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‘Capital controls and their effect on stock market prices and volume of trade: The cases of Greece and Cyprus

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Abstract

In theory the imposition of capital controls could increase the firms' cost of capital, curb investment, and hence cause a drop in the share prices. Further, the credit constraints created by the imposition of capital controls are also more likely to be binding for firms that depend heavily on external rather on internal finance.

This dissertation evaluates the effects of capital controls on the Cypriot stock market on two fronts. Particularly, the study examines, using monthly time-series data, the effects of capital controls on the *market capitalization* (its level, absolute, and percentage changes) of the Cypriot stock exchange. The study also, using daily data, looks at the effects of capital controls on the daily index value, actual returns, and cumulative returns, of the Cypriot *stock market general index*.

The effect of capital controls is examined within the framework of event-study analysis, where the study's "event window" is defined as the period under which the Cypriot economy was under the influence of capital controls, that is, over the period spanning from March 2013 to April 2015. The "estimation window" of the analysis runs for an equal number of months prior and after the period of capital controls.

The empirical evidence do not point to any significant decline in cumulative abnormal returns for Cypriot stock market following the imposition of capital controls in March 2015, and for as long they remained in place. The general conclusion that can be derived from the study's empirical findings is that that Cypriot stock exchange was largely unaffected by the imposition of capital controls.

Keywords: capital controls, market capitalization, stock market, Cyprus

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Preface

In the past, many Emerging Market Economies (EMEs) and advanced economies had to weather the potentially harmful effects of capital outflows on the economy's growth record, and, in general, on the stability of the financial system. The most well-known examples are the cases of Argentina (over the period 2001–2002), Iceland (2008), and Ukraine (2008). Predominantly, capital outflows have to do with developments in the domestic market. For example, a currency crisis developed in Argentina due to the fact that the economy's macroeconomic policies, which were in place, were largely unsustainable; in Iceland an overly-growth banking sector collapsed thus causing large capital outflows; In Ukraine the weak management of the macroeconomic brought about a banking and currency crisis.

There is also the possibility that such outflows could be down to global causes (like for example a sudden shift in the global investors' risk appetite or changes in interest rates), which lie outside the control of the country. However, the cases of Cyprus (2013) and Greece (2015) made quite clear how much the mal-management of the domestic economy will eventually trigger, in an era of open capital markets, the domestic residents' need to channel their funds abroad, into "safety" and away from the economically precarious domestic environment.

The effectiveness of capital controls on outflows is judged on the ground of whether they put an end in the drainage of capital. So, it seems that the basic precondition for the effectiveness of constraints on capital outflows is for consistent (and sound) macroeconomic policies to be in place. For example, in the case of Argentina (2001–2002) and Ukraine (2008) where the fiscal policy was inconsistent with exchange-rate-regime policy), the controls imposed on capital did not make much of a difference.

Contents

Chapter 1: INTRODUCTION

The first chapter begins with some background information of the dissertation's topic (Section 1.1), i.e. historical information on the imposition of capital controls in both Cyprus and Greece. Then, it goes with the discussion of the study's main research question (Section 1.2), and it ends with the presentation of the dissertations' structure (Section 1.3).

1.1 BACKGROUND INFORMATION

In their most general form, **capital controls** involve financial measures taken by the government or the country's Central Bank as to limit capital inflows into and/or outflows from the domestic economy. There are extraordinary measures taken by a country's banking system as a measure to be protected by a looming bank run on its deposits (see Magud et al, 2011).

These measures can be applied either to the whole economy or to specific sectors (for example the financial sector, or to some strategically important industries). They can also be applied either to all capital flows, or they can be differentiated by the type of capital flow (e.g. loans, equity investments) or the duration of the capital flow (short-term, medium-term, long-term flows). Capital controls can greatly affect the financial performance of a country, since they afflict various classes of assets such as stocks, bonds, foreign exchange transactions, import duties products and the level of exports. Finally, capital controls can be imposed either on inflows or outflows.

There are several reasons that may prompt the residents and investors, alike, in a country to start wanting to channel their funds outside the country (see Forbes and Warnock (2011)). To begin with, a deterioration (due to, perhaps, a random shock) of the country's terms of trade could give rise to depreciation expectations. Another reason, could be the application of an *inconsistent macroeconomic policy,* which eventually calls for a macroeconomic adjustment as a policy response. In this case the implementation of capital-control measures may be for the required macroeconomic adjustment to take

place. Finally, capital outflows could be the result of a sagging confidence in the country's financial system, or the result of *global changes*, like for example, an increase in investors' risk aversion (and an "appetite" for the safety of advanced economies) or a restrictive monetary policy in the main advanced economies.

Capital-control outflows were imposed in both Cyprus and Greece, and this decision was a result of the debt crisis as well of political decision making. The imposition of capital controls in Greece and Cyprus did not aim to stabilize the countries' balance of payments or to protect the loss of foreign-exchange reserves, rather it was a temporary measure (in the case of Cyprus) aiming at curtailing deposit outflows and safeguarding the domestic financial system stability.

Some of these capital-control measures involved the following

- Increased transaction taxes.
- Withdrawal limits from the ATMs.
- Limited access to bank accounts for both individuals and businesses.
- Control in the export and import activity.
- Prohibition of early withdrawals from time deposits.
- Checks over a certain amount of money could not be redeemed; bank checks were redeemable however.
- Limited use of credit / debit cards within the country.
- Limits on transactions with foreign sector.

1.2 AIM AND RESEARCH QUESTIONS

In theory, the imposition of capital controls is expected to increase the cost of capital and hence reduce private-sector investment. Further, the credit constraints are expected to be quite restraining for firms relying too much debt capital for financing their operations. However, firms that can more easily

access debt capital at low cost may be able to weather the limitations barriers brought about by the imposition of capital controls.

To this end, the aim of this dissertation is to explore the impact of the imposition of the capital controls in the cases of Cyprus and Greece. Particularly, we want to examine how the stock market in these two countries reacted, and in which of the two the impact was stronger and why.

The main hypothesis of the dissertation is the following: “The imposition of capital controls adversely affected the stock markets in Greece and Cyprus. To investigate the specific hypothesis, we rely on an event study around the date of announcement of the capital control measures, focusing on the effect of these measure of aggregate stock-price indices. If the research hypothesis holds, then we should expect statistically significant decline in cumulative abnormal stock-market returns, in the wake of the imposition of capital controls.

Chapter 2: LITERATURE REVIEW

Capital controls limit the unrestricted international flow of capital. They can be imposed either on *capital inflows,* through taxation, whenever these flows tend to appreciate the international value of the domestic currency, thereby reducing exports, or on capital outflows, through limitations on withdrawals or remittances. At any rate, the affect the country's capital-account (Section 2.1).

According to financial theory the liberalization of capital flows leads to a reduction of their costs, while financial systems, through free competition, do gain in flexibility and efficiency. "Open capital (and money) markets" essentially ensure the discipline on the part of national governments, which are forced to align their fiscal spending plans with the demands of the markets, otherwise they will face high costs for their sovereign bonds.

2.1 THE CAPITAL ACCOUNT OF THE BALANCE OF PAYMENTS

Capital controls essentially are imposed on components of the country's *capital account*, which is part of its balance of payment.

A country's **capital account** records the transactions (i.e. purchases and sales) by its residents on *physical assets* (for example factories and property) and *financial assets* (*for* example government securities and equities). Table 1-2 presents the five basic components of a country's capital account. These components are (a) the private foreign direct investments (FDI); (b) private loans; (c) private portfolio investments; (d) governmental and multilateral flows; and (e) residential transfers.

