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Shanghai Pilot Free Trade Zone: China’s Exploration To an Economic Heavyweight

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a thesis submitted to the Faculty of Emory College of Arts and Sciences
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Abstract

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Shanghai Pilot Free Trade Zone (SHPFTZ) was launched on September 29, 2013. The establishment of SHPFTZ is meant to serve as a significant measure to promote reform and opening-up under changing global economic conditions. It also reflects the Chinese Government's commitment to a new system of foreign investment management based upon China's structure of Socialist Democracy.

In light of this development, the paper is aimed at discussing the internal economic and legal impact of the establishment of SHPFTZ after two years' development. The first part of this paper provides a comprehensive understanding of SHPFTZ including its operations, structure, role and functions. The second part will mainly focus on using the Difference-in-Difference, ARIMA and OLS empirical models to analyze the growth of FDI compared with other major cities along the eastern coast of China after the establishment of SHPFTZ. Both DD and OLS models show that the establishment of SHPFTZ attracts more inflow FDI, but the effect is not significant in ARIMA model. More data and research are needed to testify the applicability of creating FTZ in other cites.

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I. INTRODUCTION

With the development of global production and the international trade, the establishment of Free Trade Zones (FTZ) has always been part of the effort to facilitate competitive economic foundation in China. It always serves as a representative way to attract foreign and domestic investment. The Chinese central government usually offers a series of investment tax breaks to further attract FDI and thus hopes to boost economic growth (Schulze, 2002). However, most of the reports about FTZ in China only focus on the absolute increase of FDI locally and merely question whether setting up FTZ is really effective in attracting FDI to China overall or only shifting investments from other regions to a geographically limited area where FTZ are located.

Shanghai Pilot Free Trade Zone (SHPFTZ) was finally launched on September 29, 2013. This experimental action has caused great attention not only from Chinese media but also from Western media around the world. Currently, China is confronted with pressure of economic transition, restructuring and optimization process, which makes it imperative to close down outdated and inefficient cooperates in labor intensive industries. Meanwhile, China has passed its peak of plentiful “cheap labor” and the demographic dividend has gradually been cashed out, causing labor costs and products prices to increase and further reducing China’s GDP growth rate (Jiao, 2014). Therefore, many Western media and economists predict that the China’s economic growth rate will slow down recent years.

Certain voices and urges have always existed, which call for the Chinese Government to take economic reforms with respect to the “middle class” gap and reducing GDP growth rate. The government has reacted to these phenomena and has claimed to take economic reform for quite a long time. The last successful reform can be dated back to 1978, when Deng Xiaoping implemented the Reform and Opening Up Policy in China's southern city Shenzhen. As a pioneer city of China's economic reform, Shenzhen has maintained its rapid economic growth for nearly twenty years, topping other big cities in the field of culture, education and service industry and thus has been regarded as the benchmark for Chinese economic reform.

Such a long wait for nearly 40 years has already caused the lack of trust for citizens to the Central Government's determination of pushing forward the reform. It is inevitable that the Chinese will regard the establishment of SHPFTZ as a medicine for the ailing Chinese economy: the slowdown GDP growth rate and high unemployment rate of college undergraduates (Davis and Silk, 2014). Obviously, it is important and necessary to systematically compare the economic performance of Shanghai with that of other major cities in China's eastern coastal areas without FTZ after its second-year anniversary.

The remainder of the research project is organized as follows: Section Ⅱ will introduce some basic backgrounds about FTZ. Section Ⅲ will focus on the coverage and sources of the data employed in this project, including its strengths and weaknesses. Section Ⅳ provides a detailed description of empirical methods such as ARIMA Model and statistic tests applied to analyze the FDI in different cities. Section Ⅴ focuses on the results gained from running regressions and possible interpretations to these outcomes. The Conclusion section briefly sums up the results and involves a discussion on limitations of the economic model used, in order to offer a better solution to analyze the effect after the establishment of FTZ in the future work.

II. LITERATRE REVIEW

1. Definition of Free Trade Zone

A Free Trade Zone is a specific category of Special Economic Zone. Any foreign and domestic merchandise may be brought into the FTZ without interventions, except goods that are prohibited by Customs laws, the Administration Board of Import and Output or regarded as detrimental to the public safety (Landy and McGinnis, 1978). To maximize the potential profit, it is typically established around transition centers such as international airports, main seaports or major crossings of the railways (Friedman, 1990), where loading, unloading, shipping, and exhibiting goods are convenient.

FTZ are areas where countries agree to eliminate or reduce trade barriers and intend to provide a free environment for investment, often accompanied by other loose trade confinement in order to attract FDI. Thus, FTZ are of much importance in strengthening economic and trade cooperation among different countries. Setting up FTZ is no longer a program used exclusively in developed countries. Many developing countries also build FTZ to offer certain benefits to foreign investments by reducing tariffs, taxes and other traditional investing barriers. There are more than 2,500 FTZ established in both developing and developed countries (Malhorta, 2008). In terms of China, there have already been 15 FTZ in use. Most of them are located on the eastern and southern coasts of China.

2. Characteristics of SHPFTZ

According to the history data published on Shanghai Customs, FDI in Shanghai has experienced a rapid growth. However, it is distributed unevenly among different districts in Shanghai. Not surprisingly, FDI in Pudong District has the most, accounting for more than a quarter of Shanghai's total. The extreme unevenness is attributable to the previous establishment of the four national zones: Waigaoqiao Free Trade Zone, Lujiazui Finance and Trade Zone, Jinqiao Export Professing Zone and Zhangjiang High-Tech Development zone. These four zones focused on different investment areas to maximize individual's location advantage. Through providing well-developed infrastructure, convenient transportation and professional services, these zones continued to attract a steady stream of FDI since the mid-1980s.

In contrast, the new SHPFTZ aims to experiment a new idea about loosing financial supervision, easing state control in foreign and private investment and relaxing the currency Renminbi (RMB). For international and foreign-funded enterprises, the new deregulation of censorship means more investment opportunities relating to financial products, which have long been strictly regulated by the central government. The ultimate goal is to promote the reform of foreign investment administrative system, which takes into account China's national conditions. The establishment of SHPFTZ is a meaningful and innovative plan towards further liberalizing financial market not only in Shanghai but also in the entire China (Kreigler, 2014).

Different from other FTZ in China, SHPFTZ will pay more attention on service and the institutional innovation in the financial sector. The test area may be eventually expanded to the whole Pudong district, if the new reform and opening-up strategy is proved effective, measured by international standards: whether it can attract abundant FDI or foreign enterprises to be settled down. Experience gained in establishing SHPFTZ would serve new approaches in the coming future for opening up the economy further. Thus, SHPFTZ is recognized as a test field to promote reform and raise the level of open economy that would eventually spread throughout China (Shen, 2014).

3. Major Reforms

SHPFTZ's significance could be comparable to that of the Shenzhen Special Economic Zone established more than 30 years ago. According to the *Regulations of China (Shanghai) Pilot Free Trade Zone* on the official website of SHPFTZ, major reforms will appear in three major areas, including: financial sector, shipping industry and commercial services. This paper will mainly focus on the innovations on the financial sector:

- Deregulate administrating powers to a lower level, including the liberalization of many investment sectors currently restricting foreign investment
- Encourage foreign enterprises to fully exploit both domestic and foreign resources to facilitate cross-border financing
- Expand the opening of financial service, commercial and trade service. Cancel or relax certain strict qualification requirements or restrictions on foreign investors

- The innovation of new Customs supervision, which further promote trade within the Shanghai FTZ

In addition, special tax policies will also in effect in SHPFTZ to further promote the foreign trade. The so-called “Negative List”, which sets out certain areas and industries where foreign enterprises are prohibited to invest in, will also be shortened in the near future. Oversea enterprises can invest in other industries, areas, and economic activities, without any restrictions or conditions of joint venture. The expectations are more than just free trade, but a free market where the central government will loosen the economic controls. Table 1 below lists part of the measures for the financial sector in SHPFTZ as an example.

