

Inequality evidence from accounting data visualisation

Chika SAKA* · Masayuki JIMICHI**

〈 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

* Kwansei Gakuin University

** Kwansei Gakuin University

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 hyper-concentrated wealth exists among countries worldwide, and whether 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 high-speed data communication, high-performance computers, 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' visual 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 firms' 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.

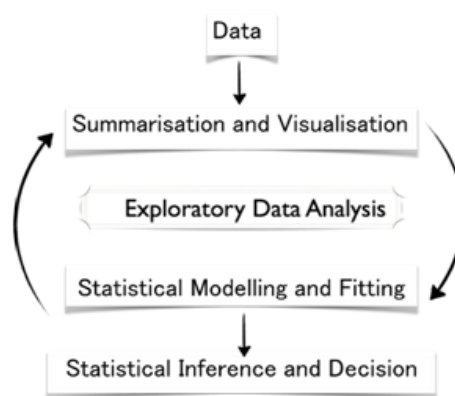


Figure 1 Conceptual diagram of exploratory data analysis

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.

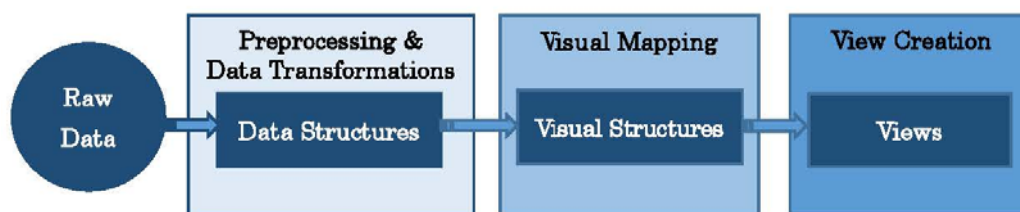


Figure 2 Flow of visual representation

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 between ‘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.

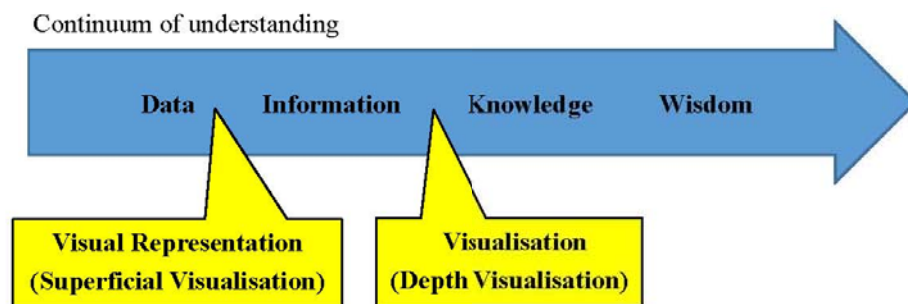


Figure 3 Visual representation and visualisation in Shedroff's continuum of understanding

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. ... 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.

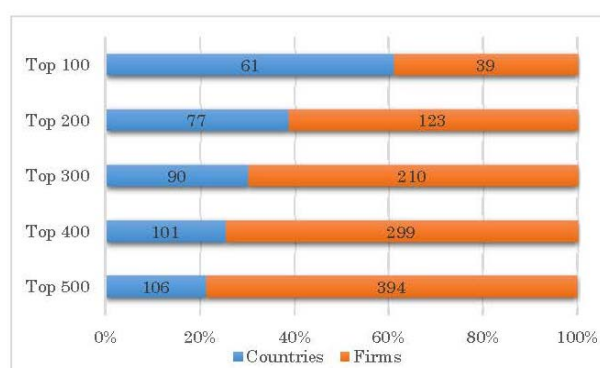


Figure 4 Numbers of countries and firms in the top 500 ranking

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 r s 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%.

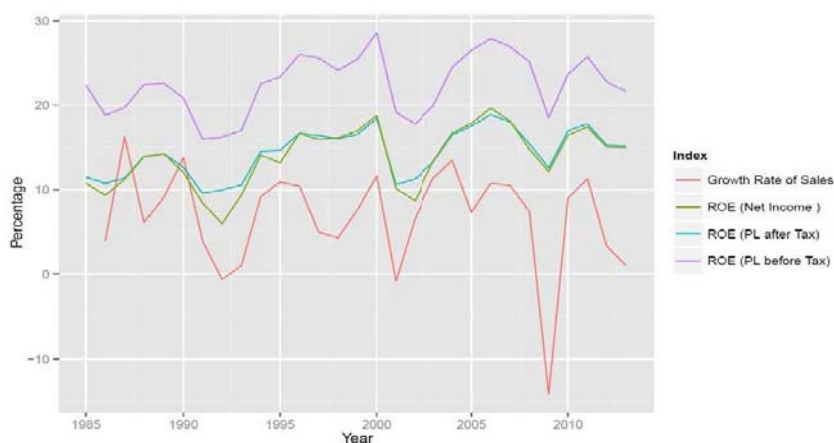


Figure 5 r (ROE) and g (growth rate of sales) of worldwide listed firms from 1985 to 2013

<u>Average Rate of r and g for 1985-2013</u>		
	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 listed firms' 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.

