Working Paper # 192

Hot Money Cools on Pakistan amid COVID-19: Evidence from Nonlinear ARDL

Fareeha Adil[1], Asma Fiaz[2], Nisar Ahmad[3]

January 2021

[1] Dr. Fareeha Adil is an Associate Research Fellow at Sustainable Development Policy Institute.
[2] Ms. Asma Fiaz is a Doctoral Candidate of Economics at Quaid-I-Azam University, Islamabad.
[3] Dr. Nisar Ahmad is an Associate Professor of Economics at Sultan Qaboos University, Oman

A publication of the Sustainable Development Policy Institute (SDPI).

Sustainable Development Policy Institute is an independent, non-profit research institute on sustainable development.

First edition: January 2021

Mailing Address: PO Box 2342, Islamabad, Pakistan.
Telephone ++ (92-51) 2278134, 2278136, 2277146, 2270674-76
Fax ++(92-51) 2278135, URL: www.sdpi.org

Abstract

This study investigates key determinants, and the behaviour of hot money in Pakistan for the period from May 2015 to June 2020 with a view to capture the impacts of COVID-19. It specifically assesses the asymmetric impact of interest rate on hot money quantum. In the context of Pakistan, such asymmetric impact appears to be neglected. In an attempt to fill this gap, this study pays special attention to the curious case of hot money invasion and exit in recent years. This is taking a note on Pakistan's debt and equity markets that are over-heated due to massive inflows of hot money in to the economy. In this process, it examines the impact of COVID-19 outbreak on hot money and how it has accelerated outflows. In doing so, a Nonlinear Autoregressive Distributed Lag (NARDL) framework has been employed to capture inherent nonlinearities that may otherwise give misleading inference. The results reveal that there exists a long-run asymmetric association between the policy rate and hot money quantum. The results show a long-run positive effect of the increase in the policy rate. At the same time, there is a negative effect of decrease in policy rate on hot money inflows. Moreover, the findings explicitly show that COVID-19 had a drastic impact on hot money, where despite a high interest rate, hot money flushed out of the market.

Keywords: *NARDL; hot money; T-bills; exchange rate; Pakistan*

JEL Classification: ***E40, E47, E59, G01, G18***

Table of Contents

1. Introduction

Hot money refers to capital flow across the border for the purpose of earning a short-term profit that is motivated by interest rate differences. The world has witnessed a dramatic growth of hot money from $82 billion in the 1970s to a staggering $1,680 billion approaching the 2008 financial crisis. However, hot money often imposes significant risks in financial markets, triggering financial crisis and may be even big economic fluctuations mostly in developing economies (Chari and Kehoe 2003). Some studies have investigated the impact of short-term international capital in the form of so-called hot money on major financial markets (Filer II 2004; Guichard 2017; Zhang et al., 2019).

The existing literature is divided among two distinctive viewpoints as far as recipient economies are concerned. The first strand of literature considers the consolidated impact of long-term and short- term capital flow and puts forth the positive economic effects hypothesis. The second strand of literature isolates short-term capital from long-term international capital and centers upon effect of Foreign Direct Investment (FDI) on economic growth & industrial output (Kokko 1992; Markusen and Venables 1999).

Those supporting a positive economic impact assert that international capital flow facilitates economic growth through reducing the cost of capital (Henry 2000), rising of domestic deposits (Mishra, Modi and Murshid 2001), and technological spillovers (Feldstein 2000; Prasad, Rajan and Subramanian. 2007). The economic impact is more pronounced in industrial economies as compared to non-industrial economies due to higher absorption capacity of capital (Prasad et al. 2007).

On the contrary, the advocates of negative economic impact argue that developing economies are inherently prone to overheating via excessive capital and money supply (Filer II 2004). These groups believe that excessive liquidity pushes the economy to inflationary flashpoint via a cyclical increase in bank loans and asset bubbles; negatively affecting aggregate demand (Celasun, Denizer and He 1999) and deterioration in terms of trade and local currency depreciation (Athukorala & Rajapatirana 2003). When coupled with poor governance and regulatory quality, the negative impact predominantly increases as banks and corporate sector are in a position to take up risk in excess (Guichard 2017). The supporters of this view advocate that excess liquidity, hightened inflation, cyclical increase in bank loans and asset bubbles created by the hot money inflow along with financial crisis and vulnerabilities induced by hot money outflows, all cause considerable macro-economic risk to receiving economies.