Table 1: The Components of the Capital Account

CAPITAL ACCOUNT COMPONENT	Description
A. PRIVATE DIRECT FOREIGN INVESTMENT	Purchases by Japanese of US real estate (+)
	Investment in plant expansion in Ohio by Honda (+)
	New investment in a German chemical plant (-)
B. PRIVATE LOANS	Foreign loans by private international banks (+)
C. PRIVATE PORTFOLIO INVESTMENTS	Purchases by the French of IBM stock (+)
	Deposits in Swiss banks by Americans (-)
	Purchases of Japanese stocks and bonds (-)
D. GOVERNMENT AND MULTILATERAL FLOWS	
D1. Loans	Purchases of US Treasury bonds by Bank of Japan (+)
	A World Bank Loan (+)
D2. Grants	

D3. Debt Amortization	Gradual reduction of the principle on former loans (-)
E. RESIDENTIAL CAPITAL OUTFLOW	Wealthy LDC nationals, who sent vast amounts of money into developed-nation bank accounts, stock and bond purchases, and real estate (-)

The capital account essentially captures the difference between *capital inflows,* and *capital outflows.* **Capital inflows** result from the *sale of assets* to foreigners, while **capital outflows** involve the *purchase of assets* from foreigners.

So capital inflows correspond to increases in domestic liabilities, while capital outflows correspond to an increase of domestic assets abroad. Specifically, the change in the foreign assets (FA) held by the domestic private sector represent the **private capital outflows**, and the change in the foreign assets held by the public sector stand for the **government capital outflows** (the latter is the change in the official foreign reserves of the government sector. Likewise, the change in the foreign liabilities (FL) of the domestic private held by the foreigners represent the **private capital inflows**, while the change in the foreign liabilities of the public sector stand for the **government capital inflows.** If a country's net foreign assets are positive, this means that the country is a creditor country, while if net foreign assets are negative, the country is a debtor country.

2.2 THE LITERATURE ON THE EFFECT OF RESTRICTIONS ON CAPITAL INFLOWS

The literature on the restrictions placed on capital inflows has shown (for example see Ariyoshi et al 2000; Baba and Kokenyne 2011; and Magud *et al.*, 2011) that such restrictions ease the pressure on the domestic currency to appreciate, give the monetary authorities the freedom for the conduct of a relatively more free monetary policy, and (as expected) shift the composition of capital inflows in the direction of investments with lower maturities. Furthermore, a particular study (see Binici *et al* (2010)) documented that restrictions on capital outflows turned out to be more effective when they are imposed by an advanced economy than by a less advanced economy; the reason for this has to do with the improved institutional and regulatory environment advanced economies enjoy relatively to less advanced economies.

2.2.1 The Study of Alfaro *et al.* (2014)

Alfaro *et al.* (2014), using of quarterly data over the period 2006/Q1- 2012/Q4, assessed the effects of capital controls on firm-level stock returns and real investment in Brazil.

Brazil imposed controls on the capital inflows with the purpose to contain the sustained increase in the international value of its currency. The Brazilian economy grew consistently during the 2000s, as commodity prices surged, and Brazil being a main commodity-export nation. The boom in commodity prices was accompanied by increased capital inflows, thereby putting upward pressures on the Brazilian Real (BRL). Indeed, the exchange rate USD/BRL, in 2008, traded at 1.6 BRL to USD, while four year ago, that is, in 2004, it had reached a high of 3.1 BRL the USD. The Brazilian government in order to restrict the excessive capital inflows into the country, and the stabilize the exchange rate (USD/BRL) from further dropping (i.e. in order to avert a further strengthening of the Brazilian currency), introduced, in March 2008, controls on capital inflows, by imposing a financial-transactions tax of 1.5% incoming foreign fixed-income investments. Despite these controls the appreciation of the Real kept on, and as of the end of end of October 2010, the tax on capital inflows for fixed-income investment reached 6%. However, as of December 2011, the financial tax of 2% capital inflows for equities was ditched.

The authors, within the framework an event-study methodology, estimated an econometric model where the dependent variable was the *cumulative abnormal return* on the stock of firm *i* over the event window *t*. The empirical results of the study revealed that across all events, a significant (at the 1% level of significance) average decline in stock returns was observed to the tune of 0.43% over a two-day window (surrounding the capital control announcements).

Controlling for the effect of *firm size* (with the size variable measured by the lagged value of total firm assets), the authors found that the cumulative abnormal returns fall on average by statistically-significant 3.39%. Since the coefficient on the control variable for firm size was positive, this implies that for large firms the effect of capital-control announcements on their cumulative abnormal returns was less. Controlling for the effect of the firm being an *exporting company,* the average decline in abnormal cumulative stock returns was 3.48%.

The authors found a significant decline in cumulative abnormal returns for Brazilian firms following the imposition of capital controls in 2008-2009. Conditioning on firm-characteristics such as firm size and export status, the empirical evidence revealed that large firms and the largest exporting firms were less affected by the controls.

Firms that are more dependent on external finance are however more adversely affected by the controls. The evidence is consistent with the hypothesis that capital controls increase market uncertainty and reduce the availability of external finance, which in tur lowers investment at the firm-level.

2.3 THE LITERATURE ON THE EFFECT OF RESTRICTIONS ON CAPITAL OUTFLOWS

The main objective of placing restrictions on capital outflows is to mitigate the tendency for capital outflows from the country.

2.3.1 Various Case Studies

The literature on the effects of controls on capital outflows involves, as it is expected, a significant number of case studies, carried out within the framework of event-study methodology. In a relatively recent survey of literature by Magud *et al.* (2011), it was shown that controls on capital outflows have a limited effectiveness, in stemming the domestic capital from flowing abroad, barring Malaysia back in 1998.

2.3.2 The Study of Saborowski *et al.* (2014)

Saborowski *et al.* (2014), using a sample of 37 emerging market economies, over the period 1995Q1-2010Q4, examined the effectiveness of the imposition of restrictions on capital outflows on reversing net capital outflows, and on stabilizing the country's exchange rate and interest rate stabilization, thereby allowing monetary authorities a greater monetary-policy independence.

The authors made use of a panel vector autoregression approach, where the endogenous variables were (1) an outflow control index, (2) net assets as a percent of GDP, (3) the interest rate, (4) the inflation rate, (5) the local currency/USD exchange rate, and (6) the net capital flows (either inflows or outflows) as a percent of GDP.

The empirical results of the study revealed that measures of capital-outflow tightening are effective if they are implemented within a framework of sound macroeconomic fundamentals or good institutions, or capital-outflow restrictions were already in place (that is, when the value of the *outflow control index* was already relatively high at the time of application of the capital controls on outflows). If these conditions are not met, then a tightening of capital-outflows restrictions fails to reduce net capital outflows from the country, due to a sizeable reduction in gross inflows. So, if countries with sound macroeconomic fundamentals or strong institutions impose restrictions on capital outflows, this will eventual indeed lead to an important drop of net capital outflows from the country.

2.3.3 The Study of Paricha *et al.* (2015)

Pasricha *et al.* (2015) examined, on the one hand, whether capital controls can be employed to manage the macroeconomy, and, on the other hand, if they could for macroeconomic policy purpose, how these controls would affect the capital flows in the economy. In addition, the authors examined the spillover effects of capital control actions by the major EMEs.

The original sample of the study consisted of 21 EMEs, which comprise the MSCI Emerging Markets Index, along with Argentina. Then, three central and eastern European countries were excluded from the sample (i.e. Czech Republic, Hungary and Poland), since, according to the authors, the capital control measures they took since 2001 were mainly down to the process of accession into the EU. Additionally, two other countries, specifically Taiwan and Morocco, were excluded from the sample due data limitations. As a result, the final sample included 17 countries observed over the period 2001/Q1 το 2011Q4.

The *endogenous variables* of (the baseline) model included, the following variables, at quarterly frequency:

- net inflow tightening.
- net outflow easing measures.
- The spot exchange rate against the US dollar.
- A monetary-policy autonomy measure.
- a capital flow variable.

