



Fintech disclosure: true statement or exaggerated statement?

--Research based on total factor productivity of enterprises

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Abstract. Based on the research background that Chinese governments at all levels actively promote the Fintech strategy, this paper collects and sorts out the Fintech related information disclosed in the annual reports of A-share listed companies from 2010 to 2021. Via python crawler and text analysis techniques, this paper estimates the heterogeneous influence of the exaggeration effect of financial technology on total factor productivity by using two-way fixed effect model and quantile regression. The study finds that the higher the degree of financial technology exaggeration in corporate text, the stronger the promotion effect on corporate productivity. However, this promotion effect is constrained by certain conditions, and only when the firms are in the early stage of the life cycle, the above effect will be significant. Further research finds that the impact of fintech text manipulation on productivity is different in different enterprise sizes, and it has a positive impact on large enterprises. Through the research mechanism, we find that the impact of corporate fintech exaggeration is transmitted through corporate financing constraints and internal value deviation degree. Finally, according to the internal motivation of enterprises to conduct text manipulation, this paper puts forward relevant suggestions for enterprises, financial institutions, governments and other market participants, in order to provide rational thinking for the development of fintech.

Keywords: Fintech; Text Manipulation; Total Factor Productivity; Financing Constraint.

1 Introduction

Manufacturing industry is the top priority of the real economy, and total factor productivity is the core competitiveness of the manufacturing industry. The high-quality development of the economy increasingly depends on the improvement of total factor productivity, which is the inevitable result of the transformation of China's economy to the stage of high-quality development. The existing literature has analyzed many

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factors affecting the level of enterprise productivity¹, such as macro policies and enterprise characteristics².

In recent years, the new industrial and technological revolutions led by big data, cloud computing, artificial intelligence, blockchain and mobile Internet are causing the boundaries and research paradigms of finance to be constantly broken and reconstructed³. The implementation of fintech can enable financial institutions to comprehensively analyze various aspects, reduce information asymmetry and inject new vitality into the development of real economy. Fintech plays an increasingly important role in the modernization of enterprises, and many scholars have proved that the development of fintech has a positive effect on the production efficiency of enterprises. The rise of text analysis method provides a new perspective for such research. The existing research generally adopts the Digital Inclusive Financial Index of Peking University compiled by Guo Feng et al. or they design their own fintech development index. Based on the data of A-share listed companies, Xin Daling, explored the impact of fintech on enterprises⁴; Liu Xiaotong et al., measure the development of fintech⁵. As the Internet engine search data is based on the needs of many individuals⁶; therefore, the use of text analysis to construct the fintech development index has gradually become a widely used method in the current academic world. Because commercial banks are more inclined to allocate credit resources to enterprises with national strategic planning in lending⁷, enterprises have the motivation to manipulate the text⁸. This manipulation will have various potential impacts on enterprises, such as boosting their stock prices and affecting their long-term value⁹.

So, under the background of the development of fintech, will enterprises also conduct impression management by manipulating the information of this article related to fintech within enterprises? Will this disclosure behavior have an impact on their productivity? The above questions are not only important topics for theoretical and practical research, but also related to the rationality of resource allocation in the implementation of the national strategy of fintech. Based on the existing literature, it can be seen that many scholars have discussed the influencing factors of enterprise productivity from different perspectives, including the research on fintech emerging in recent years. However, few studies have analyzed the text manipulation of fintech. Based on the keywords related to fintech in the existing literature, this paper has finally formed 48 keywords by crawling the news of Bank information section of Hexun website. On this basis, this paper measures the degree of exaggerated disclosure of fintech information in the annual report of enterprises, and explores the relationship between it and enterprise productivity.

The marginal contribution of this article is mainly reflected in the following two aspects: (1) At the theoretical level, this paper focuses on the text manipulation of non-financial information, which expands the research perspective of text information manipulation and enterprise productivity. (2) In addition, this paper uses nonlinear effects to describe the heterogeneous impact of text manipulation on productivity, which can more accurately capture the impact of text manipulation on total factor productivity.