Table 1: Major Measures for The Financial Sector Reform (Wan, 2014)

1. Banking Services	
Measures	(1) Cancel or relax some strict qualification requirements of investors, such as share ratio of foreign investment.
	(2) The payment of guarantee fess for individual corporation in the Pilot Zone is cancelled, and the financial corporations are allowed to directly engaged in the foreign exchange activities.
2. Insurance Companies	
Measures	(1) The China Insurance Regulatory Commission approves to further simplify the Administrative Approval System in SHPFTZ. (2) Prior approval of establishing subsidiaries is no longer needed. Filing management forms in CIRC Shanghai Bureau is enough.
3. Financial Leasing	
Measures	(1) The oversees lease examinations are cancelled.
	(2) Restrictions on minimum registered capital are eased for financial leasing companies within the FTZ.

4. Previous and Current Evaluation or Comment on FTZ

A number of economists from last century speculated that the establishment of FTZ would increase economic dependence on foreign countries and the cultural imperialism is also an inevitable threat if developing countries increasingly rely on FDI as a major tool to achieve rapid economic growth and technology (Wei and Leung, 2005). However, numerous studies have practically or theoretically shown that FTZ have a certain effect on alleviating the absolute level of unemployment in a country's economy. In Basu' s *Unemployment Reduction in the Presence of a Rural Based Free Trade Zone: Some Policy Implications*, he uses rigorous mathematics models to prove that the establishment of a FTZ reduces the host country's unemployment rate but may exacerbate the national income level, especially when per unit output of FTZ occupies more domestic capital than the output from urban sector does (Basu, 1996).

Dula Borozan, an economics professor in Croatia, evaluates the economic benefits brought by FTZ in Croatia from past several decades till now and concludes that establishing FTZ is among one of the best political instrument to boost economic growth. It enables a large number of countries to experience a fast economic growth, without creating unpractical economic bubble or consuming massive domestic investments (Borozan, 2011).

III. DATA ANALYSIS

In this paper, I will mainly use two datasets. The first one is the monthly statistics published by China Data Center (CDC) online, which is a Chinese monthly

Macroeconomics database to analyze the main economic indicators of industrial enterprises, such as the foreign direct investment (FDI), wages and labor force and employment etc. The database is sponsored by The China Data Center at the University of Michigan. It is an international center designed to advance the study and understanding of China.

The second database is the monthly statistic reporting and statistical yearbooks published by Statistical Bureaus of various cities. They contain comprehensive statistics of different cities' social and economic development since China adopted the policy of reform and opening to the outside world.

The purpose of this project is to analyze the internal economic effect brought by the establishment of SHPFTZ. Therefore, much attention will be focused on the comparison of data before and after September 2013 in Shanghai, with other major cities like Shanghai in adjacent provinces such as Zhejiang and Jiangsu, which have not established FTZ. Suzhou is the most important city in Jiangsu province. As an inshore-developed city, Suzhou has a well-developed manufacturing industry. The continued expansion of the manufacturing industry also provides tremendous room for the growth of service industry. On the other hand, Ningbo is an important seaport in Zhejiang province. It is located in the middle of the China's coastline and in the south of Yangtze River Delta areas. It is adjacent to Shanghai and Hangzhou. Both of two cities are the most developed cities in Yangtze River Delta areas. In terms of geographical position and economic conditions, they are quite alike Shanghai but without FTZ. Thus, they are two perfect reference cities used in this project.

What’s more, the economic significance is more important than geographical position to some extent, when choosing the reference city. Therefore, the reference group is appropriate to include Shenzhen. Shenzhen, a port city in China's South near Hong Kong, was one of the first to be designated as a special economic zone when the country began liberalizing its economy. It is one of the first cities on the mainland to open its commercial doors to the world, and it is renowned for its development, towering skyscrapers, and thriving tourist industry. Other reference cities may include Shaoxing in Zhejiang Province, Fuzhou in Fujian Province, Wuxi in Suzhou Province etc.

One significant advantage of these two datasets is their completeness. In terms of cross sectional dimensions, the Statistical Bureaus of each city provides more than 50 kinds of macro data for analysis, including population, living standards, employments and wages etc. In terms of time-series dimensions, the seasonal unadjusted data is reported monthly from January 2003 to October 2015. Thus, I can employ seasonal modeling techniques in the Empirical Methodology part to make my regression on FDI more precise. In addition, the dataset also lists the percentage change of unadjusted data value compared to that of previous year, which makes my time series analysis more convenient. Furthermore, the Chinese government publishes these data monthly so they are trustworthy. In conclusion, these two datasets are perfectly suitable for analyzing FDI in Shanghai.

The major weakness of the dataset used in this project is to compile and reorganized the FDI of different cities from the statistical yearbooks. The process of collecting and even combining these data for direct use in Stata is time-consuming. More importantly, SHPFTZ is a fairly new project. The available monthly FDI data is limited, compared to the historical FDI before. In order to get ideal results and meaningful insights, I have to be critical in determining the appropriate data categories and numbers of observations used in analysis.

IV. EMPIRICAL METHODOLOGY

As mentioned above, SHPFTZ is a testing zone. If the new reform policies in SHPFTZ are proved effective, the concepts will gradually extend to the whole country. Therefore, much of the research will focus on solving these questions:

1. Whether Shanghai's FDI increases after the establishment of SHPFTZ;
2. Whether the positive effect is obvious, compared with other major nearby and other special economic zones such as Shenzhen;
3. Whether the increase in FDI is the effect of new foreign investment or other political reasons, or just shifting from other cities to Shanghai;
4. Whether the concept of free trade zone would be effective in other cities;

Basically, the empirical strategies used in this project can be divided into three parts: Difference in Difference Model (DD), ARIMA model and Model of Multiple Linear Regressions.

Part One: Difference in Difference Model

In this research, Difference in Difference (DD) technique will be used to answer the first two questions: test the impact of the establishment of SHPFTZ on total realized FDI in Shanghai. DD is a preferred estimation as it calculates the effect of SHPFTZ on FDI by comparing Shanghai's average FDI over time with the average of control groups, which include reference cities such as Suzhou and other major cites similar to Shanghai but without FTZ listed above in Data Analysis part. It measures the differences between Shanghai and control cities over time. In addition DD requires observational data measured at different time periods, which is a perfect match with monthly data collected on the database. The main variable of interest in this study will be Shanghai's FDI. Unemployment rate and personal disposable income are also valuable variables to analyze and can be regarded as dependent variables using DD model.

The most important independent variable is the dummy variable *FTZ*. The research will focus on the comparison of FDI before and after the establishment. Controlling the whole investment environment and economic conditions is an important part in this project. Since the general economic environment is changing all the time, the regressions should strip those observable and detectable economic shocks and adversity. The macro-indicators such as inflation rate and unemployment rate should be into consideration. In Seyoum's paper, he uses: HDI (Human Development Index), GDP Growth, Inflation and Unemployment (Seyoum, 2011) to control the investment environment, which enlightens me about the controlling variables used in OLS (the last model).