Further, macro-risk studies found that economic crisis and booms in emerging economies are highly linked to hot money flows (Chari & Kehoe 2003). Hot money generates first order effect on financial stability and hot money waives normally crowd in emerging economies (Mckinnon

2014). However, economies experience devastating destabilization when asset bubble burst and outflow of hot money takes place. Though the hot money inflow builds up gradually, the outflow normally occurs instantaneously with actors race to exit first (Domowitz, Domowitz, Glen, Madhavan 1997), a scenario that was witnessed when sudden capital outflow triggered East Asian financial crisis of 1997 (Sarno and Taylor 1999).

For a developing economy of South Asia like Pakistan, hot money is considered beyond a simple financial phenomenon of cross-border movement of capital. In past decades, the volume of FDI and US dollar inflow from the country's exports have significantly dropped. During previous governments, hot money has been instrumentally used for attracting the flow of US dollars into Pakistani economy. This has been highly needed to stabilize Balance of Payment (BoP) as well as the local economy. Over the recent years, Pakistan has observed periods of which hot money has significantly flown in and out of its financial markets. In other words, hot money has found a route to be a part of Pakistan's modern economy.

This is largely due to a simplified tax regime imposed on international investors by the government (Waheed, 2020). The country's convenient nature of entertaining hot money incorporates multiple risks, like currency risk, interest rate risk, exchange rate risk and inflationary risk (price shock) that can put the economy under severe pressures. So far, there exists very limited research on hot money in Pakistan.

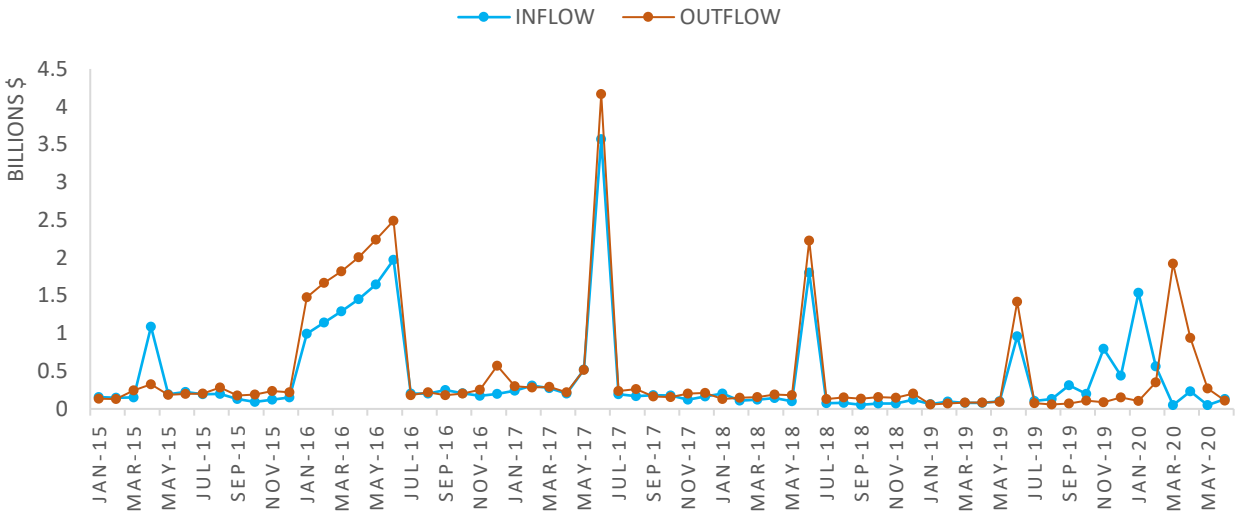
In this backdrop, , this paper brings adequate contributions to this area of research through bridging this gap by analyzing the notion of hot money in the context of Pakistan. Therefore, the primary objective of this paper is to assess the asymmetric impact of interest rate on hot money quantum in Pakistan during May 2015 June 2020, using NARDL framework. Special focus has been on the period when hot money *pouring in* was taking place. Further, we also model the impact of COVID-19 outbreak on hot money in Pakistan and how it triggered the outflows?