2 Theoretical analysis and research hypothesis

2.1 Total factor productivity under enterprise text manipulation

Since the information contained in corporate texts can provide corroboration and supplement for corporate financial data⁷, the text analysis of non-financial information has become a hot topic in corporate behavior research¹⁰. However, since there is no fixed disclosure mode for non-financial information, enterprises will use massive information to distract investors' attention from corporate violations and other ways to gloss over corporate text information¹⁰. Since the fintech information disclosed by enterprises can provide more relevant information for evaluating the product positioning and development prospects of enterprises⁷, it is widely concerned by external investors. The improvement of investors' attention has a positive role in promoting the innovation performance of enterprises¹¹, which will eventually lead to the improvement of total factor productivity of enterprises. At the same time, fintech is an important national strategy, and governments at all levels will favor the implementation of fintech related enterprises, which will help to improve the uncertainty of enterprises' future production and operation, and thus improve the total factor productivity of enterprises¹².

Hypothesis 1: Firms' use of fintech information to conduct text manipulation will have a positive impact on productivity

2.2 Relationship between corporate text manipulation and productivity from the perspective of financial constraints

Because financial information is measured based on historical cost, it is not comprehensive enough to predict the future development trend of enterprises. The emergence of non-financial information makes up for its deficiency in this aspect, so the two have become important references for commercial banks to make credit decisions. In order to alleviate the financing constraints, enterprises will cater to the macro policy to manipulate the enterprise text¹³, exaggerate the relevant information of fintech to white-wash the operating conditions of enterprises¹⁴, and send the signal of positive prospects to the market¹⁴, which is conducive to the improvement of the total factor productivity of enterprises.

Hypothesis 2: Firms' fintech text manipulation will alleviate financial constraints and further strengthen the positive effect of text manipulation on productivity.

2.3 Transmission path of corporate internal value deviation

Under the condition of imperfect information in the capital market, the market value of listed companies is often not an accurate reflection of their intrinsic value. Zhang Zongxin et al.¹⁵ pointed out that in the case of adverse selection in the market, companies with good performance are motivated to adopt positive information disclosure strategies to reveal corporate value to external investors, so as to distinguish themselves from listed companies with poor quality. On this basis, the management of the company will use the annual report, which is a public information document, to carry out

corresponding text manipulation, so as to alleviate the deviation between the internal value and the market value caused by the market information asymmetry, correct the deviation of investors' expectation on the future development prospects of the listed company, and improve the allocation of capital factors.

Hypothesis 3: Fintech text manipulation will promote the correction of market valuation bias and play a positive role in corporate productivity.

2.4 Fintech text manipulation and the binding conditions of total factor productivity

In addition to technological innovation, firm productivity is also affected by firm life cycle: when firms are in the lead-in period, their size is small, they are less affected by financing constraints, and their negative effect on productivity is not obvious; After entering the growth stage, enterprises have high growth potential, which can effectively alleviate financing constraints through commercial credit financing, promote investment and significantly improve production efficiency¹⁶; In the mature period, the growth power of enterprises decreases rapidly, which has a significant negative effect on enterprises. In the recession period, enterprises are in urgent need of seeking new profit growth points¹⁷, which are greatly restricted by financing constraints, thus affecting the improvement of total factor productivity of enterprises.

Hypothesis 4: For firms in the early stage of the life cycle, fintech text manipulation is more conducive to the improvement of productivity.

2.5 Heterogeneous effect of firm size

This paper argues that firm size also has a significant nonlinear effect on the impact of text manipulation on TFP. First of all, the larger the enterprise size is, the greater the market power it has, so it is easier for its innovation achievements to be converted into sales revenue¹⁸, and it is more likely to use the funds obtained from text manipulation to efficiently increase the innovation investment and output of the enterprise, thus improving the enterprise productivity. For small enterprises, in order to solve the problem that they are inferior to large enterprises in terms of scientific and technological strength and social network relationship, they may have rent-seeking behavior¹⁸, and use the funds obtained from text manipulation for rent-seeking, thus crowding out some R&D funds for innovation, resulting in little improvement in productivity.

Hypothesis 5: fintech text manipulation has different effects on the productivity of enterprises of different sizes, and the negative effects on small-scale enterprises are more significant.

