
<td>Vision and strategy</td>
<td>0.137*** (4.85)</td>
<td>-0.013 (-0.56)</td>
<td>0.093*** (4.49)</td>
<td>0.021 (0.89)</td>
<td>0.073*** (3.08)</td>
<td>0.020 (0.79)</td>
</tr>
<tr>
<td>Compensation policy</td>
<td>0.053** (2.44)</td>
<td>-0.009 (-0.40)</td>
<td>0.032** (2.32)</td>
<td>0.025* (1.77)</td>
<td>0.024* (1.67)</td>
<td>0.026* (1.78)</td>
</tr>
<tr>
<td>Board structure</td>
<td>0.076*** (3.33)</td>
<td>0.049* (1.94)</td>
<td>0.009 (0.57)</td>
<td>0.007 (0.42)</td>
<td>-0.004 (-0.23)</td>
<td>0.001 (0.04)</td>
</tr>
<tr>
<td>Board functions</td>
<td>0.043* (1.82)</td>
<td>-0.049* (-1.75)</td>
<td>-0.006 (-0.34)</td>
<td>-0.026 (-1.43)</td>
<td>-0.022 (-1.16)</td>
<td>-0.031 (-1.58)</td>
</tr>
<tr>
<td>Time dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Country dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Firms</td>
<td>3,844</td>
<td>3,844</td>
<td>3,844</td>
<td>3,844</td>
<td>3,844</td>
<td>3,844</td>
</tr>
<tr>
<td>$R^2$ (range)</td>
<td>(0.432-0.464)</td>
<td>0.463</td>
<td>(0.402-0.414)</td>
<td>0.412</td>
<td>(0.208-0.218)</td>
<td>0.218</td>
</tr>
</tbody>
</table>

Notes: OLS, firm random effects (RE), and firm fixed effects (FE) regressions of ln (Tobin’s q) on aspects of ESG and control variables for 2003-2016. All variables are winsorized at 1 and 99 percent. $t$-values (in parentheses) use firm clusters. Significant results (at 5 percent level or better) are in italic. *,**,***Significant at 10, 5 and 1 percent level, respectively (suppressed for constant term)
6. Conclusions

Prior research provides evidence that CSR predicts firm market value. However, there is little evidence on which aspect(s) of CSR drives this result in a robust empirical setting with firm-FE and extensive covariates, including controls for other aspects of CSR. We seek here to begin to fill that gap.

We find robust evidence that CSR predicts market value using a country-benchmarked overall CSR index. The power to predict firm value comes solely from the social dimension of this measure, which captures firm-level practices related to treatment of employees and stakeholder relations including those with customers and the broader community. These results suggest that firms, in responding to investor pressure for better CSR, and investors, in assessing CSR, would do well to focus on the social aspect of CSR practices.

Three elements drive the social index: customer/product responsibility, human rights, and employment quality. None of the remaining 12 elements significantly predicts firm value in an empirical setting with firm-FE and extensive covariates. We also show that omitted aspects of CSR can easily lead to an OVB and that the magnitude of this bias is potentially greater with an OLS specification. When studying CSR, the approach of using a single construct, which omits a variety of other CSR aspects, is likely to work poorly.

Notes
1. The mean effect size emerging from the surveys suggests a partial correlation coefficient (accounting for the impact of employed covariates), which is around 0.13.
2. Many prior papers use the KLD (Kinder, Lydenberg, and Domini) database to study the link between CSR and firm value. This database provides CSR data only for large US companies and is not available on an international basis.
4. This is true both when we use a smaller sample with reported R&D/Sales and when we replace missing values with zeros.
5. The coefficients reported in in odd-numbered columns come from three separate regressions. To save space, we report the coefficients on the covariates obtained when using the social score. We present the range of $R^2$s obtained. The coefficient estimates from separate regression are available upon request.
6. For RE, $p$-values for Breusch-Pagan test for presence of firm effects and Hausman test for differences in coefficients between RE and FE are both $p = 0.000$.
7. We report the within $R^2$ for FE, the overall $R^2$ for RE, and the adjusted-$R^2$ for pooled OLS specifications.
8. Similar to Table V, columns 1, 3 and 5 summarize coefficients from 15 distinct regressions. The full results of element specific regressions are available upon request.

References


Further reading


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A dynamic model for housing price spillovers with an evidence from the US and the UK markets

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Hasan Murat Ertugrul
Republic of Turkey Prime Ministry Treasury, Ankara, Turkey, and
Yener Coskun
Capital Markets Board of Turkey, Ankara, Turkey

Abstract
Purpose – The purpose of this paper is to introduce an empirical model for house price spillovers between real estate markets. The model is presented by using data from the US-UK and London-New York housing markets over a period of 1975Q1-2016Q1 by employing both static and dynamic methodologies.

Design/methodology/approach – The research analyzes long-run static and dynamic spillover elasticity coefficients by employing three methods, namely, autoregressive distributed lag, the fully modified ordinary least square and dynamic ordinary least squares estimator under a Kalman filter approach. The empirical method also investigates dynamic correlation between the house prices by employing the dynamic control correlation method.

Findings – The paper shows how a dynamic spillover pricing analysis can be applied between real estate markets. On the empirical side, the results show that country-level causality in housing prices is running from the USA to UK, whereas city-level causality is running from London to New York. The model outcomes suggest that real estate portfolios involving US and UK assets require a dynamic risk management approach.

Research limitations/implications – One of the findings is that the dynamic conditional correlation between the US and the UK housing prices is broken during the crisis period. The paper does not discuss the reasons for that break, which requires further empirical tests by applying Markov switching regime shifts. The timing of the causality between the house prices is not empirically tested. It can be examined empirically by applying methods such as wavelets.

Practical implications – The authors observed a unidirectional causality from London to New York house prices, which is opposite to the aggregate country-level causality direction. This supports London’s specific power in the real estate markets. London has a leading role in the global urban economies residential housing markets and the behavior of its housing prices has a statistically significant causality impact on the house prices of New York City.

Social implications – The house price co-integration observed in this research at both country and city levels should be interpreted as a continuity of real estate and financial integration in practice.

Originality/value – The paper is the first research which applies a dynamic spillover analysis to examine the causality between housing prices in real estate markets. It also provides a long-term empirical evidence for a dynamic causal relationship for the global housing markets.

Keywords Dynamic correlation analysis, House price spillover, The UK housing market, The US housing market

Paper type Research paper

JEL Classification — R31, R32, C58
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The paper is an academic study and does not reflect the institutions that the authors work for.
1. Introduction
Changing investment preferences of individuals, companies and institutional investors makes real estate investment increasingly global. Asset managers may optimize their return globally through REITs and securitized real estate investments or directly investing in commercial/residential estates in different countries. High net worth individuals (HNWI), managing majority of the world financial/real assets, also have such opportunities. It is not a surprise that a sovereign wealth fund invests in The Empire State Building in New York, office markets of London are also dominated by foreigners or HNWIs inflate residential prices in a global financial center. However, investment patterns may change depending on the characteristics of the relevant real estate sub-markets, and this global trend is specifically noteworthy in USA/New York and UK/London due to socio-cultural, economic and political reasons. Close economic and political relationships between both sides of the Atlantic, specifically after the Second World War, have made their financial markets increasingly integrated. However, risks caused by globalization and internationalization of financial and real estate markets are typically observed in several financial crises such as the Asian financial crisis (1997) and the recent global financial crisis. This integrated trend has long raised questions on the inherent risks of globalization of real estate markets.

