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Effect of Intelligent Logistics Policy on Shareholder Value: Evidence from Chinese Logistics Companies

Abstract: This paper empirically investigated the effects of intelligent logistics policies (ILPs) on shareholder value of the 149 listed logistics companies from 2013-2018 in China. The research results shown that ILPs will result in a positive stock market reaction, and this effect is increasing along with the increase of policy contents related to intelligent logistics or the decrease of company service breadth. The market reaction will be affected by the way that policies are issued and type of company. The logistics service providers are more positive when their financial performances are better, while the opposite result is observed for logistics equipment manufacturers.

Key words: Intelligent Logistics; Government Policy; empirical research; stock market reaction

1 Introduction

Along with the fourth revolution of science and technology, the world has stepped into a new era of intelligence, which has led to a wave of technology research and implementation, such as smart factories, smart production and intelligent logistics (Tjahjono et al., 2017). The fast growth of intelligent logistics is a response to the increasing demand of today's global supply chains and transportation systems to provide customers with resource-efficient, secure, sustainable, and timely services anytime and anywhere (Jabeur et al., 2017). Uckelmann (2008) first defined intelligent logistics, which is a new mode driven by emerging technologies, such as big data, Internet of Things, and cloud computing, and realizing industry-wide connectivity, sharing and symbiosis through automation, visualization and informatization in the operation of logistics services. Intelligent logistics is a special system supported by advanced information technology to realize system perception, comprehensive analysis, timely processing and self-adjustment in various procedures of logistics, such as warehousing, distribution, and information service. It has the characteristics of automation, intelligence, visualization, networking, flexibility, etc., and thus can promote manufacturing, retail and e-commerce in an all-around way. The biggest difference between intelligent logistics and traditional logistics is that intelligent logistics can plan, manage or control logistics operations (inventory, transportation or order management) in a more intelligent way, thus making the whole process of

logistics visible, perceptible and real-time adjustable to improve the economic efficiency of the whole industry (McFarlane, 2016). In this paper, we will select policy samples according to these characteristics of intelligent logistics.

Intelligent logistics policies (ILPs) are policies issued by the government to promote the development of the intelligent logistics industry. These logistics policies cover a wide range of subjects and usually involve the demand, supply, facilities and equipment, information technology, management system and other aspects of intelligent logistics. For example, for the demand aspect of intelligent logistics, the policy "Guiding Opinions on Promoting the Intelligent Development of Transportation Informatization"[1] issued by the Ministry of Transport of PRC (MOT) highlighted that "intelligent logistics drives the rapid growth of the transportation information consumption scale". For the supply aspect of intelligent logistics, The National Development and Reform Commission of PRC (NDRC) and MOT jointly launched the policy "Promoting 'Internet +' Convenient Transportation to Promote the Development of Intelligent Transportation"[2], and it referred to "the development of intelligent logistics as the guide, enhancing the industry's innovation ability, providing diversified products and meeting diversified needs." For the facilities and equipment aspect of intelligent logistics, the NDRC launched the policy "'Internet +' Efficient Logistics Implementation Opinions"[3], and it referred to "encouraging the development of logistics for robot technology, promoting the application of robots in the logistics field, promoting breakthrough technology of robot image recognition, high-density storage mechanical arm picking, voice picking etc., and developing multi robot applications in the warehouse." In the information technology aspect of intelligent logistics, the policy "Medium and long-term planning for the development of logistics industry (2014-2020)"[4] issued by the State Council mentioned that we should "strengthen the application of Beidou navigation, Internet of things, cloud computing, big data, mobile Internet and other advanced information technologies in the field of logistics." In the management system aspect of intelligent logistics, the policy "Notice on Forwarding the Special Action Plan for the Reduction and Efficiency of Logistics Industry (2016-2018)"[5] issued by the General Office of the State Council referred to "establishing a standardized, information-based, networked, intensive and intelligent modern logistics

[1] URL: http://xxgk.mot.gov.cn/jigou/kjs/201309/t20130930_2975104.html
[2] URL: http://zfxxgk.ndrc.gov.cn/web/iteminfo.jsp?id=2538
[3] URL: http://zfxxgk.ndrc.gov.cn/web/iteminfo.jsp?id=2535
[4] URL: http://www.gov.cn/zhengce/content/2014-10/04/content_9120.htm
[5] URL: http://www.gov.cn/zhengce/content/2016-09/26/content_5112169.htm

service system".

As a new form of logistics industry, intelligent logistics has attracted the attention of many investors. The release of intelligent logistics policies may have an impact on the relevant enterprises, which may affect the shareholder value of logistics listed companies. This paper empirically investigated the effects of ILP on shareholder value of the 149 listed logistics companies from 2013-2018 in China and provides suggestions for governments and logistics companies in the development of intelligent logistics.

It is very important to study the market reaction of intelligent logistics policies for two main reasons. For industrial practice, although the Chinese government has issued a large number of logistics policies, it has not comprehensively studied the effect of the policies and cannot determine whether the policies are accurate and efficient. Research on the impact of policies on the market will help the government more effectively promote the development of the industry (Tambe, 2014; McFarlane et al., 2016). This paper studies the response of logistics enterprises to intelligent logistics policies, which is of great significance for improving the accuracy of the policies and facilitating governmental decision-making. What's more, a large number of empirical articles have focused on changes in performance caused by the issuance of government policies (Chatfield and Reddick, 2016; Chatfield and Reddick, 2018), and many empirical articles have used second-hand data to study the stock market reaction to events related to operation and management (Hendricks and Singhal, 1997; Lin and Su, 2013; Jacobs, 2014). However, the stock market reaction caused by the release of government policies has not been studied quantitatively, which has led to obvious theoretical defects. Therefore, this paper will help to make up for this limitation and provide a new evaluation perspective for policy release.

Many important conclusions have been derived from this paper. We study the impact of the policy content and release mode on the shareholder value of logistics companies. The market reaction is more positive with increased policy contents related to intelligent logistics. Surprisingly the General Office of the State Council, which is the leading agency, has a lower impact than its subordinate ministries (e.g., NDRC). In terms of the policy release mode, a centralized release will hinder the positive effect of policies on the market. Moreover, we study the effect of company type on the stock market reaction. The reaction decreases as the companies' service breadth increases. In addition, state-owned logistics companies are more active than other companies. The relationship between the firm's financial performance and its business type is significant. For a logistics service company, when its prior financial performance (PFP)

is better, its shareholder value will be more positively affected by the intelligent logistics policy than that when its PFP is worse; and for a logistics equipment manufacturing company, when its PFP is worse, its shareholder value will be more positively affected than that when its PFP is better.

The remainder of this paper is organized as follows. Section 2 presents a review of the existing literature on intelligent logistics, policies and event studies. Section 3 introduces the research methods and the basis and process of sample selection. Section 4 proposes the hypotheses. Section 5 presents the analysis results and model expansion. Section 6 discusses the conclusions and the significance of management. Section 7 gives a brief account of the shortcomings of the article and the future research directions.

2. Literature review

Many enterprises and governments are developing intelligent logistics, and many logistics & supply chain academic research have begun to use the event studies method for in-depth analysis. Therefore, the literature review will focus on three aspects: intelligent logistics, intelligent logistics and government decision-making, event studies of logistics and supply chain management.

2.1 Intelligent Logistics

Some researchers consider intelligent logistics as a system with management and coordination, adaptation, optimization and scheduling, monitoring and intelligent supervision and direct control layers dedicated to dynamic, stochastic, multicriteria intelligent logistics decision problems (Adamski, 2011). The current intelligent logistic research has focused on intelligent technologies, such as Automatic Logistics (Windt et al., 2007), Product Intelligence (Mcfarlane et al., 2013), Intelligent Transportation System and Physical Network (Montreuil, 2011), Self-Organized Logistics (Bartholdi et al., 2009), Big Data Analysis (Govindan et al., 2018), RFID Technology (Kirchet al., 2017). Most of the research focused on how technological innovation can improve the efficiency of the logistics system. For example, Intelligent Interconnected Logistics is an intelligent interconnected product system (AGV, Automated Storage Device, etc.) that can share data among enterprises through cloud collaboration and big data (Gregor, 2017). Intelligent logistics will achieve the efficient organization of logistics and information flows within the transportation network across companies or across industries, and it is an inevitable trend in the development of modern logistics (Kirch et al., 2017). Due to the wide application of information technologies, such as big data and Internet of Thing, the traditional logistics industry is undergoing an innovative transformation. Emerging technologies make logistics services more flexible and

intelligent, thus forming a service paradigm of intelligent logistics (McFarlane et al., 2016). However, research on intelligent logistics from the perspective of management is still relatively scarce. Some of these studies have emphasized the coordinated relationship between the upstream and downstream (Mcfarlane et al., 2016), demand and supply visibility for logistics flexibility (Srinivasan and Swink, 2018) or the added value logistics services in the supply chains (Eckhardt and Rantala, 2012). Mature theoretical research has not been performed on how government departments influence and promote the development of intelligent logistics. Some scholars have already regarded this as an important future research direction (Tambe, 2014).

2.2 Intelligent Logistics and Governmental Decision-making

Information and Communication Technology (ICT), infrastructure, workers and governmental policymaking are the four main pillars of intelligent logistics (Jabeur et al., 2017). ICT and infrastructure support the planning and scheduling processes with the relevant information resources at the right time and right place. Logistics workers should have an accurate understanding for the management and connotation of intelligent logistics. Governmental policymaking plays an important role in intelligent logistics, especially since their policies have a central impact on logistics costs (Jabeur et al., 2017). At present, many scholars have studied logistics from the perspective of the government. McKinnon (2010) believed that the logistics policy has a great impact on the circular logistics, green logistics and other logistics industries. Magalhaes et al. (2017) found that the government can support logistics enterprises through data opening. Dockerty et al. (2018) shown that smart mobility needs long-term supervision by the government. Wang et al. (2019) studied the incentive mechanism for cooperation between the government and logistics enterprises. Li et al. (2019) discussed policy-making on automated vehicles. Reigner and Brenac (2019) conducted a comprehensive evaluation on the transportation policy of France. The above literature show that many scholars have made contributions to the relationship between policies and the logistics market; however, insufficient research has focused on the relationship between intelligent logistics policy and intelligent logistics development. This paper will try to supplement this gap.

2.3 Event Studies in Logistics and Supply Chain Management

Logistics and supply chain management plays a vital role in generating shareholder value through the mechanisms of revenue growth, operating cost reduction, and efficient use of fixed and working capital (Martin and Lynette, 1999). Researchers have conducted various empirical studies to analyze the connection between logistics

& supply chain management and shareholder value, among which the event study method represents one of the most popular methodologies adopted in the literature (Ding et al., 2018).