In addition, fixed effects will be superposed in all economic models used in this research. Two independent variables θ_i and γ_t will control the invariable city characteristics and time-invariant characteristic individually. Because the database provides FDI and many of the other variables in a monthly frequency, it would be ideal to use a Difference in Difference model in the following form to analyze the change about FDI in Shanghai:

$$\ln(FDI_{it}) = \beta_1(FTZ_i) + \beta_2(after_t) + \beta_3(FTZ_i * after_{it}) + \theta_i + \gamma_t + \varepsilon_{it} \quad (1)$$

The following table summarizes important variables used in the next Empirical Methods part:

Variable Name	Definition	Expected Sign	Source
$\ln(FDI)_{it}$	Log value of FDI	/	Statistical Yearbook Starting Month: 2009 Jan
FTZ_i	FTZ Dummy	+	/
$after_t$	Time Dummy	+	/
θ_i	Unknown Intercept for Different Cities	?	/
γ_t	Monthly Dummies	?	/

FDI_{it} represents the total realized Foreign Direct Investment summarized monthly for individual city *i* at time *t*, FTZ_i is a dummy variable assigned one for Shanghai and zero in other reference cities, and $after_t$ is a dummy variable taking the value one after the establishment of SHPFTZ: Sep, 2013, and zero before. The coefficient on the interaction term β_3 gives us the DD estimate of the effect brought by SHPFTZ and θ_i denotes the unknown intercept for each different city, which represents the subject fixed effect.

Analogously, γ_t denotes the time-fixed effect. In this project, the FDI is measured monthly so γ_t contains 12 different terms, which represents a specific month individually. Though it seems redundant, it is the most effective way to control any time specific, subject-invariant variable like total FDI in China in order to answer the critical question: whether the FDI change in Shanghai is due to actual "increase" or "transfer" only. Lastly, ε_{it} is the unobserved error term, which contains all determinants of FDI_{it} the model omits. The traditional DD model should include all variables listed above. However, I am also interested in the transfer of FDI. There is a considerable transaction cost to transfer FDI from other major cities to Shanghai. If the "transfer" issue should be seriously concerned, a new empirical model is needed to discover the relationship between the "transfer" decision and those independent variables.

Three independent variables in formula (1) are dummy variables. Thus, perfect multicollinearity and serial correlation are not major problems in this project. In Results part, Haussman test will be applied if necessary. After checking all Gauss-Markov assumptions, the DD model in a linear form is BLUE can thus can give us unbiased and efficient estimators.

Part Two: Autoregressive Integrated Moving Average (ARIMA)

In this part, ARIMA technique will be employed to answer the last question: Whether the experience of SHPFTZ can be expanded to whole China. Using ARIMA, if the forecasting results show a steady growth of FDI in Shanghai, then establishing FTZ in other cities may be an acceptable strategy.

Before running Ordinary Least Squares (OLS) on Stata, to check whether the time series data in this project is stationary or not is necessary. Non-stationary series must be transformed into stationary series before we can use them to obtain reliable forecasts. Non-stationary time series have non-constant variance and may also have non-constant means. Regression analysis with non-stationary series is misleading in suggesting a relationship among series where, in fact, it may not exist at all. Thus, non-stationary time series data can generate spurious correlations because the different, unrelated series, perhaps, also have a common random trend. Thus, forecasting is impossible in the presence of non-stationary process since the series do not converge and hence, past values cannot provide the basis of reliable future forecasts. We need to test for the presence of non-stationarity.

In time-series project, a unit root test analyzes whether the dataset of independent variables is stationary or not using an autoregressive model. A well-known test that is valid in large samples is the Dickey–Fuller test. There are three types of Dickey-Fuller tests: a test for the basic stochastic trend non-stationary series, a test for non-stationary stochastic trend series with drift and a test for non-stationary stochastic trend series with drift plus a deterministic trend. I need to decide which test is the most suitable for the dataset in this project, by examining the graphs of the series in levels and the series in first differences.

Figure 1 plots Shanghai's FDI in Levels From 01/2009 to 10/2015 and Figure 2 plots the First Difference of FDI From 01/2009 to 10/2015 individually. The result suggests that FDI Index series in level is obviously nonstationary but the first differenced form of FDI is approximately a white noise with a constant zero mean, without any trend or drift. Therefore, the first Dickey-Fuller test without an intercept or a drift is sufficient for our need in this project.

The specific process is illustrated as follows:

$$Ho: \rho = 1 \Leftrightarrow \gamma = 0$$

$$H_1: \rho < 1 \Leftrightarrow \gamma < 0$$

$$\Delta FDI_t = \gamma FDI_{t-1} + v_t \ \ where\, \gamma = (\rho - 1) \qquad (2)$$

The null hypothesis is that the time series is non-stationary. Therefore, rejecting the null hypothesis suggests the series is stationary, while the failure to reject it indicates the time series is non-stationary.

Another issue I must decide before the Dickey-Fuller Test is how many lags of the 1st differences I need to include. We start by adding ΔFDI_{t-1}, then ΔFDI_{t-2} etc. until the lag variable is no longer significant. This is called the Augmented Dickey-Fuller Test (ADF) test for stationarity. For example the ADF test containing 1 first-differenced lag would be:

$$\Delta FDI_t = \gamma FDI_{t-1} + \alpha_1 \Delta FDI_{t-1} + v_t \ \ where\, \Delta FDI_{t-1} = (FDI_{t-1} - FDI_{t-2}) \qquad (3).$$

As shown in the above equation (3), we start by adding ΔFDI_{t-1}, then ΔFDI_{t-2} etc.

The intention of including enough lags it to make sure that there will be no serial correlation in the error term due to the exclusion of a relevant lag variable from the model. Thus, the model is correctly specified. The number of lags can be based on the result of AIC and SIC using General Least Squares (GLS). The result is attached on Table 2.

The results of Dickey-Fuller Test for FDI series in levels and in first differenced form are compiled in Table 3 together. They are in accordance with our conjecture above. For the series in level, the test statistics is -3.280; we cannot reject the null hypothesis at 1% significance level. In contrast, the test statistics for the first differenced form is -6.550 < -2.608, which is significant even at 1% significance level. Therefore, we can reject our null hypothesis and conclude that the first differenced form is stationary.

Using R-squared to assess the effectiveness of regressions gives substantially misleading results for time series with trends. Murray (2001) showed using linear regressions on non-stationary time series data is a dangerous approach, which could produce spurious correlation, since standard detrending techniques can result in data that are still non-stationary. To avoid the risk of spurious correlation, we should apply Dickey-Fuller test to the errors rather than the series themselves. However, the only time series data series included in this project is FDI. Therefore, Cointegration Test is unnecessary and spurious correlation is not a concern.

In this project, I use $ln(FDI)_t$ as the dependent variable instead of directly using FDI_t. Taking log of a set of data with wide variation in its distribution reduces the distances between the observations, making it a more compact set and closer to a bell shape normal distribution. From a statistical point of view, one reason to take logarithm is because time series are heteroskedastic frequently. In usual, the local variance of the series is larger when the level of the series is higher. When this happens, it is likely that a stationary or integrated model can be fitted after the transformation. From an economic point of view, the regression coefficient of the log-transformed data is elasticity. If we run a regression model for $ln(FDI)_t$ and time, the regression coefficient is interpreted as a percent change in FDI. This elasticity-interpretation is more meaningful than just interpret the result in FDI numerical value without log transformation.

Before creating the empirical model, several hypothesis are formulated and provided:

(a) Seasonal Effects are involved in predicting future FDI.

Seasonal modeling techniques play important roles in forecasting FDI. To provide a visual check of the adequacy of seasonal effects for the FDI, we check the line chart of Shanghai's FDI in Figure 1 again. There is a substantial FDI decrease at the end of each year and it backs to the "normal" level at the beginning of next year. The line chart suggests Shanghai's FDI may depend on the month: it drops significantly on December and back to the approximate previous level on January next year. Therefore, we can create 12 seasonal dummies to better capture this seasonal characteristic.

Rawski (2002) attributed the evident seasonal pattern of large fluctuations of FDI to China's centrally planned economic regime. The author concludes that China's investment mechanism still keeps up an old tradition, in spite of its reform for more than two decades. The author also noted that the investment system would become an obstacle to China's future economic growth and a new measure is necessary to analyze the progress of reform.