In this study, we analyze aggregate- and city-level house price spillovers between USA-UK and New York-London housing markets over the period of 1975Q1-2016Q1. The study employs Ng and Perron (2001) test to investigate the stationarity of the variables. After defining dependent and independent variables through Toda and Yamamoto (1995) causality test, we explore the spillover relationship between the variables by employing both static and dynamic models. For the static analysis, we first check the co-integration between the variables utilizing bounds test analysis proposed by Pesaran et al. (2001). After defining country- and city-level co-integration, we employ an ARDL model to investigate the long-term static spillover. FMOLS[1] and DOLS[2] models are also used to check for robustness. Dynamic house price spillover is investigated using Kalman filter and dynamic conditional correlation-GARCH (DCC-GARCH) models.

The study provides contribution to the international real estate investment literature in two ways. First, this is the first study to analyze house price spillovers between USA-UK and New York-London for over 40 years since 1975. Long observation period provides an important opportunity to understand both historical trends and the current picture of the linkages between these leading countries and cities from the spillover perspective. Second, on the empirical side, we found a unidirectional spillover running from US to UK house prices at the country level. However, when we investigate the spillover relationship at city level, we found a unidirectional relationship running from London to New York.

In the next section, we review the literature. Section 3 involves research strategy with the results. The paper ends with a fact sheet summary and a conclusion.

2. Literature review
The empirical literature reveals that the end demand in a real estate market is dependent on local factors rather than global factors (Lekander, 2015), and the global real estate market has been growing with its own dynamics. The evidence of the benefits of international real estate investment is convincing (Eichholtz and Kok, 2007) and mostly suggests return enhancement through diversification benefits[3]. For example, Conover et al. (2002) empirically showed that by having a significant weight in efficient international portfolios, foreign property has a lower correlation with US stocks than foreign ones. Hoesli et al. (2004) found that real estate is an effective portfolio diversifier and optimal allocation to real estate is 15-25 percent. In their studies, Glascock and Kelly (2007) analyzed real estate investment
diversification across 21 countries with a dataset from January 1990 to July 2005, and found that property type effects are smaller than country effects. Liow and Adair (2009) provided evidence that by using Asian real estate for diversification purposes, the portfolio risk and return profile may improve.

However, growingly globalized and internationally integrated real estate markets may result in co-movements in risk and return. From the risk perspective, spillover and contagion risks[4] are analyzed in the literature. But, the studies mostly focused on REIT shares, securitized property markets and inter-country/regional analysis rather than housing markets and cities across countries. Yunus (2009) found evidence that property portfolios from Australia, Hong Kong, Japan, the UK and the USA were tied together in the securitized property markets during January 1990 and August 2007. By employing wavelet analysis for the USA, the UK, Japan, Australia, Hong Kong and Singapore, Zhou (2010) pointed out the fact that not only the co-movement but also its frequency is important in international portfolios. By utilizing the case-resampling bootstrap technique, Hatemi and Roca (2011) found that the relationship of the US market with Australia, Japan and the UK markets after the global financial crisis cannot be characterized as the contagion effect. By using a multivariate regime-dependent asymmetric dynamic covariance methodology, Liow et al. (2011) found significant mean-volatility linkages among the five major securitized real estate markets under different volatility regimes. From this perspective, Liow and Newell (2012) found that Mainland China, Hong Kong, Taiwan and USA were integrated over 1995-2009 because of their close economic relations and geographical positions. They also suggest that it would be expected that unsecuritized real estate and real estate securities show different behaviors in their volatility interdependence and correlation relationships.

By using asymmetric t-BEKK (Baba-Engle-Kraft-Kroner) specification of their covariance matrix and a time-varying copula framework, Hoesli and Reka (2013) analyzed the time-varying behavior between local and global securitized real estate markets, and also between securitized real estate and common stock markets. The authors found evidence of the market contagion between the US and the UK markets after the 2008 crisis. What is more, the findings indicate that we observe a higher level of spillover effects in the US markets from local and global perspectives. Liow and Ye (2014) found a significant volatility shifts in the times of crises in international public property markets. Jones and Richardson (2014) indicated that despite differences in the global financial crisis-related downturns in countries, common outputs are observed, including a decrease in material, in residential construction and property ownership.

This paper provides a contribution to real estate finance and portfolio management from both methodological and empirical perspectives. Taking the interactions between the US and the UK financial markets into account, the literature involves studies on defining co-movement, contagion and spillover effects in stock and other financial markets between the USA and UK (i.e. Finta et al., 2015). However, there is a lack of empirical research on the house price spillovers between the US-UK and London-New York housing markets based on a dynamic model with a long-period data set. In the next section, we examine the spillover analysis between the US and the UK markets at aggregate and the city level, namely, between New York City and London. Any statistically significant result for spillover impacts between these housing markets based on a dynamic model by employing a long-term data will close the gap in the literature.

3. Research strategy and results
In the empirical research, we employ quarterly housing prices for the USA and the UK and New York City and London from 1975Q1 to 2016Q1. All four variables are used in logarithmic form in order to obtain elasticity coefficients.
We use R statistical computing software to run the (DCC-GARCH) model. Kalman filtering process is achieved by using Gauss Mathematical and Statistical System 5.0. The other empirical tests are conducted in EViews 9.5 for Windows. The data and codes are available upon request.

**Stationarity check**

In the empirical analysis, we first investigate the stationarity level of the variables by using Ng and Perron (2001) test. Ng and Perron (2001) test results are shown in Table I, where LHP_US, LHP_UK, LHP_NY and LHP_LON denote logarithm of the USA, the UK, New York City and London house price indexes, respectively.

The null hypothesis of $M_0$ and $M_2$ is tested using unit root test and the null hypothesis of MSB and MPT is tested assuming variables are stationary. According to Table I, all house price index variables are found as I(1).

**Causality analysis**

After the stationarity investigation, we used the Toda and Yamamoto (1995) causality test in order to find causality direction between the variables to define dependent and independent variables. For Toda and Yamamoto approach, we should know the maximum order of integration of the investigated variables. Ng-Perron test shows that maximum order of integration is 1. Then, we estimate VAR(k) model in levels and extended VAR(k) model with maximum order of integration number (dmax), and we finally estimate augmented VAR (k+dmax) model. This approach allows us to avoid the information loss due to differencing. After we estimate VAR (k+dmax) model, we make Wald test for first k variables. Toda and Yamamoto (1995) causality results are indicated in Table II.

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Test Statistics</th>
<th>Prob value</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>LHP_US</td>
<td>LHP_UK</td>
<td>2.694</td>
<td>0.033</td>
<td>Causality</td>
</tr>
<tr>
<td>LHP_UK</td>
<td>LHP_US</td>
<td>1.263</td>
<td>0.286</td>
<td>No causality</td>
</tr>
<tr>
<td>LHP_NY</td>
<td>LHP_LON</td>
<td>1.085</td>
<td>0.340</td>
<td>No causality</td>
</tr>
<tr>
<td>LHP_LON</td>
<td>LHP_NY</td>
<td>4.688</td>
<td>0.010</td>
<td>Causality</td>
</tr>
</tbody>
</table>

**Table I.** Unit root test results

**Table II.** Toda and Yamamoto (1995) test results
According to Toda and Yamamoto (1995) test results, we found a unidirectional causality running form the US house price to the UK house price at the country level. However, when we investigate the causality relationship at the city level, we found a unidirectional causality running from London to New York City.

**Static analysis**

After we investigate the causality relationship and define dependent and independent variables, we first check the co-integration relationship between the variables by using the bound test model. At the country-level analysis, causality is found from the USA to the UK; however, at city-level analysis, causality is found from London to New York City. So, in the first model, UK house price is chosen as dependent and US house price is chosen as an independent variable. In the second model, New York house price is chosen as dependent and London house price is chosen as an independent variable.