The event study method is applied to different topics of logistics and supply chain management, such as supply chain disruption (Hendricks and Singhal, 1997; Zhao et al., 2013), green logistics and supply chain (Jacobs, 2014; Klassen and McLaughlin, 1996) and logistics and supply chain service quality (Lin and Su, 2013; McGuire and Dilts, 2008). However, the topics of current event study articles are generally focused on the business level of enterprises. For example, Kavussanos & Marcoulis (1997) undertook a comparative analysis of the stock market perception of risk of U.S. listed water transportation and other transport sectors such as air transportation, rail transportation, trucks. Many studies have examined the effects of deregulation (Lepak, 1997) or pollution (Seufert et al., 2017) on stock price movements for the airline industry. Few articles have used the event study method to explore government policy issues or the relationship between logistics policy and shareholder value. Therefore, this paper will analyze the impact of different intelligent logistics policies on shareholder value using the event research method to provide suggestions for the development of intelligent logistics for both the government and enterprises.

3 Methodology

In answering the research questions, we adopted the event study methodology for this research. The below sections will justify in detail and describe the sample collection process, including the samples selected from two parties, namely, government policies and logistics companies, and explain the establishment of the sample database.

3.1 Event Study Methodology

This study employed the event study methodology to estimate the market reaction to relevant ILPs. The event study method is a statistical method proposed by Brown and Warner (1985). Generally, the market reaction was estimated by the magnitude of the abnormal returns associated with the event. Abnormal returns refer to the difference between the actual stock return and the expected return on the event day.

For each sample, calendar time is converted to event time according to the following rules. The date on which the policy was published is the event day or day 0. If the date of the policy is not a trading day or if its trading ceases on that date for any reason, then the next trading day is set as day 0. The trading day before day 0 is day -1, the trading day after day 0 is day 1, etc. Furthermore, if the policy is released after 3:00 pm, then the stock market could not react to the policy until the next trading day

(because it is closed after 3:00 pm). If so, then the trading day after the day of publication is day 0.

In this paper, we estimated abnormal returns using the Market model, which is the most commonly used model in event studies (Brown and Warner 1985). The Market model posits a linear relationship between the stock return and the return on the market portfolio (market return) over a given time period:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (1)$$

where R_{it} is the Day t return of stock i; R_{mt} is the Day t market return; α_i is the intercept of the relationship for stock i; β_i is the systematic risk (or beta) of stock i, which measures the sensitivity of stock i's return to the market return; and ε_{it} is the error term for stock i on Day t. Stock market movement accounts for a portion of stock i's return and is represented by the term $\beta_i R_{mt}$ (the systematic component of stock i return). The portion of the return that is unexplained by market movements is ε_{it} (the idiosyncratic component of stock i return).

We estimated the expected return for each sample firm using data from a 200-day estimation period that begins on Day -210 and ends on Day -11. We ended the estimation period 2 weeks (10 trading days) prior to the event day to shield the estimates from the effects of the policy and to ensure that any nonstationarity in the estimates is not an issue. Moreover, for Policy A, if another Policy B was issued during the estimated period of Policy A, to avoid the interaction between these two policies, we excluded the market returns of Policy B and do not take it as the estimation period. In estimating the parameters, we required that a firm must have a minimum of 40 stock returns during the estimation period of 200 trading days, which is consistent with other studies that use the same estimation period (Jacobs and Signhal, 2014; Hendricks et al., 2014). We calculated least squares estimate based on the 200-day data to obtain $\hat{\beta}_i$ and $\hat{\alpha}_i$.

During the event period, the expected return of stock i on day t is

$$\hat{R}_{it} = \hat{\alpha}_i + \hat{\beta}_i R_{mt} \quad (2)$$

The abnormal return of stock i on day t is

$$A_{it} = R_{it} - \hat{R}_{it} \quad (3)$$

N is the sample size. The mean abnormal return for Day t is given by the following:

$$\bar{A}_t = \sum_{i=1}^{N} (A_{it} / N) \quad (4)$$

Because ILPs may have an impact on the stock price of many logistics companies, the R_{mt} of day 0 may also be affected. Therefore, before calculating the abnormal return of the sample, we calculate the market index of the company excluding the sample and check its correlation with the market index of the company including the sample to verify whether Rmt is affected.

Meanwhile, we are estimating the abnormal returns for multiple firms with an event on the same calendar day, which can cause cross-sectional dependence in abnormal returns across the sample firms. If such cross-sectional dependence is not adjusted for, then the standard deviation may be underestimated and the magnitude of the test statistics may also be overestimated. In response to this, we use the test advocated by Brown and Warner (1985) that adjusts for cross-sectional dependence. We compute the mean abnormal return A for the 200-day estimation period as

$$\overline{\overline{\mathrm{A}}} = \frac{\sum_{t=-202}^{t=-3} \overline{A_t}}{200} \tag{4}$$

We then estimate the standard deviation from the mean daily abnormal returns for the 200-day estimation period as

$$\hat{S}(\overline{A_t}) = \sqrt{\sum_{t=-202}^{t=-3} (\overline{A_t} - \overline{\overline{\mathrm{A}}})^2} \,/199 \tag{5}$$

We calculate the Day t-test statistic TS_t as

$$\mathrm{TS}_t = \overline{A_t} / \hat{S}(\overline{A_t}) \tag{6}$$

Next, we used two nonparametric tests to check whether the outliers affect the results, as seen in Jacobs and Singhal (2014). The first is the Wilcoxon signed-rank test, which is used to assess whether the median of the abnormal returns is significant. The other is the binomial sign test, which is used to assess whether the probability of positive returns is significantly greater than 50%. These two tests are very common in event study papers published in top journals (Jacobs and Singhal, 2014; Hendricks et al., 2014), and they are performed to demonstrate that the positive market reaction is not caused by some extreme values.

3.2 Policies Sample

3.2.1 Selection of the government department

First, the data sample is obtained from Chinese government departments. According to the official statement of the Chinese government website (www.gov.cn), the State Council of the People's Republic of China, namely, the Central People's Government, is the executive department of the highest state power and the highest state administrative department. Under the State Council, an office has been set up to manage state administrative affairs. Because the State Council and the General Office

are similar leaders and have a common website to publish policy, we classified the State Council and the General Office as one class in the following test. The policies in this paper are all documents published by the State Council, the office and its subordinate organizations. Due to the large number of departments and institutions under the State Council, in addition to those policy documents issued by the State Council and the General Office, we also ensured that the selected departments and institutions are directly related to the logistics industry according to [2005] No.288 "the Circular of the National Development and Reform Commission on Establishing the Inter-ministerial Joint Conference System of Modern Logistics Work". These departments are as follows: National Development and Reform Commission (NDRC), Ministry of Industry and Information Technology (MIIT), Ministry of Public Security (MPS), Ministry of Transport (MOT), Ministry of Commerce (MOC), Ministry of Finance (MOF), General Administration of Customs (GACC), Civil Aviation Administration of China (CAAC), State Post Bureau (SPB), Standardization Administration (SAC), National Railway Administration (NRA), State Taxation of Administration (STA), and China Federation of Logistics & Purchasing (CFLP). It should be noted that the China Federation of Logistics and Purchasing is an industry association and does not have the power to issue policies, although it does have a strong influencing role on the logistics industries.

3.2.2 Selection of policies

First, because our research scope is the Chinese logistics industry, we only study the policies issued by state-level departments and do not consider regional factors and policies issued by provinces and municipalities.

Second, because we focused on the overall market value of the logistics industry, the selected policies should be able to impact all logistics companies. For policies aimed at standardizing specific industrial logistics or a single transportation mode, the number of influenced companies is small and the policies only affect a limited number of companies; thus, including these policies may introduce errors. Therefore, these types of policies were not considered in this research. For example, this study did not consider the "Opinions on Accelerating the Development of Cold Chain Logistics to Ensure Food Safety and Promoting Consumption Upgrade" issued by the General Office of the State Council (this policy is limited to cold chain logistics) and the "Circular on Publishing Action Plan for Further Structural Reform of Water Transport Supply Side (2017-2020)" issued by the MOT (this policy is limited to the water transport market), the "Guiding Opinions on Promoting the Development of the Aviation Logistics Industry" issued by the CAAC (this policy is limited to aviation logistics), etc.

Finally, this research limited the policy issue time to the period from 2013 to 2018 based on the following two reasons.

1) From a global perspective, Germany proposed the “Industry 4.0” strategy in 2013 and considered it to be part of a smart, networked world, which led to the rise of intelligent logistics (Kagermann et al., 2013). Since then, a new round of industrial transformation competition has been launched on a global scale, which has set off a wave of technological R&D and implementation of smart factories, smart production and intelligent logistics, and it became the symbol of the fourth industrial revolution (Tjahjono et al., 2017).

2) From a Chinese perspective, the 18th National Congress of the Communist Party of China has witnessed profound changes in Chinese policies. In the new era, new leaders have paid more attention to the promotion and application of information technology, such as the Internet, and transforming traditional industries to "wisdom +". Hence, after 2013, policies about intelligent logistics began to emerge.

During the selection process, we first focused on all 262 logistics and supply chain related policies issued by the targeted departments from 2013 to 2018 organized by CLFP (URL: http://www.chinawuliu.com.cn/special/wlycgzcfg.htm). CLFP is the first logistics and procurement industry organization in China and has been authorized to perform functions of foreign affairs, industry statistics and standard revisions by the government. It is also the Chinese representative of the Asia-Pacific Logistics Alliance and International Procurement Alliance and has a high authority level. The official websites of ministries and commissions were then checked to avoid missing policies. We excluded policies that only focused on certain logistics industries, which eliminated 86 policies so that 176 were retained. Meanwhile, the websites also contain a total of 21 policy interpretations and related news that do not belong to the policy category and have been removed, which means that 155 remained. Finally, according to the characteristics of intelligent logistics described above, we set up keywords as the criteria for selecting policies on intelligent logistics as shown in Table 1. In addition to the policies whose titles included the keywords, we also read all the full text of the logistics policies and set the relevant policies related to the keywords in the whole paragraph or chapter as policy samples. Panel A of Table 2 presents the method of selecting 20 intelligent logistics policies from 155 policies, and Panel B of Table 2 presents the titles and the release time of the policies, with seven from the State Council or the General Office, two from the MOC, three from the MOT, two from the NDRC, one from the SPB, one from the MOF, and four from multiple ministries.