(b) The model should include FTZ, the dummy variable which represents the SHPFTZ.

The project mainly discusses the FDI change brought by the establishment of SHPFTZ. Thus, it is intuitive to include the FTZ as a dummy variable. To check the coefficient is statistically significant is necessary to obtain a reliable conclusion.

(c) Future FDI will grow as a simple linear trend

A simple linear trend may be included in the model as well, in which case the model is

$$\ln(FDI)_t = \beta_0 + \beta_1 TIME_t + \beta_2 FTZ + \sum_{t=1}^{11} \gamma_i D_{it} + \varepsilon_t \quad (4)$$

where D_{it} are the monthly dummy variables; The variable $TIME_t$ is constructed as a time trend or time dummy.

In addition, I will employ Autoregressive Integrated Moving Average (ARIMA) models and combine that with the model listed above. The fact that FDI variation in time series is because of shocks such as national policies and economic conditions, which suggests the necessity of modeling time series with lags of current and past shocks. The current value of FDI may also be related to its past values, plus an additive stochastic shock. Therefore, combining autoregressive and moving average models should be a better strategy to forecast FDI in the future.

To combine all factors we considered so far, the final model I employ is

$$\ln(FDI)_t = \beta_0 + \beta_1 TIME_t + \beta_2 FTZ + \sum_{t=1}^{11} \gamma_i D_{it} + \varphi_1 \ln(FDI)_{t-1} + \cdots + \varphi_p \ln(FDI)_{t-p} + \varepsilon_t + \theta_1 \varepsilon_{t-1} + \cdots + \theta_\eta \varepsilon_{t-\eta} \qquad (5)$$

$$\varepsilon_t \sim WN(0, \sigma^2)$$

We examine all ARIMA (p,d,q) models with p and q less than or equal to 4. The AIC and the SIC will become guidance for deciding the exact value of p and q in ARIMA (p,d,q).

The Akaike information criterion, or AIC, is effectively an estimate of the out-of-sample forecast error variance, as is s^2, but it penalizes degrees of freedom more harshly. It is used to select among competing forecasting models. The formula is

$$AIC = e^{\left(\frac{2k}{T}\right)} \frac{\sum_{t=1}^{T} e_t^2}{T}.$$

The Schwarz information criterion, or SIC, is an alternative to the AIC with the same interpretation but a still harsher degrees-of-freedom penalty. The formula is

$$SIC = T^{\left(\frac{k}{T}\right)} \frac{\sum_{t=1}^{T} e_t^2}{T}.$$

It is widely accepted that financial data in Macroeconomics often exhibit volatility clustering, where time series show periods of high volatility and periods of low volatility. In fact, time-varying volatility is more common than constant volatility, and accurate modeling of time-varying volatility is of great importance in economic modeling. ARIMA models are used to model the conditional expectation of a process given the past, but the conditional variance given the past in an ARIMA model is constant. Thus, we need better time series models if we want to model the nonconstant volatility. ARCH time series models are becoming widely used in econometrics and finance because they have randomly varying volatility.

To test whether ARCH model is suitable or not for the dataset in this project, we can have a visual check first. We first estimate the mean equation, a regression of dependent variable $\ln(FDI)_t$ on a constant:

$$\ln(FDI)_t = \beta_0 + \varepsilon_t \quad (6)$$

This is an equation with just an intercept and the dependent variable. The Residual plot is shown in Figure 3. The volatility is somehow clustered: periods of large deviations from the mean are followed by other large deviations. Nevertheless, we cannot jump to the conclusion that ARCH model is suitable. The formal test employs The Lagrange Multiplier (LM). After we obtain the estimated residual, we run an autoregressive equation of residuals squared:

$$\hat{e}_t^2 = \gamma_0 + \gamma_1 \hat{e}_{t-1}^2 + \mu_t \quad (7) \quad \textit{where } \mu_t \textit{ is a random error}$$

$$Ho: \gamma_1 = 0$$

$$H_1: \gamma_1 \neq 0$$

Given ARCH effects ($\gamma_1 \neq 0$), R_e^2 will be relatively high due to dependence of $\hat{e}_t^2$ on $\hat{e}_{t-1}^2$. LM test statistics is $(T-q)R_e^2$ where T is the sample size and q is the order of terms in the equations. With ARCH (1), reject Ho if $(T-q)R_e^2 > \chi_q^2$ at a given confidence level.

Using command: estat archlm, lag(1/15), Stata provides the test result, reorganized in Table 4. The p-values for first several lags are statistically large. Thus, we cannot reject the null hypothesis. There is not enough evidence to show that using ARCH model is necessary. ARMA model mentioned above is fine.

Part Three: Linear Multiple Regression

In Linear Multiple Regressions, the model specification is fairly important. To build the model, we first consider the most fundamental determinants of FDI. Recall the basic production function:

$$Y = f\ (K, L)$$

where Y represents the output level (i.e., regional GDP), K denotes the capital (measured by Gross Capital Formation (GCF) as percentage of GDP), and L symbols the amount of labor (measured by labor force in the specific region). If the technology stays constant, any increase in the amount of labor and/or capital will increase the level of output. Obviously, foreign investments have more concern on the profitability. Cities with higher output level, capital and labor forces are tend to attract more FDI. In this model, GDP per capita (GDPP) calculated by real GDP divided each city's population will be used to represent the output level of a specific city, because there are large population disparities among different cities in China. What's more, FDI growth rate (FDIG) is calculated monthly and will be included in OLS because it is an indicator of foreign investors' confidence.

In addition, labor forces can be discussed and portioned into several categories: the human capital plays an important role in determining the labor quality. The human capital can be measured by illiteracy rates and university students' enrollment rates. Since labor quality directly affects labor productivity, and the growing technology-intensive manufacturing sector and services sector have created need for higher-quality labor, the labor forces L can be expanded using illiteracy rates (IR) and university students enrollment rate (UER).

Furthermore, transportation and management infrastructure (TRANS) should be included as well. Better transportation and management infrastructure tend to increase the accessibility and thus reduce operational and transportation costs. Rehman, Ilyas and Alam (2011) claim that foreign enterprises can further reduce the cost of doing business for public goods, which leads towards maximization profit. Recent empirical studies also propose that public goods have vital impact on cost structure and productivity of private firms. Erenberg (1993) assumes that if such kinds of infrastructure were not extend to local and multinational enterprises publicly, then these enterprise would be operating with less efficiency as they would have to build their own infrastructure which results in duplication and wastage of resources. Hence, the more public infrastructure, which reduces transportation cost for enterprises, the more FDI for an individual city in general.

Last but not least, it is necessary to include the international economic environment, macroeconomic policies and macro indicators in China. Ordinarily, low interest rates (IR) lead to more borrowing and also more investment. Low foreign exchange (FEX) rate makes investments in China more attractive because the lower cost of capital has made it easier for foreign enterprises to invest, to innovate. These two macro indicators are both critical to determine FDI in China.

Combined with these discussions aforementioned, the dependent variable is the realized FDI in different cities. The following equation is formed to test the effect of FTZ on realized FDI:

$$\begin{aligned} log(FDI_{it}) = \beta_0 + \beta_1 log(GDPP) + \beta_2 log(FDIG) + \beta_3 log(IR) \\ + \beta_4 log(UER) + \beta_5 log(InR) + \beta_6 log(FEX) + \beta_7 log(TRANS) \\ + \beta_8 log(FDI_{it-1}) + \beta_9 (FTZ_i) + \gamma_t + \varepsilon_{it} \quad (8) \end{aligned}$$

where FDI_{it} is the total realized Foreign Direct Investment for individual city *i* at time *t*, FTZ_i is a dummy variable assigned one for cities with free trade zones and zero for those which do not have. Analogously, γ_t denotes the time-fixed effect. In this project, the FDI is measured monthly so γ_t may contain 12 different terms, which represents a specific month individually.