For the bound test approach, we estimated the unrestricted error correction model (UECM). The UECM model for our study is presented in the following equations for both country and city levels, respectively:

\[
\Delta \text{LHP}_\text{UK}_t = \alpha_1 + \sum_{i=1}^{m} \alpha_2 \Delta \text{LHP}_\text{UK}_{t-i} + \sum_{i=0}^{m} \alpha_3 \Delta \text{LHP}_\text{US}_{t-i} + \alpha_4 \text{LHP}_\text{UK}_{t-1} + \epsilon_t
\]

\[
\Delta \text{LHP}_\text{NY}_t = \alpha_1 + \sum_{i=1}^{m} \alpha_2 \Delta \text{LHP}_\text{NY}_{t-i} + \sum_{i=0}^{m} \alpha_3 \Delta \text{LHP}_\text{LON}_{t-i} + \alpha_4 \text{LHP}_\text{NY}_{t-1} + \epsilon_t
\]

When we estimate Equations (1) and (2), we test the null hypothesis of \( H_0 = \alpha_4 = \alpha_5 = 0 \). For decision procedure, we compare the calculated \( F \)-statistics with Pesaran et al. ’s (2001) table critical values. If the calculated \( F \)-statistics is lower (higher) than the bottom (upper) bound, it shows no co-integration (co-integration) between the variables (Narayan, 2004). If the estimated \( F \)-statistics is between upper and lower bounds, we could not make any exact opinion. Table III presents the co-integration results.

According to Table III, if \( F \)-statistics are greater than the upper bound, then we reject the null hypothesis for both country-level and city-level models. As a result, we found a long-run co-integration relationship between US and UK house prices and London and New York house prices. After we found the long-run co-integration relationship, we analyzed a long-run static spillover relationship between the house prices variables by using

<table>
<thead>
<tr>
<th>( K )</th>
<th>( F )-statistics</th>
<th>Critical values at 5% significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{Bottom bound} )</td>
<td>( \text{Upper bound} )</td>
<td></td>
</tr>
<tr>
<td>Country-level analysis (Equation (1))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>5.99</td>
<td>4.94</td>
</tr>
<tr>
<td>City-level analysis (Equation (2))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>5.96</td>
<td>4.94</td>
</tr>
</tbody>
</table>

**Table III.** Bound test results

**Notes:** \( k \) shows independent variables for Equation (1). Critical values are obtained from Table C1. iii from the research work of Pesaran et al. (2001, p. 300)
the ARDL model. ARDL model representation of our study is presented in the following equations:

\[ LHP_{UKt} = \alpha_0 + \sum_{i=1}^{m} \alpha_1 LHP_{UKt-i} + \sum_{i=0}^{n} \alpha_2 LHP_{US_{t-i}} + \mu_t \] (3)

\[ LHP_{NY} = \alpha_0 + \sum_{i=1}^{m} \alpha_1 LHP_{NYt-i} + \sum_{i=0}^{n} \alpha_2 LHP_{LONt-i} + \mu_t \] (4)

For country- and city-level analysis in Equations (3) and (4), respectively, ARDL (4,0) model is selected employing AIC. As a robustness check, we estimate the FMOLS and the DOLS models. The estimated long-term spillover coefficients using ARDL, FMOLS and DOLS models are shown in Table IV for both country and city levels[5].

As can be seen from Table IV, FMOLS and DOLS model results are consistent with the ARDL model results. According to static model results, for country-level analysis, we found that 1 percent increase in the US house price causes 1.56-1.63 percent increase in the UK house price. For the city-level analysis, 1 percent increase in London house price causes 0.60-0.67 percent increase in New York house price.

**Dynamic analysis**

After investigating the static spillover relationship between US-UK and London-New York house prices, we investigate the same relationship dynamically for both regressions- and correlations-based analysis. For correlation-based analysis, we used the DCC-GARCH methodology to detect the time-varying correlation between US-UK and London-New York house prices, in order to analyze spillover. By using the DCC-GARCH methodology, we analyze the dynamic relationship and the behavior of correlations during certain time periods.

DCC-GARCH, which was first introduced by Engle (2002) to investigate the dynamic conditional correlation between two variables, is based on Bollerslev (1990) constant conditional correlation estimator. The most important superiority of DCC-GARCH model is that it can capture possible changes in conditional correlations over time. Therefore, the time-varying DCC-GARCH models allow us an opportunity to analyze the dynamic relationship between two variables. Moreover, DCC-GARCH estimates standardized residuals correlation coefficients and directly takes heteroscedasticity into consideration (Chiang et al., 2007). Furthermore, the DCC-GARCH estimators are often more robust than the GARCH estimators (Engle, 2002).

Figures 1 and 2 denote the dynamic conditional correlation between the US-UK house prices and London-New York house prices, respectively. Both figures indicate that the dynamic correlation between the US-UK and London-New York shows a sharp decline.

<table>
<thead>
<tr>
<th>Country-level Analysis (Equation (3))</th>
<th>ARDL (4,0) Model</th>
<th>FMOLS</th>
<th>DOLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LHP_US</td>
<td>1.560</td>
<td>1.628</td>
<td>1.623</td>
</tr>
<tr>
<td>C</td>
<td>-2.465</td>
<td>-2.911</td>
<td>-2.884</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>City-level analysis (Equation (4))</th>
<th>ARDL (4,0) Model</th>
<th>FMOLS</th>
<th>DOLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LHP_LON</td>
<td>0.602</td>
<td>0.669</td>
<td>0.668</td>
</tr>
<tr>
<td>C</td>
<td>2.330</td>
<td>1.812</td>
<td>1.830</td>
</tr>
</tbody>
</table>

Table IV. Estimated long-term spillover coefficients

A dynamic model for housing price spillovers
during global financial crises and mid-1990s. This result may indicate that the house pricing relationship is broken under the crisis. Thus, the correlation observed between these markets has conditional characteristics, i.e. it disappears under the stress periods. This requires a more nuanced analysis.

After the dynamic correlation analysis, we employ dynamic regression analysis by employing Kalman filter model. The Kalman filter model allows us to investigate the dynamic spillover relationship both for country-level and city-level variables. Our dynamic Kalman filter approach is based on Harvey’s methodology (Harvey, 1989).

The Kalman filter model for our study is shown in the following equations:

\[ LHP_{UK_t} = a_0 + a_{1,t}LHP_{US_t} + \epsilon_t \]  
\[ a_{i,t} = a_{i,t-1} + \nu_{i,t} \]  
\[ LHP_{NY_t} = a_0 + a_{1,t}LHP_{LON_t} + \epsilon_t \]  
\[ a_{i,t} = a_{i,t-1} + \nu_{i,t} \]

The time-varying regression parameter estimates for the US-UK house price spillover coefficients are shown in Figure 3 and London-New York house price spillover coefficients are shown in Figure 4.
As the results display clearly, the dynamic regression coefficients are consistent with the static model results. However, the spillover impact dramatically decreases in the crisis period.

4. Research summary and conclusion
The empirical tests based on different methodologies produce the results as shown below.

Causality analysis
We found a unidirectional causality running from the US house price to the UK house price at the country level. However, when we investigate the causality relationship at city level, we found a unidirectional causality running from London to New York.

Results of static model analysis
According to static model results, for the country-level analysis, 1 percent increase in the US house price has 1.56-1.63 percent increase in the UK house price. For the city-level analysis,
1 percent increase in London house price results in 0.60-0.67 percent increase in New York City house price.

Static model results increase 1% in house prices

| USA 1% ↑ | UK 1.56-1.63% ↑ |

Static model results Increase 1% in house prices

| London 1% ↑ | New York 0.6-0.7% ↑ |

**Dynamic model analysis**

We observe a dynamic conditional correlation between the US-UK and London-New York house prices. There are highly sensitive dynamic correlations, which decline sharply during the crisis period.