Table 1 Intelligent logistics keywords

Keywords
Intelligent logistics, Smart logistics;
Big data, blockchain, cloud computing, artificial intelligence, Internet of things, Internet, information platform, informatization, automation, visualization
Sharing, symbiosis and connectivity

Table 2 ILP samples

Panel A Policy Screening Process			
Step	Criteria	Before screening	After screening
1	Eliminate policies that are specific to a particular industry or to a single mode of transport	262	176
2	Remove policy interpretations and news	176	155
3	Screening by keywords	155	20
Panel B Samples			
No.	Policy Name	Date	Department
1	“Deepening the Reform of Circulation System and Accelerating the Division of Labor of Key Work Departments in the Development of Circulation Industry”	2013.6.5	The General Office
2	"Guiding Opinions on Promoting the Intelligent Development of Transportation Informatization"	2013.9.30	MOT
3	“Notice on Printing and Distributing the Standardization Construction Plan for the Public Information Platform for Transportation and Logistics (2013-2015)”	2013.11.14	MOT
4	“Medium and long-term planning for the development of logistics industry (2014-2020)”	2014.10.8	The State Council
5	"Guiding Opinions on Actively Promoting ‘Internet +’ Actions"	2015.7.6	The State Council
6	"Several Opinions on Strengthening the Construction of Short-term Logistics to Promote Effective Investment and Household	2016.3.3	NDRC

	Consumption"		
7	"National E-Commerce Logistics Development Special Plan (2016-2020)"	2016.3.23	MOC, NDRC, MOT, GACC, SPB, STA
8	"Development of Service-Oriented Manufacturing Special Action Guide"	2016.7.26	MIIT, NDRC
9	"'Internet +' Efficient Logistics Implementation Opinions"	2016.7.29	NDRC
10	"Promoting "Internet +" Convenient Transportation to Promote the Development of Intelligent Transportation"	2016.8.5	NDRC, MOT
11	"Promoting the Supply Side Structural Reform and Promoting the Logistics Industry to Reduce Costs and Increase Efficiency"	2016.8.11	MOT
12	"Notice on Forwarding the Special Action Plan for the Reduction and Efficiency of Logistics Industry (2016-2018)"	2016.9.26	The General Office
13	"13th Five-Year Development Plan for Domestic Trade Circulation"	2016.11.11	MOC, NDRC, MIIT, MOF
14	"E-commerce 13th Five-Year Development Plan	2016.12.29	MOC
15	"Thirteenth Five-Year Plan for the Development of Trade and Logistics"	2017.2.8	MOC
16	"Opinions on Accelerating the Structural Reform of the Supply Side of the Postal Industry"	2017.5.18	SPB
17	"Opinions on Further Promoting Logistics Cost Reduction and Efficiency Promotion to Promote the Development of the Real Economy"	2017.8.17	The General Office
18	"Guiding Opinions on Actively Promoting Supply Chain Innovation"	2017.10.13	The General Office
19	"Opinions on Promoting the Coordinated Development of E-Commerce and Express Logistics"	2018.1.23	The General Office
20	"Notice on Launching the Construction of Modern Supply Chain System in the Circulation	2018.5.28	MOF

Sector in 2018”

3.3 Company Samples

3.3.1 Sample range

First, we selected companies listed on the China A-share market as the selection scope. Among the A-share companies, the common stock of RMB is issued by domestic companies for subscription and trading in the RMB by domestic institutions, organizations or individuals. It is the most mature stock market in the mainland of China and includes traditional large-scale enterprises as well as many new and high-tech enterprises. There are three reasons why we selected these three stocks: first, they are the stock markets of mainland China and thus match our research scope; second, the total number of A-share listed companies is more than 3600, which can ensure the adequacy of the sample size; finally, the data integrity of the companies is better. We collected sample companies and related data from the RESSET database, which has good information on China. The website of the database is http://www3.resset.cn:8080/product/index.jsp. The RESSET database is widely used by Chinese scholars to study Chinese listed companies, and it contains comprehensive data and information (Wang and Qian, 2011; Li et al., 2015).

3.3.2 Sample selection

The development of intelligent logistics is the result of technology empowerment, innovative leading and software and hardware development (Oh and Jeong, 2018). Thus, while we study the impact of ILP on logistics service companies, we also analyze intelligent logistics equipment or system manufacturing companies. We defined these two types of companies as follows: 1) Logistics Service Companies (LSCs), which refer to service-oriented companies that provide transportation, warehousing, distribution and other logistics services; and 2) Logistics Equipment or System Manufacturing Companies (LESMCs), which refer to manufacturing enterprises that mainly produce and develop hardware for intelligent logistics equipment and technology-based companies focused on software development (Tjahjono et al., 2017). We also set up keyword databases of logistics service companies and logistics equipment manufacturing companies to screen samples as shown in Table 3.

From October 2018 to March 2019, we searched the official introduction of the current "main business" of the all 3609 companies listed on A-share in the RESSET database. We used keywords to filter the "main business" text data one by one. If one of the keywords appeared in the "main business" text, then the corresponding company

was selected as our sample company. Finally, 118 LSCs and 31 LESMCs were identified, for a total of 149 company samples. The proportion of these two types of companies is consistent with the actual situation in the industry, meaning that there are more logistics service companies.

Table 3 Keywords for the logistics companies

Category	Keywords	N
Logistics service company	Logistics, logistics services, warehousing services, cargo transport services, logistics management, supply chain, supply chain services, supply chain management	118
Logistics equipment and systems manufacturing company	Intelligent logistics equipment, automatic logistics equipment, intelligent warehouse, automatic three-dimensional warehouse, logistics robot, warehousing robot, transportation robot, intelligent transportation belt, logistics system, logistics information system, intelligent logistics accessories, logistics equipment, logistics equipment, transportation equipment, transportation equipment, storage equipment, storage equipment	31

4 Hypothesis

In this section, we discussed the factors from the perspective of the government and explored the different market reactions of different enterprises in the face of ILPs from the perspective of enterprises.

4.1 ILP Release and Operating Performance

Policy issuance is a national macro control method aimed at ensuring the rapid, coordinated and sustained development of the national economy. When the government promulgates policies to promote the development of the industry, it will promote the development of the enterprises concerned and the market will respond positively (Koussouris et al., 2015). First, if the government issue policies and sets clear development orientation for a specific industry, it is an indicator of how the government relegalized the importance of that industry, which also indicates positive prospects for its future development potential and improvement space (Chen et al., 2016). Second, the release of the policy is often accompanied by some supportive actions for enterprises, such as funds, land, talent and other support, which are beneficial to the future development of the enterprises. Finally, the government is an organization that ensures the stable development of society and economy (Ferro et al., 2013). Especially

in China, the government has a high position in the hearts of the people; therefore, the public will follow the direction of the government when making decisions. To sum up, we make the following assumption.

H1: ILP will result in a positive stock market reaction.

4.2 Government Factor and Market Reaction

4.2.1 Intelligent Logistics Word Ratio (ILWR)

At present, the Chinese government has not issued policies specifically for intelligent logistics, although many logistics policies have mentioned intelligent logistics; therefore, developing a method of evaluating how different logistics policies focus on intelligent logistics is an important issue. Because the contents and the total word number of different policies differ, the number of intelligent logistics words in each policy is not an effective method of measuring the attention of intelligent logistics. However, the proportion of the intelligent logistics word number in the total word number represents the proportion of the government's work arrangement for intelligent logistics in the overall work. The government has made more efforts to promote intelligent logistics in a policy, which means that the government has given more support. Therefore, we use the intelligent logistics word ratio (ILWR) to evaluate how different logistics policies focus on intelligent logistics (Yang et al., 2019).

We classified the policies according to the ILWR (Chen et al., 2016). Starting from the definition of intelligent logistics, we read all the policies to build a statement base according to the keyword database in Table 1. Table 4 illustrates our screening criteria. We have counted the number of words in the sentences containing key words in all 20 intelligent logistics policies. Table 5 shows the number of intelligent logistics words in each policy, the total number of words in the policy and its ILWR. Since intelligent logistics has become a strategic goal of the government, a focus of enterprises and an expectation of the public (Speranza, 2017), we assumed that when the policy pays more attention to intelligent logistics, that is, the larger the ILWR, the more positive the market reaction will be. Therefore, the second hypothesis is given as follows:

H2: The more ILWR in a policy, the more positive the market will react.

Table 4 Intelligent logistics policy statement base

Keywords	Examples of ILP statements
Intelligent logistics, Smart logistics	A smart logistics ecological system based on the Internet, featuring openness, sharing, win-win cooperation, efficiency, convenience, green security, will be formed (P9). We will implement three major initiatives to promote

	consumption, modernize distribution, and develop a smart supply chain (P13). The level of industrial integration and collaboration should be improved to build an intelligent supply chain system supported by big data, networked sharing and intelligent collaboration (P18) …
Big data, blockchain, cloud computing, artificial intelligence, Internet of things, Internet, information platform,	Encourage the development of logistics robot technology, promote the application of robots in the field of logistics, focus on breaking through the robot image recognition picking, high-density storage mechanical arm picking, voice picking and other technologies, to carry out warehouse robot multimode application (P9). We will strengthen the application of advanced information technologies such as Beidou navigation, the Internet of things, cloud computing, big data and mobile Internet in the logistics sector. Speed up the construction of enterprise logistics information system, give full play to the integration ability of core logistics enterprises, open up the logistics information chain, and realize the whole process of logistics information tracking (P4) …
Sharing, symbiosis and connectivity	To promote logistics information technology in the fields of logistics information coding, logistics information collection, logistics carrier tracking, automatic control, management decision support, information exchange and sharing (P4). We will institutionalize the exchange of business data between departments and regions, and jointly build and share information. We will encourage enterprises to use Internet platforms to optimize the allocation of social resources and develop new models of sharing economy, collaborative economy and experience economy (P13) …

Table 5 Intelligent Logistics Word Ratio (ILWR)

No.	Intelligent Logistics Word Number	Total Word Number	Proportion
1	609	5797	10.50%
2	1466	2834	51.73%
3	750	7283	10.31%
4	1382	12700	10.88%
5	1809	16682	10.84%
6	409	3104	13.18%
7	921	6704	13.74%
8	1353	8964	15.09%
9	2661	8168	32.58%

10	369	2598	14.20%
11	531	4953	10.72%
12	812	7403	10.97%
13	2470	17276	14.30%
14	1519	13066	11.63%
15	1427	9080	15.72%
16	655	6743	9.72%
17	856	5991	14.29%
18	643	5652	11.39%
19	388	3701	10.48%
20	501	4334	11.56%

4.2.2 Government department (GD)

We assumed that ILPs will result in a positive stock market reaction; however, the government has different departments, and their main responsibilities and power division are different. Therefore, we will investigate how different GDs will affect the market reaction (Liu et al., 2015). Among the 262 policies from 2013 to 2018, 73 policies were issued by the MOC, 59 were issues by the State Council and the General Office, and 22 were issued by the NDRC. The total number of logistics policies issued by these three departments is much larger than that of the other departments, and the proportion is 58.8%. Therefore, we focused on analyzing these three departments. In addition, considering that there are several ministries jointly promulgating policies, we studied the following four aspects.

1) The State Council and the General Office are directly led by the Premier and the Secretary-General of the State. At the same time, they lead other ministries and commissions. Because of their greater powers, we speculated that the policies issued by them will result in the most positive stock market reaction (Sims, 1986).

2) The Ministry of Transport is the department responsible for transportation and logistics business, which is directly related to the development of the logistics industry; therefore, we speculated that the policies issued by the MOT may result in a more positive reaction among the ministries.

3) The NDRC is mainly responsible for economic development and reform and innovation; therefore, we speculated that the policy of the NDRC may also result in a more positive reaction in all ministries.

4) Four of the policy samples were issued jointly by multiple ministries. We

expected that the policies issued jointly will result in a more positive stock market reaction because of the joint efforts of multiple ministries in the implementation. In summary, this research proposed the following hypotheses:

H3-1: The policies issued by the State Council and the General Office will result in the most positive stock market reaction;

H3-2: The policies issued by the MOT may result in a more positive reaction among the ministries;

H3-3: The policy of the NDRC may also result in a more positive reaction in all ministries;

H3-4: The policy issued jointly will result in a more positive stock market reaction.

