Inequality evidence from accounting data visualisation

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< Abstract >

Purpose – Using Piketty's (2013) theory on inequality, this paper sheds light on the inequality among countries and firms through the data visualisation of accounting big data from listed firms of 140 countries for 1985-2013.

Design/methodology/approach - The design is exploratory data analysis and reproducible research using data visualisation tools, namely, R with dplyr, ggplot2, and googleVis (Geo Chart and Motion Chart), to present the evidence in an easily understood way.

Findings - The paper's findings are as follows: (1) multinational firms have economic power which is greater than the gross domestic products (GDPs) of most small, medium-sized, and developing countries; (2) inequality force (r > g) exists from the accounting perspective, using return on equity (ROE) data for r and the sales' growth rate for g; (3) inequalities of firms' wealth are greater than inequalities of firms' income; (4) hyper-concentrated wealth exists among countries worldwide; and (5) hyper-concentrated firms' wealth exists worldwide and in the US, China, and Japan.

Research limitations/implications – Further research is needed into the contribution which accounting can make to the issues of inequality and hyper-concentrated firms' wealth highlighted in this paper.

Practical implications - This paper's results provide a chance to tackle the inequality issue with objective evidence.

Originality/value - For the first time, evidence of the inequality of firms' wealth is shown using accounting big data. This paper also provides a novel methodology of accounting research through visualisation.

Key word : Inequality, Data Visualisation, Accounting data, Exploratory data analysis, Reproducible research

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1. Introduction

According to Sen (1992), 'a common characteristic of virtually all the approaches to the ethics of social arrangements that have stood the test of time is to want equality of something – something that has an important place in the particular theory'. However, globalisation has played a part in the increase in inequality. The underlying thesis is that the world is paying a high price for inequality with an economic system which is less stable and efficient, and has less growth, and a democracy which has been placed in peril. In addition, the financial crisis of 2007/8 unleashed a new realisation that the economic system is not only inefficient and unstable but also fundamentally unfair. The forces which have created these outcomes are self-reinforcing. Thus, outsize inequality is likely to become worse. Such inequality contributes to the instability of the economic system, which in turn contributes to increased inequality. This represents a downward spiral into which the world has descended (Stiglitz, 2012).

Worldwide inequality has grown to the point where it can no longer be ignored (Stiglitz, 2012). As global firms' power has increased through globalisation, their business activities have come to affect society and people's lives more significantly than ever before. Further, although global firms' wealth has increased rapidly each year, not all the world enjoys the subsequent economic affluence, for example, through sufficient wages. If significant inequality continues to be disregarded, it could threaten the sustainability of firms and society.

Accountability has taken root and prospered in a specific economic, social, and political context in which there is extreme wealth inequality (Cooper and Johnston, 2012). If there is evidence of worldwide inequality of firms' wealth, there might be a way to tackle this issue from the perspective of accountability. Thus, this paper first shows global firms' power compared with national power represented by gross domestic products (GDPs), and then provides evidence of the inequality associated with firms from several perspectives both worldwide and within countries.

Piketty (2013) states in his book Capital in the Twenty-First Century that a market economy based on private property, if left to itself, contains powerful forces of convergence; however, it also contains powerful forces of divergence, which potentially

threaten democratic societies and the values of social justice on which they are based. The principle of destabilising force is related to the fact that the private rate of return on capital, r, can be significantly higher for long periods than the rate of income and output, g. The inequality r > g implies that wealth accumulated in the past grows more rapidly than output and wages. In addition, Piketty (2013) shows hyper-concentrated wealth using individual data. This paper, as evidence of the inequality of firms' wealth, examines whether the same result (r > g) exists from firms' perspectives, whether inequalities of firms' wealth are greater than inequalities of firms' income, whether wealth hyper-concentrated exists among countries worldwide. and hyper-concentrated firms' wealth exists worldwide and in the top three countries (the US, China, and Japan) in terms of GDPs.

In order to show inequality evidence, this paper analyses financial big data from listed firms of 140 countries for nearly 30 years (from 1985 to 2013). Such raw data have over two million rows and their text file's volume is over one gigabyte. Even a few years ago, it was impossible to handle and visualise such a big volume of data. However, the recent rapid development of information communication technology (ICT), such as communication, high-performance computers, high-speed data high-functionalised software, and large storage facilities, has produced a phenomenon referred to as the 'data explosion', also known as 'big data'. In this circumstance, collecting, arranging, and processing useful data in an efficient way, and finding new knowledge and ways for decision-making, are fresh challenges. For example, few people can detect patterns among rows of numbers. Instead, humans are intensely visual creatures. Even young children can interpret bar charts and extract meaning from numbers' representations. For this reason, data visualisation is a powerful tool; indeed, visualising data is the fastest way to communicate with others. Of course, visualisations, like words, can be used to lie, mislead, or distort the truth. However, when practised honestly and with care, the process of visualisation can help to see the world in a new way, revealing unexpected patterns and trends in otherwise hidden information (Murray, 2013). For the first time, this paper uses visualisation tools in order to gather and address accounting big data and to present the data in an easily understood way.

The results of this paper's analysis through accounting data visualisation using global listed firms' data from 140 countries for nearly 30 years offer the following evidence:

(1) multinational firms have economic power which is greater than the GDPs of most

small, medium-sized, and developing countries; (2) inequality force (r > g) exists from the accounting perspective, using return on equity (ROE) data for r and the sales' growth rate for g of worldwide firms which are listed continuously from 1985 to 2013; (3) inequalities of firms' wealth are greater than inequalities of firms' income; (4) hyper-concentrated wealth exists among countries worldwide; and (5) hyper-concentrated firms' wealth exists worldwide and in the top three countries, the US, China, and Japan.

Consequently, this paper contributes to the literature in two key ways. First, it shows unique evidence of the inequality of firms' wealth, using global data for nearly 30 years, through data visualisation tools; that is, R (software environment) with the packages dplyr, ggplot2, and googleVis. Although the visual domain is a communication method which offers an abundant array of signs and is discussed in the accounting and accountability field (e.g. Davison and Warren, 2009), the literature considers the process of visual representation, which is superficial visualisation, not the process of visualisation, which is depth visualisation. The first evidence of accounting data visualisation is shown in this paper. Data visualisation presents accounting big data in an easily understood way and at its best is an expert means of storytelling (Murray, 2013). Second, through visualisation, this paper provides a novel methodology of accounting research and finds the frontier of a new research question which considers how accounting can solve wealth inequality which has grown to the point where it can no longer be ignored. With regard to inequality, the problem is not that globalisation is bad or wrong but that governments are managing the situation poorly - and largely for the benefit of special interests. Interestingly, however, in Japan, the degree of inequality is more moderate than elsewhere worldwide and particularly in the US and China. In accounting practice and research, which grants primary importance to efficiency, equity has been relegated to secondary status. However, is accounting's objective to maximize wealth and ignore the social desirability of the distribution of wealth? Accounting information should ultimately serve to enhance social welfare (Lehman, 1992). This paper's evidence identifies that now is the time for accounting research to tackle inequality issues with available knowledge.

The remainder of this paper is organised as follows. Section 2 provides the background to the analyses and reviews the related research. Section 3 presents the research design, and Section 4 develops the hypotheses and explains the data. Section 5 describes the

results of the analyses and Section 6 is the conclusion.

2. Background

The word 'accountability' has taken root and prospered in a specific economic, social, and political context in which there is extreme wealth inequality (Cooper and Johnston, 2012). However, with accounting practice and research granting primary importance to efficiency, equity has been relegated to secondary status. Comments which refer to equity as an implicit objective are mystifying because in the pursuit of efficiency, researchers completely ignore issues concerning equity (Lehman, 1992). Little literature exists on inequality and accounting in a power inequality context (e.g. Gray and Laughlin, 2012) or on the theory of earnings and wealth inequality (e.g. Castañeda et al., 2003). One of the reasons why accounting research does not discuss the inequality issue is that there is no solid evidence of worldwide inequality using global firms' accounting data. In order to show such evidence, this paper uses the research design of visualisation.