Unidirectional causality in house prices from the US to the UK markets might be seen as a reflection of the consequence of general dominance of the US financial markets over the international markets. However, our findings imply that the dynamic spillover relationship is broken under crisis. The reason for this might be specific for the selected countries. For example, Fernandez *et al.* (2016) discussed transnational wealth elites buying residential properties in New York City and London as an investment rather than as a primary residence.

New York City and London real estates are perceived as a highly liquid investment. Together with the safe haven and socio-cultural characteristics of both cities and the way the real estate market and its professionals is organized, the global city residential market may seem as a “safe deposit box.” We observed a unidirectional causality from London to New York house prices, which is opposite to the aggregate country-level causality direction. This might be explained by London’s specific power in the real estate markets. London has a leading role in the global urban economies residential housing markets and the behavior of its housing prices has a statistically significant causality impact on the house prices of New York City. Finally, the house price co-integration observed in this research at both country and city levels should be interpreted as a continuity of real estate and financial integration in practice.

The future research on this issue may focus on several questions. The first focus might be on the question that why and how the dynamic conditional correlation between the US and the UK housing prices breaks during crisis periods. Markov switching regime shifts might be selected to investigate the answer of this question empirically. Second, the timing of the causality between the house prices can be examined empirically. Methodologies based on wavelets might be applied to discuss the timing impact of the causality on the housing prices in the markets.

**Notes**

1. FMOLS model is more robust for serial correlation, endogeneity and multicollinearity problems and superior than simple OLS model (Stock and Watson, 1993).

2. In the DOLS model, right-hand side differenced lead and lag variables are used in order to control endogeneity and serial correlation problems (Stock and Watson, 1993).
3. As an example of the opposite view, Bardhan et al. (2007) found a negative correlation between a country’s risk-adjusted real estate security excess and its openness.

4. Perry and Lederman (1998) differentiated contagion from spillover effects. In this respect, authors argued that while contagion results in financial vulnerability and crisis, spillover effects do not necessarily result in crisis. Dornbusch et al. (2000) discussed that contagion indicates the diffusion of market disturbances between countries, a process observed through co-movements in financial indicators/markets. In this respect, spillover is defined as one of the causes of contagion arising from interdependence among market economies. These forms of co-movements would not normally cause contagion, but if they happen during crises period and have a negative effect, then they may be thought as contagion.

5. According to diagnostic checks for ARDL models in Equations (3) and (4), there are not any serial correlations, misspecification and heteroscedasticity problems for our models. The results could be taken from authors upon interest.

References


Further reading


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Cointegration and causality in capital markets

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Finance, Bryant University, Smithfield, Rhode Island, USA

Abstract
Purpose – The purpose of this paper is to study the efficiency of different oil and gas markets. Most previous studies examined the issue using low frequency data sampled at monthly, weekly, or daily frequencies. In this study, 30-minute intraday data are used to explore efficiency in energy markets.

Design/methodology/approach – Sophisticated statistical analysis techniques such as Granger-causality regressions, augmented Dickey-Fuller tests, cointegration tests, vector autoregressions are used to explore the transmission of information between oil and gas energy markets.

Findings – This study provides evidence for efficiency in energy markets. The new information that arrives either to futures markets or spot markets is digested correctly, completely, and in a fast manner, and is propagated to the other market. The evidence indicates high efficiency.

Originality/value – This study is one of the first papers that uses 30-minute interval intraday data to investigate efficiency in oil and gas commodity markets.

Keywords Cointegration, Energy, Commodity markets, Oil and gas markets

Paper type Research paper

1. Introduction

Capital markets enable the trade of innumerable tangible and intangible items, including financial and commodity products. Oil markets have been the primary medium of energy exchange for the governments, all major industries, companies, geographical regions, and most countries all around the world for more than a century. One can certainly admit that in recent decades, there is a growing effort toward finding, harnessing, and utilizing alternative energy sources. There are several reasons for this effort. First, oil provides power to a certain number of countries, which possess surplus resources of this energy source. Second, these countries can act unilaterally to control the supply and therefore, the price of this energy source. The well-known group of the Organization of Petroleum Exporting Countries is claimed to have acted as a cartel in the past in order to influence the price of oil. Third, gasoline use has increased at an enormous rate over the last century as the primary source of fuel in internal combustion engines. This in turn has had a significant negative impact on the environment. The health hazards to humans and to other living organisms due to the pure quality of air, potential leaks and the consequences of these natural disasters, the benzene and other carcinogens that exist in the composition of oil have enormous real and potential costs. All these factors have nudged researchers and governments to find alternative energy sources, and several potential replacements have emerged in recent years.

Even with all the recent alternatives that have been introduced as potential replacements, oil continues to be the primary source of energy for the majority of industries. Oil industry and all the sub-industries, along with all the by-products continue to
be the primary drivers of many economies all around the world. Oil continues to be traded non-stop at spot markets and futures markets 24 hours and seven days a week.

In this paper, the focus is on the efficiency of oil markets and on the determination of how quickly and completely new information is incorporated into these markets. The paper also explores how information propagates from one market to another. Is there symmetry or asymmetry in the propagation of information? How fast does information travel from one market to the other? Again, is the speed synchronous, or is the speed of propagation asymmetric? The majority of papers, which examine these issues in oil markets, have used data samples and sample periods with low sampling frequencies, ranging from quarterly, to monthly, weekly, or, daily. In recent years, there is a trend to apply intraday prices. One such example is Inci and Seyhun (2018). This current paper is a continuation of that study with further analysis using intraday data.

The primary innovation in this paper is the utilization of intraday oil prices. The paper explores oil spot and oil futures markets focusing on the Brent Index spot and futures markets. Daily and 30-minute intraday data are used for the investigation. All these are unique characteristics of this paper. The study shows that oil spot and oil futures markets are quite attractive for numerous different types of investors. The markets exhibit high degrees of efficiency. Institutional investors, pension funds, mutual funds, insurance company funds, endowments, investment companies, professional investors, international and domestic investors, individual investors can all participate in these markets – for numerous different investment objectives.

The rest of the paper is organized as follows. The next section presents an overview of the previous literature on oil markets. Section 3 is about the data used in the study. Section 4 presents the results, along with the interpretation and discussion. The last section follows the conclusion.

2. Literature review

Well-connected oil markets are attractive to producers and consumers of oil. These markets are also very attractive for investors who are not necessarily interested in producing or consumer oil, but are more interested in the dynamics of oil process. These investors are primarily interested in enhancing their wealth through trading contracts on oil either in real time or through futures. For these professional, investors and financial institutions, efficiency and effectiveness of these markets, as well as the connection between different kinds of oil markets and oil contracts are of enormous interest. The risk management strategies and profit generation strategies are all influenced heavily by whether the markets exhibit efficiency.

The research on oil in the literature goes back a long time. One of the early studies in the area by Garbade and Silber (1983) concluded that oil markets are integrated and that risk management tools can be applied in these markets. Schwarz and Szakmary (1994) focus on futures markets on oil and document that oil futures markets achieve risk transfer and accurately price oil. Silvapulle and Moosa (1999) examine the reaction of oil markets to the arrival of new information. They document that the price reaction to new information is typical of those in efficient markets. Moosa (2002) utilizes sophisticated statistical estimation techniques and the analyses through the empirical systems of equations method confirm the results and conclusions of earlier studies. In a similar vein, Bekiros and Diks (2008) use sophisticated dynamic linear and non-linear models to determine the impact of the interaction between oil spot and oil futures markets. They find the necessity and the usefulness of both of these types of markets in trading oil for producers, consumers, and investors – both of these markets are found to be essential in the price discovery process of oil.