4.3 Company Factors and Market Reaction

4.3.1 Corporate ownership (CO)

State-owned enterprise refers to the companies that are invested by the State Council and the local government that is performing the responsibilities of investors on behalf of the state. (Cull and Xu, 2003). Within the 149 company samples, there are 80 state-owned enterprises (53.7%) and 69 non-state-owned enterprises (46.3%), which shows that the state-owned components of logistics listed companies account for a large proportion in China. State-owned enterprises play an important role in promoting national economic development (Yu et al., 2016). Therefore, we expect that ILPs will have a more positive impact on the market value of state-owned enterprises compared with private enterprises.

H4: ILP has a more positive impact on the market value of state-owned enterprises.

4.3.2 Business types (BT)

The application of intelligent technology and equipment is essential and crucial for the development of intelligent logistics; therefore, we further studied the degree of policy impact on intelligent logistics equipment and system manufacturing enterprises (Uckelmann, 2008). Most of the specific policy formulations were aimed at optimizing the logistics service procedures, although a few mentioned logistics equipment manufacturing specifically. Logistics equipment manufacturing enterprises are suppliers of logistics service enterprises (Cho et al., 2012), and we believe that the market reacts more positively to intelligent service enterprises than to intelligent logistics equipment manufacturing enterprises.

H5: The market reacts more positively to intelligent service enterprises than to intelligent logistics equipment manufacturing enterprises.

4.3.3 Prior financial performance (PFP)

We discuss how prior financial performance influences the market reaction to policy. A company with a good performance has a market base and a good momentum of development. When the government gives further instructions to the company's business, investors believe that it will take advantage of the situation to achieve better development. Therefore, the market reaction to policy will be more positive for companies with good financial performance (Barber and Lyon, 1995). At the same time, companies with poor performance may not present appropriate decision-making for the current market situation and cannot respond to changes of policy quickly and reasonably (Worrell et al., 1991; Iqbal and Shetty, 1995). Therefore, the following hypothesis is proposed:

H6: The market reacts more positively to companies with good performance than to companies with poor performance.

4.3.4 Service breadth of logistics service companies

Logistics refers to controlling the flow of raw materials, work in process and finished products in the whole supply chain operation and providing inventory management, such as for the inventory, transportation, storage, enterprise order management, packaging and other service procedures (Donald et al., 2012). We call every basic service, such as transportation and storage, in logistics a procedure. Based on previous research (Karim, 2003; Torres et al., 2005; Liu et al., 2019), we adopted the number of service procedures to measure the service breadth and divided the sample companies into three categories: 1) a company with low service breadth (C_L) refers to an enterprise that provides only one service procedure, for a total of 55 samples; 2) a company with a medium service breadth (C_M) refers to an enterprise that provides multiple logistics service procedures at the same time, for a total of 31 samples; and 3) a company with a high service scope (C_H) refers to an enterprise that provides value-added services, such as supply chain management and financial services, while also providing all procedures, for a total of 32 samples. Intelligent logistics is performed to form a logistics ecosphere with logistics platform enterprises as the core (Speranza, 2017). C_H has richer resources and can provide more service procedures. Driven by intelligent technology, C_H is likely to transform into a platform enterprise and build a logistics ecosystem. Therefore, C_H may be more important and should be more susceptible to the government's policy on intelligent logistics. The following hypothesis is proposed:

H7: The higher the service breadth of enterprises, the more positively the market reacts.

5 Results

5.1 Abnormal Returns

Because ILP may have an impact on the stock price of many logistics companies, the R_{mt} of day 0 may also be affected. However, this will not change the qualitative part of our conclusion because if the stock price of all logistics companies increases under the influence of ILPs, R_{mt} will be larger than that without the event, and because the estimated $\hat{\beta}_i$ is almost all positive, A_{it} and $\overline{A_t}$ will be smaller, which also reduces the test statistics. However, we still verify whether the market return R_{mt} of day 0 is affected. We verify whether the market return of all companies is significantly different from the market return of the companies excluding the sample. We use the F-test and t-test to verify the relationship between their variance and mean. The results in Table 6 show that the stock price fluctuation of the sample companies does not cause abnormal fluctuations of the market average return (R_{mt}).

Table 6 Market return of day 0

Policy number	Mean market return including the sample companies /%	Mean market return excluding the sample companies /%	F-test	T-test
1	-1.603	-1.621	0.179	-0.307
2	1.628	1.608	0.004	0.291
3	1.968	1.965	0.024	0.052
4	1.507	1.500	0.000036	0.113
5	-8.932	-8.977	0.538	0.401
6	-3.370	-3.374	0.062	0.414
7	-1.567	-1.570	0.078	0.032
8	-4.795	-4.867	0.287	0.799
9	-1.711	-1.741	0.003	0.419
10	-0.505	-0.503	0.001	-0.023
11	-1.538	-1.536	0.000172	0.327
12	-2.355	-2.358	0.036	0.043
13	0.040	0.017	0.004	0.383
14	0.150	0.153	0.133	-0.077
15	-0.131	-0.167	0.044	0.619
16	-0.597	-0.599	0.092	0.020
17	-0.335	-0.363	0.104	0.583
18	-1.908	-1.922	0.098	0.222
19	0.228	0.213	0.001	0.307

20	-0.793	-0.809	0.009	-0.273

We calculated the abnormal return of 149 sample companies on day 0 and conducted the clustered version of the t-test to analyze its significance according to Brown (1985) and Hendricks et al. (2019). Finally, 20 test results are shown in Panel A of Table 7. Because some stock data were missing on the event day, we excluded those companies in the analysis, and N is the validation sample size on the event day. The mean and median abnormal returns of 11 policies (Policy 1, 2, 3, 6, 8, 9, 13, 15, 17, 18, and 20) are both significantly greater than zero at the 1%-10% level. In addition, the positive percentage of the accumulated abnormal returns is not significantly greater than 50%. Three reasons are found for the policies that have no significant reaction: 1) four of these policies (Policy 4, 5, 14, and 16) are due to previous briefings or related news releases ranging from one week to one month in advance, and our calculations show that the market also reacts positively when the policy is disclosed in advance; 2) three of these policies (Policies 7, 10 and 11) are issued within 10 trading days after the last one, and the results show that the market cannot react positively again in a short time; thus, we analyze policies issued in a short period of time in section **5.2.3**; and 3) although the average abnormal return of two policies (Policy 12 and 19) is significantly greater than zero at the level of 10%, the median and positive percentage are not significant, which indicates there are some unknown factors in the market and some extreme values affect the test results. In summary, because the special situation of nine policies (Policy 4, 5, 7, 10, 11, 12, 14, 16, and 19) is not within our research scope, we excluded them and only consider the other 11 policies in the subsequent analysis. We analyzed the results of the 11 policies together to obtain the average level. Panel B of Table 7 shows that the mean and median abnormal returns of day 0 are 0. 625% and 0.352%, which are significantly greater than zero at the 1% level. The positive percentage is 63%, which is significantly greater than 50%.

Table 7 Event period abnormal returns under the ILPs

Panel A Event Period Abnormal Returns for Every Policy

No.	N	Mean abnormal return/%	t-statistic	Median abnormal return/%	Wilcoxon signed-rank Z-statistic	Abnormal returns positive/%	Binomial sign test Z-statistic
1	107	0.39	1.400*	0.304	2.999***	65	3.094***

2	107	0.86	3.080***	0.406	2.956***	64	2.707***
3	101	0.61	2.365***	0.056	2.723***	59	1.700*
4	99	0.33	1.031	-0.14	-0.129	46	0.603
5	97	0.25	0.781	-0.4	-0.754	43	1.218
6	107	0.76	1.467*	0.537	2.138**	59	1.740*
7	111	0.31	0.969	-0.2	-0.494	41	1.898
8	113	1.03	2.751***	0.862	3.691***	67	3.575***
9	115	0.52	1.379*	0.284	1.934**	58	1.679*
10	117	-0.04	-0.125	0.1	0.330	53	-0.555
11	111	0.23	0.606	0.232	2.115**	59	1.708*
12	111	0.28	0.823	0.374	2.587***	60	2.002**
13	114	0.72	2.396***	0.216	3.609***	66	3.278***
14	120	-0.07	-0.219	0	-0.431	48	0.269
15	121	0.65	2.332**	0.469	4.034***	67	3.636***
16	120	0.17	0.531	-0.1	-0.079	43	1.514
17	118	0.56	1.454*	0.412	3.084***	66	3.406***
18	117	0.47	1.346*	0.214	2.933***	58	1.664*
19	112	0.30	0.741	-0.065	0.581	47	0.472
20	128	0.39	1.378*	0.505	3.515***	66	3.624***
Panel B Event Period Abnormal Returns for 11 Effective Policies							
Σ N 1248		0.625	9.253***	0.352	10.123***	63	9.370***

All tests are one-tailed: *p<=0.10, **p<=0.05, ***p<=0.01

Part 4.2.1 shows that most of the 11 policies contain 10% to 20% of the content of intelligent logistics, which is a relatively low number. To illustrate whether the intelligent logistics sector makes the market react more positively or not, we conducted a control test on every policy sample. Table 8 shows the control policies (non-ILPs) that have a similar theme, the same publishing department and a publishing time that does not exceed one year from the sample policies. Because the themes of Policy 2 ("Guiding Opinions on Promoting the Intelligent Development of Transportation Informatization") and Policy 9 ("'Internet +' Efficient Logistics Implementation Opinions") are intelligent logistics, none of the policies are similar to their themes but do not include intelligent logistics. Thus, they are excluded in the control test.

Table 9 shows the clustered version of the t-tests of 11 control policies on day 0, which indicates only two policies have a significant impact on the market while most

of them have not. The nine ILPs and corresponding control policies were tested by the one-sample T-test, nonparametric test and independent sample T-test to compare their differences. Table 10 shows that the mean abnormal return caused by the ILP is 0.613%, which is significantly greater than zero at the 1% level. The statistical data of the non-ILPs are not significant. In addition, through independent sample T-test, we concluded that the impact of ILPs on the market is significantly greater than that of non-ILPs; therefore, we can explain the part of the intelligent logistics policies that produces a market reaction or because it makes the market reaction more positive. Therefore, $H1$ is accepted.