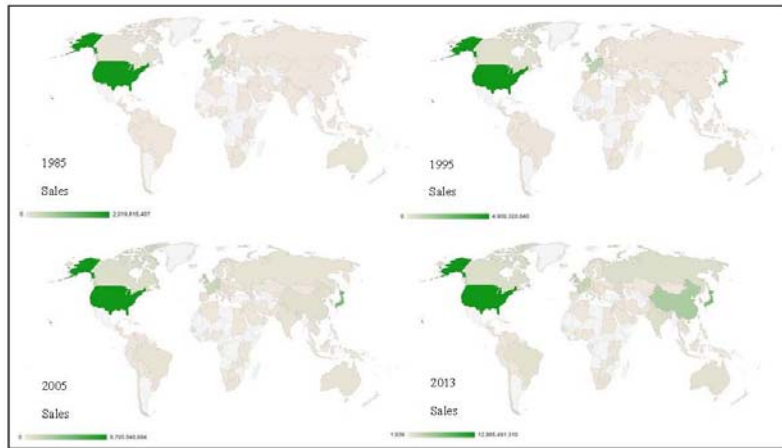


Figure 6 Snapshots of Geo Chart: the degree of concentration of the sum of listed firms' sales in 140 countries for 1985, 1995, 2005, and 2013

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

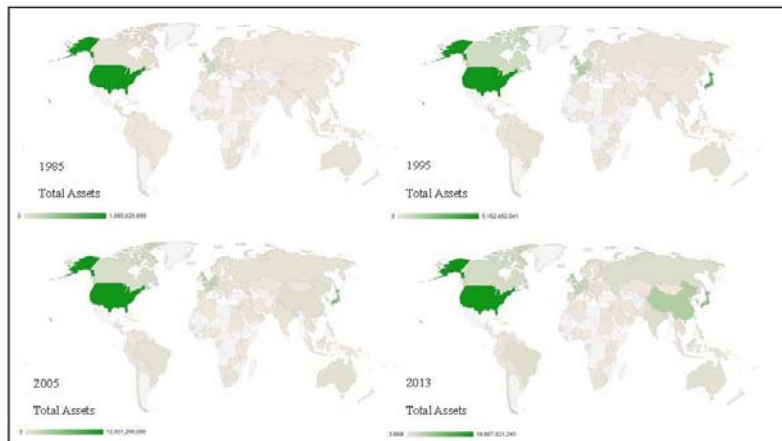


Figure 7 Snapshots of Geo Chart: the degree of concentration of the sum of listed firms' total assets in 140 countries for 1985, 1995, 2005, and 2013

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

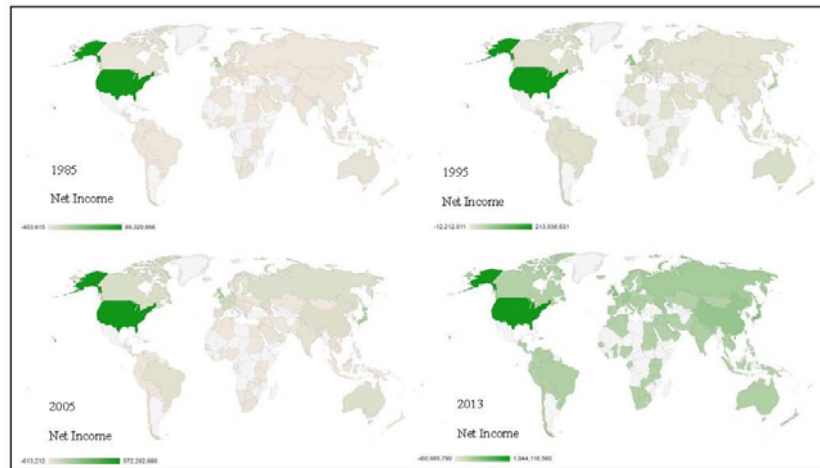


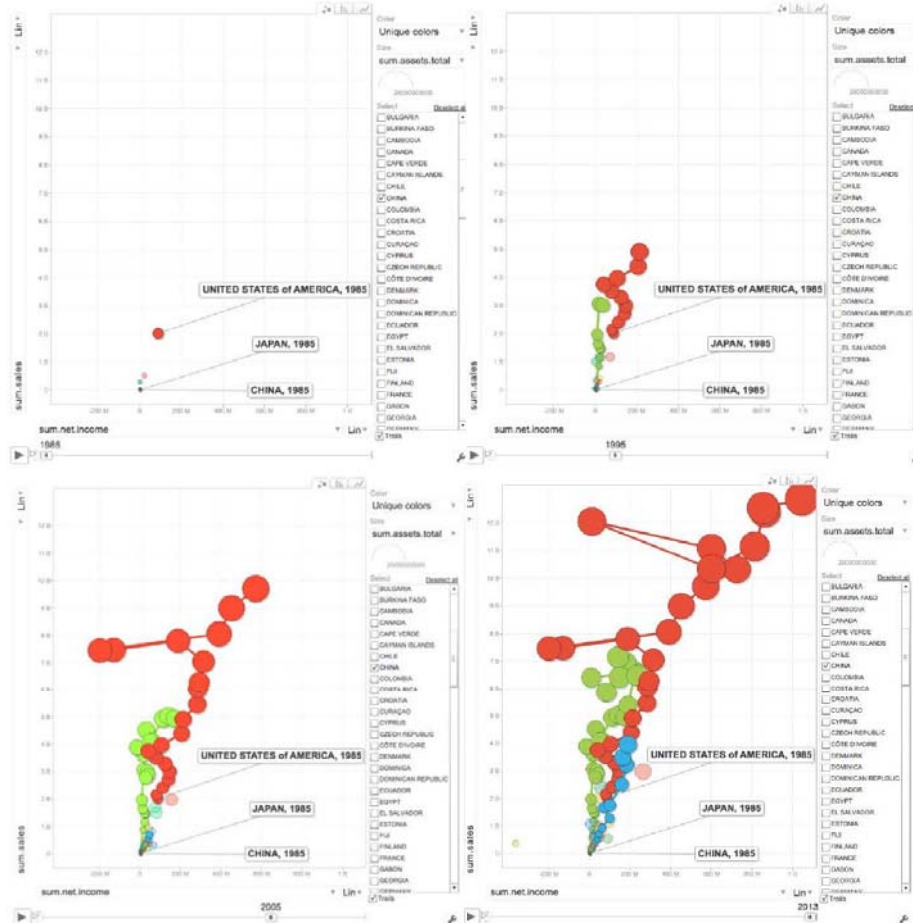
Figure 8 Snapshots of Geo Chart: the degree of concentration of the sum of listed firms' net income in 140 countries for 1985, 1995, 2005, and 2013