3 Data sources and research design

3.1 Data source and processing

The empirical research samples of this paper are A-share listed companies from 2010 to 2021. The text data about fintech are from the annual reports of listed companies from Juchao Consulting website, and the rest of the original data are from CSMAR database and WIND database. At the same time, in order to ensure the robustness of the results, this paper carries out the following processing: (1) excluding ST, ST* and PT enterprises; (2) Abnormal enterprises with negative total assets or asset-liability ratio greater than 1 are excluded; (3) The continuous variable was treated with 1% bilateral tail reduction; (4) The enterprise productivity is lagged by one period. After the above processing, the final sample involves 21238 observed values from 2010 to 2020.

3.2 Model and variable setting

This paper uses a two-way fixed effect model to estimate the impact of the exaggerated effect of enterprises on fintech on enterprise productivity, and the model is set as follows:

$$TFP_{i,t+1} = \beta_0 + \beta_1 \times Overstat_{i,t} + \beta_2 \times X_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t} \quad (1)$$

$TFP_{i,t+1}$ is the total factor productivity of firm i in year $t+1$; $Overstat_{i,t}$ is the degree of "exaggeration" of fintech by enterprise i in year t ; $X_{i,t}$ is a series of control variables of enterprise i in year t . Stands for individual fixed effect, stands for time fixed effect and stands for random disturbance term. The specific variables in the model are defined as follows.

(1) Explained variable: TFP

At present, the methods commonly used in literature to measure TFP mainly include OP, LP, OLS, GMM and so on. Considering the problem of sample selection bias caused by unbalanced panel data and firm exit, this paper uses the OP method¹⁹ to calculate the firm's total factor productivity, and uses the results obtained by other methods as robustness test.

(2) Core explanatory variable: Fintech

Based on the ideas of Cao Wei et al.⁷, this paper uses the abnormal disclosure of fintech in the annual report of enterprises to measure the degree of exaggeration of fintech. The constructed measurement model is shown in Eq.(2).

$$Fintech_{i,t} = \alpha_0 + \alpha_1 \times Merge_{i,t} + \alpha_2 \times Cityfintech_{i,t} + \alpha_3 \times Finance_{i,t} + \alpha_4 \times X_{i,t} + \sum Ind + \sum Year + \sigma_{i,t} \quad (2)$$

Where the number of abnormal exposure is represented by, the higher the number of times, the higher the degree of exaggeration. In Eq.(2), the explained variable represents the disclosure degree of fintech in the annual report. The specific measurement method refers to the research of Zhao Can et al.¹³, which is carried out in three steps: (1)

Selecting keywords related to fintech. Most of the keywords selected in this paper are from the research results of Yu ping²¹. On this basis, this paper also crawled and collected the words from the Banking Information section of Hexun website, identified and expanded the keywords related to fintech from the top 500 words, and finally formed 48 keywords. (2) Use Python to crawl the annual report of enterprises and decompress the words in it. (3) The occurrence times of the keywords in (1) in the annual report are counted, and the keyword frequencies of the i th enterprise in the t th year are summarized and the logarithm is taken as the disclosure degree of the enterprise to fintech.

The explanatory variables in Eq.(2) include: (1) the degree of integration between enterprises and fintech ($Merge_{i,t}$). Referring to the similar practice of Song Deyong et al.²², we use the fintech-related keywords obtained in the previous paper to calculate the proportion of the net value of fintech-related intangible assets to the total intangible assets in the details of intangible assets disclosed in the notes to the annual reports of listed companies to estimate the degree of integration between enterprises and fintech. (2) The fintech development level of the prefecture-level city where the enterprise is located ($Cityfitech_{i,t}$). This paper refers to the practice of Li Chuntao et al.²³, uses Baidu News Advanced search results of the previous keywords, and matches them with prefecty-level cities. The number of search results of all keywords in the same prefecty-level city or municipality directly under the Central Government is summed to obtain the total search volume, and the logarithm of this index is taken after adding 1 to measure the level of fintech development in the prefecty-level city where the enterprise is located. (3) Financialization degree of enterprises ($Finance_{i,t}$). Referring to the practice of Du et al.²⁴, this paper uses the ratio of financial assets to total assets as an indicator to measure corporate financialization, and according to the processing method of Du et al.²⁵, the monetary funds from the original financial assets are removed and the investment real estate is included to better meet the definition of corporate financialization.