One primary deficiency of previous research in this area has to do with the sampling of the data used in the empirical studies. The statistical tests, causality analyses, theoretical models, and their application to real life empirical data all use low frequency sampling of
the data. Sampling frequency is as low as quarterly or monthly in some studies. Recent papers mainly use daily sampling of the prices and returns, however, in today’s world of optical cables, ultra-high frequency trading, daily updates or portfolios, minimized financial frictions, ease of capital mobility across borders and markets necessitate the use of higher frequency data. Only that way, the statistical causality analyses can be properly conducted, and market efficiency explorations can be correctly concluded. When new information arrives, the prices react fast. To see that reaction and to determine how completely and correctly process respond to information requires the use of intraday data. The propagation of price and return adjustments from one market to the other can only be investigated using intraday data.

The purpose of this paper is to utilize intraday data to better address the effectiveness and efficiency of information reaction, and the oil spot and the oil futures markets’ connections. The statistical causality and the lead or lag relationships between spot prices and between futures prices of different contract maturities can be more correctly analyzed only with intraday data. From these perspectives, this paper furthers the conjectures of the Inci and Seyhun (2018). That study utilizes ultra-high frequency tick data. The synchronized two-minute returns in the futures contracts are examined in that paper to answer efficiency concerns in oil markets. In this study, 30-minute prices and returns are used, where the information reaction can be better informed. The arrival of new information can be interpreted differently by markets participants. Positive or negative interpretations, the intensity of the news varies among market participants. The wide geographic dispersion of oil markets around the globe, non-stop continual trading 24 hours a day and seven days a week, lead to a critical limitation in the interpretation of new information. This leads to heightened volatility around the immediate arrival of new information.

Many structural factors unique to oil spot and oil futures markets contribute to accentuated volatility in the very short term. For example, West Texas Intermediate oil prices are recorded at the Dubai oil price benchmarks with a delay of one day. Second, there exist nonsynchronous trading periods, such as the closure of the New York Mercantile Exchange oil trading pit trading 2.30 p.m. eastern US time, with the simultaneous non-stop continuation of electronic trading in systems such as Globex. Geographically, there are other trading platforms such as the Intercontinental Exchange (ICE) in London where electronic trading continues electronically for more than 22 hours a day from 12.55 a.m. to 11 p.m. London time.

The trading ecosystem of accentuated volatility in the very short term would see the heightened instability subside somewhat in a half-hour time segment, after the interpretations of new information become more meaningful, structured, and objective. Therefore, the focus of intraday sampling in this paper is the 30-minute sampling period to investigate the efficiency of oil spot and oil futures markets.

3. Data and sample characteristics
3.1 Connection between spot and futures markets
The fundamental relationship between oil spot prices and oil futures prices is based on the cost-of-carry relation. The future delivery price of an existing quantity of oil depends on the purchase spot price of the same quality and same quantity oil and the physical cost of storing that amount of oil until the future delivery date. Furthermore, any additional advantages of having possession of that amount of time between the spot and future dates, known as the convenience yield, must be taken into account. Finally, the prevailing interest rate throughout the spot and future data must also be considered. All these components are combined together under the umbrella of the cost-of-carry relationship. The resulting connection from the cost-of-carry relationship indicates the interchangeable nature of the oil spot and oil futures contracts. This fundamental cost-of-carry relationship between the
oil spot and oil futures prices has been investigated theoretically and empirically, and has been documented in numerous academic articles in the literature. Examples of some recent research in this area can be summarized with Quan (1992), Huang et al. (2009), Lee and Zeng (2011), Jin et al. (2012), Lu et al. (2014), and Alzahrani et al. (2014). The empirical investigation in this current paper naturally starts from this well-established theoretical setting. The empirical analyses also start from the fundamental connection, but consider and test various expansions of the original setting.

The summary of the data variables is presented in Table I. The table provides the summary statistics for the intraday 30-minute ICE Brent Futures prices and returns. ICE Brent Futures average prices, as well as the minimum and maximum price levels track the corresponding prices for the spot quite closely. Overall, a comparison of the minimum, average, and maximum prices for the spot and futures contacts with different maturities indicate that there are both backwardation (the futures price lower than the spot price) and contango (the spot price lower than the futures price) periods.

Formal empirical investigation of spot and futures prices must start with the exploration of the potential presence of non-stationary components. This set of analyses is conducted with augmented Dickey-Fuller (ADF) tests and the results are reported in Table II. Panel A is about the daily time series for spot prices and returns, as well as the daily prices and returns for futures with one-month, two-month, and three-month maturities. Panel B presents the 30-minute intraday ICE Brent Futures prices and returns. As generally anticipated with time series data, the table indicates the presence of unit roots (UR) in level data variables without much ambiguity. The level price series for all the variables contain UR according to every version of the Dickey-Fuller tests. On the other hand, when first differenced, the return series of every variable is free from UR at the 1 percent significance level.

For the return series in Table II, very high $\rho$ values are estimated in the ADF tests that also lead to consequent $\tau$ values. In these cases, the $\rho$ values all converge together for each of the three versions of the ADF tests. That is why similar/same values appear for some of the return series in the ADF tests. Consequently, the $\tau$ values are also very close to each other in these three versions of the ADF tests for the return series. The results indicate clearly that the return series exhibit no evidence of UR.

### 3.2 Oil prices and returns

The oil spot price index used in the paper is the Brent Index. Brent Index is the closing price, more specifically, the last price of a trade before the closure of the market for the day. This settlement index price from the ICE for Brent in London is calculated as the average of the trading prices in the 25-day Brent-Forties-Oseberg-Ekofisk (BFOE) market in the related

<table>
<thead>
<tr>
<th>Ice Brent Crude Futures (CO)</th>
<th>30-minute intraday data</th>
<th>n</th>
<th>Mean</th>
<th>SD</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-month Futures prices</td>
<td></td>
<td>45,648</td>
<td>103.4969</td>
<td>13.93815</td>
<td>68.31357</td>
<td>127.3761</td>
</tr>
<tr>
<td>2-month Futures prices</td>
<td></td>
<td>41,346</td>
<td>103.1628</td>
<td>13.45866</td>
<td>69.20139</td>
<td>126.46</td>
</tr>
<tr>
<td>3-month Futures prices</td>
<td></td>
<td>33,301</td>
<td>103.3742</td>
<td>12.80124</td>
<td>69.79</td>
<td>125.8933</td>
</tr>
<tr>
<td>1-month Futures returns</td>
<td></td>
<td>45,647</td>
<td>0.000001</td>
<td>0.0023</td>
<td>−0.03088</td>
<td>0.02606</td>
</tr>
<tr>
<td>2-month Futures returns</td>
<td></td>
<td>41,345</td>
<td>0.000001</td>
<td>0.00237</td>
<td>−0.03008</td>
<td>0.02627</td>
</tr>
<tr>
<td>3-month Futures returns</td>
<td></td>
<td>33,300</td>
<td>0.000001</td>
<td>0.00261</td>
<td>−0.02904</td>
<td>0.02753</td>
</tr>
<tr>
<td>Brent Index Spot</td>
<td></td>
<td>1,066</td>
<td>103.1509</td>
<td>14.22045</td>
<td>69.07</td>
<td>126.14</td>
</tr>
<tr>
<td>Brent Index Spot Return</td>
<td></td>
<td>1,065</td>
<td>0.00003</td>
<td>0.01227</td>
<td>−0.04918</td>
<td>0.04322</td>
</tr>
</tbody>
</table>

**Notes:** Raw price values and raw return values are used for the statistical calculations in the table. The sample period is from January 2010 to March 2014.
delivery month reported by the industry media. Only the published cargo size trades and assessments are considered in the calculations.