Table 8 Control policy

ILP					Control Policy (non-ILP)				
No.	Name	Date	Department	Number	No.	Name	Date	Department	Number
1	“Deepening the Reform of Circulation System and Accelerating the Division of Labor of Key Work Departments in the Development of Circulation Industry”	2013.6.5	The General Office	5797	1a	“Notice on the Comprehensive Work Plan for Reducing Circulation Expenses and Improving Circulation Efficiency”	2013/1/15	The General Office	2588
3	“Notice on Printing and Distributing the Standardization Construction Plan for the Public Information Platform for Transportation and Logistics (2013-2015)”	2013.11.14	MOT	7283	3a	“Opinions on Strengthening the Standardization of Transportation”	2013/9/17	MOT	2683
6	"Several Opinions on Strengthening the Construction of Short-term Logistics to Promote Effective Investment and Household Consumption"	2016.3.3	NDRC	3104	6a	“Guidance on promoting the improvement of logistics service quality, speeding up the development of service-oriented manufacturing”	2017/3/2	NDRC	4274
8	"Development of Service-Oriented Manufacturing Special Action Guide"	2016.7.26	MIIT, NDRC	8964	8a	“Accelerate the development of service-oriented manufacturing”	2015/5/25	MIIT	5071
13	"13th Five-Year Development Plan for Domestic Trade Circulation"	2016.11.11	MOC	17276	13a	"13th Five-Year Plan for Domestic Trade Circulation Standardization Construction (2016-2020)"	2016/12/22	MOC	10738
15	"Thirteenth Five-Year Plan for the	2017.2.8	MOC	9080	15a	"13th Five-Year Plan for	2017/3/2	MOC	21678

	Development of Trade and Logistics"					Service Trade Development"			
17	"Opinions on Further Promoting Logistics Cost Reduction and Efficiency Promotion to Promote the Development of the Real Economy"	2017.8.17	The General Office	5991	17a	“Work plan to reduce the cost of the real economy enterprise”	2016/8/22	The State Council	10002
18	"Guiding Opinions on Actively Promoting Supply Chain Innovation"	2017.10.13	The General Office	5652	18a	“Reply on agreeing to deepen the pilot reform of service trade innovation”	2018/6/8	The State Council	5511
20	“Notice on Launching the Construction of Modern Supply Chain System in the Circulation Sector in 2018”	2018.5.28	MOF	4334	20a	“Notice on the construction of the supply chain system”	2017/8/11	MOF	4294

Note: The left side of each column in the table shows the ILPs studied in this paper (Policy 1, 3, 6, 8, 13, 15, 17, 18, 20, with the same policy number as in Table 2), and the right side is the control policies (non-ILPs 1a, 3a, 6a, 8a, 13a, 15a, 17a, 18a, 20a) that we have selected without intelligent logistics content. The table shows their policy name, publisher, release date and total words, which can be used to test the role of intelligent logistics content in the sample.

Table 9 Event period abnormal returns under the control policies

No.	N	Mean abnormal return/%	t-test	Median abnormal return/%	Wilcoxon signed-rank Z-statistic	Abnormal returns positive/%	Binomial sign test Z-statistic
1a	108	-0.11	-0.396	-0.24	2.569***	36	-2.791***
3a	121	-0.07	-0.252	0.288	1.684*	40	-2.000**
6a	132	0.45	1.607*	0.254	3.576***	66	3.642***
8a	107	0.42	1.220	0.592	1.383	55	0.967
13a	125	0.14	0.467	0.071	0.538	51	0.179
15a	122	-0.38	-1.355*	-0.27	-2.827***	37	-2.705***
17a	126	-0.10	-0.267	-0.14	-1.411	43	-1.514
18a	141	-0.05	-0.148	-0.06	-0.536	48	-0.337
20a	130	-0.17	-0.439	-0.02	-0.594	48	-0.263

All tests are one-tailed: *p<=0.10, **p<=0.05, ***p<=0.01

Table 10 ILPs and non-ILPs

	ILPs	non-ILPs
Σ N	1248	1492
Mean abnormal return/%	0.545	0.024
t-test	8.674***	0.434
Median abnormal return/%	0.36	0.08
Wilcoxon signed-rank Z-statistic	10.039***	-1.233
Abnormal returns positive/%	63	48
Binomial sign test Z-statistic	9.143***	-1.269
independent sample T test	6.186***	

All tests are one-tailed: *p<=0.10, **p<=0.05, ***p<=0.01

5.2 Cross-sectional Regression Analysis

We examined the multiple hypotheses in the fourth section. We used multiple regression estimates to test how independent variables express the hypotheses. The dependent variable is the average abnormal return of the sample company on day 0. The independent variable includes the variable and the control variable corresponding to the hypothesis.

5.2.1 Independent variable

Intelligent Logistics Words Ratio (ILWR): Considering that the ILWR values of

some policies are too large and discontinuous (Policy 9 is 32.58%, Policy 2 is 51.73%, and other policies are approximately 10%), we used the median ILWR value to distinguish between high and low ILWR, with values higher than the median given a value of 1 and the remaining values given a value of 0. Referring to hypothesis 2, the coefficient of the variable should be positive.

Government Department (GD): There are different government departments in the sample. According to hypothesis 3, the samples are classified as follows: 1) If the policies are issued by the State Council and the General Office, the variable is 1 and named THE STATE COUNCIL; otherwise, it is 0. Referring to hypothesis 3-1, the variable coefficient should be positive. 2) If the policies are issued by the MOT, the variable is 1 and named MOT; otherwise, it is 0. Referring to hypothesis 3-2, the variable coefficient should be positive. 3) If the policies are issued by the NDRC, the variable is 1 and named NDRC; otherwise, it is 0. Referring to hypothesis 3-3, the variable coefficient should be positive. 4) If the policies are issued by two or more departments, the variable is 1 and named THE MULTIPLE MINISTRIES; otherwise, it is 0. Referring to hypothesis 3-4, the variable coefficient should be positive. To avoid the influence of the same type of variables, we did not use the four variables (THE STATE COUNCIL, MOT, NDRC, THE MULTIPLE MINISTRIES) in the basic model but analyzed them one by one in 5.3.1 as a model extension.

Corporate Ownership (CO): The main types of company are state-owned, private, joint venture, etc. This paper mainly studied the difference between state-owned enterprises and other non-state-owned enterprises. Therefore, TOC is 1 if the company is state-owned; otherwise, it is 0. Referring to hypothesis 4, the coefficient of the variable should be positive.

Business Type (BT): We have defined the logistics service company and the logistics equipment and system manufacturing company. If the company is a LESMC, then the BT is 1. If it is an LSC, then the BT is 0. Referring to hypothesis 5, the coefficient of the variable is negative.

Prior Financial Performance (PFP): We used the company's total return on assets (ROA) in the last quarter before the policy announcement to represent the company's prior financial performance (Jacobs and Singhal, 2014). Referring to hypothesis 6, the variable coefficient should be positive.

5.2.2 Control variable

We introduced several control variables based on policy and company aspects to evaluate the stability of our hypothesis test. On one hand, we considered whether the

market pays attention to a policy in time, which depends on whether the policy will provide some financial support to the industry. Because financial support is the most direct driving factor for the development of the company. Financial support (FST) is set to 1 if the policy provides financial support and the criteria are as follows: 1) The policy from the MOF. 2) Policies issued by other departments and supported by the MOF. That means the policy contains the content that there is financial support and the MOF is responsible for the implementation of the policy, such as Policy 1: "Central and local funds should actively support the construction of qualified multimodal transport facilities, urban and rural distribution network, cold chain logistics of agricultural products, logistics standardization and information technology and other logistics projects through existing channels; therefore, as to give full play to the exemplary role of government investment (Ministry of Finance is in charge)."

On the other hand, we considered the firm size (FS) that will impact the market reaction. We used the natural logarithm of the company's total assets in the quarter prior to the policy release to represent the size of the company (Shams and Gunasekarage, 2016).

5.2.3 Basic regression model

We first analyzed the following basic regression models to test the hypotheses.

$$A_{i0} = \beta_0 + \beta_1 ILWR + \beta_2 BT + \beta_3 CO + \beta_4 PFP + \beta_5 FST + \beta_6 FS + \varepsilon_i \quad (7)$$

where A_{i0} is the day 0 abnormal return from the Market model, ε_i is the error term, and the other variables are as defined above. Table 11 presents the parameter estimates (t-values in parentheses) for the regression model in Equation (7). As predicted, the ILWR is positive and statistically significant at the 1% level. Thus, when the ILWR is high, the market reaction will be more positive. At the same time, we conduct a one-sample T-test to test whether the market reactions of two kinds of samples are significantly positive and independent sample T-test to test whether they are significantly different. The results shown in Panel A of Table 12 supported our hypothesis; therefore, we accepted *H*2.

Meanwhile, CO is positive and statistically significant at the 1% level, which shows that state-owned firms experienced more positive abnormal returns compared to non-state-owned firms. The one-sample T-test and independent sample T-test results shown in Panel B of Table 12 also support our hypothesis; therefore, we accepted *H*4.

Given the theoretical and empirical literature that we outlined in the development of *H*5 and *H*6, the lack of a significant association among the abnormal returns, PFP, and BT is surprising. To explore this issue further, we examined whether the market

reaction to the BT is moderated by the firm's prior financial performance. To test this, we performed a model expansion in 5.3.2.

Table 11 Parameter estimates (t-statistics) from basic regression results

Panel A：Model				
R^2	Adjusted R^2	Durbin-Watson value	F-value	N
3.4%	3.1%	1.761	8.463***	1470

Panel B：Parameter Estimates					
	Variable	Expectation	Parameter	T-value	VIF
Intercept	$\beta 0$		-0.012	-1.191	
Intelligent Logistics Word Ratio	ILWR	+	0.003	2.806***	1.085
Type of Business	TOB	—	-0.00022	-0.126	1.283
Type of Company	TOC	+	0.007	4.546***	1.499
Prior Financial Performance	PFP	+	-0.014	-0.812	1.018
Financial Support	FST		-0.000324	-0.265	1.076
Firm Size	FS		0.001	1.187	1.352

All tests are one-tailed: *p<=0.10, **p<=0.05, ***p<=0.01.

Table 12 T-test for ILWR and TOC

Category	One-sample T test							Independent sample T-test
	ΣN	Mean abnormal return/%	t-statistic	Median abnormal return/%	Wilcoxon signed-rank Z-statistic	Abnormal returns positive/%	Binomial sign test Z-statistic	T
Part A ILWR								
High	795	0.72	7.827***	0.4	8.094***	64	7.803***	2.992***
Low	675	0.38	5.410***	0.3	6.848***	61	5.774***	
Part B TOC								
State-owned	901	0.86	12.46***	0.5	13.12***	69	11.39***	6.054***
non-State-owned	569	0.097	0.922	0.1	0.932	53	1.174	

All tests are one-tailed: *p<=0.10, **p<=0.05, ***p<=0.01.

5.3 Model Expansion

5.3.1 Government department

We estimated the following regression model to test H3:

$$A_{i0}=\beta_0+\beta_1 ILWR + \beta_2 BT + \beta_3 CO + \beta_4 PFP + \beta_5 FST + \beta_6 FS + \beta_7 GD+\varepsilon_i \quad (8)$$

where A_{i0} is the day 0 abnormal return from the Market model; GD is the government department, which includes THE STATE COUNCIL, MOT, NDRC and THE MULTIPLE MINISTRIES; ε_i is the error term; and the other variables are as defined above.