(3)Control variable: X

In order to avoid the problem of missing variables in the estimation process, the following control variables are selected: (1) size, the value is equal to the natural logarithm of total assets; (2) cashflow: net cashflow from operating activities/total assets; (3) Indep: the value is the number of independent directors/the total number of directors; (4) Top5: shareholding ratio of top five shareholders; (5) Listage: the value is the logarithm of the years of establishment of the enterprise; (6) Opinion: if the company's financial report of the year is issued with standard audit opinion, the value is 1, otherwise it is 0.

4 Empirical results

4.1 Benchmark regression

Table 1 presents the impact on productivity of the extent to which firms overstate fintech. Columns (1) and (2) show the regression results of firm productivity calculated

by OP method and without/with control variables, column (3) shows the regression results of firm productivity calculated by LP method, and column (4) shows the results calculated by OLS method. It can be seen that there is no significant difference in the results obtained by using the three methods, and enterprises' exaggeration of fintech helps to improve their own productivity. Column (5) validates the impact of enterprises' own fintech development on their productivity, and the measurement method is consistent with the above. It can be seen that the coefficient of *Fintech* is also significantly positive, indicating that fintech helps to improve the productivity of enterprises, which is also consistent with the current research conclusions of many scholars²⁶.

Table 1. Benchmark regression results

	(1)	(2)	(3)	(4)	(5)
	Tfp_op	Tfp_op	Tfp_lp	Tfp_ols	Tfp_op
Overstat	0.023*** (4.12)	0.021*** (4.55)	0.027*** (5.73)	0.016*** (3.52)	
Size		0.346*** (31.42)	0.517*** (41.80)	0.626*** (47.77)	0.341*** (30.67)
Cashflow		0.375*** (6.11)	0.410*** (7.18)	0.454*** (7.94)	0.375*** (6.11)
Indep		0.194** (1.97)	0.266*** (2.65)	0.285*** (2.97)	0.193* (1.96)
Top5		0.111** (2.12)	0.111** (2.05)	0.166*** (3.02)	0.121** (2.30)
ListAge		0.053*** (4.92)	0.079*** (7.09)	0.126*** (11.54)	0.051*** (4.70)
Opinion		0.134*** (4.51)	0.188*** (6.19)	0.207*** (6.87)	0.135*** (4.54)
Fintech					0.022*** (4.63)
Constant	8.011*** (2,880.19)	-1.353*** (-5.30)	-2.968*** (-10.50)	-3.729*** (-12.50)	- (-4.83)
Observations	19,769	21,231	21,231	21,231	21,231
R-squared	0.857	0.855	0.900	0.924	0.855
Company FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

4.2 Regression results by group

(1) Based on enterprise life cycle

This paper uses the method of cash flow division²⁷ to divide the enterprise life cycle into five stages, and carries out regression on the enterprises in each stage. The results (Table 2) show that only the exaggeration of fintech in the introduction group and the growth group will lead to the improvement of productivity, while the exaggeration of the decline group will lead to the decline of productivity. Due to the lack of resources, enterprises in the growth stage are forced to choose technology-oriented activities and

improve their productivity by improving technology²⁸. Therefore, the overstatement of fintech is true. In the decline period, due to the deterioration of financial conditions, enterprises turn to risk aversion, tend to passive shrinking strategy²⁹, and there are problems such as structural rigidity and organizational inertia. Therefore, the exaggeration of fintech is merely a show, which cannot substantially improve the internal productivity of enterprises.

Table 2. Regression results of enterprise life cycle groups

	(1)	(2)	(3)	(4)	(5)
	Tfp_op	Tfp_op	Tfp_op	Tfp_op	Tfp_op
Overstat	0.076*** (3.58)	0.019** (2.48)	-0.000 (-0.04)	0.008 (0.37)	-0.073 (-1.12)
Constant	-3.127*** (-3.49)	-1.469*** (-3.09)	-1.664*** (-3.23)	-0.680 (-0.52)	-0.509 (-0.24)
Controls	YES	YES	YES	YES	YES
Observations	2,152	6,316	6,479	1,954	516
R-squared	0.904	0.906	0.917	0.878	0.885
Company FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