More explicitly, the index is the average of three parts: First part is the weighted average of the cargo trades of the first month in the 25-day BFOE market. The second part is the weighted average of the cargo trades of the second month in the 25-day BFOE market.
augmented with a straight average of the spread trades between the first and second months. The third part is the average of designated assessments printed in the conventional media reports.

As explained further at the ICE resources, the first part weighted average is the average of the cargo trade prices reported that are weighted by the volume in order to include multiple trades at any one price level. If conventional media sources do not agree on the number of trades at a given price, then the ICE Futures attempts to clarify the actual number and amount of trades – with the condition and flexibility of omitting unsubstantiated trades that do not meet the satisfaction of the ICE London Exchange. The second part averages produce an inferred price for the first month of the 25-day market. This is accomplished by averaging the second month traded cargo prices and by using the averages of the spreads of the first month trades and the second month trades. The average spread value is determined using the standard average price of spread trades documented by conventional media sources. The average spread is then added to the weighted average trade price representing the second month in order to build the implied first month price level. Traded in the second month of the 25-day market are naturally taken into consideration in this second part calculation as well, after they are adjusted for the size of the differential between the first 25-day month and the second 25-day month. The third part of the Brent Price Index is acquired from the conventional industry media publications of 25-day BFOE market price assessments throughout the trading day. The mid-point of each quote is utilized to calculate an average value representing the whole trading day.

The second group of data is the futures prices obtained from the ICE Brent Futures contracts based on Brent Crude Oil. The intraday sample period for these futures prices and trading volume is from January 2010 to March 2014. ICE futures contracts are applied as a chief trading classification tool for oil and these futures contracts serve as fundamental benchmark prices for the purchases and the sales of oil all around the world. These oil futures contacts’ prices are extracted from the North Sea and they include Brent Blend, Forties Blend, Oseberg, and Ekofisk crude oil elements and markets, known shortly as the BFOE. The oil futures markers at trading markets are also known under alternative names, such as the Brent Blend, the London Brent, or the Brent Petroleum. These futures contracts were originally traded through the traditional open outcry system of the International Petroleum Exchange in London, but since 2005 the futures contracts are traded at the electronic ICE—the ICE in London. The size of one futures contract constitutes 1,000 barrels of oil. The currency of quotation of these oil futures contracts is in term of US dollars. Each positive (up) or negative (down) tick is a $10 amount[1].

The trading medium for the ICE oil futures contracts and the ICE oil option contracts is the ICE Futures Europe Exchange. Trades are given and executed at the web-ICE trading platform, which has a distribution and maintenance presence in more than 70 countries around the world. ICE Brent Futures became the world’s largest crude oil futures contracts in 2012 in terms of volume. The ICE Brent Futures market share has more than doubled since 2008. The largest group of trading participants in the ICE Brent Futures contracts and the ICE Brent options contracts is commercial hedgers in the form of oil producers, oil consumers, oil processors, and oil merchants. These participants demonstrate ICE futures importance as a risk-reduction tool for these tangible market participants. With a strong and dispersed market, and an easily accessible worldwide trading platform, ICE oil futures exemplify a reachable hedging tool and symbolize a useful indicator of global, regional, and domestic fundamentals. Other fundamental global commodity indices have been resorting to the use of ICE oil futures more frequently and have been increasing the representation of ICE oil futures within the indices because of the growing popularity and importance in the pricing of crude oil.

The summary of the data variables is presented in Table I. The table provides the summary statistics for the intraday 30-minute ICE Brent Futures prices and returns[2].
ICE Brent Futures average prices, as well as the minimum and maximum price levels track the corresponding prices for the spot quite closely. Overall, a comparison of the minimum, average, and maximum prices for the spot and futures contacts with different maturities indicate that there are both backwardation (the futures price lower than the spot price) and contango (the spot price lower than the futures price) periods.

4. Empirical results

The initial investigation of UR clearly reveals that level series – prices – do have UR, while the differenced series – returns – are free from UR. For completeness and for the potential interactions between futures contracts of different maturities, cointegration tests are conducted in order to determine whether the spot and futures prices share a common, non-stationary component. Table III presents these cointegration and rank tests of the interactions between futures prices of different maturities. Panel A presents the results for daily futures prices, while Panel B presents the results for intraday 30-minute price ticks. The cointegration rank test result for each pair of futures price series provides evidence of the rank being equal to one. Therefore, spot prices and futures prices share a common, non-stationary component. These results point out that one can investigate the relations between spot and futures markets either using price levels or returns. Returns are used in this paper because using returns leads to more robust results and conclusions[3].

The interaction of the futures contracts with different maturities between each other, as well as their interactions with the spot index series require the implementation of Granger-causality tests. While Granger-causality tests are not helpful in providing the economic intuition or the tests of economic causality, they are useful in describing the characteristics of the raw data, indicating the presence or absence of lead-lag relations. Consequently, in order to find out any discernible patterns of the interaction between the data series, Granger-causality tests are conducted next.

In the next set of statistical analyses, vector autoregressive technique is employed in order to examine further the integration of oil markets. The statistical models in Table IV use the contemporaneous return along with six lagged values of the independent variable and six lagged values of the dependent variable as the explanatory variables. The order of the lags is determined by using several information criteria, such as the Akaike Information Criterion, Schwarz Bayesian Information Criterion, Hannan-Quinn Information Criterion, and the Final Prediction Error Criterion. One cannot detect a pattern of significance emerging from the causality regressions for the lagged variables. The contemporaneous return is the only explanatory variable that is consistently significant at the 1 percent significance level in every regression with a highly significant $t$-statistics value of at least 190. In the rare situations when the lagged variables have some sort of statistical meaningfulness, they are significant barely at 5 percent level. Therefore, only the contemporaneous explanatory variable and its statistical characteristics are reported in the table.

The regressions in Table IV use the order of six as the order for the autoregressive and moving average components. The results of the Granger-causality regressions between the ICE Brent Futures contracts with different maturities are provided. The table focuses on reporting the estimate and the relevant statistics of the contemporaneous explanatory variable. The first two columns report the Granger-causality regression results of the daily futures results. The last two columns are about the 30-minute returns.

For the causality regressions using daily returns, 1-m to/from 2-m only has the first two lags of the independent variable significant in both directions. 3-m on 1-m exhibits an ARMA (1,4) model, while in the reverse direction the fifth lag of the dependent variable and the first two lags of the independent variable are significant. In the 3-m on 2-m regression, the first two independent variables are significant, while in the reverse direction the second lag of the dependent and the first two lags of the independent are significant.
### Panel A: daily futures prices

ICE Brent Crude Futures prices: 1-month vs 2-months

<table>
<thead>
<tr>
<th>Ho: rank = r</th>
<th>H1: rank &gt; r</th>
<th>Eigenvalue</th>
<th>Trace</th>
<th>5% crit. val.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.0324</td>
<td>40.7115</td>
<td>19.99</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0.0046</td>
<td>5.0373</td>
<td>9.13</td>
</tr>
</tbody>
</table>

Hypothesis test of the Ho restriction

<table>
<thead>
<tr>
<th>Rank</th>
<th>E-value</th>
<th>Rest. E-value</th>
<th>df</th>
<th>Pr &gt; χ²</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.0324</td>
<td>0.0324</td>
<td>2</td>
<td>0.30</td>
</tr>
<tr>
<td>1</td>
<td>0.0046</td>
<td>0.0046</td>
<td>1</td>
<td>0.28</td>
</tr>
</tbody>
</table>