To avoid the influence of the same type of variables, four factors (THE STATE COUNCIL, MOT, NDRC, THE MULTIPLE MINISTRIES) of GD are added to the regression equation one by one (Tambe, 2014) and the regression analyses are carried out separately. Table 13 shows that THE STATE COUNCIL and MOT are insignificant and NDRC and THE MULTIPLE MINISTRIES are positive and statistically significant at the 10% and 5% level, respectively. Therefore, we reject *H*3-1 and *H*3-2 and accept *H*3-3 and *H*3-4. The policy influence of the State Council and the General Office, which are the leading bodies, is not the highest and inferior to that of the NDRC. The market will react more positively when multiple ministries jointly issue policies. In addition, we observed that the ILWR and CO are still significant in different regression equations, which can prove the robustness of the model.

Table 13 Parameter estimates (t-statistics) from GD regression results

	（1） THE STATE COUNCIL	（2） MOT	（3） NDRC	（4） THE MULTIPLE MINISTRIES
Intercept	-0.965 （-0.0111）	-1.049 (-0.0123)	-1.081 (-0.0125)	-1.109 (-0.0127)
ILWR	1.555* （0.0024）	1.713** (0.0027)	1.635** (0.0026)	1.791** (0.0029)
BT	-0.130 (-0.0003)	-0.121 (-0.0002)	-0.129 (-0.0002)	-0.127 (-0.0002)
CO	4.526*** (0.0076)	4.479*** (0.0076)	4.510*** (0.0076)	4.558*** (0.0077)
PFP	-0.765 (-0.0147)	-0.792 (-0.0153)	-0.770 (-0.0148)	-0.784 (-0.0150)

FST	-0.3364 (-0.0006)	-0.246 (-0.0004)	-0.258 (-0.0004)	-0.297 (-0.0005)
FS	1.029 (0.0005)	1.080 (0.0006)	1.039 (0.0005)	1.045 (0.0005)
THE STATE COUNCIL	-0.3418 (-0.0006)			
MOT		0.394 (0.0009)		
NDRC			1.564* (0.0005)	
THE MULTIPLE MINISTRIES				2.110** (0.0024)
Observations	1248	1248	1248	1248
R^2	3.5%	3.5%	3.5%	3.5%
D-W	1.720	1.720	1.720	1.720
F	6.447***	6.452***	6.449***	6.482***

All tests are one-tailed: *p<=0.10, **p<=0.05, ***p<=0.01.

5.3.2 BT and PFP

To explore whether the market reaction to the BT is moderated by the firm's prior financial performance, we estimated the following regression model with reference to Jacobs and Singhal (2014):

$$A_{i0} = \beta_0 + \beta_1 LWR + \beta_2 BT + \beta_3 CO + \beta_4 PFP + \beta_{4a}(BT\_PFP') + \beta_5 FST + \beta_6 FS + \varepsilon_i \quad (9)$$

where BT_PFP' is the interaction between prior financial performance and BT and PFP' is an indicator variable that is 1 if the company's PFP is greater than the median of all sample companies and 0 otherwise. Table 14 presents the parameter estimates (t-values in parentheses) for the regression model in Equation (9). The results indicated that the coefficients for PFP and BT are still insignificant. However, the coefficient for BT_PFP' is statistically significant (at the 5% level).

To obtain a clearer interpretation of the regression results from Equation (9), Figure 1 plots the regression lines for the abnormal returns as a function of the firm's prior financial performance, which is conditioned on the two kinds of companies—LSC and LESMC. For LSC (i.e., BT = 0), the abnormal returns are increasing in the PFP (slope is 0.011). When LSCs have a financial performance equal to that of industries (i.e., PFP = 0), the model predicts that the day 0 abnormal return is 0.7%. However, for LESMCs, the abnormal returns are decreasing in the PFP (slope is -0.078). At PFP = 0, the model predicts that the day 0 abnormal return is 0.38%. The evidence suggests that the market reaction as a function of the BT is strongly moderated by the firm's prior

financial performance, which verifies hypothesis 6 and supports hypothesis 5.

Table 14 Parameter estimates (t-statistics) from interaction regression results

Panel A：Interaction Model				
R^2	Adjusted R^2	Durbin-Watson value	F-value	N
3.9%	3.3%	1.723	7.118***	1248

Panel B：Parameter Estimates				
Variable	expectation	Parameter	T-value	VIF
β_0		-0.0110	-0.957	
ILWR	+	0.0026	1.732**	1.143
BT	—	0.0031	1.2167	2.058
CO	+	0.0077	4.599***	1.503
PFP	+	-0.0004	-0.022	1.140
FST		-0.0009	-0.639	1.135
FS		0.0005	0.971	1.366
BT□PFP'		-0.0073	-2.157**	1.876

All tests are one-tailed: *p<=0.10, **p<=0.05, ***p<=0.01.

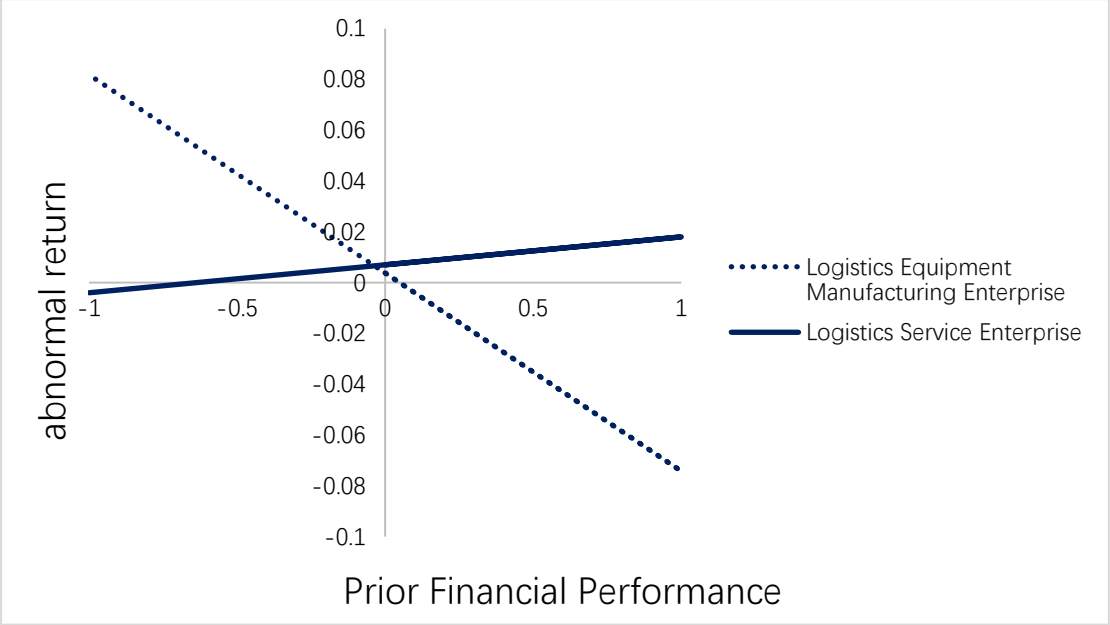

Fig. 1. Relationship between the abnormal returns and PFP of different types of companies

We found that for a logistics service company, when its PFP is better, its shareholder value will be more positively affected by ILPs than that when its PFP is worse; and for a logistics equipment or system manufacturing company, when its PFP

is worse, its shareholder value will be more positively affected than that when its PFP is better.

This conclusion is new and counter intuitive because many researchers have shown that companies that always perform better will have a more positive market reaction to external positive events (such as policy support, awards, etc.) (Xia et al., 2016). The reason for this conclusion is closely related to the current development of Chinese intelligent logistics industry: in China, logistics service is a relatively mature industry but the intelligent logistics equipment manufacturing industry is still in a growing period.

In the mature logistics service industry, the market reaction of the company with good PFP is more positive because the competition is fierce in the mature industry, and only companies with a good PFP can have greater profit and development space; therefore, the market capital is more inclined to the company with a good PFP. In the immature intelligent logistics equipment manufacturing industry, the market reaction of the company with a poor PFP is more positive because the competition is relatively low among growing industries regardless of whether the PFP is good or bad because of the many development opportunities for companies. Many companies with poor PFP are very likely to increase their performance in a short period. Investing in these companies can lead to more profits in a short time. Therefore, market capital tends to flow towards companies with a poor PFP. This conclusion is similar to that of previous studies (Iqbal and Shetty, 1995; Khurana and Lippincott, 2000). Because of the duality of the impact of corporate performance, such cross conclusions often appear when analyzing the market reaction of companies (Jacobs and Singhal, 2014).

5.3.3 Interval of policy issuance

First, we calculated the average time interval for a government department to issue logistics policies. According to H2, the departments that issue the most relevant policies are the State Council, General Office, MOT and NDRC. In the past five years, these three departments have issued 154 policies, which exceed 58% of the total number of policies. Then, we calculated the average interval through these three departments. We found that each department publishes a logistics policy every 35 days. In this section, to prevent the omission of the sample, certain policies (No. 7, 10, 11) are temporarily excluded because the issue of the time interval should be included at the same time to ensure that the demonstration is more comprehensive. Therefore, based on the 11 policies above (Policy 1, 2, 3, 6, 8, 9, 13, 15, 17, 18, and 20), we added Policy 7, 10, and 11 into the model.

We defined the release time variable (Time) according to the following rules: We defined a policy with a release interval of less than 35 natural days as a centralized release, and if other intelligent logistics policies are issued within the first 35 natural days of the policy release, the Time is 0; otherwise, it is 1. There are four centralized policies (policies 7, 9, 10, and 11). Through a preliminary observation, we found that a centralized release will not be conducive to the market reaction; therefore, the expectation is positive.

We estimated the following regression model:

$$A_{i0} = \beta_0 + \beta_1 ILWR + \beta_2 BT + \beta_3 CO + \beta_4 PFP + \beta_5 FST + \beta_6 FS + \beta_7 Time + \varepsilon_i \quad (10)$$

Table 15 indicates that Time is positive and statistically significant at the 1% level, which proves that a centralized release is not conducive to a positive market reaction and will reduce the effect of policy implementation. Thus, a valuable suggestion to the government would be to focus additional efforts on the quality of the policy rather than the quantity. At the same time, ILWR and CO are still significant, which once again confirmed the robustness of the previous conclusions.

Table 15 Parameter estimates (t-statistics) from time regression results

Panel A：Model				
R^2	Adjusted R^2	Durbin-Watson value	F-value	N
0.062	0.058	1.685	14.848***	1578
Panel B：Parameter Estimates				
Variable	expectation	Parameter	T-value	VIF
$\beta 0$		-0.0072	-0.715	
ILWR	+	0.0034	2.580***	1.277
BT	—	-0.0015	-0.858	1.283
CO	+	0.0058	3.972***	1.498
PFP	+	-0.0145	-0.970	1.018
FST		-0.0040	-3.150***	1.165
FS		0.0001	0.270	1.362
Time	+	0.0083	5.948***	1.166

All tests are one-tailed: *p<=0.10, **p<=0.05, ***p<=0.01.