(2) Nonlinear test

In this paper, B-spline non-parametric quantile regression method is used for fitting. Referring to the study of Landajo et.al.³⁰, the constructed model is shown as follows:

$$Q_{y_i}(\tau) = \sum_{m=1}^{M+1} \alpha_m(\tau) B_{m,p}(\text{overstat}) + \sum_{n=1}^N \beta_n(\tau) x_{n,i} \quad (3)$$

Where $\tau(0 < \tau < 1)$ is the quantile, $Q_{y_i}(\tau)$ is the τ quantile of the explained variable y_i , $\alpha_m(\tau)$ and $\beta_n(\tau)$ is the parameter to be estimated, and $B_{m,p}(x)$ is the B-spline basis function of the MTH piecewise polynomial order p . Generally, better empirical results can be obtained when the order p is 3, so this paper takes $p=3$ to measure the nonlinear relationship between enterprises' exaggeration of fintech and production efficiency³¹. Using R software to take 0.25, 0.5 and 0.75 quantiles to carry out quantile regression on the whole sample, the results are shown as Fig.1. The results show that text manipulation has no positive impact on the productivity of small-scale enterprises, and the higher the productivity level of enterprises, the greater the damage caused by text manipulation. On the contrary, large-scale firms benefit from text manipulation, which can alleviate financial constraints and improve productivity. This suggests that investors should pay more attention to the actual output of enterprises than to the textual information of enterprises.

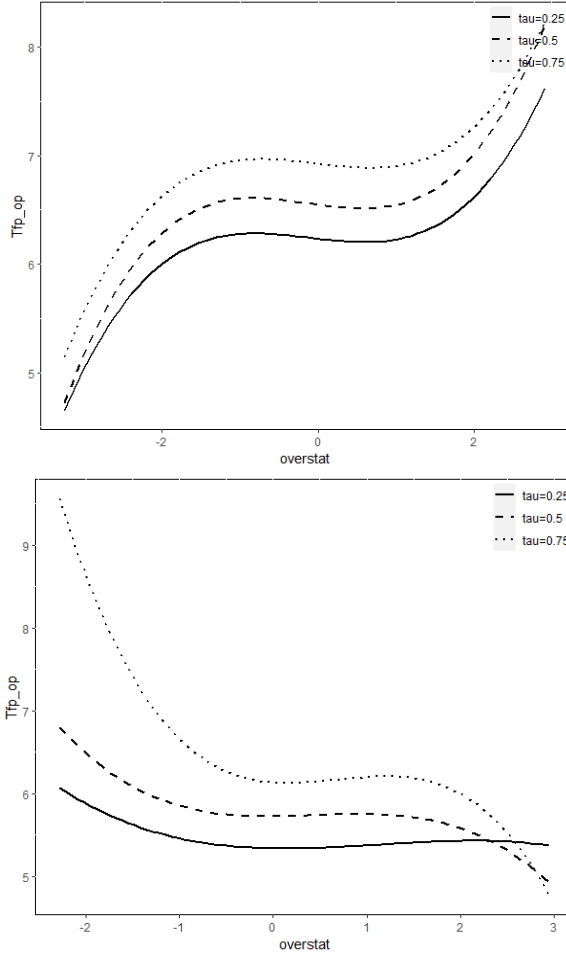


Fig. 1. Quantile regression results of firm size (Above picture is large enterprises, below picture is small enterprises).

5 Mechanism analysis

5.1 Financial constraints

As mentioned above, the existence of financial constraints will have a negative impact on the productivity of enterprises, which is specifically reflected in the R&D activities of enterprises³², thus affecting the production efficiency of enterprises. In this paper, the SA index proposed by Hadlock³³ is used to calculate the degree of corporate financial constraints, and the regression results obtained after one-period-lagged processing are shown in the first two columns of Table 3. It can be seen that the exaggeration of enterprises reduces financial constraints at the significance level of 10%. From the

perspective of interaction effect, the environment with high financial constraints is more conducive to the promotion effect of information exaggeration on corporate productivity; The positive coefficient of the interaction term also indicates that information exaggeration helps to alleviate the negative effect of financial constraints on production efficiency. Therefore, Hypothesis 2 above is basically valid.