The first two variables captured the capital-control measures taken by the governments, and these measures aimed at restricting both the capital inflows and the capital outflows. The spot exchange rate involved the quarterly change of the spot exchange rate of the local currency vis-à-vis the US dollar, and hence an increase in the value of the exchange rate implied an appreciation (depreciation) of the dollar (domestic currency) vis-à-vis the domestic currency (dollar). The measure of monetary policy autonomy that was used was the **Aizenman-Chinn-Ito index** of Monetary Policy Autonomy, an index-

computed as the reciprocal of the within-quarter correlation of the interest rates between the home country and the base country (i.e. the US), using daily data for money market interest rates. A monetary policy autonomy corresponds to a higher level of the index, which, by construction, can fluctuate between 0 and 1.

The capital flow variable included all capital flows excluding FDI and transactions for monetary authority and genera government in the "other investment" category

The **exogenous variables** of the model included the following variables

- The global real GDP growth,
- The increase in the S&P 500 index,
- The US inflation rate
- A dummy for quantitative easing in the U.S.
- A dummy for the global financial

2.4 CASE STUDIES OF CAPITAL CONTROLS ON OUTFLOWS

2.4.1 The Case of Iceland

In the wake of the global financial crisis in 2007-08, Iceland experienced the collapse of its three largest commercial banks, all of which were burdened with short-term foreign liabilities, to the tune of 600% of GDD (see Saborowski *et al.* (2014)).

The turmoil caused by the aforementioned event, prompted a wave of panic capital outflows, which, as expected, put significant downward pressures on the domestic currency. As a result, the government of Iceland, in November 2008, decided to impose comprehensive restrictions on capital outflows from the country in an effort to stabilize the international value of the domestic currency. The measures taken involved restrictions on capital transactions applied to residents and nonresidents alike, like for example the banning on the movement of capital. No restrictions were placed however on foreign exchange transactions needed to be carried out within framework of external-trade activities.

2.4.2 The Case of Ukraine

The impact of the 2007-2008 financial manifested in Ukraine through a collapse in its exports, a sharp deterioration of its terms of trade, and a wave massive capital outflows. As a result, the country's Central Bank, as to reduce the wave of capital outflows and stabilize the exchange rate of the *hryvnia* (Ukraine's domestic currency), imposed exchange-rate restrictions and a 5-day waiting period for non-residents wishing to convert their domestic-currency-denominated proceeds on their local investments into foreign currency. But despite the application of tightening measures on capital outflows, Ukraine's stock of international reserves dropped by 30 percent six months in the wake of the exchange restrictions.

2.4.3 The Case of Cyprus

The roadmap of the Cypriot debt crisis and the ensuing capital controls involved two landmarks.

The first one was back in 2011, in the midst of the debate on the Greek PSI, Cyprus takes a hit from the explosion in its the naval base "Evangelos Florakis", which resulted in pecuniary losses to the tune of €1.5 billion; that was a huge amount, considering the fact that the size of the Cypriot GDP in 2011 was stood at €20.2 billion. The second landmark involved the Greek PSI per se. Cypriot banks having a large exposure to Greek government bonds, took a heavy blow from the restructuring of the Greek debt, losing in total, close to 4.5 billion euros on the Greek bonds they held in their books, amounting to 25% of the GDP of Cyprus.

Then following the downgrades of Cyprus' credit rating, the yield on its 10-year bond climbed above 12%, thereby rendering any funding from the markets highly prohibitive. Finally, after receiving € 2.5 billion a loan of from Russia, at an interest rate of about 4.5%, Cyprus officially asked Europeans for help.

In the meantime, the banking crisis in Cyprus had peaked with the closure of the banks between March 16 and 28, 2013. During that period, and specifically until Friday, March 22, the daily cash withdrawal limit from Cypriot banks was set at €500, and then from that Friday onward, due to a lack of liquidity, the daily withdrawal limit was lowered to

a mere €260 for all banks. On Sunday afternoon (24/3/2013), at the time when a critical Eurogroup meeting was taking, the daily withdrawal limit from the ATMs of the Central Bank of Cyprus was limited to €100.

The €10-billion bailout package presented to Cypriot authorities, on **25th of March, 2013** came with strings attached. The first involved the *imposition of capital controls*, which were finally lifted on **6 th of April 2015**, when Cyprus returned to normality after two years and having diligently implemented a major fiscal adjustment program. The capital controls in imposed in Cyprus involved the following measures

- The amount of cash withdrawals from the deposit accounts were restricted to € 300.
- Cypriot citizens traveling abroad could hold a limited amount of funds, up to 2000 euros.
- Cypriot students studying abroad were allowed to receive up to 5000 euros per quarter.
- The export of currency was forbidden for the sole purpose of foreign investments.
- Checks on sight deposits were only used for deposits in the payee's name.
- Time deposits that expired in the next month following the implementation of restrictions were extended for at least one month and only a part of them could then be transferred to a checking account.
- A monthly ceiling of € 5000 was imposed on remittances.
- It is forbidden for a credit institution to make non-cash payments or transfers of funds aiming at circumventing the restrictive measures.

Besides the imposition of capital controls, the rescue package for Cyprus involved a *haircut on demand deposits* exceeding €100,000 in value per account. These funds were used to recapitalize the Bank of Cyprus, while *Laiki Bank*, the second largest Cypriot bank, was liquidated. At the same time, the terms of the support scheme included ditching Greek financial support.

2.4.5 The Case of Greece

The roadmap of capital controls imposed on Greece involved five phases. (see Monokroussos *et al.* 2016). In what follows we go over the first phase only.

Phase 1 (June 28, 2015-July 19, 2015)

The measures taken during the first phase of capital controls in Greece were the following

- A Bank Holiday was imposed on credit institutions, which had operations in Greece. The bank holiday was also applied to branches of foreign credit institutions operating in Greece (based on Law 4261/2014). According to length of this Holiday, all banking institutions remained closed to the public from June 29 until the aftermath of the referendum, which took place on July 5, 2015
  - The bank holiday was also applied to branches of foreign credit institutions operating in Greece (based on Law 4261/2014
  - The cash withdrawal limit was set at € 60 for each account per day. However, credit cards issued outside Greece were not subject to the above limitations
  - All capital outflows from the country were restricted or banned. No restrictions were place, though, on capital inflows into the Greek Sovereignty.
  - Time deposits had to mature at the date of their maturity, and no possibility of early withdrawal was allowed.
  - Unrestricted transactions with credit cards and debit cards were permissible for payment purposes within the country, i.e. for payments through crediting on checking accounted maintained in a Greek financial institution. In addition, payments were allowed only through the use of prepaid cards, but exclusively up to an amount appearing as a balance before the onset the bank holiday. However, new prepaid cards could not be issued.
  - Remote banking transactions, like e-banking or phone-banking transactions, were allowed for payments within it country, i.e. for payments on checking accounts held in Greece.
  - Cash withdrawals from Automated Teller Machines (ATMs) were allowed through cards issued abroad.

The exceptions to the above include the clearing of transactions, which had been registered in their respective central payment systems (TARGET2-GR, EURO1, DIAS) and settlements (like, for example, the Athens Central Depository). During the bank holiday, no other banking work could be carried.

Finally, we need to point that the **Banking Transactions Approval Committee** was established, in the General Accounting Office, in order to approve or disapprove transactions, which were deemed necessary for the wider social interest, like for example payments for expenses, and payments for the import of important, for the public heath, pharmaceutical products.

Chapter 3: METHODOLOGY

This chapter discuss the statistical methods that shall be used in order to derive our conclusions. The underlying idea of these methods involve the event-study methodology.

In finance research, an "**event**" is usually the public announcement of a corporate action by a public listed firm. An "event" could also be some other announcements which made by a third party. For example, credit agencies, like Moody's , S&P and Fitch, may change credit rating for the public listed companies, due to the changing default risk underline.