5.3.4 Service breadth of the logistics service companies

We proposed the definition and classification criteria of three types of companies

with low, medium and high service breadth in section 4.3.4. Panel A of Table 16 shows statistical descriptions of the abnormal returns of the three types of companies on the event day. The mean (median) of the abnormal returns of C_L is 1.04% (0.65%), which is significantly greater than 0 at the 1% (1%) level; the mean (median) of the abnormal returns of C_M is 0.64% (0.36%), which is significantly greater than 0 at the 1% (1%) level; and the mean (median) of the abnormal returns of C_H is 0.17% (0.14%), which is insignificantly different from zero. We performed the F-test (joint hypotheses test) to better compare the differences among the three types of companies. Panel B of Table 16 shows that the significance is 0.168 (>0.05) and the F value is 12.576, which are statistically significant at the 1% level, indicating that there are significant differences between at least two groups of data. The abnormal returns of C_L are different from that of C_H at the 1% level, while those of C_M are different from that of C_L and C_H at the 5% level. The market reaction of C_L is the largest, followed by C_M and C_H. Unexpectedly, this is exactly the opposite of our hypothesis; therefore, we reject hypothesis 7. This finding shows that although companies with high service breadth will have more resources, the market still believes that companies with only a single service link (warehousing, transportation, distribution) can take the lead in the breakthrough of intelligent logistics because their business is more focused and the application of intelligent technology is more convenient. Thus, intelligent logistics brings the most obvious benefit to them.

Table 16 T-test and F-test for different service breadth of LSCs

Panel A：One-sample T-test			
Company type	C_L	C_M	C_H
N	505	271	246
Mean abnormal return /%	1.04	0.64	0.17
t-statistic	10.911***	4.430***	1.171
Median abnormal return /%	0.65	0.36	0.14
Wilcoxon signed-rank Z-statistic	11.783***	4.909***	0.895
Abnormal returns positive /%	73	65	53
Binomial sign test Z-statistic	10.413***	4.860***	0.956
Panel B：F-test			
significance		0.168	
F-value		12.576***	
Sign.	C_L	C_M	C_H

C_L		0.018**	8.2667E-7***
C_M	0.018**		0.019**
C_H	8.2667E-7***	0.019**	

All tests are one-tailed: *p<=0.10, **p<=0.05, ***p<=0.01.

5.4 Summary of the Hypothesis Test Results

According to the analysis in this chapter, we have tested all seven hypotheses and found that *H1*, *H2*, *H3-3*, *H3-4* and *H4* are accepted while the other hypotheses are rejected.

Table 17 Summary of hypothesis test results

No.	Result	Remarks
H1	Accepted	
H2	Accepted	
H3-1	Rejected	The market reaction by policies of NDRC are more positive than that by policies of the State Council and MOT
H3-2	Rejected	
H3-3	Accepted	
H3-4	Accepted	
H4	Accepted	
H5	Rejected	For LSC, when its PFP is better, its shareholder value will be more positively affected by the ILP than that when its PFP is worse; for LESMC, when its PFP is worse, its shareholder value will be more positively affected than that when its PFP is better. Contrary to our expectation, the market reaction of the company will decrease with the increase of its service breadth.
H6	Rejected	
H7	Rejected	

From Table 17, H1, H2, H3-3, H3-4 and H4 are consistent with our expectations; however, for H3-1 and H3-2, the market reaction by policies of NDRC are more positive than that by policies of the State Council and MOT. We find a cross conclusion in H5 and H6. For an LSC, when its PFP is better, its shareholder value will be more positively affected by the ILP than that when its PFP is worse. For a LESMC, when its PFP is worse, its shareholder value will be more positively affected than that when its PFP is better. Contrary to our expectation, the market reaction of the company will

decrease with the increase of its service breadth according to H7.

6 Summary and Managerial Implication

6.1 Summary

Based on 20 intelligent logistics policies issued by the Chinese government in the past five years from 2013 to 2018, this paper explored how intelligent logistics policies affect the operating performance of 149 listed logistics companies in China. The results show that the mean (median) abnormal return on the event day is 0. 625% (0. 352%), and the value is greater than 0 at the level of 1%. The average positive rate is 63%, which is significantly higher than 50%. We can see that the ILP will result in a positive stock market reaction. In addition, 1) the market reaction will be more positive with the increase of the proportion of the intelligent logistics contents and the policies issued by the State Council and the General Office as the leader will produce less positive reactions than that by the subordinate ministries. The impact of the NDRC is the greatest. Moreover, jointly released policies often have a better effect while a centralized release is not a good choice. 2) ILPs have a more positive impact on the market value of state-owned enterprises, and the lower the service breadth of enterprises, the more positively the market reacts for all logistics companies. 3) For an LSC, when its PFP is better, its shareholder value will be more positively affected by the ILP than that when its PFP is worse. For a LESMC, when its PFP is worse, its shareholder value will be more positively affected than that when its PFP is better.

6.2 Managerial Implications

This paper provided empirical implication for the future decision-making of the government and companies.

6.2.1 For the government

According to H1 and H2, ILPs have a positive impact on the logistics market. When the government pays more attention to intelligent logistics, the proportion of the policy content about intelligent logistics will be greater and the market reaction will be more positive. These findings show that intelligent logistics is a trend of logistics, which can prompt the government to enhance the strategic goals of intelligent logistics and use macro-control to promote the development of intelligent logistics and stimulate market vitality.

According to H3-1, H3-2 and H3-3, the influence of the State Council and the General Office is inferior to that of the NDRC because the policies of the General Office usually clarify the tasks of the ministries and stipulate the direction of development while policies issued by the ministries are more specific and conducive to the

implementation of enterprises. Therefore, the government should fully consider the practice of implementing policies and make more detailed provisions so that the market can obtain policy dividends. At the same time, they should pay more attention to the role of the NDRC in the development of intelligent logistics.

According to H3-4, which is focused on the release mode, we found that all ministries should strengthen their cooperation to jointly issue policies, which will have a more positive impact on the market. Moreover, according to section 5.3.3, when policies are issued centrally, the market will not react very positively to the subsequent policies and the effect will be weakened. Because a regulatory ceiling is observed under continuous policy promotion in a certain period, the government should pay more attention to choosing the right time to avoid centralized policy release and increasing the quality of the policy rather its quantity.

According to H7, considering intelligent logistics is still at the initial stage in China, and the government should give priority to the intelligent construction of logistics services in transportation, warehousing, distribution and other basic procedures, which can not only improve the market reaction to ILPs but also effectively lay a solid foundation for the systematic construction of intelligent logistics.

6.2.2 For companies

According to H4, we found that state-owned enterprises receive a more positive market reaction than non-state-owned enterprises. When the government actively develops the intelligent logistics, state-owned capital as a manifestation of the government plays a role of leading the development of intelligent logistics. Therefore, state-owned logistics enterprises should take measures to innovate bravely and lead the development of the logistics industry in the future.

According to H5, H6 and section 5.3.2, for an LSC, when its PFP is better, its shareholder value will be more positively affected by the ILP than that when its PFP is worse. For a LESMC, when its PFP is worse, its shareholder value will be more positively affected than that when its PFP is better. These findings provide managerial implications for these companies. Logistics service companies should closely follow the government orientation when their performance is good and try their best to respond to the policy to expand their own advantages and achieve greater development. Logistics manufacturing companies should pay close attention to government guidance to actively adjust their product range, optimize the quality and turn losses into profits.

According to H7, we found that logistics companies with a low service breadth have more positive market reaction. Therefore, in the process of developing intelligent

logistics, enterprises should gradually develop it more comprehensively. They should first pay attention to upgrading and innovating their basic business, such as warehousing, transportation and distribution, and then consider integrated intelligent service.

6.3 Limitations and Future Research Directions

There are still some limitations in this research that need to be further studied in the future. First, we focused on ILPs and the development of intelligent logistics in China. The results may be more applicable to China or other developing countries but cannot be fully extended to all countries. Therefore, we could study the logistics markets of developed countries based on the ideas of this paper in the future. Second, we use the ILWR as the criterion to measure the degree of the policy's concern about intelligent logistics, which is not detailed enough. In the future, we could perform policy text mining to analyze the role of some key words to predict the development direction of intelligent logistics. Finally, this paper mainly focused on how the government affects the development of intelligent logistics but does not reflect corporate behavior. In the future, we can explore intelligent logistics by studying product development and announcements.

References

Adamski, A., 2011. Hierarchical Integrated Intelligent Logistics System Platform. Proced. - Soc. Behav. Sci. 20 (none), 1004-1016.

Barber, B.M., Lyon, J.D., 1996. Detecting abnormal operating performance: The empirical power and specification of test statistics. J. Financ. Econ. 41(3), 359-399.

Bartholdi, J.J., Eisenstein, D.D., Lim, Y.F., 2010. Self-organizing logistics systems. Annu. Rev. Control. 34(1), 111-117.

Brown, S.J., Warner, J.B., 1985. Using daily stock returns: The case of event studies. J. Financ. Econ. 14(1), 3-31.

Chatfield, A.T., Reddick, C.G., 2019. A framework for Internet of Things-enabled smart government: A case of IoT cybersecurity policies and use cases in U.S. federal government. Gov. Inf. Q. 36(2), 346-357.

Chen, Q., Xu, X., Cao, B., et al., 2016. Social media policies as responses for social media affordances: The case of China. Gov. Inf. Q. 33(2), 313-324.

Cho, D.W., Lee, Y.H., Ahn, S.H., et al., 2012. A framework for measuring the performance of service supply chain management. Comput. Ind. Eng. 62(3), 801-818.

Cull, R., Xu, L.C., 2003. Who gets credit? The behavior of bureaucrats and state banks in allocating credit to Chinese state-owned enterprises. J. Dev. Econ. 71(2), 533-559.

da Mota, Pedrosa, A., Blazevic, V., Jasmand, C., 2015. Logistics innovation development: a micro-level perspective. Int. J. Phys. Distrib. Logist. Manag. 45(4), 313-332.

Ding, L., Lam, H.K.S., Cheng, T.C.E., et al., 2018. A review of short-term event studies in operations and supply chain management. Int. J. Prod. Econ. 200, 329-342.

Docherty, I., Marsden, G., & Anable, J., 2018. The governance of smart mobility. Transportation Research Part A: Policy and Practice, 115, 114-125.

Donald, J., BOWERSOX, C., DAVID, J., & COOPER, M., 2012. Supply chain logistics management. MCGRAW-HILL EDUCATION.

Eckhardt, J., Rantala, J., 2012. The role of intelligent logistics centres in a multimodal and cost-effective transport system. Proced. - Soc. Behav. Sci. 48, 612-621.

Ellram, L.M., Tate, W.L., 2016. The use of secondary data in purchasing and supply management (P/SM) research. J. Purch. Supply Manag. 22(4), 250-254.

Ferro, E., Loukis, E.N., Charalabidis, Y., et al., 2013. Policy making 2.0: From theory to practice. Gov. Inf. Q. 30(4), 359-368.

Freeman, C., 1989. Technology policy and economic performance. Pinter Publishers, Great Britain.

Govindan, K., Cheng, T.C.E., Mishra, N., et al., 2018. Big data analytics and application for logistics and supply chain management. Transp. Res. Pt. e-Logist. Transp. Rev. https://doi.org/10.1016/j.tre.2018.03.011.