*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' movements (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

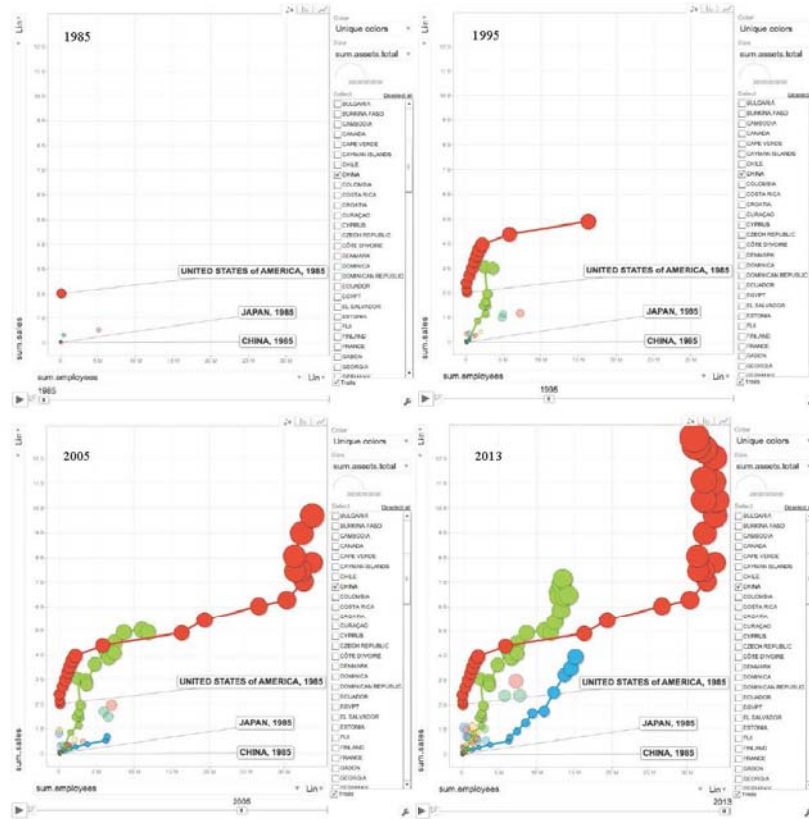
countries, can be seen.



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)

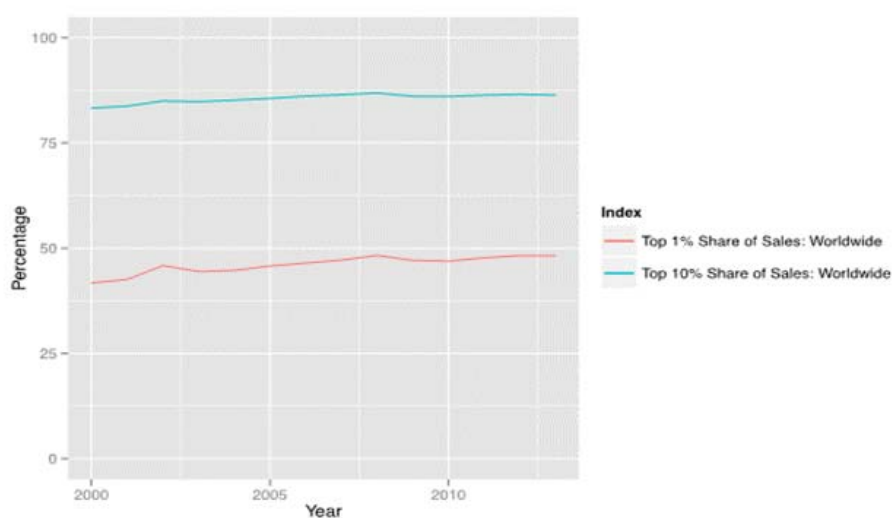
1. Vertical (y) axis: sum of sales (US\$ billion) of all listed firms in the country.
2. Horizontal (x) axis: sum of number of employees (million) of all listed firms in the country.
3. Area of circle: sum of total assets of all listed firms in the country.
4. Colour: country (140 countries are coloured 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.



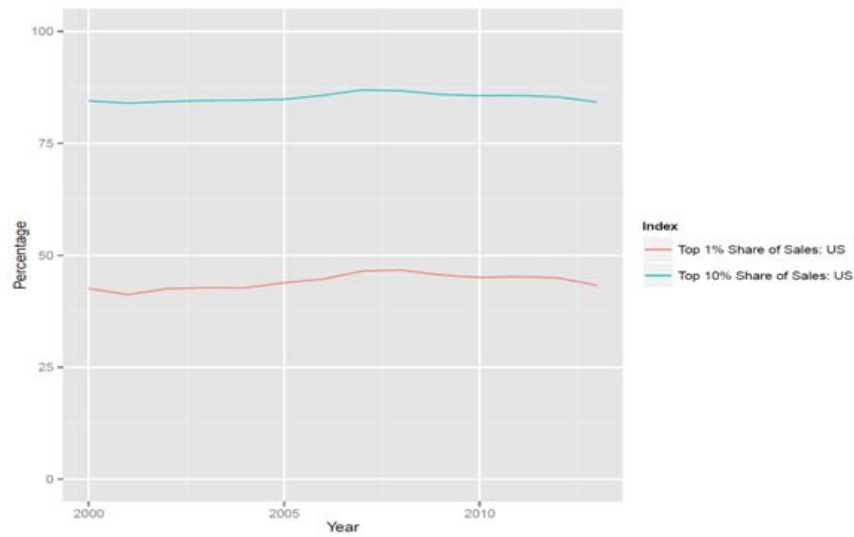
Worldwide: the top 1% and 10% shares of sales