An event study can also be used to test in what way the imposition of capital controls in Cyprus the stock market. But since we deal with only one "event", i.e. the namely the case of Cyprus, a standard application of the event study methodology cannot be applied

3.1 EVENT STUDY METHODOLOGY AND THE ECONOMETRIC MODEL

3.1 The Standard Design of an Event Study

Consider Fig. 1, which illustrates, with a time line, the timing sequence normally to be encountered in an event study.

The first specification in an event study is that of the "event window**"** and the "estimation window"**.** Let $L_{\text{est}} = t_u - t_l$ and $L_{\text{eve}} = \tau_u - \tau_l$ be the length of the **estimation window** and the **event window** respectively. Even if the event being considered is an announcement on given date it is typical to set the event window length to be larger than one.

Day '0' is defined as the day of a hypothetical event for a given security. For each security a maximum of $T_{\max}$ daily return observations is used for the period around its respective event, starting at day $t = t_l$and ending at day $t = t_u$ relative to the event. The first $t_u - t_l$ in this period are designated as the 'estimation period', and the following 11 days (- 5 through + 5) is designated the '**event period'**.

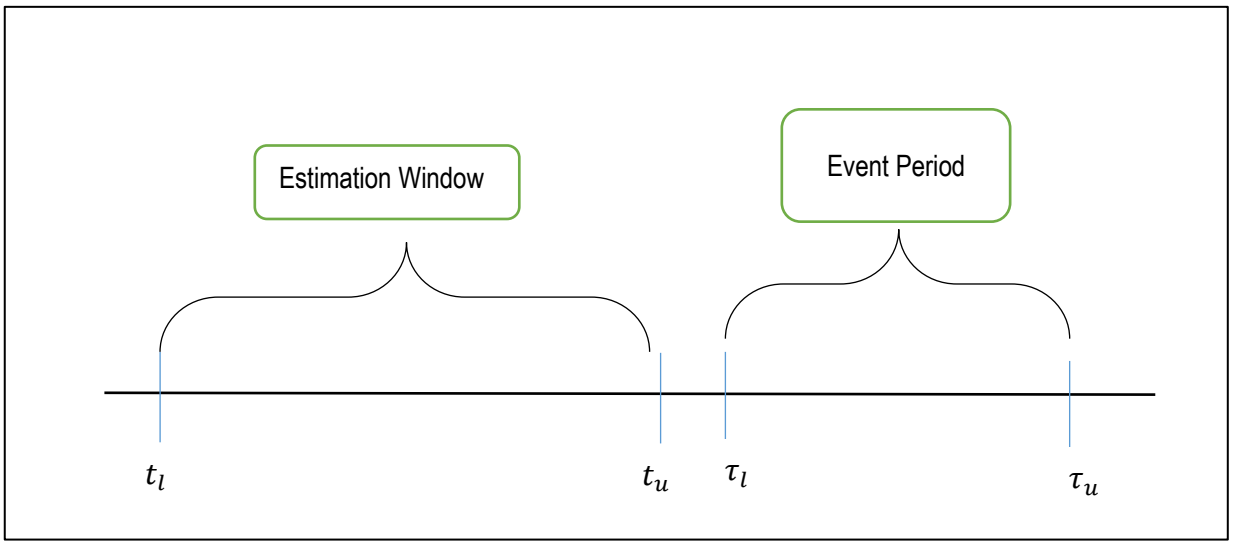

Figure 1: Event Study Methodology

Source: author

The purpose of "event study" is to examine the stock price or bond price change for a given "event". According to efficient market hypothesis, stock price (also bond price) incorporates all available information. How do we know which part of price change is

due the “event”, not other information? For example, if a major macroeconomic event hits the economy, then all shares in the stock market either increase or fall in tandem.

Hence, as to “isolate” the effect of an “event” on the price of a share, we cannot use the **actual return** for event study research directly. Rather, the *abnormal return* is employed in event study to measure the impact of an “event” on the price change.

The **Abnormal Return** (AR) is defined as the difference between the actual return and **normal return** (if the “event” does not take place). For example, if a positive shock hits the economy, and as a result all shares in the stock market soar, by say 7%, then, a stock with a beta coefficient of 1 should also land a periodic share price return of 7%. Now in order to isolate the effect an event, say, for example the company announcing a profit warning, which cause the actual share price to rise by 3% only, we work out the abnormal return, which in this case turns out to be -4% (= 3% - 7%).

For any sample security i, the return on that security for time period t relative to the event, (R_{it}), is defined as follows:

$$R_{i,t} = K_{i,t} + \varepsilon_{i,t} \qquad 3.1$$

where K_{it} is the “**normal**”, or **expected**, or **predicted return** given a particular (equilibrium) model of expected returns, and ε_{it} is the component of returns which is abnormal or unexpected. Given this return decomposition, the **abnormal return**, $\varepsilon_{it} = AR_{it}$, is the difference between the observed return and the predicted, or normal, return, that is, :

$$\begin{aligned} \varepsilon_{it} = AR_{it} &= R_{it} - K_{it} \\ &= R_{it} - E(R_i) \end{aligned} \qquad 3.2$$

Where $E(R_i)$ the expected return on share i. There several options to calculate the **expected return** for security i. The first, and simpler way, is to simply calculate the historical average return of the stock over the estimation window of length, $L_{\text{est}} = t_u - t_l$, that is, we estimate

$$E(R_i) = \frac{1}{L_{est}} \sum_{t=t_l}^{t=t_u} R_{i,t} \qquad 3.3$$

For example, if day 0 is designated as "event" day, and we may collect, say, 120 daily returns, in the estimation window of (-120,-1), prior to the "event", and calculate the average daily return in those 120 trading days. If the average daily return, in the afore-mentioned estimation window is, say, 3%, then the "normal return" (if the event does not occur) at day 0 should also be 3%. Some theoretical backgrounds may support the use of this approach: share price is time correlated; "mean reversion "of stock return and so on. Brown and Warner (1980, 1985) show that results based on this model do not systematically deviate from results based on more sophisticated models for analysing short-term event studies.

The above approach is consistent with the **constant-mean-return model**, according to the which, the periodic return of stock i, R_{it}, depends on a constant mean return (μ_i) plus a random variable U_{it} with zero mean and constant variance (i.e. $\text{var}\,(U_{it}) = \sigma_i^2$ for all t in the estimation window.

Each firm i has L_{eve} abnormal returns over the event window, AR_{it}, for $t = \tau_l, \tau_l + 1, \dots, \tau_u$,.

Then there are two different alternatives of aggregating the abnormal returns that are commonly used in event study analyses (see Table 2). The first way involves aggregation of abnormal returns across time for each firm i, across the event window $[\tau_l, \tau_u]$. This type of aggregation yields N **average abnormal returns**, $\overline{AR}_i(\tau_l, \tau_u)$, for $i = 1, \dots, N$, firms . The average abnormal return is used to examine whether mean abnormal returns for periods around the event is equal to zero. Since the event window is a multi-period window, we may estimate, for each security i, the **cumulative abnormal return** (CAR) over the event window.

$$CAR_i(\tau_l, \tau_u) = \sum_{t=\tau_l}^{t=\tau_u} AR_{it} \qquad 3.4$$

This type of aggregation yields N cumulative abnormal returns, $CAR_i(\tau_l, \tau_u)$, for $i = 1, \dots, N$, where, as it has been pointed out, τ_l stands for the lower end of the event window and τ_u stands for the upper end of the window