In the accounting field, visual images are important because they influence the knowledge set and the ways in which knowledge is developed. This concept recognises the multiplicity of ways in which different people 'see' and interpret images while at the same time suggesting that multiple ways of seeing and interpreting cumulatively offer valuable additions to an understanding of phenomena (Parker, 2009). In addition, visual methodology places stronger emphasis on salient and under-researched elements (Warren and Parker, 2009). For example, Warren (2005) shows that photographic images can communicate participants' views of their worlds with more primacy than language alone, raising their voices in the dissemination of research. Further, Brennan et al. (2009) show that impression management is pervasive in corporate financial communications using multiple impression management methods. In one sense, all research attempts to help the reader or student form images and visualise what is being conveyed through words, numbers, charts, graphs, quotations, and so on (Parker, 2009). Thus, the visual domain is a further method of communication which offers an abundant array of signs which relate to accounting. Accounts are in themselves visual artefacts, whose presentation has influenced patterns of thinking from Pacioli onwards. Contrary to popular, or indeed many an economist's, belief that accounting is all about numbers, matters relevant to accounting are communicated in three 'languages': numbers, words, and visual images (Davison and Warren, 2009).

The design of prior accounting research uses visual representation in a number of ways: to discuss how photography might help to give research participants a greater role in accounting research (Warren, 2005); to explore the methodological dimensions and potential of photo-elicitation as a historical research tool (Parker, 2009); to discuss impression management effects through visual presentation (Brennan et al., 2009); to analyse relations among different kinds of visualisation in annual reports and to trace their interactions with marketing and sales activities (Justesen and Mouritsen, 2009); to present methods that clarify the complexity of intellectual capital (Cuganesan and Dumay, 2009); to explore the potential of visual cultural studies (Brown, 2010); and to examine visual images of professional accountancy (Davison, 2011). The empirical focus of such research is similarly varied and includes the following: visual elements in annual reports, logos, adverts, professional magazines, and web pages, and three-dimensional (3-D) visualisations (Davison and Warren, 2009).

The modern information age more often feels like an era of information overload. Excess amounts of information can be overwhelming; only when researchers apply methods which derive insights from raw data can such data become useful. Visualisation is a process of mapping information to visuals. However, static visualisations can offer only pre-composed 'views' of data (Murray, 2013). Although the visual domain is a communication method which offers an abundant array of signs and is discussed in the accounting and accountability field (e.g. Davison and Warren, 2009), the literature considers the process behind the 'views' of data. However, multiple static views are often needed to present various perspectives of the same information. Consequently, dynamic, interactive visualisations can explore data for themselves. The basic functions of most interactive visualisation tools have changed recently. Interactive visualisation which offers an overview of data alongside tools for drilling down into the details can successfully fulfil many roles at once, addressing the different concerns of different audiences, from those new to the subject matter to those already conversant with the data (Murray, 2013). Such interactive visualisation tools are Google Geo Chart (Geo Chart, hereafter) and Google Motion Chart (Google Motion, hereafter), which are included in googleVis. This paper uses these data visualisation tools, as discussed in the next section. Such visualisation can address and display the results of big data in an easily understood way.

3. Research design

3.1 Exploratory data analysis and reproducible research with R

An important point of data analysis is the exploratory data analysis (EDA) proposed by Tukey (1977). EDA offers a core concept and specific method by using the following cycle: data summarisation, visualisation for exploratory data analysis, statistical modelling and fitting, and statistical inference and decision-making. Figure 1 shows the cycle, and illustrates that through the appropriate application of EDA, statistical inference and decision-making can be realised. The key part of EDA, data visualisation (e.g. Chen et al., 2008) or, in a wider sense, information visualisation (e.g. Tufte, 1990, 1997, 2001, 2006; Mazza, 2009), is to re-realise the importance, along with statistical modelling, of the development of the ICT environment. The software environment for statistical computing and graphics to enable the implementation and realisation of EDA is R, which is developed by Ihaka and Gentleman (1996). This paper uses R in order to conduct our analyses and ensure reproducible research practices as referred to in Xie (2013). The version of R is 3.2.1.

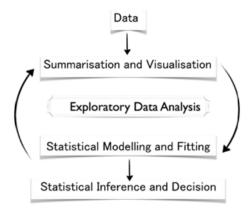


Figure 1 Conceptual diagram of exploratory data analysis

Results from scientific research have to be reproducible in order to be trustworthy. The idea behind reproducible research is that the final product of research is not only the study but also the full computational environment used to produce the study's results. This environment includes the code and data necessary to reproduce the results and build upon the research (Xie, 2013). All the analyses in this paper is reproducible.

3.2 Data visualisation

Visual representation is conducted by data mapping into visual attributes. Such attributes have colour, form, spatial position, and motion. They are treated in a pre-attentive process through visual cognitive capacity (Ware, 2013), thus mapping complicated information, which is difficult to verbalise, in a visual way which humans can understand instantly. In addition, mapping multiple information about data makes it possible to produce visual representations that enable an understanding of features at the same instant. However, it is important to avoid distorting what the data have to say (Tafte, 2001).

Figure 2 shows the flow of visual representation based on Mazza (2009). At the first step of 'Preprocessing & Data Transformations', raw data is structuralised through logical patterns and data conversion to treat outliers and missing values in order to enable data processing with software. The second step of 'Visual Mapping' is a data mapping process from a logical structure into a visual structure. The elements of a visual structure comprise a spatial substrate, a graphical element, and graphical properties. The third step of 'View Creation' is the final result of visualisation through a visual structure which is shown on the computer screen.

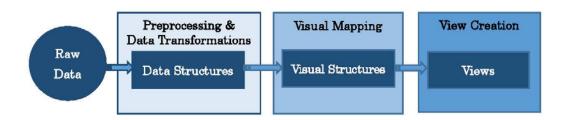


Figure 2 Flow of visual representation

According to Mazza (2009) and Spence (2014), visualisation is a cognitive activity, facilitated by graphical external representations from which people construct internal mental representations of the world, which we call depth visualisation. This is different from a superficial definition of visualisation, as we refer to it, which merely results in graphics from data, i.e. visual representations. Shedroff (1994) analyses how the process of understanding data comes about, and defines this process as the 'continuum of understanding'. Shedroff (1994) describes it as a continuum that generates information from data. In addition, the information can be transformed into knowledge and finally into wisdom (see also Mazza, 2009). 'Visual Representation', that is, superficial visualisation, is located between 'Data' and 'Information'. 'Visualisation', which is the depth definition of visualisation and is an internal cognitive activity, is located 'Information' and 'Knowledge'. Figure 3 shows the 'continuum of understanding', and the position of the depth definition of visualisation ('Visual Representation') and the superficial definition of visualisation ('Visualisation') in it.

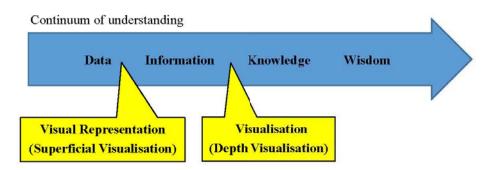


Figure 3 Visual representation and visualisation in Shedroff's continuum of understanding

In this paper, because we examine sequential observational data with temporal and spatial variation, we use time-series and cross-sectional charts. A time-series chart is a fundamental tool with which to observe the temporal variation of data. Further, integrating the cross-sectional information of data into time-series variation enables us to understand the data comprehensively. At present, the best application software to visualise the data from such point of views is Motion Chart. This software is based on Gapminder World, developed by the Gapminder Foundation, whose director is Hans Rosling, and is a dynamic chart that enables the exploration over time of several indicators. Motion Chart can create visualisations which are easier to understand panel

data. The package which provides an interface between R and Google Chart Tools, including Geo Chart and Motion Chart, is googleVis (see Gesmann and de Castillo, 2011). This paper uses this package with R and visualise accounting data with Geo Chart and Motion Chart.

When processing big data in order to divide the data structure into homogeneous pieces, apply a function to each piece, and then combine the results, it is necessary to use a set of split-apply-combine strategic tools for R 'plyr'. In this paper, we use 'dplyr', the package which applies plyr on the R data frame. This enables filtering (maintaining rows of matching criteria), selecting (choosing columns by name), mutating (adding new variables), arranging (reordering rows), and summarising (reducing variables to values) at high speed (see Wickham, 2014). All these tools are available from the Web (see 'Tools' after the references). Working with Web-standard technologies means that one's work can be seen and experienced by any person who uses a recent web browser, regardless of the operating system and device type (Murray, 2013).

This paper also uses ggplot2, which is an R library for creating data visualisations. ggplot2 is a plotting system for R by Wickham (2009), which takes care of many of the fiddly details that make plotting a hassle as well as providing a powerful model of graphics that makes it easy to produce complex multi-layered graphics. In order to determine the globally skewed distribution of wealth, this paper uses R with dplyr, ggplot2 and googleVis (Geo Chart and Motion Chart).