2. An Overview of Hot Money in Pakistan

Easy Come, Easy Go, Hot Money: Temperature of Pak's Money & Debt Market in Recent Times:

Pakistan has seen episodes of hot money coming in and exiting the financial markets, over the recent

Fig-1: Hot Money-Total Inflow & Outflow (Jan-2015 to June 2020)

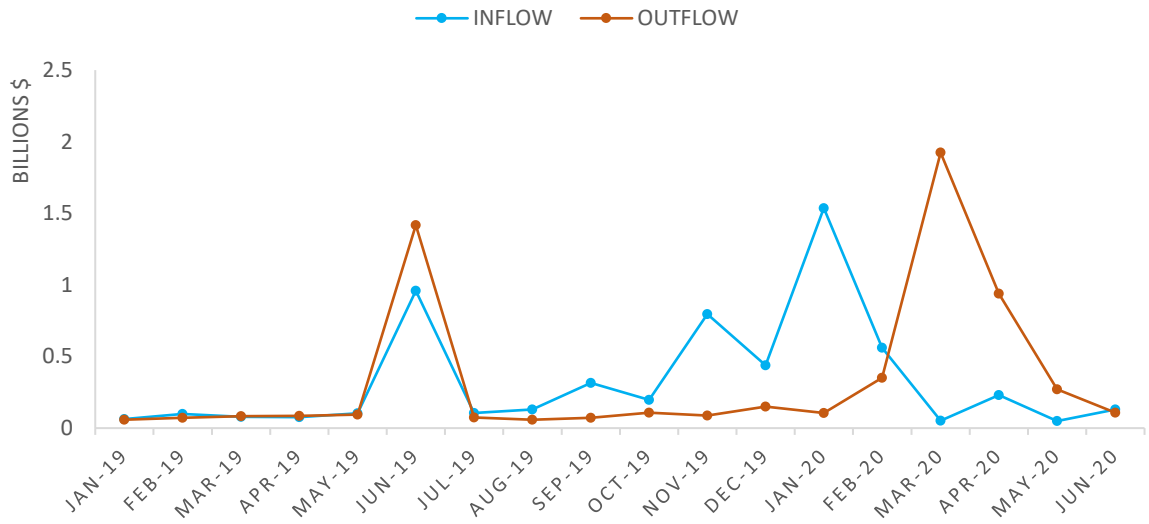


Source: Author's Representation (Fig1-4)

years. Fig-1 shows the total inflow and outflow of hot money in last four years or so, from the period between Jan 2015 to June 2020.

Hot Money Inflows: The hot money found route to Pakistan due to simplified tax regime for international investors by the Government of Pakistan. Pakistan witnessed a *pouring in* of hot money by foreign investors after the hiking up of policy rate to 13.25% by the central bank in July 2019; causing a surge in interest rate on government securities, inclusive of T-bills to be as high as 13.66% (Fig-2). Since July 2019, $ 4.1 billion found route to Pakistan's debt and equity markets with major investments in T-bills. SBP's data shows that foreign investors increased investing in the government's debt papers, majorly in treasury bills (Ahmed, 2020). A $1.5 billion investment in January 2020 alone accounted for nearly 50% of the total portfolio and then pushed up further to $ 3.4 billion in March 2020 (SCRA, SBP).

Fig-2: Heat-Up Period: Hot Money-Total Inflow & Outflow (Jan-2019 to June 2020)



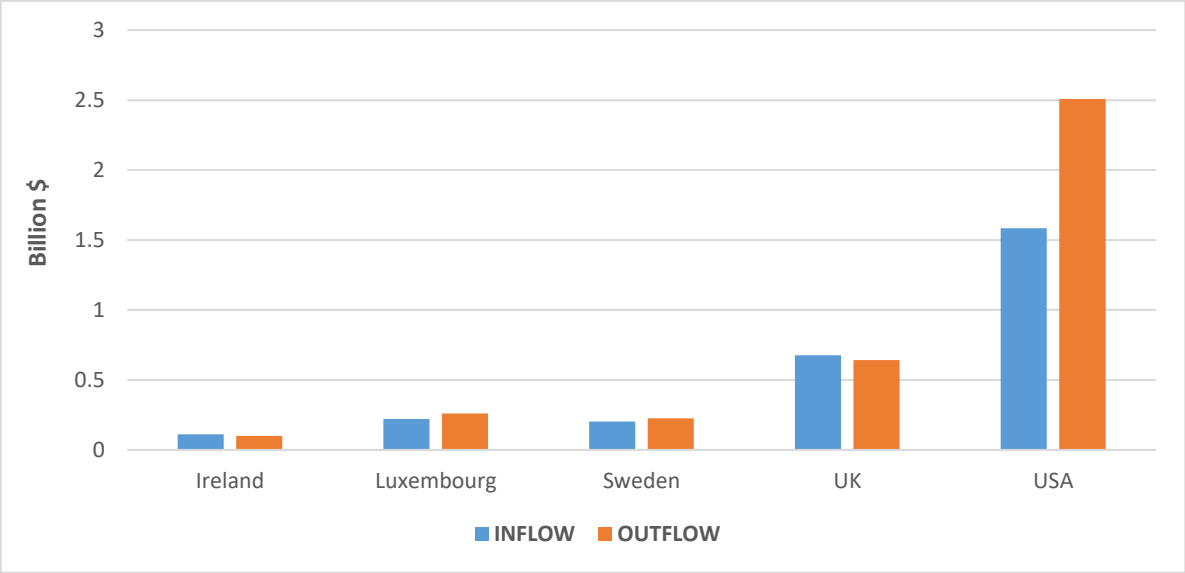
Out of this $1.5 bill received, $25.5 million comprised of comparatively longer term investment in Pakistan Investment Bonds (PIBs) which the government offers for 3, 5, 10, 15 and 20 years (Iqbal, 2020). The hot money flow majorly came from UK and US (Fig-3). UK turned out to be the T-bills biggest investor as Pakistan crossed the $2 billion mark in terms of inflows received during the current fiscal year, followed by US with an investment of $ 792 million and UAE at $ 109,353.