Year	Total firms	Top 1% Sales share	Top 10% Sales share
2000	23,791	41.8%	83.3%
2001	25,773	42.6%	83.7%
2002	28,086	45.9%	85.0%
2003	29,656	44.5%	84.9%
2004	32,736	44.7%	85.2%
2005	34,833	45.8%	85.6%
2006	37,502	46.5%	86.1%
2007	38,918	47.2%	86.5%
2008	39,257	48.3%	86.9%
2009	39,357	47.1%	86.1%
2010	40,108	46.9%	86.0%
2011	40,928	47.7%	86.4%
2012	41,958	48.2%	86.6%
2013	41,166	48.2%	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.

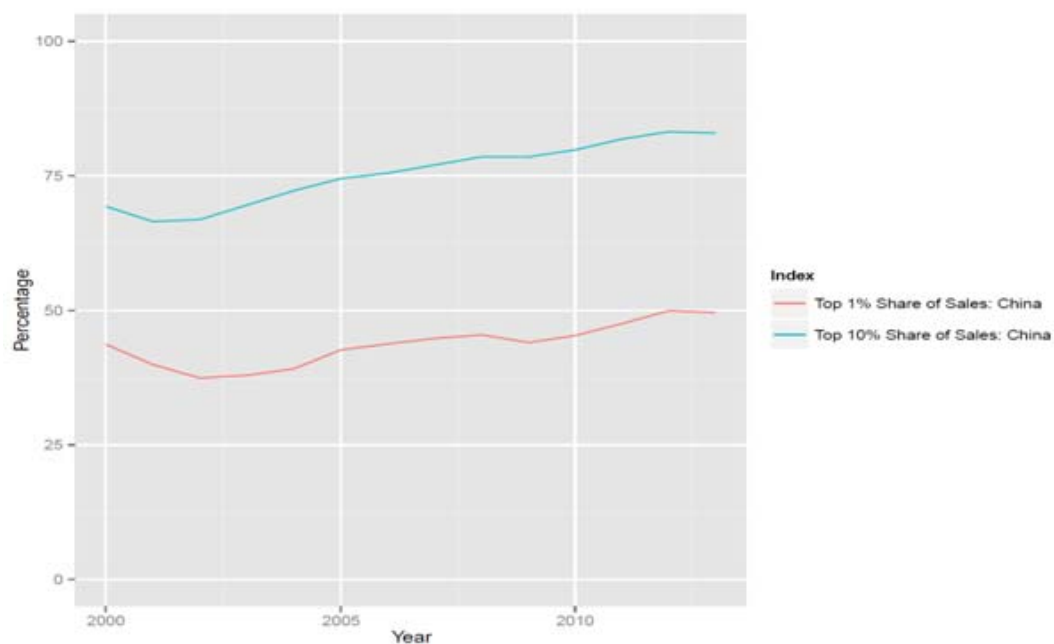
Piketty (2013) points out that at all times, the top decile of the wealth hierarchy owns a clear majority of what there is to own (generally more than 60% of total wealth and sometimes as much as 90%). In the US in 2010, the top 1% share of individual wealth was 33.8% and the top 10% share of individual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

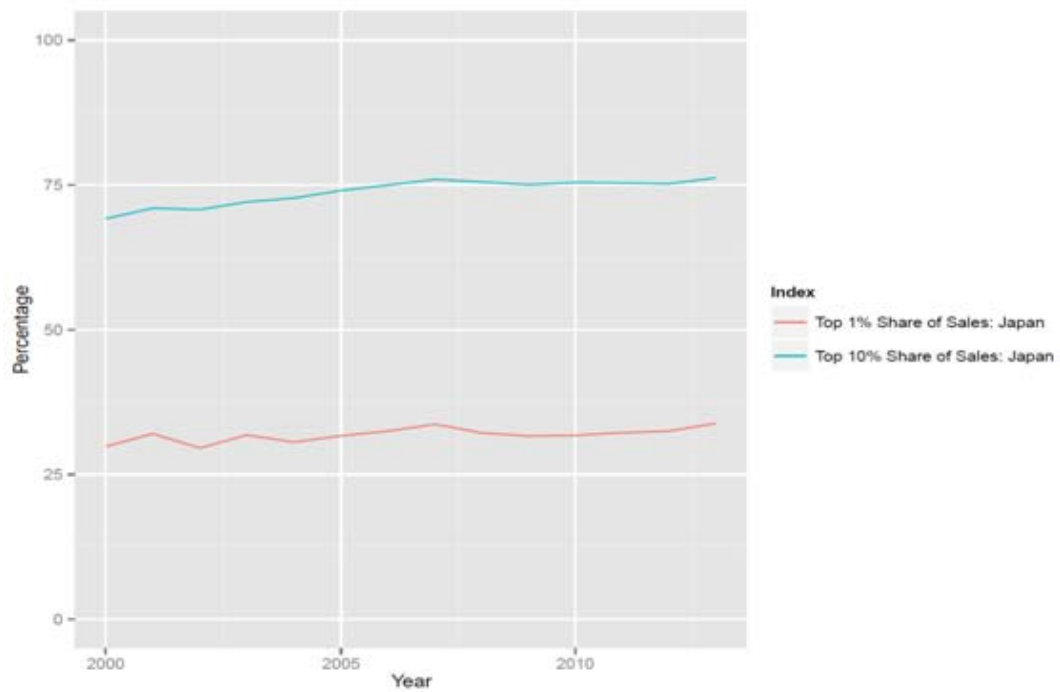
Figure 12 Sales inequality of firms in the US, 2000-2013: the top 1% and 10% shares