4. Hypotheses development and data

4.1 Hypotheses development

Globalisation has led to the emergence of multinational firms with economic power which is greater than the GDPs of most small, medium-sized, and developing countries. First, we confirm this situation by comparing the annual amounts of national GDPs and firm sales. Thus, our first hypothesis is as follows.

Hypothesis 1: Multinational firms' economic power is greater than the GDPs of most small, medium-sized, and developing countries.

Although the globalisation of the world economy has seen global wealth measured by GDP increase annually, not all the world enjoys economic affluence. Piketty (2013) states that because

'the rate of return on capital remains significantly above the growth rate, then the risk of divergence in the distribution of wealth is very high. This fundamental inequality, which I will write as r > g (where r stands for the average annual rate of return on capital, including profits, dividends, interest, rents, and other income from capital, total value, and g stands for the rate of growth of the economy) will play a crucial role. When the rate of return on capital significantly exceeds the growth rate of the economy, then it logically follows that inherited wealth grows faster than output and income. \cdots Under such conditions, it is almost inevitable that the concentration of capital will attain extremely high levels'. Piketty (2013)

Here, we examine this theory from the accounting perspective. Thus, our second hypothesis is as follows.

Hypothesis 2: The rate of return on equity (r) remains significantly above the growth rate of sales (g) (r > g).

Stiglitz (2012) states in his book The Price of Inequality that inequalities in wealth are greater than inequalities in income. To examine whether the same situation exists from the perspective of firms' wealth, a third hypothesis is proposed as follows.

Hypothesis 3: Inequalities of firms' wealth are greater than inequalities of firms' income.

Global wealth measured by GDP has increased annually, but not all the world benefits from the subsequent economic affluence. As aforementioned, Piketty (2013) states that a market economy based on private property, if left to itself, contains powerful forces of divergence. The principle of destabilising force is related to the fact that the private rate of return on capital, r, can be significantly higher for long periods than the rate of income and output, g. The inequality r > g implies that wealth accumulated in the past

grows more rapidly than output and wages. In such a context, this implies that if Hypothesis 2 is supported, this leads to powerful forces of divergence among firms from the perspectives among countries, within the world, and within each country. This leads to the fourth and fifth hypotheses.

Hypothesis 4: Hyper-concentrated wealth exists among countries worldwide.

Hypothesis 5: Hyper-concentrated firms' wealth exists in the world and in the top three countries.

4.2 Data sampling

To gain the broadest possible worldwide perspective, two data sources are used. The first is the Bureau van Dijk's Orbis database for all listed firms worldwide, and the second is the World Economic Outlook Database of the International Monetary Fund (IMF) (2014). For analytical purposes, countries which have had large-scale redenomination of their currencies between 1985 and 2013, and whose firms' data is NA, are excluded: Argentina, Belarus, Belize, Benin, Gambia, Liechtenstein, Mexico, Mozambique, Niger, Saint Vincent and the Grenadines, Suriname, Togo, Turkey, Uzbekistan, and Zimbabwe. In addition, firms without all the necessary financial data for analysis are excluded. Thus, the final sample is 78,502 firms for nearly 30 years from 1985 to 2013 taken from 140 countries.

5. Results of the analysis

5.1 The growing power of global firms (Hypothesis 1)

The state, which since the middle of the seventeenth century has been the most important of all modern institutions, is in decline. From Western Europe to Africa, many states are either combining into larger communities or falling apart. In this context, many state functions are likely to be taken over by various organisations which, whatever their precise nature, are not states (van Creveld, 1999). The general evolution

is clear: bubbles aside, what we are witnessing is a strong resurgence of private capital in rich countries (Piketty, 2013). The organisations which own large amounts of such private capital are global firms. Here, to show the extent of global firms' influence, we compare national GDPs with firm sales. Table presents the ranking of national GDPs and firm sales in 2013.

[Table here]

Table shows that the United States is ranked first, followed by China and Japan. The names of countries continue to appear in the rankings up to 27. However, Wal-Mart Stores(US) is ranked 28th, Royal Dutch Shell(UK), China Petroleum & Chemical(China), and Exxon Mobil(US) are 29th, 30th, and 31st respectively. These firms' sales are larger than the national GDPs of Austria, the United Arab Emirates, and Thailand. BP(UK)'s sales are almost the same as the GDP of Colombia. Petro China(China)'s sales exceed the GDPs of Iran, South Africa, Denmark, Malaysia, Singapore, Israel, Chile, HongKong, the Philippines, and other low-ranking countries. In Table, firms and their rankings are highlighted in yellow.

More firms appear lower down the rankings. Up to the 100th ranking, there are 61 countries and 39 firms. Up to the 200th ranking, there are 77 countries and 123 firms. Up to the 300th ranking, there are 90 countries and 210 firms. Up to the 400th ranking, there are 101 countries and 299 firms. Up to the 500th ranking, there are 106 countries and 394 firms. Figure 4 illustrates this.

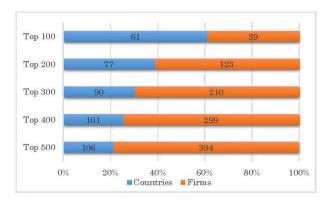


Figure 4 Numbers of countries and firms in the top 500 ranking

5.2 Inequality force (r > g) from the accounting perspective (Hypothesis 2)

To investigate Hypothesis 2, three types of ROE for r (annual rate of return on capital) are used: (1) profit and loss (PL) before tax divided by shareholders' equity, (2) PL after tax divided by shareholders' equity, and (3) net income divided by shareholders' equity. For g (the rate of growth of the economy), the rate of growth of firms' sales is used. For this analysis, among all sample firms of 140 countries (78,502), worldwide firms which are continuously listed from 1985 to 2013 are selected. The number of these firms is 807 from 20 countries (Australia, Bermuda, Canada, Denmark, Finland, France, Germany, Hong Kong, Ireland, Malaysia, Netherlands, Norway, Singapore, South Africa, Spain, Sweden, Switzerland, Thailand, the United Kingdom, and the United States of America)

In Figure 5, the purple line represents ROE (PL before tax) for type (1), the blue line represents ROE (PL after tax) for type (2), the green line represents ROE (net income) for type (3), and the red line is the rate of growth of firms' sales worldwide. These lines and the table below Figure 5 clearly show the evidence for r > g. The 29-year average rate of all three rs is more than 10% (22.48% for PL before tax ROE, 14.48% for PL after tax ROE, and 13.99% for net income ROE) and the rate of g (growth rate of sales) is 6.76%.

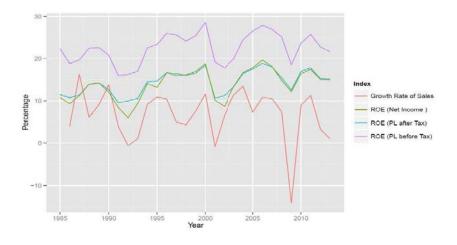


Figure 5 r (ROE) and g (growth rate of sales) of worldwide listed firms from 1985 to 2013

Averag	Average Rate of r and g for 1985-2013					
	ROE (PL before Tax)	22.48%				
r	ROE (PL after Tax)	14.48%				
	ROE (Net Income)	13.99%				
g	Growth Rate of Sales	6.76%				

5.3 Inequalities of firms' wealth and income (Hypothesis 3)

The principle of the powerful forces of divergence is related to the fact that r can be significantly higher for long periods than g (Piketty, 2013). In such a context, if Hypothesis 2 is supported, this would lead to powerful forces of divergence among firms. To confirm this, the googleVis R package is used to illustrate the dynamic movement from 1985 to 2013 of the sum of listed firms' sales in each of the 140 countries on a world map. googleVis is an interactive visualisation tool; however, because it is difficult to show comprehensive interactive dynamic movement on paper, the following are presented: (1) snapshots of Geo Chart with the degree of concentration of the sum of sales in 140 countries for 1985, 1995, 2005, and 2013 in Figure 6; (2) snapshots of Geo Chart with the degree of concentration of the sum of listed firms' total assets in 140 countries for 1985, 1995, 2005, and 2013 in Figure 7; and (3) snapshots of Geo Chart with the degree of concentration of the sum of listed firms' net income in 140 countries for 1985, 1995, 2005, and 2013 in Figure 8. The bars under each map show the sum of worldwide sales, total assets, and net income in the year. Figures 6, 7, and 8 illustrate the globally skewed distribution and high degree of concentration of wealth from the perspectives of sales and total assets, together with the moderate degree of concentration from the net income perspective.