Table 2: Event Study Statistics

Firm	Abnormal Return over Event Window			Average ARs across Time
	$\boldsymbol{\tau_l}$	⋯	$\boldsymbol{\tau_u}$	$[CAR_i(\boldsymbol{\tau_l}, \boldsymbol{\tau_u})]$
1	AR_{1,τ_l}	⋯	AR_{1,τ_u}	$CAR_1(\tau_1, \tau_2) = \sum_{t=\boldsymbol{\tau_1}}^{\boldsymbol{\tau_u}} AR_{1,\boldsymbol{t}}$
2	AR_{2,τ_l}	⋯	AR_{2,τ_u}	$CAR_2(\tau_1, \tau_2) = \sum_{t=\boldsymbol{\tau_1}}^{t=\boldsymbol{\tau_2}} AR_{2,\boldsymbol{t}}$
⋮	⋮	⋯	⋮	⋮
N	AR_{N,τ_l}	⋯	AR_{N,τ_u}	$CAR_N(\tau_1, \tau_2) = \sum_{t=\boldsymbol{\tau_1}}^{t=\boldsymbol{\tau_2}} AR_{N,\boldsymbol{t}}$
Aver-age ARs across Firms	$\overline{AR}_{\tau_l} = \frac{1}{N}\sum_{i=\boldsymbol{1}}^{\boldsymbol{N}} AR_{i,\tau_l}$	⋯	$\overline{AR}_{\tau_u} = \frac{1}{N}\sum_{i=\boldsymbol{1}}^{\boldsymbol{N}} AR_{i,\tau_u}$	

The second way involves aggregation of abnormal returns cross-sectionally for each period over the event window $[\tau_l, \tau_u]$. This type of aggregation yields and $L_{\text{eve}} = \tau_u - \tau_l$ abnormal returns, $\overline{AR}_{\tau_l}, \overline{AR}_{\tau_l+1}, \dots, \overline{AR}_{\tau_u}$, for $i = 1, \dots, N$, where, as it has been pointed out.

Statistical tests of abnormal returns are commonly based on the cross-average of each measure. For cumulative abnormal returns (CAR) the cross-sectional average and variance are defined as follows:

$$\overline{CAR}(\tau_1,\tau_2)=\frac{1}{N}\sum_{i=1}^{N}CAR_i(\tau_1,\tau_2) \qquad 3.5$$

$$\text{var}\left[\overline{CAR}(\tau_1,\tau_2)\right]=\frac{1}{N(N-d)}\sum_{i=1}^{N}\left[CAR_i(\tau_1,\tau_2)-\overline{CAR}(\tau_1,\tau_2)\right]^2 \qquad 3.6$$

And the cross-sectional T test will be

$$T=\frac{\overline{CAR}(\tau_1,\tau_2)}{\sqrt{\text{var}\left[\overline{CAR}(\tau_1,\tau_2)\right]}} \qquad 3.7$$

The null hypothesis to be tested is that the mean day t excess return (e.g., the simple average of excess returns) is equal to zero. The test statistic is the ratio of the day 't' **mean excess return** to its estimated standard deviation; $\overline{AR}_t$

$$Tets=\frac{\overline{AR}_t}{\hat{S}\left(\overline{AR}_t\right)}$$

Where

$$\overline{AR}_t=\frac{1}{N_t}\sum_{i=1}^{i=N_t}AR_{i,t}$$

The aggregation is along two dimensions— through time and across securities. We will first consider aggregation through time for an individual security and then will consider aggregation both across securities and through time. The concept of a **cumulative abnormal return** is necessary to accommodate a multiple period event window.

Given the null distributions of the abnormal return and the cumulative abnormal return, tests of the null hypothesis can be conducted

$$\bar{\bar{\mathrm{AR}}}_{\tau} = \frac{1}{N}\sum_{i=1}^{N} AR_{i,\tau} \qquad 3.1$$

Using these estimates, the abnormal returns for any event period can be analyzed. The average abnormal returns can then be aggregated over the event window using the same approach as that used to calculate the cumulative abnormal return for each security *i*.

3.2The Econometric Model

Given the above discussion, we define the *event window*, as the period under which controls on capital outflows were in place, and the *estimation window* as the time-period under which the economy did not have any capital controls. Hence the relevant econometric model that can be estimated is the following

$$y_{it} = \beta_0 + \beta_1 d_{it} + \varepsilon_{it} \qquad 3.8$$

Where

y_i: The value of the dependent variable i (for example, the value of the Cypriot stock market index) at time-period t

ε_t: A normally distributed random variable

d_i: A dummy variable defined as follows

$$d_i = \begin{cases} 0, \text{ for } i \text{ without capital controls} \\ 1, \text{ for } i \text{ with capital controls} \end{cases} \qquad 3.9$$

Assuming that y_{it} stands for the value or return of the stock market in day t, then in the above econometric model, the parameter β_1 would show the difference in the average

daily value or return of the stock market index before and after the implementation of capital controls (on outflows). Assuming the distribution of the disturbance condition is normal, the t-statistic of $\hat{\beta}_1$is used to examine the null hypothesis $H_0: \beta_1 = 0$ of capital controls having no statistically significant impact on the value of the dependent variable, against the alternative hypothesis $H_1: \beta_1 \neq 0$, in which case we conclude that the imposition of capital controls did affect the Cypriot stock market.

Chapter 4: EMPIRICAL EVIDENCE

This chapter presents the empirical evidence concerning the effect of capital controls in the case of the Cypriot stock exchange.

Section 4.1 examines the effects of capital controls on the market capitalization of the Cypriot stock exchange. Specifically, it presents the results from fitting model (3.1) along with the decomposition of the relevant time series. The decomposition of a time series means refers to its separation into its constituent components, which are usually a trend component, an irregular component, and a seasonal component.

Section 4.2 looks at the effects of capital controls on the daily index value and returns of the Cypriot stock market general index.

4.1 THE EFFECT OF CAPITAL CONTROLS ON THE CAPITALIZATION OF THE CYPRIOT STOCK EXCHNAGE

We start by looking at the effects of capital controls on the market capitalization of the Cypriot stock exchange. We examine daily average market capitalization of the Cypriot stock exchange over the period 2011:01-2016:12.

Since the market capitalization involves a monthly time series, it is customary first to look at the decomposition of the time series into a macroscopic component and a microscopic component. The **macroscopic component** can usually be described through a trend or seasonality, whereas the **microscopic component** includes all other components. Formally, we can write that the time series $\{Y_t\}$ is decomposed as follows

$$Y_t = T_t + S_t + C_t + N_t \qquad 4.1$$

Where T denotes the **trend** of the time series. If we believe that the time series $\{Y_t\}$will increase in constant absolute amounts each time-period, we can predict $Y_t$by fitting a linear trend model

$$Y_t = c_1 + c_2 t \qquad 4.2$$

According to the above model the value of Y_t in period $t+1$ is given by $Y_{t+1} = c_1 + c_2(t+1)$. So, the change in y_t is $\Delta y_t = y_{t+1} - y_t = c_2$. In other words, the value of Y_{t+1}will be higher than Y_t by c_2.

The **seasonality** (S) is the effect that affects the observations negatively or positively over the time, for example the consumption of water during the summer period could be increased due to extreme heat but during the winter it may decrease. In the time series analysis there is a way to remove the systematic influences that are happening over the time and affects the observations and it is called **seasonal adjustment**. The observed data may need to be seasonally adjusted because seasonal effects may conceal the true underlying tendency movement in the series.

Sometimes is almost impossible to remove seasonality because the observations in the time series may be "dominates by the trend or irregular components" (Australian Bureau of Statistics, 2008). The identification of the seasonality is possible by observing and identifying the regularly spaced peaks (the top point of an economic cycle) and troughs (the lowest point of an economic cycle), "which have a consistent direction and approximately the same magnitude every year".

Fig. 2 is showing a strongly seasonal series. After the seasonality and trend components in a time series analysis have been estimated and removed the **irregular component** (N) which is also known as the **residual** is what remains.