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

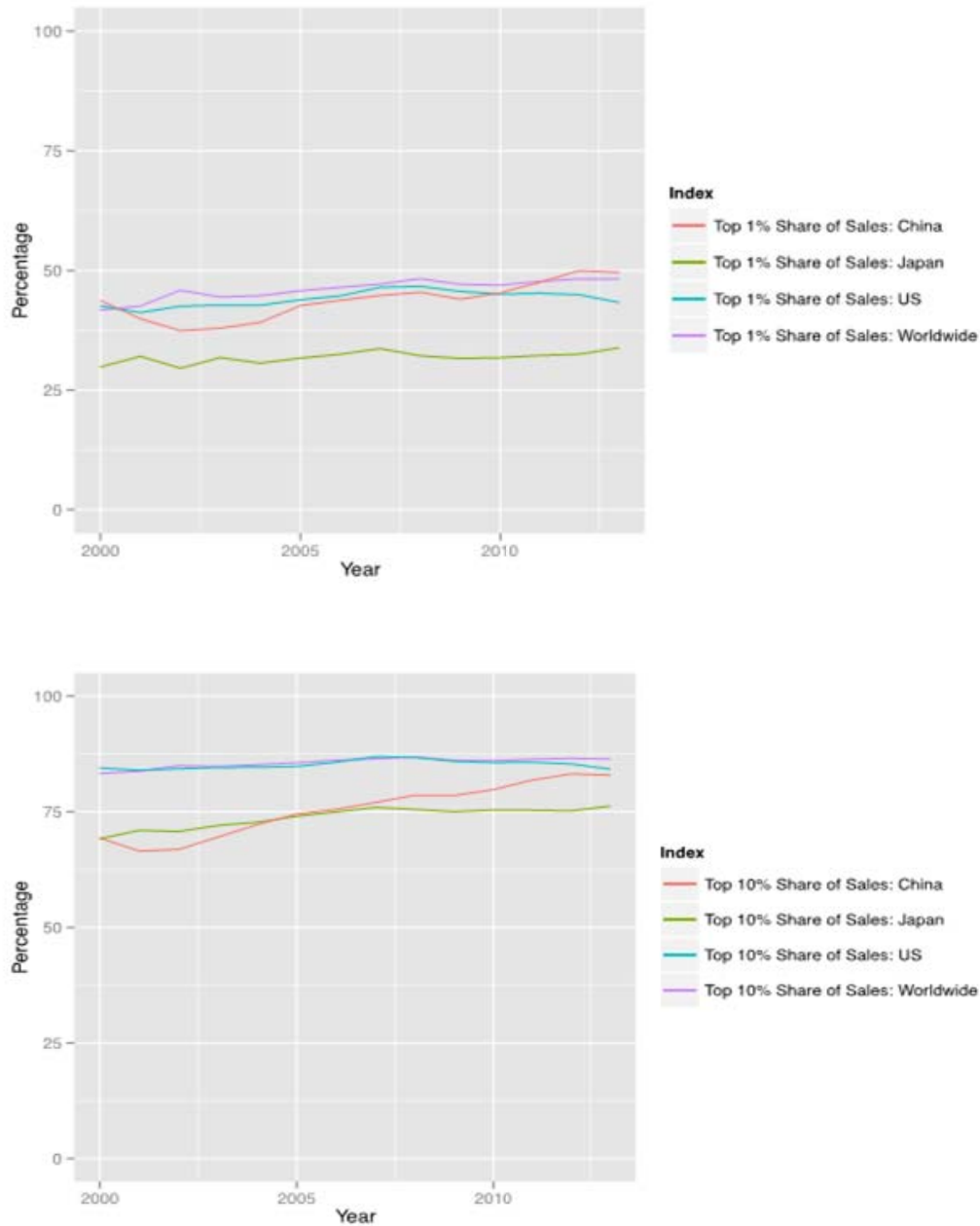


Figure 15 Sales inequality of firms worldwide and in the top three countries, 2000-2013: the top 1% and 10% shares

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 r s 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/>
dplyr, <http://cran.rstudio.com/web/packages/dplyr/vignettes/introduction.html>
R, <http://www.r-project.org/>