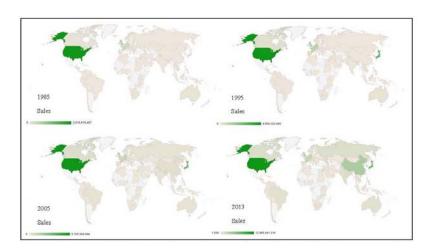


Figure 6 Snapshots of Geo Chart: the degree of concentration of the sum of listed firms' sales in 140 countries for 1985, 1995, 2005, and 2013

*The bars under the maps show the sum of worldwide sales in the year

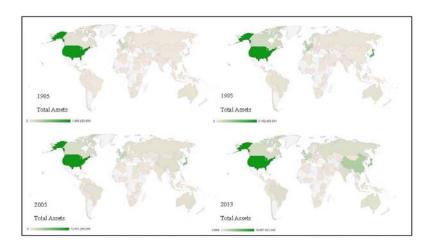


Figure 7 Snapshots of Geo Chart: the degree of concentration of the sum of listed firms' total assets in 140 countries for 1985, 1995, 2005, and 2013

*The bars under the maps show the sum of worldwide total assets in the year

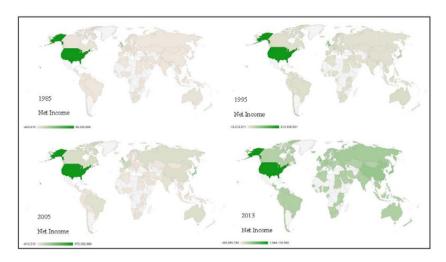


Figure 8 Snapshots of Geo Chart: the degree of concentration of the sum of listed firms' net income in 140 countries for 1985, 1995, 2005, and 2013

*The bars under the maps show the sum of worldwide net income in the year

5.4 Hyper-concentrated wealth among countries worldwide (Hypothesis 4)

To examine Hypothesis 4, Motion Chart is used to illustrate the dynamic movement from 1985 to 2013 of the sum of firms' sales, income, employees, and total assets for each of 140 countries. Motion Chart is a tool for interactive visualisation which shows five-dimensional (5-D) data: (1) the vertical (y) axis shows the sum of the sales (US\$ billion) of all listed firms in the country; (2) the horizontal (x) axis shows the sum of the net income or the employees (US\$ million or million) of all listed firms in the country; (3) the area of the circle shows the sum of the total assets of all listed firms in the country; (4) the colour shows the country (140 countries are coloured from blue, green, yellow to red gradationally by alphabetical order of country name); and (5) the tracks show the dynamic change from 1985 to 2013 of the top three countries' (US, China, and Japan). However, because it is difficult to show comprehensive interactive dynamic movement on paper, the following is presented: (1) snapshots of Motion Chart for the sales, net income, and total assets of 140 countries for 1985, 1995, 2005, and 2013 in Figure 9, and (2) snapshots of Motion Chart of the sales, number of employees, and total assets of 140 countries for 1985, 1995, 2005, and 2013 in Figure 10. From Figures 9 and 10, global hyper-concentrated wealth, especially among the top three

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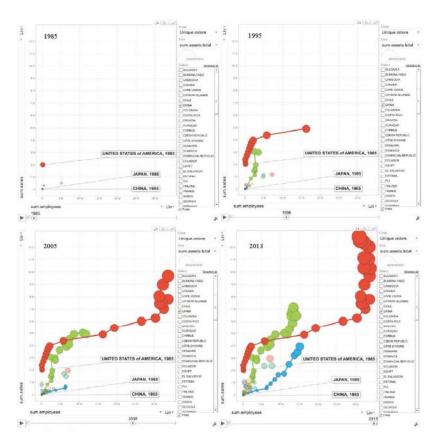
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countries, can be seen.

Five dimensions (5-D)

- 1. Vertical (y) axis: sum of sales (US\$ billion) of all listed firms in the country.
- 2. Horizontal (x) axis: sum of net income (US\$ million) of all listed firms in the country.
- 3. Area of circle: sum of total assets of all listed firms in the country.
- 4. Colour: country (140 countries are coloured from blue, green, yellow to red gradationally by alphabetical order of country name).
- 5. Dynamic change from 1985 to 2013 which tracks the top three countries' movements (US, China, and Japan).

Figure 9 Snapshots of Motion Chart of the sales, net income, and total assets of 140 countries for 1985, 1995, 2005, and 2013



Five dimensions (5-D)

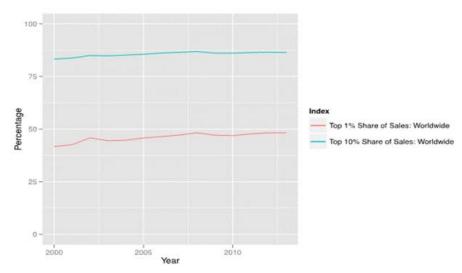
- 1. Vertical (y) axis: sum of sales (US\$ billion) of all listed firms in the country.
- 2. Horizontal (x) axis: sum of number of employees (million) of all listed firms in the country.
- 3. Area of circle: sum of total assets of all listed firms in the country.
- 4. Colour: country (140 countries are coloured from blue, green, yellow to red gradationally by alphabetical order of country name).
- 5. Dynamic change from 1985 to 2013 which tracks the top three countries' movements (US, China, and Japan).

Figure 10 Snapshots of Motion Chart of the sales, number of employees, and total assets of 140 countries for 1985, 1995, 2005, and 2013

5.5 Hyper-concentrated firms' wealth in the world and in the top three countries (Hypothesis 5)

To examine Hypothesis 5, listed firms' data of 140 countries from 2000 to 2013 are

used because it was difficult to obtain sufficient numbers of Chinese listed firms before 2000 to calculate the top 1% and 10%. Figure 11 shows the evidence regarding the sales inequality of firms worldwide from 2000 to 2013. The red line represents the sales share of the top 1% of firms and the green line represents the sales share of the top 10% of firms. The top 1% and 10% are based on sales rankings. From Figure 11, it can be seen that the sales of the world's top 1% of firms represent approximately more than 40% of total listed firms' sales worldwide, and that the sales of the world's top 10% of firms represent approximately more than 80% of total listed firms' sales worldwide. Interestingly, the trend has been maintained for 14 years.



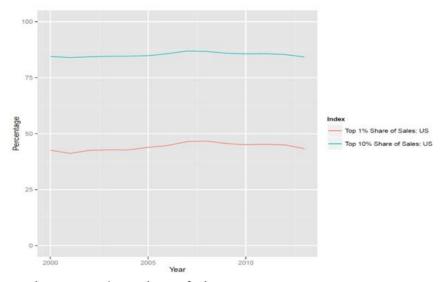
Worldwide: the top 1% and 10% shares of sales

Year	Total firms	Top 1%	Sales share	Top 10%	Sales share
2000	23,791	238	41.8%	2,739	83.3%
2001	25,773	258	42.6%	2,577	83.7%
2002	28,086	281	45.9%	2,809	85.0%
2003	29,656	297	44.5%	2,966	84.9%
2004	32,736	327	44.7%	3,274	85.2%
2005	34,833	348	45.8%	3,483	85.6%
2006	37,502	375	46.5%	3,750	86.1%
2007	38,918	389	47.2%	3,892	86.5%
2008	39,257	393	48.3%	3,926	86.9%
2009	39,357	394	47.1%	3,936	86.1%
2010	40,108	401	46.9%	4,011	86.0%
2011	40,928	409	47.7%	4,093	86.4%
2012	41,958	420	48.2%	4,196	86.6%
2013	41,166	412	48.2%	4,117	86.4%

Figure 11 Sales inequality of firms worldwide, 2000-2013: the top 1% and 10% shares

Figures 12, 13, and 14 present the sales inequality of firms in the top three countries, the US, China, and Japan, from 2000 to 2013. The red lines show the sales shares of the top 1% of firms, and the green lines show the sales shares of the top 10% of firms. The top 1% and 10% are based on sales rankings. Figure 12 shows that in the US, the share of sales of the top 1% of firms represents more than 40% of US listed firms' total sales, and that the share of sales of the top 10% of firms represents more than 80% of US listed firms' total sales. Figure 13 shows that in China, the share of sales of the top 1% of firms has increased from 30% to nearly 50% of Chinese listed firms' total sales, and that the share of sales of the top 10% of firms has increased from 69% to more than 80% of Chinese listed firms' total sales. Figure 14 shows that in Japan, the share of sales of the top 1% of firms represents 29-34% of Japanese listed firms' total sales, and that the share of sales of the top 10% of firms represents around 69-76% of Japanese listed firms' total sales. The level of inequality in the US, which is considerable, is almost the same as the worldwide level. The level of inequality in China has increased in 14 years. Indeed, in terms of the 1% share, China has exceeded the US. However, the level of inequality in Japan, especially the sales share of the top 1% of firms, is moderate. Figure 15 compares worldwide inequality and that of the top three countries.