ICE Brent Crude Futures prices: 1-month vs 3-months

<table>
<thead>
<tr>
<th>Ho: rank = r</th>
<th>H1: rank &gt; r</th>
<th>Eigenvalue</th>
<th>Trace</th>
<th>5% crit. val.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.0251</td>
<td>32.569</td>
<td>19.99</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0.0047</td>
<td>5.1139</td>
<td>9.13</td>
</tr>
</tbody>
</table>

Hypothesis test of the Ho restriction

<table>
<thead>
<tr>
<th>Rank</th>
<th>E-value</th>
<th>Rest. E-value</th>
<th>df</th>
<th>Pr &gt; χ²</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.0251</td>
<td>0.0251</td>
<td>2</td>
<td>0.31</td>
</tr>
<tr>
<td>1</td>
<td>0.0047</td>
<td>0.0047</td>
<td>1</td>
<td>0.3</td>
</tr>
</tbody>
</table>

ICE Brent Crude Futures prices: 2-month vs 3-months

<table>
<thead>
<tr>
<th>Ho: rank = r</th>
<th>H1: rank &gt; r</th>
<th>Eigenvalue</th>
<th>Trace</th>
<th>5% crit. val.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.0198</td>
<td>26.7586</td>
<td>19.99</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0.0047</td>
<td>5.1174</td>
<td>9.13</td>
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</table>

Hypothesis test of the Ho restriction

<table>
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<tr>
<th>Rank</th>
<th>E-value</th>
<th>Rest. E-value</th>
<th>df</th>
<th>Pr &gt; χ²</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.0198</td>
<td>0.0198</td>
<td>2</td>
<td>0.37</td>
</tr>
<tr>
<td>1</td>
<td>0.0198</td>
<td>0.0198</td>
<td>2</td>
<td>0.37</td>
</tr>
</tbody>
</table>

### Panel B: 30-minute intraday futures prices

ICE Brent Crude Futures prices: 1-month vs 2-months

<table>
<thead>
<tr>
<th>Ho: rank = r</th>
<th>H1: rank &gt; r</th>
<th>Eigenvalue</th>
<th>Trace</th>
<th>5% crit. val.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.0024</td>
<td>101.728</td>
<td>19.99</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0.0001</td>
<td>5.4757</td>
<td>9.13</td>
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Hypothesis test of the Ho restriction

<table>
<thead>
<tr>
<th>Rank</th>
<th>E-value</th>
<th>Rest. E-value</th>
<th>df</th>
<th>Pr &gt; χ²</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.0024</td>
<td>0.0024</td>
<td>2</td>
<td>0.32</td>
</tr>
<tr>
<td>1</td>
<td>0.0001</td>
<td>0.0001</td>
<td>1</td>
<td>0.31</td>
</tr>
</tbody>
</table>

ICE Brent Crude Futures prices: 1-month vs 3-months

<table>
<thead>
<tr>
<th>Ho: rank = r</th>
<th>H1: rank &gt; r</th>
<th>Eigenvalue</th>
<th>Trace</th>
<th>5% crit. val.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.0116</td>
<td>58.5668</td>
<td>19.99</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0.0002</td>
<td>5.7255</td>
<td>9.13</td>
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</table>

Hypothesis test of the Ho restriction

<table>
<thead>
<tr>
<th>Rank</th>
<th>E-value</th>
<th>Rest. E-value</th>
<th>df</th>
<th>Pr &gt; χ²</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.0116</td>
<td>0.0116</td>
<td>2</td>
<td>0.32</td>
</tr>
<tr>
<td>1</td>
<td>0.0002</td>
<td>0.0002</td>
<td>1</td>
<td>0.29</td>
</tr>
</tbody>
</table>

ICE Brent Crude Futures prices: 2-month vs 3-months

<table>
<thead>
<tr>
<th>Ho: rank = r</th>
<th>H1: rank &gt; r</th>
<th>Eigenvalue</th>
<th>Trace</th>
<th>5% crit. val.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.0026</td>
<td>91.751</td>
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<td>1</td>
<td>1</td>
<td>0.0002</td>
<td>5.855</td>
<td>9.13</td>
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</table>

Hypothesis test of the Ho restriction

<table>
<thead>
<tr>
<th>Rank</th>
<th>E-value</th>
<th>Rest. E-value</th>
<th>df</th>
<th>Pr &gt; χ²</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.0026</td>
<td>0.0026</td>
<td>2</td>
<td>0.32</td>
</tr>
<tr>
<td>1</td>
<td>0.0002</td>
<td>0.0002</td>
<td>1</td>
<td>0.31</td>
</tr>
</tbody>
</table>

**Notes:** Cointegration test results are presented in the table. Panel A presents the results for daily data and Panel B presents the results for the 30-minute intraday frequency data.
For the 30-minute intraday return regressions, when there is evidence of Granger causality, the 2-m on 1-m regression has the first lags of the dependent and the independent variable as statistically significant. The 3-m to 1-m regression has the first two lags of the dependent and the first lag of the independent variable significant. Finally, in the 3-m to 2-m regression, the second lag of the dependent variable and the first lag of the independent variable are significant.

One can see from the table that the slope coefficient, as the interaction term, is highly statistically significant and very close to unity in nearly all of the Granger-causality regressions. This is evidence for high interaction between futures returns with different maturities independent of the frequency of the return. Overall, the evidence in Table IV

<table>
<thead>
<tr>
<th></th>
<th>Daily 30-minute</th>
<th>30-minute</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Granger-causality regressions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-month on 1-month ICE Futures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable</td>
<td>Rco1(t)</td>
<td>Rco1(t)</td>
</tr>
<tr>
<td>Estimate</td>
<td>0.96429</td>
<td>0.96174</td>
</tr>
<tr>
<td>SD</td>
<td>0.00361</td>
<td>0.0013</td>
</tr>
<tr>
<td>t-value</td>
<td>266.89</td>
<td>742.05</td>
</tr>
<tr>
<td>Pr &gt; t</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
<tr>
<td>1-month on 2-month ICE Futures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable</td>
<td>Rco2(t)</td>
<td>Rco2(t)</td>
</tr>
<tr>
<td>Estimate</td>
<td>1.02433</td>
<td>0.98918</td>
</tr>
<tr>
<td>SD</td>
<td>0.00384</td>
<td>0.00131</td>
</tr>
<tr>
<td>t-value</td>
<td>266.95</td>
<td>739.73</td>
</tr>
<tr>
<td>Pr &gt; t</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
<tr>
<td>3-month on 1-month ICE Futures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable</td>
<td>Rco1(t)</td>
<td>Rco1(t)</td>
</tr>
<tr>
<td>Estimate</td>
<td>0.94412</td>
<td>0.94544</td>
</tr>
<tr>
<td>SD</td>
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<td>0.00218</td>
</tr>
<tr>
<td>t-value</td>
<td>194.27</td>
<td>433.19</td>
</tr>
<tr>
<td>Pr &gt; t</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
<tr>
<td>1-month on 3-month ICE Futures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable</td>
<td>Rco3(t)</td>
<td>Rco3(t)</td>
</tr>
<tr>
<td>Estimate</td>
<td>1.03491</td>
<td>0.90207</td>
</tr>
<tr>
<td>SD</td>
<td>0.00533</td>
<td>0.00208</td>
</tr>
<tr>
<td>t-value</td>
<td>194.27</td>
<td>433.57</td>
</tr>
<tr>
<td>Pr &gt; t</td>
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<td>0.0001</td>
</tr>
<tr>
<td>3-month on 2-month ICE Futures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable</td>
<td>Rco2(t)</td>
<td>Rco2(t)</td>
</tr>
<tr>
<td>Estimate</td>
<td>0.98368</td>
<td>0.91364</td>
</tr>
<tr>
<td>SD</td>
<td>0.0018</td>
<td>0.0018</td>
</tr>
<tr>
<td>t-value</td>
<td>547.43</td>
<td>507.14</td>
</tr>
<tr>
<td>Pr &gt; t</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
<tr>
<td>2-month on 3-month ICE Futures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable</td>
<td>Rco3(t)</td>
<td>Rco3(t)</td>
</tr>
<tr>
<td>Estimate</td>
<td>1.01353</td>
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</tr>
<tr>
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<tr>
<td>t-value</td>
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<td>507.14</td>
</tr>
<tr>
<td>Pr &gt; t</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

Notes: The contemporaneous explanatory variable is reported in the table. The lags of the returns are not reported because there is no uniform pattern of significance in the regressions; rather the significance of the lagged explanatory variables is spurious and when significant, it is generally barely borderline significant at the 5 percent significance level.
indicates that oil markets are strongly connected in terms of information flow. Any shock to any one contract is transmitted to the other contracts very quickly and almost fully.