Variable Name	Definition	Expected Sign	Source
$\log(FDI)_{it}$ $\log(FDI)_{it-1}$	Log value of FDI Lag value of Log FDI	/	Statistical Yearbook Starting Month: 2009 Jan
GDPP	GDP Per Capita	+	Statistical Yearbook
FDIG	FDI Growth Rate	+	Calculation
IR	Illiteracy Rate	-	Statistical Yearbook
UER	University Enrollment Rate	+	Statistical Yearbook
InR	Interest Rate	+	China Data Center
FEX	Exchange Rate	+	China Data Center
TRANS	Transportation	+	Statistical Yearbook
FTZ_i	Dummy of FTZ	+	Statistical Yearbook
γ_t	Monthly Dummies	/	China Data Center

V. Results

Part One: Difference in Difference Model

To use the DD model efficiently and intuitively, Table 5 is organized and lists the Difference and Difference-in-Difference column. Compared to Shanghai's FDI, Reference Group's FDI has decreased a lot, which is not the expected result. Examining the cause is fairly important. It brings the third question mentioned in the Empirical Methods part: whether the FDI increase in Shanghai is caused by the establishment of SHPFTZ or by the shift from other cities to Shanghai. If the latter one is the major reason, then the actual effect of attracting FDI by setting up FTZ is not as impressive as the news in Shanghai reports. The overall FDI does not increase in China overall and the FTZ may increase the imbalance of regional development. If this is the case, SHPFTZ can become evidence to reject the proposal of building another FTZ in other major costal cities in China. Thus, the total FDI in China should also be summarized and analyzed in the future research. More previous data before the establishment should be included in the formal research to test whether SHPFTZ has brought sufficient positive effect to total realized FDI or not.

If we compare the trend of FDI from 01/2009 to 10/2015, we can see an obvious increasing trend of realized FDI in Shanghai but a decreasing trend in some reference cities such as Suzhou. Whether the decrease of total realized FDI in Suzhou is because of economic shocks or because of shifting FDI to Shanghai is still in consideration. In addition, significance Tests will be performed later to test the hypothesis that SHPFTZ will boost the growth of FDI.

The OLS regressions results using DD model with formula 1 are compiled in Table 6. The R-square and adjusted R-squared are 0.947 and 0.941 individually, which are satisfactory results. The most obvious characteristic of results we gained is the statistically significance of the monthly dummies. It suggests that seasonal effects play an important role in the determinants of FDI both in Shanghai and the reference cities. Jiang (2013) mentioned in this work that FDI was the main source of flows to developing countries in the 1990s. Contrary to other capital flows, FDI is less volatile and does not show a pro-cyclical behavior.

The intercept for an individual city is also significant, which illustrates the geographical location is also a key component for FDI. It is worth noting that the most important independent variable in this model, the interaction form of FTZ and After is significant even at 1% level, which shows the establishment of SHPFTZ is one of the main cause for the increasing FDI in Shanghai recently.

Although it seems a positive sign to a certain level, some commentaries criticize that the relaxation of capital restriction and the liberalization of financial regulation in SHPFTZ are still far from satisfactory. The negative list still contains restrictions in almost 140 sectors, which is so long and comprehensive that the actual liberalizations it offered can be regarded as minimal.

In addition, there is a serious drawback for the DD model. DD estimation assumes that the treatment group (Shanghai in this research) and control groups (reference cities) have no other differences except the treatment (the establishment of SHPFTZ) and it is only appropriate if the treatment group is random. However, in this project, the treatment group Shanghai's FDI is obviously not random. What's more, DD may also involve inconsistency of the standard error, which makes significance tests inaccurate (Bertrand, Duflo and Mullainathan, 2004).

Part Two: Autoregressive Integrated Moving Average (ARIMA)

Table 7 presents estimates of the effects of $\ln(FDI)_t$ on the monthly dummy variables, time trend and the dummy variable FTZ, which is the most important research subject, without autoregressive regression and moving average techniques. R-squared is 0.804, which indicates the model explains 80.4% of the variability of historical FDI data around its mean. However, the coefficient before the variable FTZ is not significant even at 10% level and the coefficient is negative, which is out of my expectation. In comparison, most of the monthly dummy variables are significant even at 1% level.

The SIC and AIC values of Autoregressions models are compiled and organized in Table 8, using "corrgram" command to obtain plots of autocorrelation between $\widetilde{e_t}$ and $\widetilde{e_{t-j}}$ on Stata. The AIC criterion, which penalizes degrees of freedom less harshly, selects a lag value of 3, in accordance with the SIC criterion.

Though the scenario where the AIC and the SIC disagree does not happen in this case, Diebold suggests using the more parsimonious model selected by the SIC in his Elements of Forecasting (2008). If we consider a model selection strategy involving examination of not just the AIC and SIC but also autocorrelations and partial autocorrelations, which we advocate, we are led to the AR (3). The SIC, which penalizes degrees of freedom most heavily, is consistent. In spite of the theoretical asymptotic efficiency property of AIC, Diebold recommend use of the more parsimonious model selected by the SIC, other things being equal. This approach is in accord with the KISS (Keep It Strategically Simple) principle introduced in the book and with the results of studies comparing out-of-sample forecasting performance of models selected by various criteria.

The same testing strategy is employed in deciding the lag value of Moving Average model. Table 9 reports the results of OLS estimates of error on its lag values. The results suggest a strong serial correlation. The coefficient of the first lag value is significant that its p-value is 0.007. In contrast, the coefficient of the second lag value is not significant enough even at 10% confidence level. The parsimonious principal suggests using ARIMA (3,1,1) model, which is in accordance with the SIC criterion.

In conclusion, ARIMA (3,1,1) will be combined with the trend and seasonality model I discussed before. Thus, the complete model I use in this project is:

$$\ln(FDI)_t = \beta_0 + \beta_1 TIME_t + \beta_2 FTZ + \sum_{t=1} \gamma_i D_{it} + \varphi_1 \ln(FDI)_{t-1} + \varphi_2 \ln(FDI)_{t-2} + \varphi_3 \ln(FDI)_{t-3} + \varepsilon_t + \theta\varepsilon_{t-1} \quad (9)$$

$$\varepsilon_t \sim WN(0, \sigma^2)$$

The OLS results are present in Table 7. Both the R-squared and the adjusted R-squared are around 0.821, which means the model explains 82.1% of the variability of historical FDI data around its mean after combining ARIMA (3,1,1) with the model I first used. It is not a huge improvement and the model loses 3 observations because of 3 adding independent variables. Only one monthly dummy variable is significant at 10% level now. Obviously, the OLS results show that it is unnecessary to employ ARIMA technique.

In contrast, there are a few significant empirical attempts made by economists to examine the growth of FDI inflows and forecast using the ARIMA models. Perera

(2015) forecasts the FDI for Sri Lanka and other South Asian Countries for the period of 2013-2037 using ARIMA Model. Al-Abdulrazag and Bataineh (2007) forecast FDI inflows in Jordan for the period of 2004-2025 using Univariate ARIMA Model. Instead of checking AIC and SIC, they employ Box-Jenkins methodology to build ARIMA. Box-Jenkins model is also a very popular strategy to provide a simple means for choosing the effective forecasting models because of its convenience.

Forecasting inflow FDI in Shanghai is very important to economic policy-makers. The importance of this study arises from the fact that if SHPFTZ plays a key role in attracting FDI, then the policy-makers from different cities will learn from the experiment and this creation pattern of FTZ will gradually expand to whole China. Therefore, forecasting the volume of FDI in Shanghai in the near future provides policy-makers a clear vision of Macroeconomics, which helps them plan fiscal policies and monetary policies appropriately.