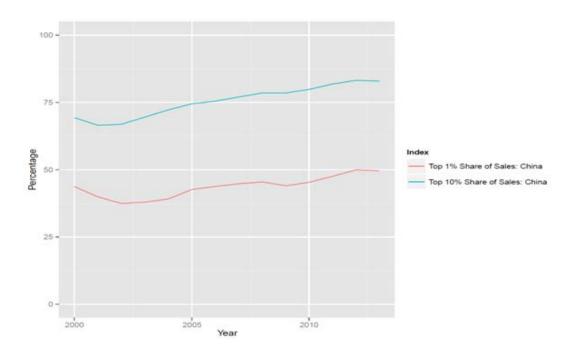
Piketty (2013) points out that at all times, the top decile of the wealth hierarchy owns a clear majority of what there is to own (generally more than 60% of total wealth and sometimes as much as 90%). In the US in 2010, the top 1% share of individual wealth was 33.8% and the top 10% share of individual wealth was 71.5% (Piketty, 2013). This paper confirms that firms' wealth is hyper-concentrated and that the degree of concentration is greater than individual wealth.



US: the top 1% and 10% shares of sales

Year	Total firms	Top 1%	Sales share	Top 10%	Sales share
2000	7,576	76	42.6%	758	84.5%
2001	7,243	72	41.2%	724	84.0%
2002	7,162	72	42.5%	716	84.3%
2003	7,094	71	42.8%	709	84.6%
2004	7,109	71	42.7%	711	84.6%
2005	7,192	72	43.9%	719	84.8%
2006	7,608	76	44.7%	761	85.7%
2007	7,797	78	46.5%	780	87.0%
2008	7,384	74	46.7%	738	86.7%
2009	7,113	71	45.6%	711	86.0%
2010	6,888	69	45.0%	689	85.6%
2011	6,694	67	45.2%	669	85.7%
2012	6,472	65	45.0%	647	85.4%
2013	5,974	60	43.3%	597	84.2%

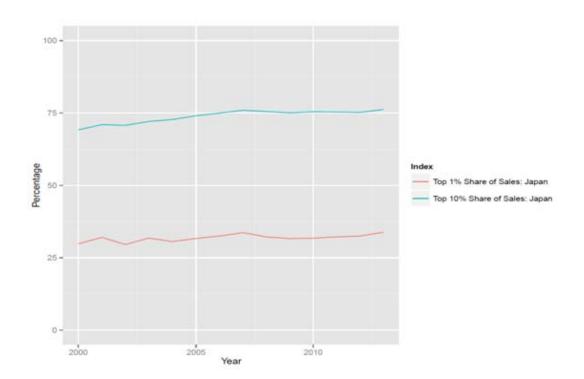
Figure 12 Sales inequality of firms in the US, 2000-2013: the top 1% and 10% shares



China: the top 1% and 10% shares of sales

Year	Total firms	Top 1%	Sales share	Top 10%	Sales share
2000	903	9	43.7%	90	69.3%
2001	1,118	11	39.9%	112	66.5%
2002	1,274	13	37.4%	127	66.9%
2003	1,382	14	37.9%	138	69.6%
2004	1,531	15	39.1%	153	72.2%
2005	1,606	16	42.7%	161	74.5%
2006	1,866	19	43.8%	187	75.5%
2007	2,252	23	44.8%	225	77.0%
2008	2,511	25	45.4%	251	78.6%
2009	2,647	26	44.0%	265	78.5%
2010	2,794	28	45.3%	279	79.8%
2011	3,345	33	47.5%	334	81.8%
2012	3,977	40	49.9%	398	83.2%
2013	3,974	40	49.6%	397	82.9%

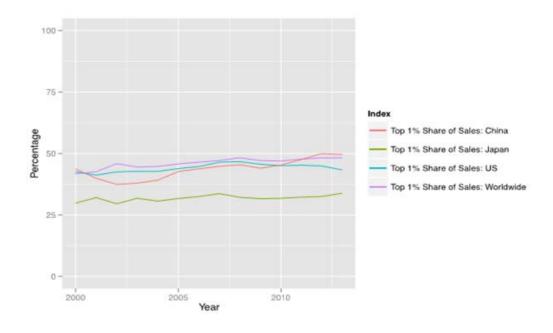
Figure 13 Sales inequality of firms in China, 2000-2013: the top 1% and 10% shares



Japan: the top 1% and 10% shares of sales

•	•					
Year	Total firms	Top 1%	Sales share	Top 10%	Sales share	
2000	1,801	18	29.9%	180	69.1%	
2001	2,175	22	32.1%	218	71.0%	
2002	2,529	25	29.6%	253	70.8%	
2003	2,754	28	31.8%	275	72.1%	
2004	3,200	32	30.6%	320	72.7%	
2005	3,395	34	31.7%	340	74.0%	
2006	3,500	35	32.5%	350	75.0%	
2007	3,468	35	33.7%	347	76.0%	
2008	3,412	34	32.2%	341	75.5%	
2009	3,380	34	31.6%	338	75.0%	
2010	3,317	33	31.8%	332	75.4%	
2011	3,352	34	32.2%	335	75.4%	
2012	3,394	34	32.5%	339	75.2%	
2013	3,431	34	33.8%	343	76.2%	

Figure 14 Sales inequality of firms in Japan, 2000-2013: the top 1% and 10% shares



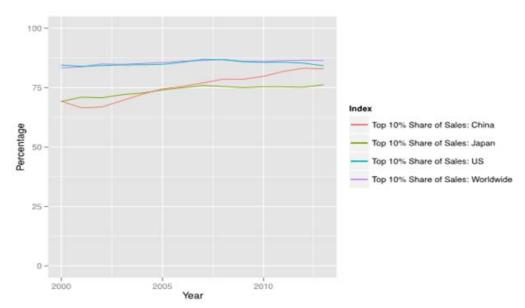


Figure 15 Sales inequality of firms worldwide and in the top three countries, 2000-2013: the top 1% and 10% shares

6. Summary and discussion

A common understanding exists that in many ways the economic and political system has failed and that both are fundamentally unfair. Indeed, worldwide inequality has grown to the point where it can no longer be ignored (Stiglitz, 2012). If significant inequality continues to be disregarded, it could threaten the sustainability of firms and society. However, little literature exists on inequality and accounting in a power inequality context (e.g. Gray and Laughlin, 2012) or on the theory of earnings and wealth inequality (e.g. Castañeda et al., 2003). One of the reasons why accounting research does not discuss the inequality issue is that there is no solid evidence of worldwide inequality using global firms' accounting data. In order to show such evidence, this paper uses the research design of visualisation.

Thus, this paper first examined the emergence of multinational firms with economic power greater than the GDPs of most small, medium-sized, and developing countries. After this, to confirm the forces of divergence, Piketty's (2013) principle was examined. This states that the rate of return on capital remains significantly above the growth rate (r > g) and thus the risk of divergence in the distribution of wealth is very high. Then, to illustrate the evidence of the existing global situation regarding firms' wealth, data visualisation methodology was used. Visualisation is the fastest way to communicate information. The process of visualisation can help us to see the world in a new way, revealing unexpected patterns and trends in otherwise hidden information. Indeed, at its best, data visualisation is an expert means of storytelling (Murray, 2013). The importance of the visual in accounting and accountability is discussed in the literature (e.g. Davison and Warren, 2009). However, the literature considers the process of visual representation, which is superficial visualisation, not the process of visualisation, which is depth visualisation. There is no research evidence which uses the visualisation of world-scale accounting big data. Thus, the inequality issue was examined from several accounting perspectives and illustrated the evidence using data visualisation tools. Consequently, this paper provided evidence and conclusions regarding the following.

(1) Multinational firms' economic power is greater than the GDPs of most small, medium-sized, and developing countries and shows the growing power of global firms over most countries. In this regard, global firms' power has increased and their

business activities affect society and people's lives more significantly than ever before. The power of markets is enormous, but they have no inherent moral character (Stiglitz, 2012). From the academic perspective of addressing firms' wealth, research in accounting must find a solution to managing this issue.