Table The ranking of national GDPs and firm sales in 2013

Rank	Country/Firm	GDP/Sales	Rank	Country/Firm	GDP/Sales	Rank	Country/Firm	GDP/Sales
1	United States	16768.05	101	SK HOLDINGS CO. LTD	105.91	201	WOOLWORTHS LTD	54.83
2	China	9489.12	102	COSTCO WHOLESALE CORP	105.16	202	CHINA COMMUNICATIONS CONSTRUCTION C	54.37
3	Japan	4898.53	103	BAYERISCHE MOTOREN WERKE AG	104.89	203	TOCHU CORP.	54.33
4	Germany	3635.96	104	STATOIL ASA	104.84	204	Guatemala	53.80
5	France	2807.31	105	44 ELECTRICITE DE FRANCE S.A.	104.25	205	THYSENKRUPP AG	53.79
6	United Kingdom	2523.22	106	EXPRESS SCRIPTS HOLDING CO.	104.10	206	NIPPON STEEL & SUMITOMO METAL CORP.	53.63
7	Brazil	2246.04	107	62 Marocco	103.82	207	LOWE'S COMPANIES, INC.	53.42
8	Russia	2096.77	108	46 NESTLE S.A.	103.62	208	Bulgaria	53.06
9	Italy	2071.96	109	47 SIEMENS AG	103.48	209	130 ACK ACTIVIDADES DE CONSTRUCCION Y SEI	52.92
10	India	1876.81	110	48 CAKEPOUR S.A.	102.47	210	INTEL CORP.	52.71
11	Canada	1826.77	111	49 BASF SE	102.02	211	CHINA TELECOM CORP. LTD	52.70
12	Australia	1505.92	112	50 NISSAN MOTOR CO. LTD	101.92	212	ROCHE HOLDING AG	52.47
13	Spain	1358.69	113	51 CARDINAL HEALTH INC	101.09	213	PFIZER INC.	51.58
14	Korea	1304.47	114	52 MARATHON PETROLEUM CORP.	100.25	214	HYUNDAI HEAVY INDUSTRIES CO. LTD	51.34
15	Mexico	1260.92	115	53 INTERNATIONAL BUSINESS MACHINES CORP	99.75	215	KOREA ELECTRIC POWER CORP.	51.20
16	Indonesia	870.28	116	54 KROGER CO.	98.38	216	RIO TINTO LTD	51.17
17	Netherlands	853.81	117	55 NOBLE GROUP LTD	97.88	217	RIO TINTO PLC	51.17
18	Turkey	819.99	118	56 CHINA MOBILE LTD	96.82	218	SSE PLC	50.99
19	Saudi Arabia	748.45	119	61 Slovak Republic	95.81	219	SAUDI BASIC INDUSTRIES CORP. (SAUDI JOIN	50.41
20	Switzerland	650.43	120	64 Ecuador	93.75	220	Costa Rica	49.62
21	Argentina	610.29	121	57 HITACHI LTD	93.50	221	A.P. MILLER - MAERSK A/S	49.19
22	Sweden	558.95	122	58 CHINA RAILWAY CONSTRUCTION CORP.	93.19	222	IDEMITSU KOSAN CO. LTD	48.95
23	Nigeria	521.81	123	59 SAIC MOTOR CO. LTD	90.41	223	3M HOLDING	48.67
24	Poland	517.71	124	60 ARCHER-DANIELS-MIDLAND CO.	89.80	224	CISCO SYSTEMS INC.	48.61
25	Norway	512.58	125	61 CHINA RAILWAY GROUP LTD	88.55	225	CHINA UNICOM (HONG KONG) LTD	48.35
26	Belgium	508.28	126	65 AMERIGO CUBERGEN CORP.	87.96	226	ENERGY TRANSFER EQUITY LP	48.24
27	Taiwan Province of China	489.09	127	63 PTT PUBLIC CO. LTD	86.63	227	81 Slovenia	48.01
28	WAL-MART STORES, INC.	476.29	128	64 BOEING COMPANY (THE)	86.62	228	Ghana	47.83
29	ROYAL DUTCH SHELL PLC	451.24	129	65 DEUTSCHE TELEKOM AG	82.93	229	ENTERPRISE PRODUCTS PARTNERS L.P.	47.73
30	CHINA PETROLEUM & CHEMICAL CORP.	433.04	130	66 HYUNDAI MOTOR CO. LTD	82.72	230	Tunisia	47.00
31	EXXON MOBIL CORP.	420.84	131	67 PROCTER & GAMBLE CO.	82.58	231	COCA-COLA COMPANY (THE)	46.85
32	Austria	416.06	132	68 AIRBUS GROUP N.V.	81.72	232	VALE S.A.	46.77
33	United Arab Emirates	402.34	133	69 ARCELOMITTAL S.A.	79.44	233	Lithuania	46.51
34	Thailand	387.25	134	70 HOME DEPOT INC.	78.81	234	CHINA SHENHUA ENERGY CO. LTD	46.51
35	BP PLC	379.14	135	71 TELEFONICA S.A.	78.69	235	ENERGY TRANSFER PARTNERS, LP	46.34
36	Colombia	378.42	136	72 MICROSOFT CORP.	77.83	236	FUJITSU LTD	46.30
37	PETROCHINA CO. LTD	370.04	137	65 Oman	77.12	237	Ethiopia	46.00
38	Islamic Republic of Iran	367.10	138	73 REPSOL S.A.	76.88	238	BOUYGUES S.A.	45.99
39	South Africa	350.80	139	74 DEUTSCHE POST AG	75.97	239	CONTINENTAL AG	45.97
40	Denmark	330.61	140	75 SONY CORP.	75.52	240	SANOFI	45.44
41	Malaysia	313.16	141	76 TOYOTA TRUSHO CORP.	75.29	241	LOCKHEED MARTIN CORP.	45.38
42	Singapore	297.94	142	77 PANASONIC CORP.	75.22	242	SCHLUMBERGER N.V.	45.27
43	Israel	290.64	143	78 INDIAN OIL CORP. LTD	74.67	243	BERKSHIRE S.A.	45.25
44	Chile	276.97	144	79 PEUGEOT S.A.	74.60	244	KIA MOTORS CORP.	45.10
45	Hong Kong SAR	274.03	145	80 AMAZON.COM, INC.	74.43	245	WALT DISNEY CO.	45.04
46	Philippines	272.07	146	81 MITSUBISHI CORP.	74.24	246	Lebanon	45.02
47	VOLKSWAGEN AG	271.69	147	66 Azerbaijan	73.54	247	KONINKLIJKE AHOLD N.V.	44.98
48	Egypt	271.43	148	82 TARGET CORP.	72.80	248	CHS INC.	44.48
49	Finland	267.41	149	83 RELIANCE INDUSTRIES LTD	72.29	249	SOCIETE NATIONALE DES CHEMINS DE FER F	44.46
50	TOYOTA MOTOR CORP.	249.80	150	84 WALGREEN CO.	72.22	250	SYSCO CORP.	44.41