Table 1-A. T-Bills Inflows into Pakistan Post IMF Bailout Package

Month	Inflow (US$ mn)	Outflow (US$ mn)	Net flows (US$ mn)
Jul-19	15	-	15
Aug-19	77	(6)	71
Sep-19	250	-	250
Oct-19	116	(8)	108
Nov-19	713	(0)	713
Dec-19	308	(5)	303
Jan-20	1,471	(32)	1,438
Feb-20	524	(263)	261
Mar-20	19	(1,313)	(1,295)
Total (Mill $)	**3,492**	**(1,627)**	**1,865**

Experts believe that jacked up interest rate at 13.25% is the reason behind the rapid growth of hot money inflows.

Fig-3: Major Countries: Equity Inflow & Outflow (Jan-2019 to June 2020)



However, the positive side of hot money invasion is that things got settled on economic front. Though the stabilization process proved hard for Pakistan's economy, but now the scenario is that free float regime addressed the exchange rate depreciation; dollar is not being used to earn income now. Exchange rate, now, is not a source of income. The current account deficit witnessed decline and a 70 billion surplus existed in October 2019 after a considerable gap of 4.5 years (Waheed, 2020). Additionally, these hot money inflows generated excess liquidity for commercial banks.

On the contrary, the downside of the hot money inflows. according to experts. is that these inflows severely affect the nation's debt carrying capacity. It is evident that high frequency T-bills investment is coming in due to an escalated interest rate set by the central bank. Such rapid is the pace that only in a single day, on Jan 16, 2020, Pakistan received a record investment of $ 536 million in T-bills. According to experts, the massive repayment of these T-bills will create problems for Pakistan's weaker economy as majority of the hot money investments are concentrated in 3 month short term T-bills.

Others have a point of view that since hot money investments are for short time period it makesthe economy of host country very volatile (Ahmed, 2020). The worries of the financial experts and the criticism on hot money got rejected by the State Bank of Pakistan stating that hot money only makes 3.5% of the total government debts. The SBP governor assured that money market temperature is not sohigh and hot money quantum is not that much to affect Pakistan's debt market temperature. He said:

> Pakistan debt market is huge — only the marketable securities are of Rs9 trillion ($57bn). Foreign investors like big deep markets so they can enter and leave without moving the market (Hussain 2020).

Hot Money & Coronavirus Outbreak: Owing to pandemic, commodity prices are falling, debt and equity markets are experiencing meltdown, which caused central banks to take the initiative of reducing policy interest rate on emergency grounds. International investors in Pakistan also followed the trend and decreased their emerging market exposures for the purpose of managing country and currency risk in their portfolio (Ahmed, 2020).

The US Federal Reserve System slashed the benchmark interest rate on 03 March, 2020 by ½ percentage point to a target level of 1% to 1.25% and later brought it down to 0-0.25% through another cut on March 13th in an attempt to ease economic activity in the face of pandemic. This cut happened to be the biggest single slash in interest rate in more than a decade which instantaneously made South Asian markets more attractive destination for hot money. The Federal Reserve, US (FED) and EU countries slashed the policy rate but South Asian countries especially Pakistan did not. The Rupee & US $ interest rate differential increased significantly. Pakistan policy rate stood at 13.25% being 13 percentage points higher than the policy rate of US at 0-0.25%. This spread[1] between the two policy rates created a massive incentive for international investors for re-routing short-term investments.