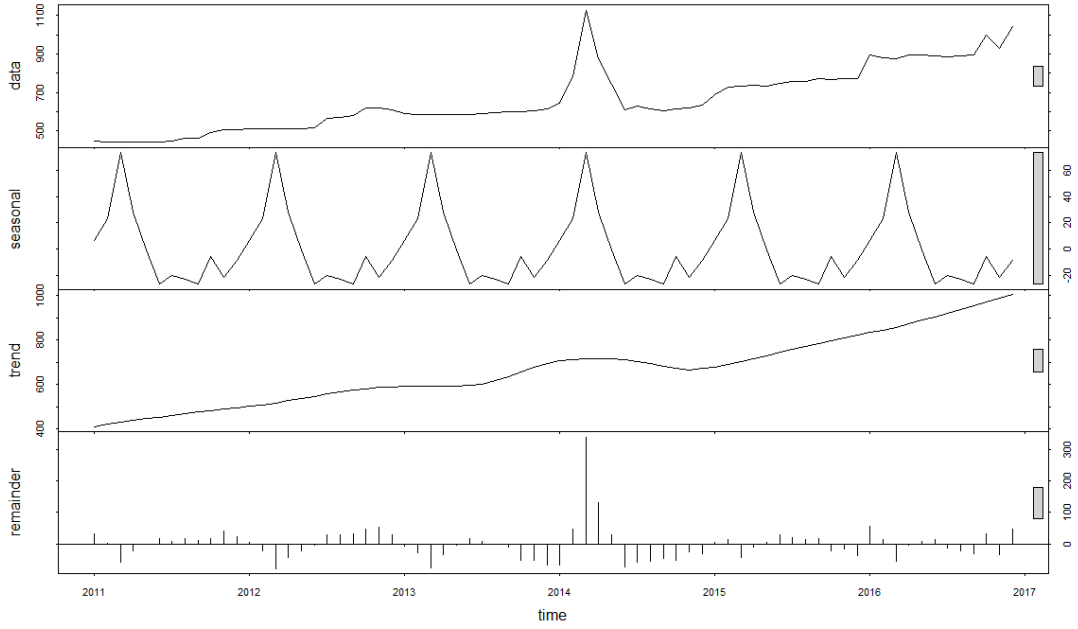

Figure 2: Decomposition of the Average Market Capitalization of the Cypriot Stock Exchange

Source: Cyprus Stock Exchange (monthly statistical bulletins) for the data and author's calculations

When we deal with a seasonal time series that can be described using an additive model, we can seasonally adjust the time series having estimated the *seasonal component* (of the time series), and then subtracting this component from the original time series. Fig. 3 and Fig.4 show the increase in market capitalization volatility in during the period of capital controls

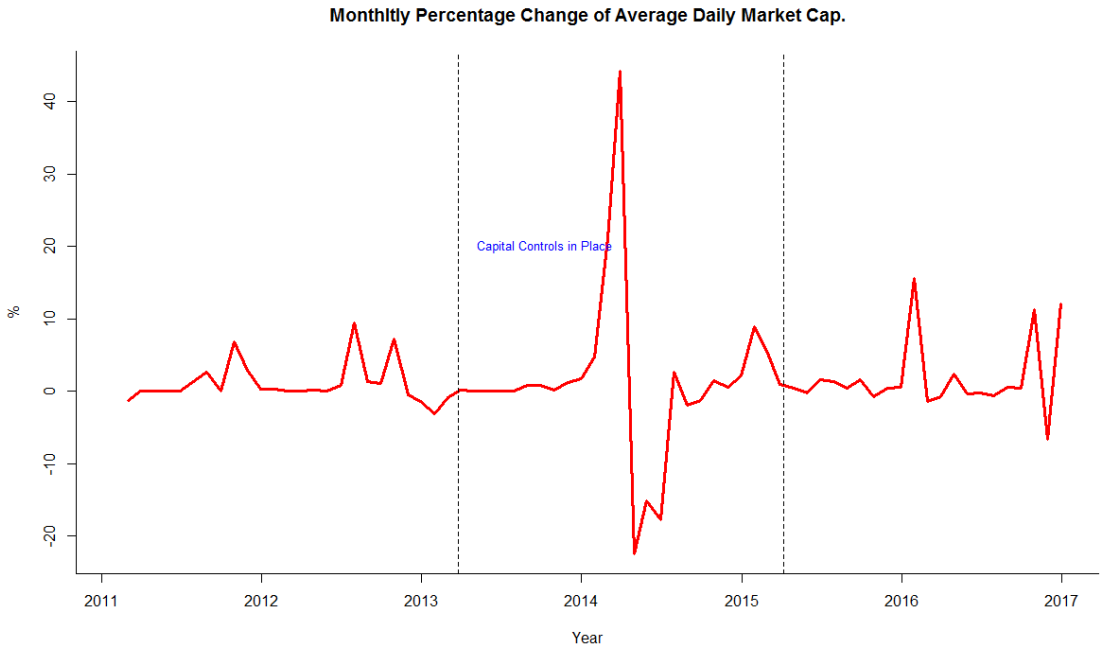

Figure 3: Daily Average Market Capitalization of the Cypriot Stock Exchange

Source: Cyprus Stock Exchange (monthly statistical bulletins) and author's calculations

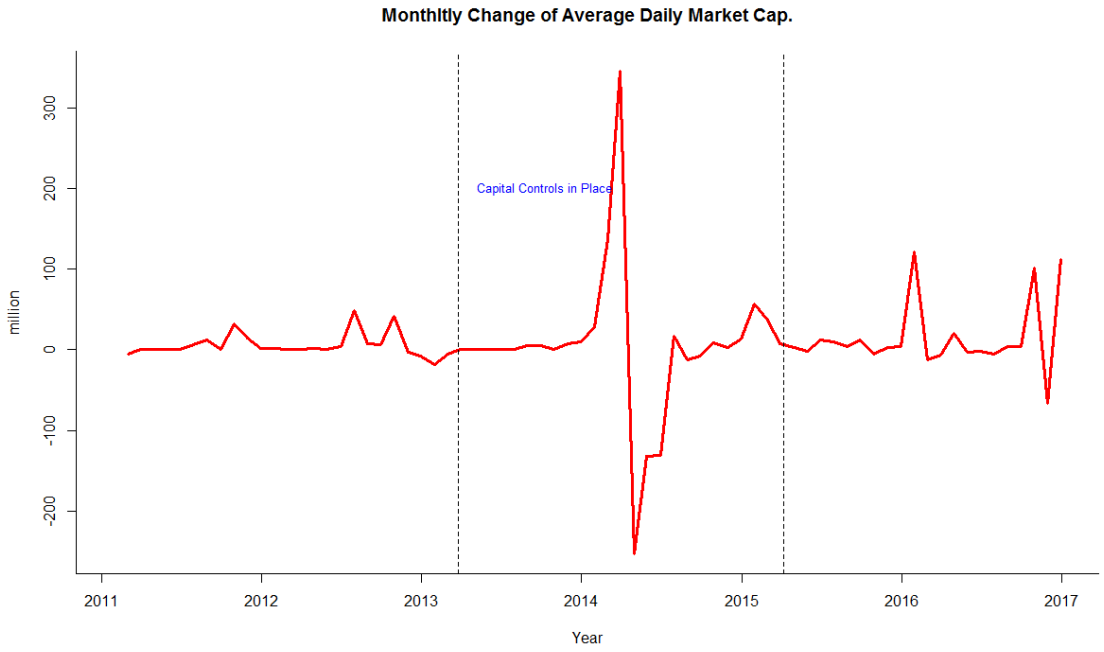

Figure 4: Monthly Change of Daily Average Market Capitalization of the Cypriot Stock Exchange

Source: Cyprus Stock Exchange (monthly statistical bulletins) and author's calculations

Table 2 presents the results concerning the effects of capital controls on the market capitalization, its percentage change, and on cumulative percentage changes, of the Cypriot Stock Exchange

Table 3: The Effects of Capital Controls on the Stock Market Capitalization of the Cypriot Stock Exchange

	Intercept Estimate	**Slope Estimate**
Market Capitalization (million euros)	659.9*	10.14
Market Capitalization (seasonally adjusted) (million euros)	660.7*	7.83
Monthly Percentage Change of Market Capitalization	1.41	0.14
Cumulative Monthly Percentage Change of Market Capitalization	1.15*	-0.011
Monthly Change of Market Capitalization	9.64	-3.67

The results of the above table can be interpreted as follows. The estimation of the intercepts parameter $\hat{\beta}_0 = 659.89$ indicates that the average daily stock market capitalization of the Cypriot stock exchange index before the imposition of capital controls stood at round 660 million. Then during the imposition of capital controls, i.e. over the period from 2013/03 to 2015/04, the estimated slope parameter $\hat{\beta}_1 = 10.14$, indicates that the average daily market capitalization of the Cypriot stock market increased by 10.14 million, in which case it reached $670 (= 659.98 + 10.14)$ million. However, since the estimate of $\hat{\beta}_1 = 10.14$ is not statistically significant we can conclude that the stock market capitalization of remained unaffected by the imposition of capital controls, that is, it remained close to 660 million.