The lead-lag relationships between oil spot prices and oil futures prices are explored next. The analyses results are reported in Table V. For oil futures prices, one-month, two-month, and three-month to maturity ICE Brent Futures contracts are used, where the prices are recorded at 4:30 p.m. local London time. For the oil spot prices, Brent Index is employed and the lead-lag relationships between spot and futures markets are examined. Contemporaneous relationships between the spot and the futures prices are strong and dominant. One-day lagged values of the ICE Brent Futures predict the next day's Brent Index spot change. The magnitude of the predictive coefficient is small though, resulting in about 0.17. This finding is quite interesting and is consistent with the exposition that the futures markets, in a general sense, tend to anticipate the developments and the dynamics in spot markets and tend to react in advance of the changes in spot prices. The remainder of the statistical models in Table V also exhibit similar relationships and linkages between the two-month to maturity ICE Brent Futures and the spot Brent Index, as well as between the three-month to maturity ICE Brent Futures and the spot Brent Index[4].

Sensitivity analysis and robustness tests are reported in Table VI. The sample period is divided into two parts. When futures contract prices are higher than spot prices, the dynamics for the commodity is named contango. One other hand, when the spot prices are higher than futures contract prices, the dynamics of the commodity is known as backwardation. The sample period in this paper is roughly split between these two dynamics. From January 2010 to mid-March 2011, the dynamics for oil markets indicate contango. The second half of the sample period exhibits backwardation from mid-March 2011 through to the end of the sample period. The purpose of the sensitivity

Cointegration and causality in capital markets

<table>
<thead>
<tr>
<th>Panel A: ( R(1\text{-m Brent Futures})<em>t = R(1\text{-m Brent Futures})</em>{t-1} + R(BI)<em>t + R(BI)</em>{t-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>(1)</td>
</tr>
<tr>
<td>( R(BI)<em>t = R(1\text{-m BF})</em>{t-1} + R(1\text{-m BF})<em>{t-1} - 1 + R(BI)</em>{t-1} )</td>
</tr>
<tr>
<td>Model</td>
</tr>
<tr>
<td>(2)</td>
</tr>
<tr>
<td>( R(2\text{-m BF})<em>t = R(2\text{-m BF})</em>{t-1} + R(2\text{-m BF})<em>{t-1} - 1 + R(BI)</em>{t-1} )</td>
</tr>
<tr>
<td>Model</td>
</tr>
<tr>
<td>(3)</td>
</tr>
<tr>
<td>Panel B: ( R(BI)<em>t = R(2\text{-m BF})</em>{t-1} + R(2\text{-m BF})<em>{t-1} - 1 + R(BI)</em>{t-1} )</td>
</tr>
<tr>
<td>Model</td>
</tr>
<tr>
<td>(4)</td>
</tr>
<tr>
<td>( R(3\text{-m BF})<em>t = R(3\text{-m BF})</em>{t-1} + R(3\text{-m BF})<em>{t-1} - 1 + R(BI)</em>{t-1} )</td>
</tr>
<tr>
<td>Model</td>
</tr>
<tr>
<td>(5)</td>
</tr>
<tr>
<td>( R(BI)<em>t = R(3\text{-m BF})</em>{t-1} + R(3\text{-m BF})<em>{t-1} - 1 + R(BI)</em>{t-1} )</td>
</tr>
<tr>
<td>Model</td>
</tr>
<tr>
<td>(6)</td>
</tr>
</tbody>
</table>

Notes: Lead-lag regression results with Brent Index (BI) and ICE Brent Futures (BF) daily returns are reported in the table. \( R^2 \) excludes the explanatory power of the error models (EM), \( \chi^2 \) statistic tests for the autocorrelation of residuals for the first six lags. \( p(\chi^2) \) indicates the \( p \)-value or the significance level of the \( \chi^2 \) statistic.
and robustness tests is to find out whether the prior conclusions of the paper continue to hold in these two sub-samples representing quite different dynamics.

Granger-causality regression test results using 30-minute intraday returns for each sub-sample are provided in Table VI. Panel A is for the dynamics when oil futures prices are higher than oil spot prices – contango. Panel B represents the dynamics when oil futures prices are less than oil spot prices – backwardation. Regardless of the different dynamics, the results depict the tight connection between futures contracts with different maturities – the slope coefficients of the regressions are consistently very close to one. These findings, as before, point out that an innovation in one futures contract with a specific maturity will propagate to other futures contracts of various maturities. This propagation will experience very little attenuation regardless of whether the financial ecology exhibits contango dynamics or backwardation dynamics. These results again exhibit the tight connection in oil markets.

5. Conclusions

This paper builds on the oil commodity literature explores further whether oil markets are efficient and whether the oil spot and oil futures markets are effectively connected. This is an important issue for a wide spectrum of market participants ranging from producers and consumers of oil, to speculators, arbitragers, risk-reducing hedgers, professional and individual investors, traders, and policy makers.
Efficiently connected oil spot and oil futures markets are indicative of well-functioning oil markets. These markets discover new, important, and relevant information quickly. Such new information, innovations, and positive or negative shocks are priced correctly and then transmitted to all related markets, quickly and completely.

Using accurate 30-minute intraday return data, the study extends the literature further and builds on Inci and Seyhun (2018). The evidence confirms that oil spot and oil futures markets are tightly linked. Economic shocks, news, innovations that arise in spot markets quickly and fully conveyed to the futures markets. The evidence shows that most of the reaction is completed within at most half an hour. Similarly, positive or negative shocks, news, innovations arriving in futures markets are transmitted to spot markets quickly and fully. The transmissions amongst futures contracts with different maturities are also fast and comprehensive, though the direction of transmission seems to be stronger from the liquid and actively traded shorter-maturity futures contracts to longer-maturity futures contracts. These conclusions are in line with efficient markets. Overall, oil spot and oil futures markets are tightly connected and innovations are communicated quickly and completely.

Notes
1. More details on the futures contracts about their construction, introduction, marketing, trading statistics, trading parties, major buyers and sellers, the number of different contracts, the maturity dates and the related processes are provided in ICE Brent Crude oil facts and summary documentation. Brent Index data are publicly available at the ICE exchange and website. Additional feature are provided at the www.theice.com/products/219/Brent-Crude-Futures
2. The 30-minute prices are volume-weighted averages of all the trading prices recorded during that relevant half-hour interval.
3. The unrestricted trace hypothesis tests were not conclusive, while the trace hypothesis test with restrictions showed that the cointegration rank was 1. In circumstances such as these, one can either utilize co-integrating regressions focusing on price series, or alternatively, one can resort to using returns series in the investigation. Since numerous different empirical issues are explored in the paper such as the Granger causality, the joint VAR analysis, and the interactions between futures series and spot series, returns of the time series variables are used in the paper.
4. Employing higher lags of both the dependent as well as the independent variables in the regressions did not produce statistically significant results.

References


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