Table 1-B. Pakistan – Policy Rate (July 2019 – June 2020)	
Date	**Key rates**
06/26/2020	7.00%
05/18/2020	8.00%
04/17/2020	9.00%
03/25/2020	11.00%
03/18/2020	12.50%
07/17/2019	13.25%

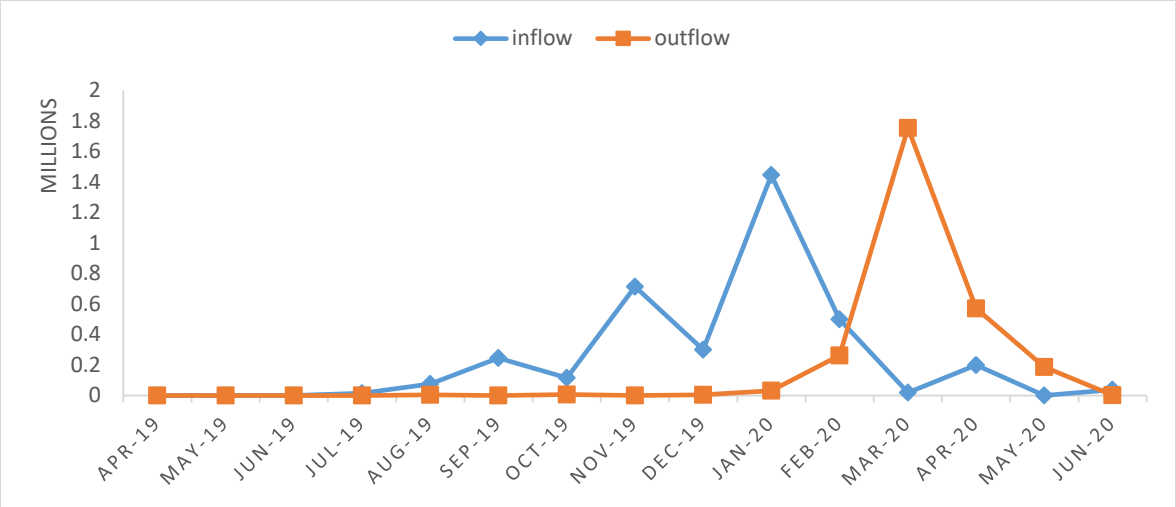
Hot Money Outflows: Amid pandemic fears, foreign investors pulled out nearly 1/6 of hot money investment of T-bills in March 2020 for making safer bets and risk mitigation in the aftermath of Coronavirus. As per Special Convertible Rupee Account (SCRA) data of SBP, the net outflows from Treasury bills touched massive amount in the month of March 2020 (Hussain, 2020).

During March 2020, the total disinvestment from capital markets, equity, Treasury bills and Pakistan Investment Bonds (PIB) reached at $ 671.37 million during March 2020. In tandem with

[1] First step was taken on March 18th, 2020 when rate was lowered from 13.25% to 12.50% and then later on March 25th , 2020 a further cut to 11%, still leaving a wide margin

pull out from short-term investments, the out flows from PIB are also washed off 50% of the long-term investments by foreign investors. The PIB's outflow amounted to $ 33.282 million in the month of March. Eventually, by the end of March 2020 due to interest rate cuts, foreign investors took out $1.7 billion from Pakistan's economy, $16 billion pulled out from debt investments, and $ 106 million from equity markets (Ahmed, 2020).

Fig-4: T-Bills Inflow & Outflow (Jan-2019 to June 2020)



These hot money inflows are in line with the emerging markets trend where steep decline in oil prices and pace of Coronavirus outbreak caused a sell-off situation in markets. Global data by international Institute of Finance shows that $30 billion has been pulled out by portfolio managers from emerging markets in the month of Feburary and March 2020. The supporters of hot money still believe that *there is nothing to worry about*, as this pulling off is happening worldwide from bond and equity markets due to pandemic and that the *money pulled out has gone in gold*.

Along with pandemic pressures, the wiping out by hot money outflow also put pressure on currency market as local currency started declining near the mid of March 2020. The exchange rate market stood steady for 6 months but in the midst of March 2020, US dollar increased significantly by Rs. 5.05. The downward trajectory of local currency is triggered by sudden changes in demand caused by foreign investors unloading their hot money positions (Hussain, 2020). Corona virus out break caused panic and instigated this unloading that battered the financial markets globally. International investors liquidated $606 million from government instruments, triggering a massive dollar outflow that earlier cushioned the central bank reserves.