Serial correlation occurs in time-series studies when the errors associated with a given time period carry over into future time periods. When error terms from different (usually adjacent) time periods (or cross-section observations) are correlated, economists claim that the error term is serially correlated. Serial correlations are highly likely to occur in time series research. It will not affect the unbiasedness or consistency of OLS estimators, but it does affect their efficiency. With positive serial correlation, the OLS estimates of the standard errors will be smaller than the true standard errors. This will lead to the conclusion that the parameter estimates are more precise than they really are. There will be a tendency to reject the null hypothesis when it should not be rejected.

The traditional Durbin-Watson Test is not applicable in this project because ARIMA technique is used in the empirical methods part. It is important to note that the Durbin–Watson statistic, while displayed by many regression analysis programs, is not applicable in certain situations. For instance, when lagged dependent variables are included in the explanatory variables, then it is inappropriate to use this test. Durbin's h-test or likelihood ratio tests, that are valid in large samples, should be used.

In this project, I use the Breusch-Godfrey Test instead. It is another alternative to the Durbin-Watson test. It's designed to detect pth-order serial correlation, where p is selected by the user, and is also valid in the presence of lagged dependent variables. Table 7 shows the Breusch-Godfrey Test result run on Stata. The p-value is 0.5028, high enough to not reject the null hypothesis. Therefore, the test result suggests that there is no serial correlation in the dataset.

To monitor the potential heteroskedasticity problem, both White test and the Breusch-Pagan test are used to test the key assumptions of regression that the variance of the errors is constant across observations before running any regression. According to the result using the data already collected, p-values are 0.0163 and 0.0093 in White test and Breusch-Pagan test individually, shown in Table 11. The p-value for White Test and Breusch-Pegan test is small enough that we can reject the claim at 5% significance level. Pegan test only includes the independent variables of the first degree but White's test also includes the quadratic form and all interaction forms. Therefore, White's test is more powerful than Pagan test and we conclude heteroskedasticity is a concern here.

The most common remedy for heteroskedasticity is using heteroskedasticity corrected standard errors or Newey West method. Heteroskedasticity-corrected errors take account of heteroskedasticity correcting the standard errors without changing the original unbiased estimated coefficients.

The results of using Newey West method with lag one are also present in Table 7 at the last column. The p-value of F test is 0.0000, which is strongly significant even at 1% level. It is the evidence that the model used in this project can explain the historical $ln(FDI)$ and thus forecast it. Like the results we gained last time, most monthly dummies are significant at 1% level and it shows $ln(FDI)$ do have seasonal characteristics. The coefficient before the FTZ is still not statistically significant, which suggests the establishment of SHPFTZ is not the main cause for the increase of FDI in Shanghai, though its p-value decreases, compared to last regression results.

In economics, most independent variables are endogenous and partially affected by other regressors in the forecasting process. *VAR* forecast models using minimized AIC and SIC takes this feature of economic data explicitly into account. In times-series research, the Granger Causality Test is a tool to test whether one time series is useful in forecasting another. In this empirical model, I do not include any lag of other variables except $ln(FDI)$, which is the dependent variable. All the other independent variables are dummies and the trend. Thus, both VAR Forecast Model and the Granger Causality Test are not included in this project.

Part Three: Linear Multiple Regression Model

The regression results using all 410 observations collected from 5 cities are presented in Table 12. Compare with other two models in Part One and Part Two, Linear Multiple Regression Model has a lower R-square: 0.713. Nevertheless, all three models employed in this research reveal a strong seasonal effect in analyzing determinants of FDI. The establishment of a FTZ is also an important factor in increasing FDI, shown by the significance at 1% level.

In addition, GDP Per Capita (GAPP), Illiteracy Rate (IR), University Enrollment Rate (UER) and Free Trade Zone (FTZ) Dummy are significant at 1% level, while other independent variables such as Interest Rate (InR), are not significant at all.

As expected, GDP Per Capita has a strong positive relationship with FDI inflow to a specific city. Nevertheless, some economists such as Tang and Selvanathan (2008) argued that China's GDP does not have much impact on inward FDI in the long run, because of excessive official involvement. Even worse, Rawski (2001) expresses doubts about the GDP statistics provided by official claims. The author speculated that official Chinese statistics contain great exaggerations and contain multiple inconsistencies.

The Chinese Interest Rate (InR) has the expected positive sign but it is not significant during the current time period. This illustrates higher returns to capital in Shanghai, China make the foreign investments more attractive. However, the positive effects may not be contemporaneous, but with time lags. The same scenario happened in USA during 1970-1999. While the US Government implemented a proactive fiscal policy and a moderately easy monetary policy with an unprecedented intensity of stimulus and at the same time kept fiscal and financial risks under control, the FDI and portfolio flows did not change much.

An approximate proxy measures the infrastructure soundness (TRANS), which is the total length of highways. It is not found to be significant in the model. While many economists believe that the requirement of efficient infrastructure services, such as water and sanitation, power and transportation, is an important determinant for economic growth and sustainable development in developing countries, in the research done by Kirkpatrick, Parker and Zhang (2006), they find a negative relationship between the physical infrastructure and FDI. They explain that more FDI is attracted to countries where the need for additional infrastructure is greater, and thus the investment can achieve higher returns. In addition, policy-makers cannot neglect the so-called “governance” infrastructure, which contains legislation transparency and the efficiency of legal process. Globerman and Shapiro (2002) claimed that governance infrastructure is also a key component for attracting FDI.

What surprised me most is the significance of Illiteracy Rate (IR) and University Enrollment Rate (UER). Noorbakhsh, Paloni, and Youssef (2001) evaluate the significance of human capital in pursuing FDI in several developing countries and conclude that human capital is one of the most important components. Its influence will gradually increase as time goes on in the long run. Therefore, they suggest developing countries establish programs to assist workers to find a new skill set and seek employment in a new industry sector or improve, upgrade their existing skill set to further increase human capital. Blomstorm and Kokko (2003) also use empirical evidences to show that training institutions such as business schools can attract FDI for host countries.

Another unexpected result is the insignificance of the Foreign Exchange Rate (FEX). The initial hypothesis is that higher exchange rate (¥/$) will give Chinese manufactures an advantage over their foreign competitors and thus makes Chinese goods cheaper in the rest of the world. It is exactly why China keeps its currency glued to the lowest numeral imaginable. Goldberg and Kolstad (1994) provided an alternative idea to link between the exchange rate variability and the foreign investment, through risk aversion hypothesis. One of their principal arguments is that higher foreign exchange rate variability lowers investors' certainty. Through rigorous analysis, they claimed that risk aversion theorem is more reliable in the short run. It is interesting to note that they did not find evidence that the change of foreign exchange rates in the short run significantly affect demand shocks, which is very similar to my results obtained in this project. Therefore, we conclude the exchange volatility is as important as the numerical value. The exchange rate uncertainty discourages investment (Escaleras and Thomakos, 2008) and is an indicator of the economic instability that makes some countries unattractive to foreign investors.

One-period-lag of FDI and the FDI growth rate seem only to have a weak positive influence on FDI in different cities. If seasonal components have a great impact on FDI, then may be to include one-year lag of FDI is a better strategy.

VI. Conclusion

This project has considered different methods to improve our understandings of the FDI change after the establishment of SHPFTZ data, using monthly data from Jan 2009 to Oct 2015. Three different empirical models including Difference in Difference, ARIMA and Linear Multiple Regressions are employed in analyzing inward FDI and their results are not exactly consistent. Results obtained from Difference in Difference model and Linear Multiple Regressions Model suggest SHPFTZ is one of the principal causes for the increase of inward FDI in Shanghai. In contrast, the positive effect does not fully reflect in ARIMA Forecasting Model.