Gregor, T., Krajčovič, M., Więcek, D., 2017. Smart connected logistics. Proced. Eng. 192, 265-270.

Hendricks, K.B., Hora, M., Singhal, V.R., 2014. An empirical investigation on the appointments of supply chain and operations management executives. Manage. Sci. 61(7), 1562-1583.

Hendricks, K.B., Singhal, V.R., 2003. The effect of supply chain glitches on shareholder wealth. J. Oper. Manag. 21(5), 501-522.

Hendricks, K.B., Hora, M., and Singhal, V.R., 2014. An empirical investigation on the appointments of supply chain and operations management executives. Manage. Sci. 61(7), 1562-1583.

Hendricks, K.B., Jacobs, B.W., Singhal, V.R., 2019. Stock market reaction to supply chain disruptions from the 2011 Great East Japan Earthquake. Manuf. & Serv. Oper. Manage. https://doi.org/10.1287/msom.2019.0777

Iii, J.J.B., Eisenstein, D.D., Yun, F.L., 2009. Self-organizing logistics systems. Annu. Rev.

Control. 42(4), 1461-1468.

Iqbal, Z., Shetty, S., 1995. Layoffs, stock price, and financial condition of the firm. J. Appl. Bus. Res. 11(2), 67.

Jabeur, N., Al-Belushi, T., Mbarki, M., et al., 2017. Toward Leveraging Smart Logistics Collaboration with a Multi-Agent System Based Solution. Proced. Comput. Sci. 109, 672-679.

Jacobs, B.W., Singhal, V.R., 2014. The effect of product development restructuring on shareholder value. Prod. Oper. Manag. 23(5), 728-743.

Jin, D.H., Kim, H.J., 2018. Integrated Understanding of Big Data, Big Data Analysis, and Business Intelligence: A Case Study of Logistics. Sustainability. 10(10), 3778.

Kagermann, H., Wahlster, W., Helbig, J., 2013. Securing the future of German manufacturing industry. Recomm. Implement. Strateg. Initiat. INDUSTRIE. 4(199), 14.

Karim, M.A., 2003. Technology and improved service delivery: Learning points from the Malaysian experience. Int. Rev. Adm. Sci. 69(2), 191-204.

Kavussanos, M.G., & Marcoulis, S.N., 1997. The stock market perception of industry risk and microeconomic factors: The case of the US water transportation industry versus other transport industries. Transp. Res. Pt. e-Logist. Transp. Rev. 33(2), 147-158.

Khurana, I.K., Lippincott, B., 2000. Restructuring and firm value: The effects of profitability and restructuring purpose. J. Bus. Finan. Account. 27(9-10), 1085-1106.

Kirch, M., Poenicke, O., Richter, K., 2017. RFID in Logistics and Production-Applications, Research and Visions for Smart Logistics Zones. Proced. Eng. 178, 526-533.

Klassen, R.D., McLaughlin, C.P., 1996. The impact of environmental management on firm performance. Manag. Sci. 42 (8), 1199–1214.

Kotter, J. P. 1995. Leading change: Why transformation efforts fail.Harv. Bus. Rev. 73(2): 59–67

Koussouris, S., Lampathaki, F., Kokkinakos, P., et al., 2015. Accelerating Policy Making 2.0: Innovation directions and research perspectives as distilled from four standout cases. Gov. Inf. Q. 32(2), 142-153.

Lepak, G.M., 1997. Airline deregulation and the impact on stock prices of major surviving carriers. Transp. Res. Pt. e-Logist. Transp. Rev. 33(2), 107-115.

Li, D., 2016. A Comparative Analysis of B2C Cross-border E-commerce Platforms: the AliExpress and the DHgate. In: International Conference on Education, Management, Computer and Society. Atlantis Press.

Li, S., Song, X., Wu, H., 2015. Political connection, ownership structure, and corporate philanthropy in China: A strategic-political perspective. J. Bus. Ethics. 129(2), 399-411.

Li, S., Sui, P. C., Xiao, J., & Chahine, R., 2019. Policy formulation for highly automated

vehicles: Emerging importance, research frontiers and insights. Transportation Research Part A: Policy and Practice, 124, 573-586.

Lin, C.-S., Su, C.-T., 2013. The Taiwan national quality award and market value of the firms: an empirical study. Int. J. Prod. Econ. 144 (1), 57–67.

Liu, S., Zhang, Y., Liu, Y., et al., 2019. An 'Internet of Things' enabled dynamic optimization method for smart vehicles and logistics tasks. J. Clean Prod. 215, 806-820.

Liu, W., Wang, D., Zhao, X., et al., 2019. The framework for designing new logistics service product: a multi-case investigation in China. Asia Pac. J. Mark. Logist. https://doi.org/10.1108/APJML-12-2017-0338.

Liu, X., Zheng, L., 2015. Cross-departmental collaboration in one-stop service center for smart governance in China: Factors, strategies and effectiveness. Gov. Inf. Q. 35(4), 54-60.

Magalhaes, G., Roseira, C., 2017. Open government data and the private sector: an empirical view on business models and value creation. Gov. Inf. Q. https://doi.org/10.1016/j.giq.2017.08.004.

Martin, C., Lynette, R., 1999. Supply chain strategy: its impact on shareholder value. Int. J. Logist. Manag. 10 (1), 1–10.

Massey, A.K., Eisenstein, J., Antón, A.I., et al., 2013. Automated text mining for requirements analysis of policy documents. In: 21st IEEE International Requirements Engineering Conference. IEEE, pp. 4-13.

Mcfarlane, D., Giannikas, V., Wong, A.C.Y., et al., 2013. Product intelligence in industrial control: Theory and practice. Annu. Rev. Control. 37(1), 69-88.

McGuire, S.J., Dilts, D.M., 2008. The financial impact of standard stringency: an event study of successive generations of the ISO 9000 standard. Int. J. Prod. Econ. 113 (1), 3–22.

McKinnon, A., 2010. Green logistics: the carbon agenda. Electron. Sci. J. Logist. 6(3), 1-10.

Montreuil, B., 2011. Toward a Physical Internet: meeting the global logistics sustainability grand challenge. Logist. Res. 3(2-3), 71-87.

Neacşu, N.A., Bălăşescu, S., 2016. Policies and Strategies Quality Courier Services Market Case Study DHL. Ovidius Univ. Ann., Ser. Econ. Sci. 16(2), 355-360.

Oh, J., Jeong, B., 2019. Tactical supply planning in smart manufacturing supply chain. Robot. Comput.-Integr. Manuf. 55, 217-233.

Ouyang, Q., Zheng, J., Wang, S., 2019. Investigation of the construction of intelligent logistics system from traditional logistics model based on wireless network technology. EURASIP J. Wirel. Commun. Netw. 2019(1), 20.

Reigner, H., & Brenac, T., 2019. Safe, sustainable… but depoliticized and uneven–A critical view of urban transport policies in France. Transportation research part A: policy and practice, 121, 218-234.

Rydzkowski, W., Barry Spraggins, H., 1994. Restructuring, privatization and deregulation of transport in Poland: new transport policy implications. Int. J. Phys. Distrib. Logist. Manag. 24(2), 23-29.

Seufert, J.H., Arjomandi, A., & Dakpo, K.H., 2017. Evaluating airline operational performance: A Luenberger-Hicks-Moorsteen productivity indicator. Transp. Res. Pt. e-Logist. Transp. Rev. 104, 52-68.

Shams, S.M.M., Gunasekarage, A., 2016. Operating performance following corporate acquisitions: Does the organisational form of the target matter?. J. Contemp. Account. & Econ. 12(1), 1-14.

Shamsuzzoha, A.H.M., Ehrs, M., Tenkorang, R.A., et al., 2013. Performance evaluation of tracking and tracing for logistics operations. Int. J. Shipp. Transp. Logist. 5(1), 31.

Sims, E.N., 1986. The Council of State Governments: A national information provider. Gov. Inf. Q. 3(4), 407-417.

Speranza, M.G., 2018. Trends in transportation and logistics. Eur. J. Oper. Res. 264(3), 830-836.

Srinivasan, R., Swink, M., 2018. An investigation of visibility and flexibility as complements to supply chain analytics: An organizational information processing theory perspective. Prod. Oper. Manag. 27(10), 1849-1867.

Tambe, P., 2014. Big Data Investment, Skills, and Firm Value. Manage. Sci. 60(6), 1452-1469.

Tian, L., Vakharia, A.J., Tan, Y., & Xu, Y., 2018. Marketplace, Reseller, or Hybrid: Strategic Analysis of an Emerging E‐Commerce Model. Prod. Oper. Manag. 27(8), 1595-1610.

Tjahjono, B., Esplugues, C., Ares, E., et al., 2017. What does Industry 4.0 mean to Supply Chain?. Proced. Manuf. 13, 1175-1182.

Torres, L., 2005. Service charters: Reshaping trust in government—the case of Spain. Public Adm. Rev. 65(6), 687-699.

Uckelmann, D., 2008. A definition approach to smart logistics. In: International Conference on Next Generation Wired/Wireless Networking. Springer, Berlin, Heidelberg, pp. 273-284.

Wang, H., Qian, C., 2011. Corporate philanthropy and corporate financial performance: The roles of stakeholder response and political access. Acad. Manage. J. 54(6), 1159–1181.

Wang, Y., Gao, H. O., & Liu, J., 2019. Incentive game of investor speculation in PPP highway projects based on the government minimum revenue guarantee. Transportation Research Part A: Policy and Practice, 125, 20-34.

Windt, K., Hülsmann, M., 2007. Changing paradigms in logistics—understanding the shift from conventional control to autonomous cooperation and control. In: Understanding autonomous cooperation and control in logistics. Springer, Berlin, Heidelberg, pp. 1-16.

Worrell, D.L., Davidson, W.N., Sharma, V.M., 1991. Layoff announcements and stockholder wealth. Acad. Manage. J. 34(3), 662-678.

Xia, Y., Singhal, V.R., Peter Zhang, G., 2016. Product design awards and the market value of the firm. Prod. Oper. Manag. 25(6), 1038-1055.

Xing, J., 2018. An Intelligent Logistics Tracking System Based on Wireless Sensor Network. Int. J. Online Eng. 14(1), 17-28.

Yang, Y., Zhang, X., Lee, P.K.C., 2019. Improving the effectiveness of online healthcare platforms: An empirical study with multi-period patient-doctor consultation data. Int. J. Prod. Econ. 207, 70-80.

Yu, S., Lee, N., 2016. Financial crisis, politically connected CEOs, and the performance of state-owned enterprises: evidence from Korea. Emerg. Mark. Financ. Tr. 52(9), 2087-2099.

Zhang, M., Xia, Y., Li, S., et al., 2019. Crowd Logistics Platform's Informative Support to Logistics Performance: Scale Development and Empirical Examination. Sustainability. 11(2), 451.

Zhao, X., Li, Y., Flynn, B.B., 2013. The financial impact of product recall announcements in China. Int. J. Prod. Econ. 142 (1), 115–123.