- (2) Inequality force (r > g) exists from the accounting perspective. In this regard, the data of three kinds of ROE (PL before tax, PL after tax, and net income) for r and the sales' growth rate for g of the listed firms of 140 countries from 1985 to 2013 were used. Because the 29-year average rate of all three rs ranges from 14% to 22%, and the rate of g is 6.8%, evidence is provided for r > g. However, when markets are competitive, profits which are above the normal return to capital cannot be sustained. A favoured tool to earn excess returns is to make markets less transparent, but there are many others such as taking advantage of information asymmetries. These cause market failure and markets have clearly not been working in the way that their supporters claim. Thus, the question that arises is how to divide these excess returns among the various 'stakeholders' in a firm (Stiglitz, 2012). Accounting can contribute with knowledge and experience; for example, Oshika and Saka (2015) suggest that value added distribution to stakeholders is a useful means of accomplishing sustainability.
- (3) Inequalities of firms' wealth are greater than inequalities of firms' income. Although snapshots of Geo Chart are shown as figures presented on paper, Geo Chart is originally an interactive dynamic visualisation tool which here moves automatically from 1985 to 2013 in order to show each year's result sequentially. From the Geo Chart results, the evidence of Stiglitz's (2012) contention that inequalities in wealth are greater than inequalities in income from the firms' perspective can be shown visually.
- (4) Hyper-concentrated wealth exists among countries worldwide. Although this paper shows snapshots of Motion Chart as figures presented on paper, Motion Chart is originally an interactive dynamic visualisation tool which here moves automatically from 1985 to 2013 in order to show each country's and each year's results sequentially. With Motion Chart, the evidence of hyper-concentrated wealth can be shown visually with five dimensions (5-D): sales, net income (numbers of employees), total assets, countries, and changes of year. Only a few countries, the US, China, and Japan, have moved to

the upper middle or right side of the chart; most countries have stayed on the lower left side, even in 2013.

(5) Hyper-concentrated firms' wealth exists worldwide and in the top three countries, the US, China, and Japan. The sales of the top 1% (10%) of firms represent more than 42%-48% (83%-87%) of total listed firms' sales worldwide. The level of inequality in the US is almost the same or more extreme than the worldwide level. The worldwide trend and that of the US have been maintained for 14 years. The level of inequality in China has increased from 2000 to 2013. However, the level of inequality in Japan is moderate.

There is market failure when competition is imperfect; for example, when imperfections or information asymmetries exist. Asymmetries arise from adverse selection and moral hazard. Markets can also concentrate wealth, pass environmental costs on to society, and abuse workers and consumers. The problem is not that globalisation is bad or wrong but that governments are managing the situation poorly - and largely for the benefit of special interests. Much of the inequality which exists today is a result of government policy in terms of what the government does and does not do. Laws governing firms interact with the norms of behaviour which guide the leaders of firms and determine how returns are shared among senior management and other stakeholders (Stiglitz, 2012). Interestingly, in Japan, the degree of inequality is more moderate than elsewhere worldwide and particularly in the US and China. In Japan, as part of the Abenomics policy, the government placed substantial pressure on listed firms to increase basic pay for employees in 2014; as a consequence, most listed firms raised their basic pay, followed by many small and medium-sized firms. Although this is just an example that is used to correct market failures through value added distribution and lead sustainability (see Oshika and Saka, 2015), accounting information should serve ultimately to enhance social welfare (Lehman, 1992).

This paper contributes to the literature in two key ways. First, unique evidence of the inequality of firms' wealth is shown using global data for nearly 30 years through visualisation tools, that is, R (software environment) with dplyr, ggplot2, and googleVis (Geo Chart and Motion Chart), in order to gather and address accounting big data and present the data in an easily understood way. Second, through visualisation, this paper provides a novel methodology for accounting research and finds the frontier of a new

research question which considers how accounting can solve firms' wealth inequality, which has grown to a point where it can no longer be ignored. With this in mind, data visualisation at its best is an expert means of storytelling (Murray, 2013). Such a visualisation approach helps to uncover the role that globalisation and its asymmetries have played in the increase in inequality. However, a more efficient and productive economy with more equality is possible (Stiglitz, 2012). The economy must be restructured to address firms' wealth (Reich, 2010). This paper's evidence identifies that now is the time for accounting research to tackle the inequality issue with available knowledge.

Nonetheless, there are further challenges. It is important to find a solution through accounting knowledge to remedy the problem of inequality and hyper-concentrated firms' wealth. Neglecting such inequality threatens the sustainability of firms and society. The consequences for the long-term dynamics of wealth distribution are potentially terrifying, the problem is enormous, and there is no simple solution (Piketty, 2013). This paper does not provide the answer to this issue but presents evidence of the inequality of firms' wealth worldwide from several perspectives. With such evidence, from the accounting perspective, further research into the contribution which accounting can make to this issue is critically important. In such a context, this paper is an initial step towards the investigation of inequality.

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Tools

ggplot2, http://ggplot2.org/

googleVis, http://cran.r-project.org/web/packages/googleVis/index.html

Google Geo Chart, https://developers.google.com/chart/interactive/docs/gallery/geochart Google Motion Chart, https://developers.google.com/chart/interactive/docs/gallery/motionchart plyr, http://plyr.had.co.nz/

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Table The ranking of national GDPs and firm sales in 2013