Although the outcomes from three different empirical models are not completely similar, my results support the hypothesis that the seasonal effect, characterized by the month, are crucial factors for explaining and forecasting the volatility of FDI experienced in different cities. The results suggest that there are significant seasonal effects on the FDI particularly during the summer and the autumn.

Till now, the research does not discuss the fourth question proposed in Empirical Methods Part: whether the experience obtained by establishing SHPFTZ can be applied to other cities. It is not a coincidence that the Pilot Free Trade Zone to be established in Shanghai. Shanghai is the most metropolitan city in China and it has become the economic and financial center in China even in the whole world. Consisting of only 0.06 percent of China’s total area, Shanghai’s GDP accounted for about 3.8 percent of China’s total in 2013. Shanghai leads China in the international economic and trade sector, which accounts for 14.3 percent of FDI in China. However, the performance of the SHPFTZ over the past year has been below expectation. The SPFTZ has not achieved the economic liberation many hoped it would provide. The 2013 version of the negative list was seen as no more than a replication of the Foreign Investment Industrial Guidance Catalogue. The 2014 list reduces restrictive regulations from 190 to 139, which is seen as a step forward, but the actual effect may need more consideration.

It must be admitted that there are still limitations on this study, which may affect our previous findings and interpretations. Faeth (2005) listed at least 8 theoretical models to explain FDI including Neoclassical Trade Theory and Heckscher-Ohlin model, Ownership advantages based on imperfect competition etc. There is a wide range of factors can be examined to determine whether they are influential in attracting FDI for a specific city. More rigorous methods or tests may be available for us to build a better model to fit this dataset and give us a more reliable analyzing model for FDI in Shanghai and other cities in China. By checking the average and standard deviation of FDI in Shanghai and other reference cities, the FDI shifting hypothesis becomes susceptible and serious in analyzing total FDI in China. Thus, further improvements on this study are needed.

The study systematically compares the large fluctuations and changes of FDI before and after the establishment of SHPFTZ by using independent variables based on a combination of different theoretical models, even with the limitations mentioned above. It also highlights the need for understanding better the nature of FDI and the links between investment decisions and such factors as exchange rates.

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APPENDIX

Table 2: DF-GLS for FDI (Number of Observations = 82)

Lags	DF-GLS Tau Statistics	1% Critical Value	5% Critical Value	10% Critical Value
11	-1.197	-3.648	-2.739	-2.465
10	-2.643	-3.648	-2.779	-2.504
9	-3.968	-3.648	-2.818	-2.542
8	-5.528	-3.648	-2.857	-2.579
7	-6.919	-3.648	-2.896	-2.615
6	-6.614	-3.648	-2.933	-2.650
5	-4.435	-3.648	-2.968	-2.683
4	-4.515	-3.648	-3.001	-2.713
3	-5.086	-3.648	-3.031	-2.741
2	-5.394	-3.648	-3.059	-2.767
1	-4.628	-3.648	-3.083	-2.788

Table 3: Augmented Dickey-Fuller Test For Unit Root

	Test Statistics	1% Critical Value	5% Critical Value	10% Critical Value
Z (t)	-3.280	-3.538	-2.906	-2.588

MacKinnon approximate p-value for Z (t) = 0.0158

D. FDI	Coefficient	Std. Error	t	Prob >|t|
L1. FDI	-0.2774631	0.0845893	-3.28	0.002
LD. FDI	-0.0040007	0.1190801	-0.03	0.973
Constant	3.482774	1.073239	3.25	0.002

	Test Statistics	1% Critical Value	5% Critical Value	10% Critical Value
Z (t)	-6.550	-2.608	-1.950	-1.610

D2. FDI	Coefficient	Std. Error	t	Prob >|t|
LD. FDI	-1.172557	0.1790058	-6.55	0.000
LD2.FDI	0.0172875	0.1183009	0.15	0.884

Table 4: LM test for autoregressive conditional heteroskedasticity (ARCH)

Lags (p)	**Chi-square**	**df**	**Prob > Chi-square**
1	1.896	1	0.1686
2	1.893	2	0.3881
3	2.421	3	0.4897
4	3.166	4	0.5304
5	3.136	5	0.6791
6	3.096	6	0.7967
7	4.218	7	0.7544
8	4.428	8	0.8166
9	4.740	9	0.8564
10	5.014	10	0.8902
11	7.831	11	0.7283
12	19.670	12	0.0736
13	19.337	13	0.1130
14	19.217	14	0.1568
15	20.910	15	0.1397

H_0: No ARCH Effects VS. H_1: ARCH (p) Disturbance

Table 5: Shanghai and Reference Cities: Realized FDI, Total Import and Total Output Before and After the Establishment of SHPFTZ

	Shanghai		Reference Cities		Differences		Differences in Differences
	Before SHPFTZ	After SHPFTZ	Before SHPFTZ	After SHPFTZ	[(2)-(1)]	[(4)-(3)]	[(5)-(6)]
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Realized FDI (US$100 million)							
	15.31	16.50	11.00	7.96	1.19	-3.14	4.34
	(1.68)	(3.3)	(2.78)	(2.7)	(0.98)	(3.19)	(2.89)
Total Import (US$100 million)							
	250.53	404.25	108.91	113.68	40.49	2.42	38.07
	(30.71)	(42.62)	(17.15)	(10.51)	(49.57)	(6.8)	(45.23)
Total Output (US$100 million)							
	404.25	404.91	144.82	152.33	-1.09	5.97	-7.06
	(42.62)	(75.72)	(19.86)	(21.65)	(56.53)	(10.9)	(53.96)

Standard Deviations in Parentheses

Table 6: OLS Estimates for the ln(FDI) Using DD Model

Variables	**(1) ln(FDI)**
Month_1	1.935***
	(0.156)
Month_2	2.043***
	(0.156)
Month_3	2.090***
	(0.156)
Month_4	2.063***
	(0.156)
Month_5	1.948***
	(0.156)
Month_6	2.047***
	(0.156)
Month_7	1.976***
	(0.156)
Month_8	1.944***
	(0.156)
Month_9	1.973***
	(0.156)
Month_10	1.715***
	(0.159)
Month_11	1.588***
	(0.168)
FTZ	0.411**
	(0.183)
After	-0.073
	(0.128)
Interaction	0.699***
	(0.132)
Observations	410
R-squared	0.947

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7: OLS Estimates for the ln(FDI) Using ARIMA (3,1,1), Time And Dummies

Variables	(9) ln(FDI)	(5) ln(FDI)	Newey-West ln(FDI)
Month_1	0.367	0.145*	0.145
	(0.327)	(0.082)	(0.123)
Month_2	0.278*	0.301***	0.301**
	(0.110)	(0.081)	(0.126)
Month_3	0.105	0.397***	0.397***
	(0.255)	(0.081)	(0.134)
Month_4	0.072	0.512***	0.512***
	(0.413)	(0.081)	(0.135)
Month_5	-0.174	0.428***	0.428***
	(0.615)	(0.081)	(0.130)
Month_6	-0.014	0.437***	0.437***
	(0.465)	(0.081)	(0.130)
Month_7	0.0980	0.540***	0.540***
	(0.479)	(0.081)	(0.081)
Month_8	-0.094	0.533***	0.533***
	(0.664)	(0.081)	(0.131)
Month_9	-0.035	0.580***	0.580***
	(0.651)	(0.081)	(0.148)
Month_10	-0.393	0.297***	0.297**
	(0.754)	(0.081)	(0.130)
Month_11	-0.038	0.176**	0.176
	(0.234)	(0.084)	(0.113)
Time	-0.005	0.010***	0.009***
	(0.017)	(0.001)	(0.001)
FTZ	0.039	-0.087	-0.087
	(0.1578)	(0.0589)	(0.0537)
Lag (1).lnfdi	1.637	/	/
	(1.809)	/	/
Lag (2).lnfdi	0.014	/	/
	(0.132)	/	/
Lag (3).lnfdi	-0.179		
	(0.124)		
Lag (1).Error	-1.320	/	/
	(1.814)	/	/
Constant	1.660	-4.027***	-4.027***
	(6.910)	(0.025)	(0.704)
Observatios	79	82	82
R-squared	0.8214	0.804	/