3. Methodology

The core objective of the study is to analyze interest asymmetries (policy rate) effect on hot money for Pakistan. It essentially requires a nonlinear framework as short-term volatilities and structural changes cannot be analyzed through linear models (Po and Huang 2008) especially in the case of time series where linear models assume linearity by default, whereas the impact of series are nonlinear in reality (Anoruo, 2011). Therefore, a nonlinear autoregressive distributed lag model has been used to analyze the key determinants of hot money, such as policy rate, exchange rate, inflation, imports and exports (Table 2). A monthly time series data of Pakistan for the period (May 2015 – June 2020) has been used.

Table 2: List of Variables Used

Variable	**Description**	**Unit**	**Source**
HOT	Hot Money	Million $	SBP
IRATE	Policy Rate	%	SBP
RER	Real Exchange Rate	Domestic Currency per dollars (LCU/$)	SBP
IMPT	Imports	Million $	SBP
EXPT	Exports	Million $	SBP
CPI	Inflation	%	SBP
D_1	COVID-19 Dummy	-	generated

To analyze the long-run relationship between hot money and mentioned variables, we devise the following linear equation;

$$HOT = \beta_0 + \beta_1(IRATE) + \beta_2(RER) + \beta_3(IMPT) + \beta_4(EXPT) + \beta_5(CPI) + \beta_6(D_1) + U_t \ldots\ldots\ldots (1)$$

Where HOT, IRATE, RER, CPI, IMPT and EXPT represent hot money, policy rate, real exchange rate, inflation, imports and exports respectively and D_1 is a dummy for COVID-19, covering the period from the outbreak of pandemic in Dec 2019 till June, 2020. The dummy intends to capture the impact of COVID-19 on hot money. We use a nonlinear framework for this study as nonlinear impact may exist in time series. The nonlinear model is:

$$HOT = f(IRATE^+, IRATE^-, RER, IMPT, EXPT, CPI, D_1) \ldots\ldots\ldots (2)$$

Based on asymmetric relationship between policy rate and hot money, the model takes the shape of:

$$HOT_t = \theta_0 + \theta_1(IRATE^+{}_t) + \theta_2(IRATE^-{}_t) + \theta_3(RER) + \theta_4(IMPT) + \theta_5(EXPT) + \theta_6(CPI) + \theta_7(D_1) + \varepsilon_t \ldots\ldots\ldots (3)$$

Where:

- $\theta_{i\ is}$ concerned with long-run parameters.

- Asymmetric impacts of policy rate are incorporated by positive changes $IRATE^{+}$ and negative changes $IRATE^{-}$ respectively.

Eq (1) depicts the long-term effects. In order to estimate short–term co-efficient, we re-specify eq (1)

$$\Delta HOT_t = \gamma_0 + \sum_{K=1}^{m} \gamma_{1K}\,\Delta HOT_{t-k} + \sum_{K=1}^{m} \gamma_{2K}\,\Delta IRATE_{t-k} + \sum_{K=1}^{m} \gamma_{3K}\,\Delta RER_{t-k} + \sum_{K=1}^{m} \gamma_{4K}\,\Delta IMPT_{t-k} + \sum_{K=1}^{m} \gamma_{5K}\,\Delta EXPT_{t-k} + \sum_{K=1}^{m} \gamma_{6K}\,\Delta CPI_{t-k} + \sum_{K=1}^{m} \gamma_{7K}\,\Delta D1 + \lambda_1 HOT_{t-1} + \lambda_2 IRATE_{t-1} + \lambda_3 RER_{t-1} + \lambda_4 IMPT_{t-1} + \lambda_5 EXPT_{t-1} + \lambda_6 CPI_{t-1} + \lambda_7 D1 + \mu_t \quad \ldots\ldots (4).$$

Eq (4) is an error–correction specification which gives both the long run and short run coefficients. λ represents long-run coefficients, while differenced variables (Δ) depicts short-run coefficients. However, (Eq-4) depicts symmetric relationship among variables while the core purpose of the study is to investigate the asymmetric effects of policy rate on hot money. Thus, concerning the asymmetric impact, we formalize the nonlinear co-integrating equation. The decomposition regression is:
Where:

$$a_t = \theta^{+} b_t^{+} + \theta^{-} b_t^{-} + \mu_t \ldots\ldots\ldots\ldots (5)$$

- θ^{+} and θ^{-} are allied with long term coefficients.
- b_t is a vector of regression decomposed as: $b_t = b_t^{+} + b_t^{-}$
- b^{+} & b^{-} are independent variables, decomposed into a partial sum of positive and negative charges.