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41 Egypt 42 Fedand 8 TOYOTA MOTOR CORP. 43 Greece 9 TOTAL SA. 44 Padintan 16 GLENCORE PLC 45 Breitan 46 Karakhatan 47 Fraq 48 Venschrafa 11 CHELYRON CORP. 49 Purnagd 12 SAMSUNG ELECTRONICS CO 49 Algreis 19 Qutar 53 Croch Republic 54 Remains 55 Croch Republic 54 Remains 55 New Zealand 66 Ukraine 19 PRIELIPH 66 14 APPLE INC. 58 Ventum 15 E ON SE 16 DANGLER AG 19 GREEKAL MOTORS CO. 19 GREEKAL MOTORS CO. 20 FORD MOTOR CO. 21 GENERAL MOTORS CO. 20 FORD MOTOR CO. 21 GENERAL MOTORS CO. 22 FORD MOTOR CO. 23 NEPTYANAY KOORPANIY. 25 MYLESSEON CORP. 25 MYLESSEON CORP. 25 MYLESSEON CORP. 25 MYLESSEON CORP. 26 MYLESSEON CORP.	271. 267. 267. 267. 267. 261. 264. 262. 262. 263. 261. 262. 262. 260. 260. 260. 260. 260. 260
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44 Padrata 16 GLENCORE PLC 45 feeland 45 feeland 46 Karalahtan 47 bra 47 bra 47 Verstanda 11 CHELYKON CORP 49 Farmgal 12 CHELYKON CORP 49 Farmgal 13 CHELYKON CORP 49 Farmgal 13 CHELYKON CORP 50 Algeria 13 Pental 15 CHEL Republic 15 Pental 15 Pental 16 Fernania 16 Pental 17 Fernania 18 Fernania 19 Pental 19 Fernania 19 Pental 10 Pental	292.2 293.2 293.2 293.2 294.2 295.2 297.2 290.2 297.2 290.2 297.2
16 GLENCOKE PLC 48 Iveland 46 Karakhatan 47 Iraq 48 Venezarla 11 CHENYKON CORP 49 Perugal 12 SANSUNG ELECTRONNCS OF 50 Algeria 53 Qutar 53 Peru 53 Crech Republe 54 Rentania 55 New Zealand 50 Ukraine 57 Koroal 57 Koroal 58 Ventania 58 Ventania 58 Coro SE 60 Apprela Novel 59 Ventania 51 E.ON SE 60 DAMELER AG 59 Bangladerh 61 OPEN JOENT STOCK COMPA 61 E.NI S.P. 61 GENERAL MOTORS CO. 62 FORD MOTORS CO. 63 FORD MOTORS CO. 64 SEPTI ANATA KOMPANIY 65 ON SE 66 TO LIKCOL 65 VALERO KORPA 66 VALERO KORPA 67 VALERO KORPA 67 VALERO KORPA 68 VENERO	253. 262. 261. 272. 273. 275. 276. 277. 277. 277. 277. 277. 277. 277
45 Ireland 46 Karakhutan 47 Izaq 47 Izaq 41 Venemela 11 CHEVNON CORP. 49 Partugal 12 SAASSUNG ELECTRONNCS CO 50 Algeria 13 Qutar 13 Qutar 13 Partu 13 Chech Republic 14 Ramania 15 Chech Republic 15 Partugal 16 Ularanie 17 Kurual 18 PHILLIPS 66 18 PHILLIPS 66 18 PHILLIPS 66 18 PHILLIPS 66 19 PARDLER AG 19 ENDREAL 11 FORD NORN TSTOCK COMPA 11 ENT S p.A. 19 GENERAL MOTORS CO. 21 GENERAL MOTORS CO. 21 GENERAL MOTORS CO. 22 SEPTYARAYA KOORPANIY 23 OAO LIKOG. 24 VALERO ENERGY CORP. 25 MCKESSON CORP. 25 MCKESSON CORP. 25 MCKESSON CORP. 26 Hingery 24 VALERO ENERGY CORP. 25 MCKESSON CORP.	22.2 20.1 20.1 20.1 20.1 20.1 20.1 20.1
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49 Purtugal 13 SAANSUNG ELECTRONNES CO 50 Algeria 13 Qutar 13 Qutar 13 Crech Republic 13 Crech Republic 13 Crech Republic 15 New Zealand 16 Utraine 17 Kurval 18 PHILLIPS 66 14 APPLE INC. 19 Vertuum 18 E ON SE 18 DADM.ER AG 19 Bangladesh 11 OPEN JOINT STOCK COMPA 18 ENIS 19 A 19 GENERAL MOTORS CO. 20 FORD MOTOR CO. 21 GENERAL ELECTRIC CO. 21 REPUTANAYA KOMPANIY/ 21 OAND UTKOCK 25 VALEEN GENEROY CORP. 25 MCKESSON CORP. 25 MCKESSON CORP. 25 MCKESSON CORP. 25 MCKESSON CORP.	200. 200 201 201 201 202 202 202 202 203 204 204 204 205 205 207 207 207 207 207 207 207 207 207 207
49 Purtugal 13 SAANSUNG ELECTRONNES CO 50 Algeria 13 Qutar 13 Qutar 13 Crech Republic 13 Crech Republic 13 Crech Republic 15 New Zealand 16 Utraine 17 Kurval 18 PHILLIPS 66 14 APPLE INC. 19 Vertuum 18 E ON SE 18 DADM.ER AG 19 Bangladesh 11 OPEN JOINT STOCK COMPA 18 ENIS 19 A 19 GENERAL MOTORS CO. 20 FORD MOTOR CO. 21 GENERAL ELECTRIC CO. 21 REPUTANAYA KOMPANIY/ 21 OAND UTKOCK 25 VALEEN GENEROY CORP. 25 MCKESSON CORP. 25 MCKESSON CORP. 25 MCKESSON CORP. 25 MCKESSON CORP.	D. LTD 2866 2022 2022 2039 188 1812 172 175 171 170 170 180 180 180 180 181 181 180 180 180 18
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90 Algoria 31 Qutar 32 Peru 33 Peru 34 Cench Republic 34 Renumia 35 New Zealand 56 Utraine 17 Kurvail 18 PHILLIPS 66 14 APPLE INC. 35 Verbaum 18 E ON SE 16 DARMER AG 19 Bangladeth 11 OPEN JOINT STOCK COMPA 11 ENI S p.A. 19 GENERAL MOTORS CO. 20 FORD MOTOR CO. 21 GENERAL MOTORS CO. 22 FORD MOTOR CO. 23 FORD MOTOR CO. 24 FORD MOTOR CO. 25 FORD MOTOR CO. 26 FORD MOTOR CO. 27 NETTYANAYA KOMPANIY/ 27 JOAN LUKOG. 28 VALENG ENERGY CORP. 25 MICKESSON CORP. 25 MICKESSON CORP. 25 MICKESSON CORP.	312.2 302.2 302.2 303.2 309.4 388.1 381.1 319.1
32 Peru 33 Croch Republic 54 Renumia 55 New Zealand 56 Utraine 77 Korwal 78	302.2 398.3 181.1 173.1 175.2 174.1 175.2 176.2
33 Cords Republe 34 Remania 35 New Zealand 35 New Zealand 35 New Zealand 36 Utraine 37 Korwal 38 PRILLIPS 66 14 APPLE INC. 39 Viennia 18 E ON SE 18 DANBLER AG 39 Bangladen 17 OPEN JOENT STOCK COMPA 18 ENT S p. A 19 GENERAL MOTORS CO. 20 FORD MOTOR CO. 21 GENERAL ELECTRIC CO. 21 GENERAL ELECTRIC CO. 22 NEFT VANAYA KOMPANIY, 23 OAO LIKOG. 42 VALENG ENKENY CORP. 25 MICKESSON CORP. 25 MICKESSON CORP. 25 MICKESSON CORP. 26 Hangary	1984 1814
33 Cords Republe 34 Remania 35 New Zealand 35 New Zealand 35 New Zealand 36 Utraine 37 Korwal 38 PRILLIPS 66 14 APPLE INC. 39 Viennia 18 E ON SE 18 DANBLER AG 39 Bangladen 17 OPEN JOENT STOCK COMPA 18 ENT S p. A 19 GENERAL MOTORS CO. 20 FORD MOTOR CO. 21 GENERAL ELECTRIC CO. 21 GENERAL ELECTRIC CO. 22 NEFT VANAYA KOMPANIY, 23 OAO LIKOG. 42 VALENG ENKENY CORP. 25 MICKESSON CORP. 25 MICKESSON CORP. 25 MICKESSON CORP. 26 Hangary	1984 1814
34 Remains 35 New Zealand 36 Uhraine 37 Kowali 38 Uhraine 37 Kowali 39 Hallaps 66 44 APPLE INC. 39 Verbain 15 E.ON SE 40 APPLE INC. 39 Remgladesh 11 GOEN SONT STOCK COMPA 18 ENI SI PA 19 GENERAL MOTORS CO. 20 FORD MOTOR CO. 21 NETYTANATA KOMPANIY; 21 OAO LUKOG. 24 VALERO ENERGY CORP. 25 MCKESSON CORP. 25 MCKESSON CORP. 25 MCKESSON CORP. 26 Hingary	181: 173: 175: 175: 170: 170: 170: 170: 170: 180: 180: 180: 180: 180: 180: 180: 18
39 Ultraine 31 Korait 31 PHILLIPS 66 14 APPLE INC. 35 Victimi 15 E ON SE 16 DARMLER AG 39 Bangladeh 11 OPEN SONT STOCK COMPA 16 ENI SI, PA 16 GENERAL MOTORS CO. 20 FORD MOTOR CO. 21 NETTYANATA KOMPANIY; 21 OAO LUKOG. 21 VALERO ENERGY CORP. 25 MCKESSON CORP. 25 MCKESSON CORP. 25 MCKESSON CORP.	181: 173: 175: 175: 170: 170: 170: 170: 170: 180: 180: 180: 180: 180: 180: 180: 18
27 Kovals 13 FRIELIPS 66 14 APPLE INC. 29 Vetnam 15 E.ON SE 16 DANNER AG 29 Bangladesh 11 EPN SONT STOCK COMPA 11 EPN SONT STOCK COMPA 11 EPN SEA AMOTOR CO. 20 FORD MOTOR CO. 21 GENERAL EMETRIC CO. 21 SETTANATA KOMPANIY 22 OAO LUKOG. 24 VALENG ENERGY CORP. 25 MCKESSON CORP. 25 MCKESSON CORP. 25 MCKESSON CORP.	135. 129. 129. 129. 129. 129. 129. 129. 129
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14 APPLE INC. 39 Vertains 13 E ON SE 14 DAIMLER AG 19 Bangladeth 11 OPPLY SORNT STOCK COMPA 11 OPPLY SORNT STOCK COMPA 19 GENERAL MOTORS CO. 20 FORD MOTOR CO. 21 GENERAL ELECTRIC CO. 22 NEFTYANAYA KOMPANIY/ 23 OAO LUKOG. 42 VALENG ENERGY CORP. 25 MCKESSON CORP. 25 MCKESSON CORP. 26 Hangary	1995 170 1682 1692
39 Venum 39 Consultation 39 Bangladen 11 OPEN SONT STOCK COMPA 11 ENI S p.A. 19 GENERAL MOTORS CO. 29 FORD MOTOR CO. 21 GENERAL ELECTRIC CO. 22 NEFTYANAYA KOMPANIY; 21 OANO LUKOCA. 24 VALENO ENERGY CORP. 25 MCKESSON CORP. 25 MCKESSON CORP.	170. 161. 162. 163. 163. 164. 165. 166. 166. 166. 166. 166. 166. 166
13 E ON SE BOADBLER AG 99 Bangladeh 11 OPEN 200NT STOCK COMPA 14 EN'S p.A. 19 GENERAL MOTORS CO. 20 FORD MOTOR CO. 21 GENERAL ELECTRIC CO. 22 NEFTYANKAY KOMPANIY/ 23 OAO LUKOG. 24 VALENG ENERGY CORP. 25 MCKESSON CORP. 25 MCKESSON CORP.	1681 1692 1892 1893 1894 1895 1895 1895 1895 1895 1895 1895 1895
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59 Bangladesh 17 OPEN YORT STOCK COMPA 18 ENTS \$1. 19 GENERAL MOTORS CO. 29 FORD MOTOR CO. 21 GENERAL ELECTRIC CO. 22 NETTYANAYA KOMPANIY/ 25 AOL UKENERAL 24 VALERO ENERGY CORP. 25 MCKESSON CORP. 60 Hungary	161 162 153 155 166 166 166 166 166 167 161 161 168 168 168 168 168 168 168 168
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II ENIS P.A. 19 GENERAL MOTORS CO. 29 FORD MOTOR CO. 21 GENERAL ELECTRIC CO. 22 NEFTYANAYA KOMPANIY; 23 OAO LUKOEL. 24 VALERO ENERGY CORP. 25 MCKESSON CORP. 66 Huspay.	198. 1855. 1865. 1866. 1867. 1867. 1877. 1887. 1887. 1887.
19 GENERAL MOTORS CO. 20 FORD MOTOR CO. 21 GENERAL ELECTRIC CO. 22 NEFTYANAY'A KOMPANIY/ 23 OAO LUKOEL. 24 VALERO ENERGY CORP. 25 MCKESSON CORP. 60 Huspay.	155- 146: 146: 146: 141- 141- 138: 137-4 132:
20 FORD MOTOR CO. 21 GENERAL ELECTRIC CO. 22 NEFTYANYA KOMPANIYA 23 OAO LUKOEL. 24 VALENO ENERGY CORP. 25 MCKESSON CORP. 60 Hungary	1463 1463 1463 1414 1384 1374 1323
21 GENERAL ELECTRIC CO. 22 NEFTYANAYA KOMPANIY/ 23 OAO LUKOEL. 24 VALERO ENERGY CORP. 25 MCKESSON CORP. 60 Hungary.	146.4 145.4 138.6 137.4 132.4
22 NEFTYANAYA KOMPANIY/ 23 OAO LUKOEL 24 VALERO ENERGY CORP. 25 MCKESSON CORP. 60 Hingary	143- 141- 138- 137- 132-
23 OAO LUKOE. 24 VALERO ENERGY CORP. 25 MCKESSON CORP. 60 Hungary	141. 138.0 137.6 132.1
24 VALERO ENERGY CORP. 25 MCKESSON CORP. 60 Hungary	138.6 137.4 132.1
25 MCKESSON CORP. 60 Hungary	137.4 132.1
60 Hungary	132.2
26 HON HAI PRECISION INDUS	TRY CO. LTD 131.5
27 PETROLEO BRASILEIRO S.A	
28 AT&T INC.	128.
29 CVS HEALTH CORP.	126.7
61 Angola	124
30 GDF SUEZ	123.3
11 JX HOLDINGS, INC.	120.0
32 VERIZON COMMUNICATION	
33 FIAT S.p.A.	119.
34 HONDA MOTOR CO. LTD	115
35 HEWLETT-PACKARD CO.	112.
36 TESCO PLC	
37 CHINA STATE CONSTRUCTI	
18 ENEL S.p.A.	109.1