51	Greece	241.80	151	67 Belarus	71.71	251	FEDEX CORP.	44.23
52	TOTAL S.A.	236.73	152	85 JOHNSON & JOHNSON	71.31	252	CNOOC LTD	44.20
53	Pakistan	232.76	153	86 RWE AG	70.88	253	WILMAR INTERNATIONAL LTD	44.09
54	GLENCORE PLC	232.69	154	87 AUDI AG	68.79	254	LYONDELLBASELL INDUSTRIES N.V.	44.07
55	Ireland	232.15	155	88 UNILEVER PLC	68.68	255	MERCK & CO., INC.	44.03
56	Kazakhstan	231.88	156	89 UNILEVER N.V.	68.68	256	NTL POSTONE INC.	43.77
57	Iran	229.33	157	90 MAXIMUS CORP.	68.60	257	CENTRICA PLC	43.76
58	Venezuela	227.18	158	91 FONCIERE EURIS S.A.	68.00	258	GLANOSMITHLINE PLC	43.46
59	CHEVRON CORP.	220.28	159	92 FINATIS S.A.	68.00	259	NTT DOCOMO INC.	43.38
60	Portugal	220.06	160	93 RALLYE S.A.	68.00	260	ANHEUSER-BUSCH INBEV	43.20
61	SAMSUNG ELECTRONICS CO. LTD	218.69	161	94 CASINO GUICHARD-PERRACHON S.A.	67.09	261	JOHNSON CONTROLS INC.	42.73
62	Algeria	212.43	162	68 Sudan	66.75	262	INGRAM MICRO INC.	42.56
63	Qatar	202.43	163	69 Sri Lanka	66.72	263	Serbia	42.49
64	Peru	202.42	164	95 PEPISCO INC.	66.42	264	AB NVOVO	42.44
65	Czech Republic	198.45	165	96 BHP BILLITON PLC	65.97	265	BEST BUY CO. INC.	42.41
66	Romania	188.89	166	70 Libya	65.52	266	PLAINS ALL AMERICAN PIPELINE LP	42.25
67	New Zealand	181.57	167	97 SOFTBANK CORP.	64.82	267	PLAINS GP HOLDINGS LP	42.25
68	Ukraine	178.31	168	98 COMCAST CORP.	64.66	268	KDDI CORPORATION	42.14
69	Kuwait	175.79	169	99 TOKYO ELECTRIC POWER CO. INC.	64.48	269	FINANCIERE AGACHE	42.08
70	PHILLIPS 66	171.60	170	100 VODAFONE GROUP PLC	63.82	270	ABB LTD	41.85
71	APPLE INC.	170.95	171	101 TOSHIBA CORP.	63.22	271	WORLD FUEL SERVICES CORP.	41.56
72	Vietnam	170.57	172	102 SK INNOVATION CO. LTD	63.17	272	DEUTSCHE LUFTHANSA AG	41.41
73	E.ON SE	168.87	173	103 AEON CO. LTD	62.82	273	ENDESA S.A.	40.99
74	DAIMLER AG	162.71	174	104 UNITED TECHNOLOGIES CORP.	62.63	274	Turkmenistan	40.83
75	Bangladesh	161.76	175	105 METRO AG	62.56	275	Panama	40.47
76	OPEN JOINT STOCK COMPANY GAZPROM	160.58	176	106 BUNGE LTD	61.35	276	Yemen	40.42
77	ENI S.p.A.	158.21	177	71 Dominican Republic	61.26	277	LVASH MOET HENNESSY - LOUIS VUITTON SA	40.20
78	GENERAL MOTORS CO.	155.43	178	72 Luxembourg	60.40	278	SAINSBURY PLC	39.97
79	FORD MOTOR CO.	146.92	179	107 AMERICA MOVIL S.A.B. DE C.V.	60.12	279	DENSO CORP.	39.82
80	GENERAL ELECTRIC CO.	146.05	180	108 GOOGLE INC.	59.83	280	JYS S.A.	39.47
81	NEFTYANAYA KOMPANIYA ROSNEFT	143.42	181	109 POSCO	58.42	281	JARDINE MATHESON HOLDINGS LTD	39.47
82	OAO LUKOIL	141.45	182	110 OMV AKTIENGESSELLSCHAFT	58.49	282	MITSUBISHI ELECTRIC CORP.	39.42
83	VALERO ENERGY CORP.	138.07	183	111 COMPAGNIE DE SAINT GOBAIN S.A.	57.96	283	HONEYWELL INTERNATIONAL INC.	39.06
84	MCKESSON CORP.	137.61	184	112 NOVARTIS AG	57.92	284	CHINA UNITED NETWORK COMMUNICATION	38.93
85	Hungary	132.26	185	73 Croatia	57.37	285	HINDUSTAN PETROLEUM CORP. LTD	38.92
86	HON HAI PRECISION INDUSTRY CO. LTD	131.56	186	113 DOW CHEMICAL CO. (THE)	57.08	286	GAZPROMNEFT	38.73
87	PETROLEO BRASILEIRO S.A.	129.53	187	74 Uzbekistan	56.81	287	LENVO GROUP LTD	38.71
88	AT&T INC.	128.75	188	75 Myanmar	56.76	288	TATA MOTORS LTD	38.38
89	CVS HEALTH CORP.	126.76	189	114 ORANGE	56.52	289	UNITED CONTINENTAL HOLDINGS, INC.	38.28
90	Angola	124.18	190	115 RENAULT	56.45	290	POLSKI KONCERN NAFTOWY ORLEN S.A.	37.80
91	GDF SUEZ	123.15	191	116 CONOCOPHILLIPS	56.19	291	DEERE & CO.	37.80
92	JX HOLDINGS, INC.	120.68	192	117 VINCI	56.18	292	DELTA AIR LINES, INC.	37.77
93	VERIZON COMMUNICATIONS INC.	120.55	193	76 Uruguay	55.71	293	TESORO CORP.	37.60
94	FIAT S.p.A.	119.73	194	118 CATERPILLAR INC.	55.66	294	SUNCOR ENERGY INC.	37.21
95	HONDA MOTOR CO. LTD	115.14	195	119 WESSFARMERS LTD	55.46	295	ORACLE CORP.	37.18
96	HEWLETT-PACKARD CO.	112.30	196	120 UNITED PARCEL SERVICE INC.	55.44	296	TOTAL PETROCHEMICALS & REFINING	37.00
97	TESCO PLC	109.38	197	121 BAYER AG	55.38	297	HANWHHA CORP.	36.68
98	CHINA STATE CONSTRUCTION ENGINEERING	107.31	198	122 SEVEN & I HOLDINGS CO. LTD	55.32	298	EMPRESA COLOMBIANA DE PETROLEOS - EC	36.63
99	ENEL S.p.A.	106.55	199	123 LG ELECTRONICS INC.	55.09	299	SEARS HOLDINGS CORP.	36.19
100	NIPPON TELEGRAPH AND TELEPHONE CORP	106.22	200	77 Kenya	54.99	300	SAFARIWAY INC.	36.14