When it comes on the effect of the monthly percentage change in the stock-market's capitalization, the estimated intercept parameter $\hat{\beta}_0 = 1.42$ indicates that on average the percentage change of the market capitalization of the Cypriot stock exchange index before the imposition of capital controls was 1.42. Then during the imposition of capital controls, i.e. over the period from 2013:03 to 2015:04, the estimated slope parameter $\hat{\beta}_1 = 0.14$, indicates that this average percentage change increased by just 0.14 percentage point, but this increase was small and at the same time statistically insignificant, and hence we can conclude that the percentage change of stock market capitalization was not affected by the imposition of capital controls.

Then we look at the effect on cumulative monthly percentage change in the stock-market's capitalization. The estimated intercept parameter of $\hat{\beta}_0 = 1.15$ indicates that the average cumulative percentage change of the market capitalization of the Cypriot stock exchange index before the imposition of capital controls was 15%. Then during the imposition of capital controls, i.e. over the period from 2013/03 to 2015/04, the estimated slope parameter $\hat{\beta}_1 = -0.01$, indicates that this average percentage change decreased by just 1 percentage point, but this decreased was very small and at the same time statistically insignificant; hence we can conclude that the cumulative percentage change of stock market capitalization was not affected by the imposition of capital controls.

4.2 THE EFFECT OF CAPITAL CONTROLS ON THE CYPRIOT STOCK MARKET INDEX

Next, we examine the effect of capital controls on the Cypriot stock market by looking at the effects on the general stock market index.

Fig. 7 shows the daily values of the main Cypriot stock market index over the period 2013:01-2016:12. Table 2 presents the results concerning the effects of capital controls on the main stock market index in the Cypriot Stock Exchange