5.2 Internal value deviation

As mentioned in the previous hypothesis, enterprises may exaggerate in the text not only for speculation, but also for the purpose of reducing their own value deviation and providing more reasonable value evaluation to the market under the condition of incomplete information market. In order to test this hypothesis, this paper uses the ratio of internal value (V) to market value (P) as the deviation of enterprise value. The results obtained after regression are shown in columns (3) - (5) of Table 3. The results in columns (3) - (4) show that firms' overstatement behavior is conducive to mitigating the deviation of internal value, and the empirical evidence shows that such deviation will have negative impact on productivity. The results of the interaction term also show that the improvement of internal value deviation is an important way of corporate manipulation, which is basically consistent with the previous hypothesis.

Table 3. Results of mechanism analysis

	(1)	(2)	(3)	(4)	(5)
	SA	Tfp_op	Deviation	Tfp_op	Tfp_op
Overstat	-0.001*	0.024***	-0.008**		0.016***
	(-1.80)	(5.43)	(-2.03)		(3.70)
SA		0.597***			
		(7.36)			
SA*Overstat		0.033*			
		(1.76)			
Deviation				-0.037***	-0.037***
				(-3.86)	(-3.87)
Devia*Overstat					0.023*
					(1.84)
Controls	YES	YES			
Constant	3.653***	-3.738***	1.291***	-1.153***	-1.618***
	(56.83)	(-9.27)	(7.00)	(-3.98)	(-6.71)
Observations	21010	21,010	18470	18470	18470
R-squared	0.958	0.858	0.392	0.857	0.857
Company FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

6 Robustness checks

6.1 Instrumental variable method

In order to alleviate the endogeneity problem caused by omitted variables and other factors, this paper uses the mean of exaggeration degree of other enterprises in the same industry in the same year and the same city in the same year as the instrumental variable, and obtains the correlation between the instrumental variable and the core explanatory variable is 0.4048, significant at the level of 1%, which meets the correlation hypothesis. In order to ensure the accuracy of the results, this paper uses the limited information maximum likelihood method, which is less sensitive to weak instrumental variables, to conduct instrumental variable regression. The Cragg-Donald Wald F statistic is 4506.67, which is much higher than the 10% critical value of 16.38, indicating that there is no weak instrumental variable problem. The selection of instrumental variables is proved to be effective.

6.2 Other robustness checks

This paper also conducts the following robustness tests: ① Dynamic panel GMM estimator. Since the system GMM estimation method integrates the characteristics of differential GMM and horizontal GMM, avoids the problem of over-identification of instrumental variables and can achieve more efficient estimation, this paper chooses the system GMM method for analysis, and the conclusions obtained remain unchanged. There is no second-order correlation, and the Hansen test statistic P value is 0.283, so there is no over-identification problem. (2) Because the disclosure of information in different positions of the annual report often represents different connotations, and the information in different positions represents different values, it will naturally have an impact on the market and investors' expectations and judgments. Therefore, referring to the ideas of Meng Qingbin et al.²⁰, this paper uses the management analysis and discussion in the annual report and the future outlook part of the management analysis and discussion as replacement variables to recalculate the degree of exaggeration according to the above method for regression, and the conclusions obtained are still robust.

7 Conclusions and Implications

This paper investigates the impact of fintech information disclosure on total factor productivity (TFP). The empirical results show that firms' whitewash of fintech information has an impact on firms' total factor productivity by affecting their financial constraints and internal value deviation. However, this phenomenon has certain constraints. When firms are in the initial stage of the life cycle, the impact of the above information manipulation on productivity is more obvious. The conclusions of this paper have important implications for both enterprises and external information users. First of all, enterprises must seize the opportunity to use the funds obtained from text manipulation

to improve productivity and transform the "mere appearance" of enterprise text information into its real name, otherwise it will have a negative impact on enterprises. Secondly, credit institutions should optimize the allocation of resources, improve the efficiency of credit decision-making, and allocate funds to enterprises in need, so as to alleviate the financial constraints faced by enterprises. Government departments should guide enterprises to improve their development ability and potential in the right way, reduce the uncertainty of industrial investment environment, reduce the operating cost of enterprises through policy means, improve the profit margin of industrial investment, make the text information of enterprises more realistic, and guide the healthy and orderly development of market economy.

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