Color: Country (White), Firm (Yellow)

Appendix 1 Sample countries for Figure 6-15

Country	Number of Firms	Country	Number of Firms
1 ALGERIA	7	71 LAO PEOPLE'S DEMOCRATIC REPUBLIC	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 AZERBAIJAN	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
12 BELGIUM	307	82 MAURITIUS	120
13 BERMUDA	872	83 MEXICO	329
14 BHUTAN	13	84 MONACO	3
15 BOLIVIA	66	85 MONGOLIA	280
16 BOSNIA AND HERZEGOVINA	103	86 MONTENEGRO	32
17 BOTSWANA	27	87 MOROCCO	80
18 BRAZIL	971	88 NAMIBIA	11
19 BULGARIA	113	89 NEPAL	47
20 BURKINA FASO	2	90 NETHERLANDS	438
21 CAMBODIA	2	91 NEW ZEALAND	270
22 CANADA	5,527	92 NICARAGUA	13
23 CAPE VERDE	9	93 NIGERIA	232
24 CAYMAN ISLANDS	1,212	94 NORWAY	415
25 CHILE	776	95 OMAN	146
26 CHINA	4,103	96 PAKISTAN	706
27 COLOMBIA	275	97 PALESTINIAN TERRITORIES	47
28 COSTA RICA	32	98 PANAMA	114
29 COTE D'IVOIRE	32	99 PAPUA NEW GUINEA	14
30 CROATIA	176	100 PARAGUAY	88
31 CURACAO	8	101 PERU	337
32 CYPRUS	174	102 PHILIPPINES	295
33 CZECH REPUBLIC	292	103 POLAND	450
34 DENMARK	330	104 PORTUGAL	137
35 DOMINICA	2	105 QATAR	47
36 DOMINICAN REPUBLIC	13	106 REPUBLIC OF KOREA	2,133
37 ECUADOR	245	107 REPUBLIC OF MOLDOVA	20
38 EGYPT	882	108 ROMANIA	120
39 EL SALVADOR	44	109 RUSSIAN FEDERATION	1,121
40 ESTONIA	29	110 RWANDA	1
41 FIJI	19	111 SAINT KITTS AND NEVIS	9
42 FINLAND	211	112 SAINT LUCIA	3
43 FRANCE	1,772	113 SAUDI ARABIA	166
44 GABON	1	114 SENEGAL	2
45 GEORGIA	8	115 SERBIA	66
46 GERMANY	1,605	116 SINGAPORE	882
47 GHANA	32	117 SLOVAKIA	71
48 GIBRALTAR	7	118 SLOVENIA	50
49 GREECE	376	119 SOUTH AFRICA	734
50 GRENADA	3	120 SPAIN	379
51 GUATEMALA	22	121 SRI LANKA	288
52 GUYANA	8	122 SUDAN	14
53 HONDURAS	19	123 SWAZILAND	7
54 HONG KONG	309	124 SWEDEN	805
55 HUNGARY	73	125 SWITZERLAND	497
56 ICELAND	39	126 SYRIAN ARAB REPUBLIC	18
57 INDIA	5,234	127 TAIWAN	2,370
58 INDONESIA	549	128 THAILAND	743
59 IRAQ	98	129 TRINIDAD AND TOBAGO	26
60 IRELAND	195	130 TUNISIA	79
61 ISLAMIC REPUBLIC OF IRAN	293	131 UGANDA	8
62 ISRAEL	802	132 UKRAINE	456
63 ITALY	543	133 UNITED ARAB EMIRATES	121
64 JAMAICA	64	134 UNITED KINGDOM	5,310
65 JAPAN	4,751	135 UNITED REPUBLIC OF TANZANIA	14
66 JORDAN	279	136 UNITED STATES OF AMERICA	16,423
67 KAZAKHSTAN	135	137 URUGUAY	33
68 KENYA	62	138 VENEZUELA	73
69 KUWAIT	225	139 VIETNAM	892
70 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