We present the partial sums of negative and positive changes in the policy rate by the following equations (6 & 7).

$$IRATE^{+} = \Sigma^{t}_{i=I} \Delta\, IRATE^{+}_{i} = \Sigma^{t}_{i=I} max\,(\Delta\, IRATE_{i,} 0) \quad -------- (6)$$

$$IRATE^{-} = \Sigma^{t}_{i=I} \Delta\, IRATE^{-}_{i} = \Sigma^{t}_{i=I} min\,(\Delta\, IRATE_{i,} 0) \quad --------- (7)$$

In the next step, we incorporate IRATE in eq (4) by $IRATE^{+}$ and $IRATE^{-}$. Hence, the nonlinear ARDL (NARDL) formulation is completed.

$$\Delta HOT_t = \theta + \sum_{K=1}^{m} \theta_{1K} \Delta HOT_{t-k} + \sum_{K=1}^{m} \theta_{2K} \Delta IRATE^{+}_{t-k} + \sum_{K=1}^{m} \theta_{3K} \Delta IRATE^{-}_{t-k} + \sum_{K=13}^{m} \theta_{4K} \Delta RER_{t-k} + \sum_{K=1}^{m} \theta_{5K} \Delta IMPT_{t-k} + \sum_{K=1}^{m} \theta_{6K} \Delta EXPT_{t-k} + \sum_{K=1}^{m} \theta_{7K} \Delta CPI_{t-k} + \sum_{K=1}^{m} \theta_{8K} \Delta D_{(t-k} + \lambda_1 HOT_{t-1} + \lambda_2 IRATE^{+}_{t-1} + \lambda_3 IRATE^{-}_{t-1} + \lambda_4 RER_{t-1} + \lambda_5 IMPT_{t-1} + \lambda_6 EXPT_{t-1} + \lambda_7 CPI_{t-1} + \lambda_8 D + \mu_t \; --(8).$$

A number of cointegration techniques were devised to establish long run relationship amongst the time series. For all these cointegration techniques, there exists an important restriction that all

series must be integrated of the same order, however, a cointegration approach, developed in recent times called Autoregressive Distributed Lag (ARDL) approach proposed by Pesaran et al. (2001), also known as bound testing. In contrast to other cointegration approaches, (i.e. Engle and Granger 1987; Johansson and Julius 1990) the ARDL is superior due to the fact that both short run and long run parameters of the specified model can be applied irrespective of the order of integration, whether the series under consideration are I (0), stationary at level or I (1), stationary at first difference. Owing to the convenience, the ARDL is extensively used in empirical works, especially multi-variant models. It is also employed to assess long run relationship in this study. After estimating eq (8), we use bounds testing on the lines of Pesaran, Shin and Smith (2001) . Asymmetric effect of interest rate is not captured by ARDL method, so we apply a new technique of NARDL model for estimation. We are interested in checking the effect of interest rate on hot money. Whenever interest changes, the ARDL model give us magnitude of the variable, but we are not in position to identify whether this is due to positive change (increase in interest rate) or negative change (decrease in interest rate) . When we apply NARDL model, the model tells us what happens when interest rate increases, or decreases; and most importantly, what happens with hot money.

4. Results & Discussion

For establishing the order of integration, we use Augmented Dickey Fuller (ADF) unit root test. The results of the ADF test are presented in Table A-1 in Appendix-A.

Lag Length Selection: We employed the AIC criterion for optimal lag length selection [Table-3]. Using lesser lags hinders capturing important information from the model; on the contrary, selecting more lags "Over fits" the model (Stock and Watson 2012).

Table 3. Test Statistics and Choice Criteria for Selecting the Lag Order

Lag	Log L	LR Test	AIC	SBC	HQ
0	405.400	NA	-5.660	-5.407	-5.557
1	1233.996	1561.813	-17.064	-16.051*	-16.652*
2	1274.058	72.0552	-17.123	-15.349	-16.402
3	1314.821	69.795	-17.191*	-14.658	-16.162
4	1339.59	40.272	-17.030	-13.736	-15.691

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Bound Testing:
After estimating eq. (10) we use bounds testing on the lines of Pesaran et al. (2001). Table 4 shows the results of cointegration/F-Statistics.