Appendix 1 Sample countries for Figure 6-15

Country	Number of Firms		Number of Firms
1 ALGERIA	7	71 LAO PEOPLE'S DEMOCRATIC REPUBL	IC 4
2 ANGUILLA	2	72 LATVIA	80
3 ANTIGUA AND BARBUDA	1	73 LEBANON	11
4 ARMENIA	14	74 LIBERIA	5
5 AUSTRALIA	2,952	75 LITHUANIA	57
6 AUSTRIA	192	76 LUXEMBOURG	133
7 AZERBAUAN	2	77 MACEDONIA (FYROM)	118
8 BAHAMAS	16	78 MALAWI	13
9 BAHRAIN	50	79 MALAYSIA	1,334
10 BANGLADESH	315	80 MALTA	39
11 BARBADOS	20	81 MARSHALL ISLANDS	44
2 BELGIUM	307	82 MAURITIUS	120
13 BERMUDA 14 BHUTAN	872	83 MEXICO	329
	13	84 MONACO	3
15 BOLIVIA	66	85 MONGOLIA	280
16 BOSNIA AND HERZEGOVINA 17 BOTSWANA	103	86 MONTENEGRO	32
	27 971	87 MOROCCO	80
18 BRAZIL 19 BULGARIA		88 NAMIBIA 89 NEPAL	11 47
	113		
10 BURKINA FASO	2 2	90 NETHERLANDS	438
11 CAMBODIA	_	91 NEW ZEALAND	270
2 CANADA 3 CAPE VERDE	5,527 9	92 NICARAGUA 93 NIGERIA	13 232
	-		
14 CAYMAN ISLANDS 15 CHILE	1,212 776	94 NORWAY 95 OMAN	415 146
16 CHINA	4.103	96 PAKISTAN	706
17 COLOMBIA	4,103 275	97 PALESTINIAN TERRITORIES	47
18 COSTA RICA	32	98 PANAMA	114
9 COTE D'IVOIRE	32	99 PAPUA NEW GUINEA	14
O CROATIA	176	100 PARAGUAY	88
1 CURACAO	8	101 PERU	337
2 CYPRUS	174	102 PHILIPPINES	295
3 CZECH REPUBLIC	292	103 POLAND	450
4 DENMARK	330	104 PORTUGAL	137
5 DOMINICA	2	105 OATAR	47
6 DOMINICAN REPUBLIC	13	106 REPUBLIC of KOREA	2,133
7 ECUADOR	245	107 REPUBLIC of MOLDOVA	20
8 EGYPT	882	108 ROMANIA	120
9 EL SALVADOR	44	109 RUSSIAN FEDERATION	1,121
0 ESTONIA	29	110 RWANDA	1
1 FUI	19	111 SAINT KITTS AND NEVIS	9
2 FINLAND	211	112 SAINT LUCIA	3
3 FRANCE	1,772	113 SAUDI ARABIA	166
4 GABON	1	114 SENEGAL	2
5 GEORGIA	8	115 SERBIA	66
46 GERMANY	1,605	116 SINGAPORE	882
7 GHANA	32	117 SLOVAKIA	71
48 GIBRALTAR	7	118 SLOVENIA	50
49 GREECE	376	119 SOUTH AFRICA	734
0 GRENADA	3	120 SPAIN	379
1 GUATEMALA	22	121 SRI LANK A	288
2 GUYANA	8	122 SUDAN	14
3 HONDURAS	19	123 SWAZILAND	7
4 HONG KONG	309	124 SWEDEN	805
5 HUNGARY	73	125 SWITZERLAND	457
6 ICELAND	39	126 SYRIAN ARAB REPUBLIC	18
7 INDIA	5,234	127 TAIWAN	2,370
8 INDONESIA	549	128 THAILAND	743
9 IRAQ	98	129 TRINIDAD AND TOBAGO	26
0 IRELAND	195	130 TUNISIA	79
1 ISLAMIC REPUBLIC of IRAN	293	131 UGANDA	8
2 ISRAEL	802	132 UKRAINE	456
3 ITALY	543	133 UNITED ARAB EMIRATES	121
54 JAMAICA	64	134 UNITED KINGDOM	5,310
5 JAPAN	4,751	135 UNITED REPUBLIC of TANZANIA	14
66 JORDAN	279	136 UNITED STATES of AMERICA	16,423
57 K.AZ.AKHSTAN	135	137 URUGUAY	33
58 KENYA	62	138 VENEZUELA	73
9 KUWAIT	225	139 VIETNAM	892
0 KYRGYZSTAN	12	140 VIRGIN ISLANDS (BRITISH)	144
		141 ZAMBIA	21
		TOTAL	78,502

Appendix 2 The number of sample listed firms for 1985-2013 for Figure 6-15