Standard errors in parentheses
*** p<0.01, ** p<0.05, *p<0.1

Table 8: AIC and SIC Values, Various Autoregressive Models

Lag Value	AIC	SIC	Q	Prob>Q
1	0.3106	0.3116	8.2026	0.0042
2	0.0563	-0.0451	8.4751	0.0144
3	-0.1518	-0.1783	10.484	0.0149
4	-0.1462	-0.0449	12.371	0.0148

Table 9: OLS Estimates of Errors On Its Lag Values

Error	Coefficient	Std. Error	t	P > |t|
L.1	0.3202807	0.1163205	2.75	0.007
L.2	0.0119205	0.119994	0.10	0.921
L.3	-0.1723982	0.120012	-1.44	0.155
L.4	-0.0028044	0.1157861	-0.39	0.699

Table 10: Breusch-Godfrey LM Test For Autocorrelation

Lags (p)	Chi-Square	df	Prob > Chi-Square
1	0.449	1	0.5028

H_0: No Serial Correlation

Table 11: White's Test for Heteroskedasticity

Source	Chi-Square	df	p-value
Heteroskedasticity	57.67	68	0.0163
Skewness	14.17	13	0.3623
Kurtosis	3.50	1	0.0612
Total	75.34	82	0.0150

Table 12: OLS Estimates for the ln(FDI) Using Linear Multiple Regressions

	(8)	
Variables	**ln(FDI)**	**Standard Deviation**
Month_1	0.114	(0.116)
Month_2	0.281**	(0.116)
Month_3	0.386***	(0.116)
Month_4	0.511***	(0.116)
Month_5	0.438***	(0.116)
Month_6	0.456***	(0.116)
Month_7	0.569***	(0.116)
Month_8	0.572***	(0.116)
Month_9	0.628***	(0.116)
Month_10	0.298**	(0.116)
Month_11	0.166	(0.120)
GDPP	0.734***	(0.290)
FDIG	0.190	(0.340)
IR	-0.573***	(0.273)
UER	1.22***	(0.132)
InR	0.127	(0.274)
FEX	0.243	(0.244)
TRANS	-0.256	(0.227)
FDI_{t-1}	0.244	(0.430)
FTZ	0.314***	(0.050)
Observations	410	
R-squared	0.713	

*** p<0.01, ** p<0.05, * p<0.1
Standard errors in parentheses

Figure 1: The FDI in Levels From 01/2009 to 10/2015

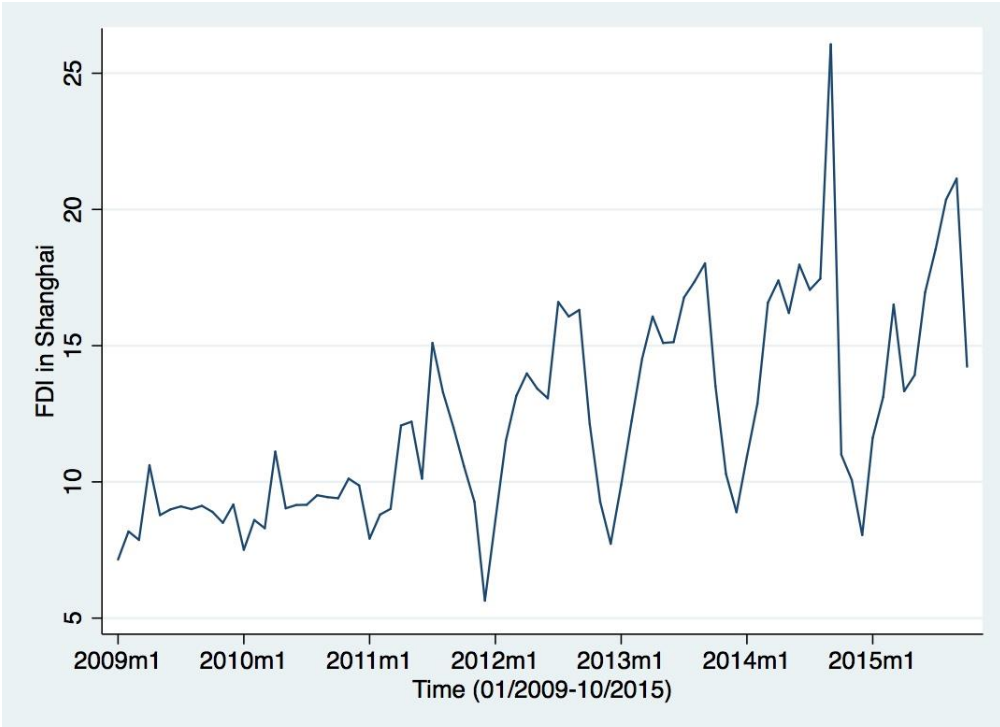

Figure 2: The First Difference of FDI From 01/2009 to 10/2015

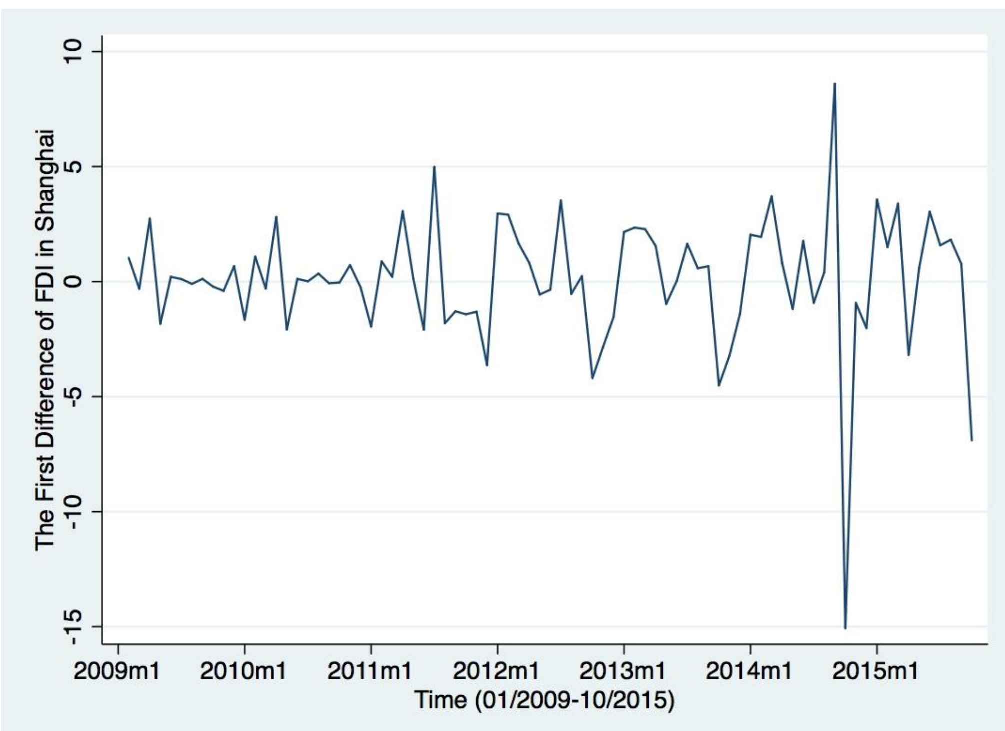

Figure 3: GARCH Residual