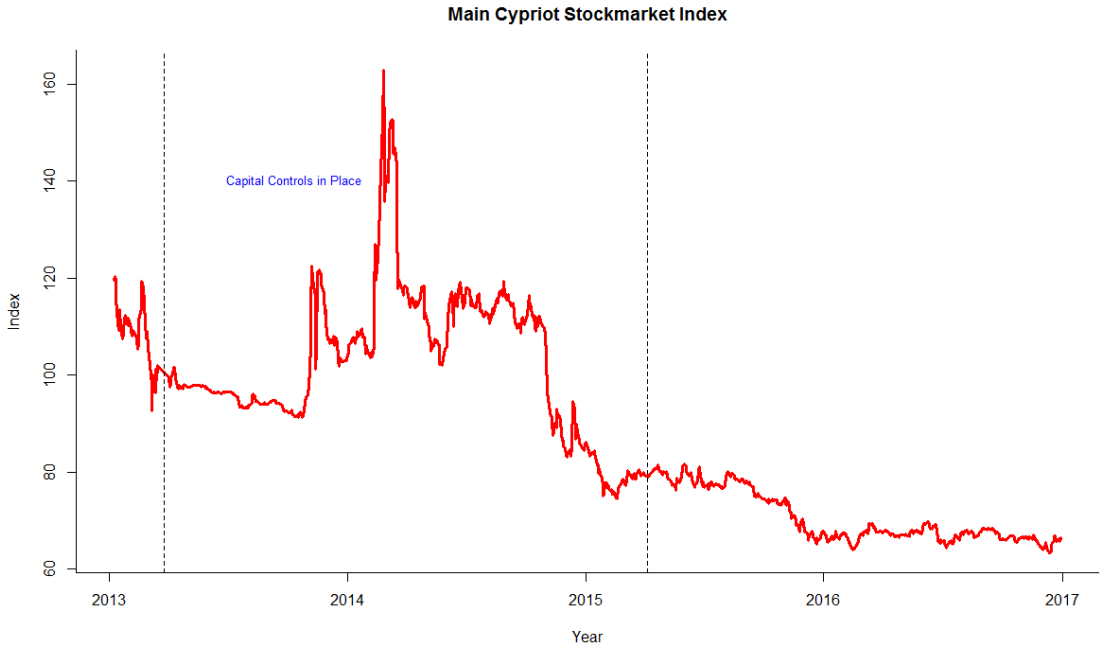

Figure 5: The Cypriot Main Stock Market Index

Source: Naftemporiki

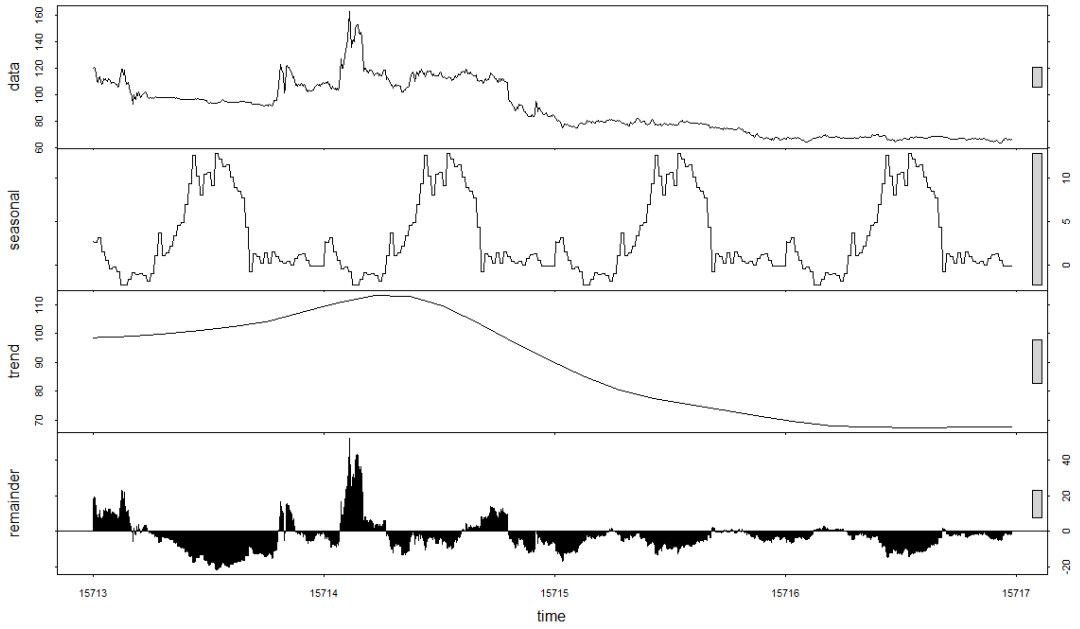

Figure 6: The Decomposition of the Cypriot Main Stock Market Index

Source: Naftemporiki

Figure 7: The Deseasonalized Cypriot Main Stock Market Index

Source: Naftemporiki

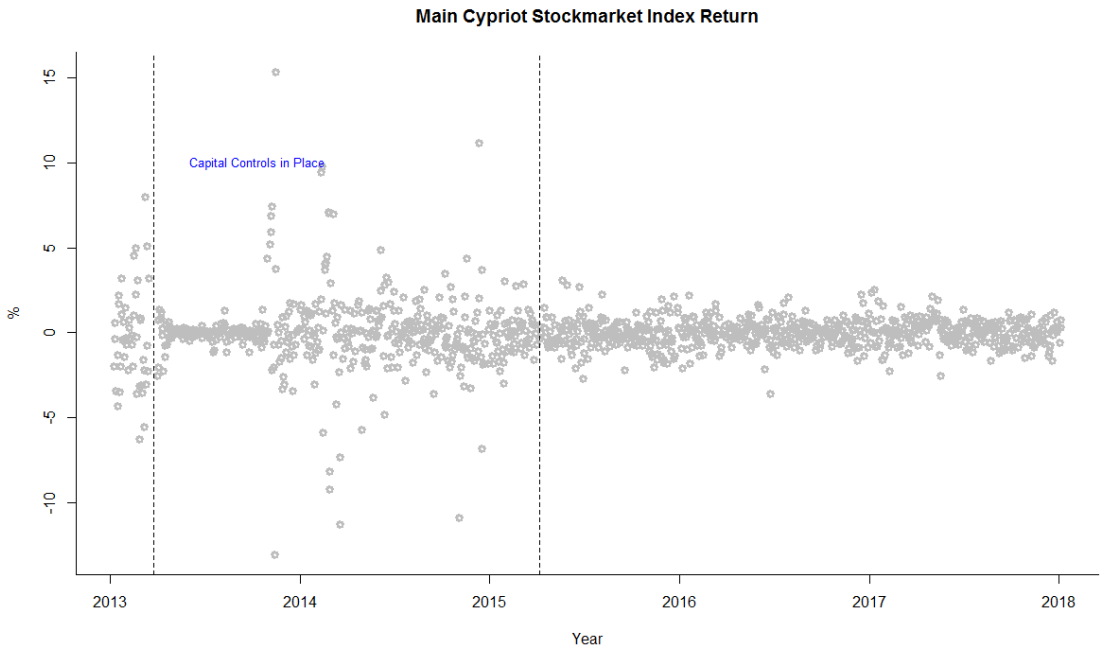

Figure 8: The Cypriot Main Stock Market Index Returns

Source: Naftemporiki and Author's calculations

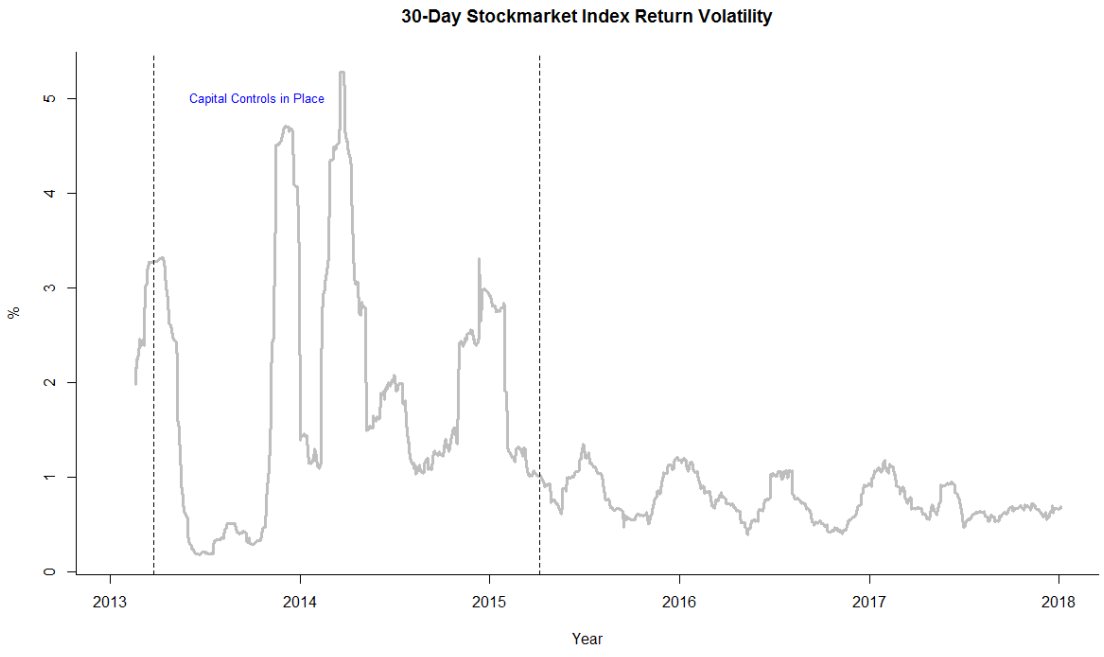

Figure 9: The Cypriot Main Stock Market Index Volatility

Source: Naftemporiki and Author's calculations

Table 4: The Effects of Capital Controls on the Cypriot Stock Exchange

	Intercept Estimate	Slope Estimate
Index Returns (%)	-0.070	0.046
Index Value	74.34*	27.51*
Index Value (seasonality adjusted)	71.04*	27.79*
30-Day Index Return Volatility (%)	0.82*	1.02*

We start the discussion with the values of the stock market. From the estimation of the parameter $\hat{\beta}_0 = 73.65$ we see that the average daily value of the Cypriot stock exchange index before the imposition of capital controls was 73.65. Then during the imposition of capital controls, i.e. over the period from Mar 25,2013 to Apr 06,2015, given the estimated slope parameter $\hat{\beta}_1 = 28.20$, the average daily return on the Cypriot stock market index increased to $101.85 (= 73.65 + 28.20)$

From the estimation of the parameter $\hat{\beta}_0 = -0.0381$ we see that the average daily return of the Cypriot stock exchange index before the imposition of capital controls stood at round -0.0381%. Then during the imposition of capital controls, ie over the period from Mar 25,2013 to Apr 06,2015, given the estimated slope parameter $\hat{\beta}_1 = 0.01394$, the average daily return of the Cypriot stock market $-0.0241 (= -0.0381 + 0.01394)$

Then we examine the results for the values of the stock market. From the estimation of the parameter $\hat{\beta}_0 = 73.65$ we see that the average daily value of the Cypriot stock exchange index before the imposition of capital controls was 73.65. Then during the imposition of capital controls, ie over the period from Mar 25,2013 to Apr 06,2015, given the estimated slope parameter $\hat{\beta}_1 = 28.20$, the average daily return on the Cypriot stock market index increased to $101.85 (= 73.65 + 28.20)$

Chapter 5: CONLUSIONS

When the financial crisis hit Cyprus, the weak link turned out to be the country's banking system and its exposure to the Greek economy. As a result, the "haircut" to the private bondholders of Greek bonds (PSIs), completely dented the balance sheets of Cypriot banks.

In any another country, the capital control measures would have no significant consequences as since transactions are carried out predominantly not with cash, but with debit cards and credit cards. But this is not the case in Greece, and hence private consumption was dented, as Greek households had to make ends meet only with the cash balances were allowed to withdraw from the banking system.

The rational for the imposition of capital controls was to force Greek residents to keep their euros within the Greek economy. This did not pose a big problem for the Greek consumer, since he would have either to find a substitute product in the Greek market (probably at a higher price and of less quality) or he would have to do without it. But capital controls did pose a serious threat for Greek enterprises, since the overwhelming majority of them have to import their raw materials.

Although (the Greek) capital controls did not completely restricted the companies' ability to trade with the foreign sector, each business transaction however did become quite time-consuming, as a long bureaucratic process of approval was required in order for such transactions to be allowed, and, added to that, the amount of the transaction could not surpass a certain ceiling. So, the Greek firms with sufficiently accumulated capital, could slow down their operations without having to lay off part of their personnel, but those firms with deficient capital buffers were forced to proceed with forced leave of absences for their employees or even layoffs.

At any rate, the impart of capital controls on the Greek economy was profound, leading to the collapse of many businesses, and hence, under no circumstances, should be ever repeated again.

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Appendix