Table 4. Bounds Tests for the Existence of a Long Relationship						
F-Statistic	**1 per cent Critical Bounds**		**5 per cent Critical Bounds**		**10 per cent Critical Bound**	
	I (0)	**I (1)**	**I (0)**	**I (1)**	**I (0)**	**I (1)**
5.362268	2.73	3.9	2.17	3.21	1.92	2.89

As per Pesaran, Shin and Smith (2001), with optional lags, the upper and lower bound values (NARDL) are 3.9 and 2.73 at a one per cent level of significance. The F-stat (cal) for NARDL is 5.36, which exceed both the upper and lower bounds depicting that there exists a long-run relationship among variables.

Dynamic Stability: We then proceed to evaluate the adequacy of the specification and dynamic stability of the model by running diagnostic tests. We check for serially independent error. This step is essential as the requirement of ARDL methodology is "Gaussian error", so it is crucial that error must be serially independent, otherwise it may affect the choice of optional lag length. Thus, we test auto correlation, heteroscedasticity and functional form to ensure the presence of Gaussian error. The diagnostic test statistics are given in table 5A.

Further ensuring the dynamic stability of the model is essential as Autoregressive models are highly sensitive to lag length, sample point, number variables. Brown, Durbin and Evans (1975) suggested CUSUM & CUSUMSQ for stability of model in case of OLS. [Fig. 1 (a, b) exhibit the graphs of CUSUMSQ and CUSUM]. We apply these tests on the lines of Brown, Durbin and Evans (1975) which clearly suggest that model does not depict any serial correlation, heteroscedasticity and residuals are distributed normally.

Estimating Long-Run Model: Table A-2 presents NARDL results (Appendix-A), while long-term coefficients from NARDL are given in Table 5. The results (Table 5) suggest a positive and significant relationship between hot money and interest rate (POS) at 1% level of significance. Results of Model-2 refer that interest rate is a determinant of hot money where a percentage rise in the interest rate leads to 27.3% increase in hot money while interest rate (NEG) also stands highly significant with a negative relationship. The percentage fall in interest rate leads to 21.08 % decrease in hot money. These results corroborate with the *invasion of hot money* in Pakistan when the interest rate was jacked up by central bank to 13.25% in July 2019 and *exit of hot money* due to multiple cuts in the policy rate as a policy response to counter COVID-19 shock, initiating from 12.50% on March 18, 2020, then 11.00% on March 25 and eventually down to 7.00% on June 26, 2020.

Table 5. Long-term Estimates of Hot-Money Model					
	1. Without COVID-19 dummy	2. With COVID-19 dummy			
Variable	**Parameter Estimates**	**Parameter Estimates**	**Std. Err.**	**t-Stat.**	**Prob.**
RER	23.55***	14.85**	6.795	2.185	0.035
IRATE_POS	6.80**	27.34***	7.306	3.743	0.001
IRATE_NEG	-3.09	-21.08***	7.345	-2.871	0.007
IMPT	-7.44***	0.23	2.540	0.094	0.925
EXPT	22.05***	15.76***	5.811	2.712	0.010
D1		-8.05***	2.691	-2.993	0.005
CPI	-2.31	-51.08***	16.320	-3.130	0.003
C	-194.37	41.28	81.473	0.506	0.615
Diagnostic					
Functional Form: 0.168					
Note: *, **, and *** depict 10, 5, and 1 percent level of significance, respectively. HOT: Hot Money IRATE: Policy Rate RER: Real Exchange Rate IMPT: Imports EXPT: Exports CPI: Inflation D1:Covid-19 Dummy					

An interesting finding of our model-2 is the highly significant COVID-19 dummy variable, D_1, at 1% level of significance, bearing a negative relationship with hot money with a long-run coefficient value of -8.05, implying that COVID-19 inflicted a negative impact on hot money quantum in Pakistan. The significance of COVID-19 dummy, D_1 can be explained from the fact that pulling out of hot money by international investors aggravated, more due to fear and uncertainty arising from COVID-19 and lesser from an initial nominal cut in the interest rate in March 2020. Though, the rate was lowered from 13.25% to 12.50% initially and then further cut to 11% in late March, still this policy rate slashing left wide margins of gains for foreign investors compared to global rates of 0 – 0.25% prevailing at that time! Despite this, debt and equity market of Pakistan saw speedy departure of hot money triggered by COVID-19. Investor behaviour converged to alternate investments in gold which they considered secure in the times of pandemic. However, when the model is estimated without COVID-dummy, IRATE (NEG) stands insignificant, coefficient of RER increases and imports become highly significant with a negative relationship, contrary to Model-2. An important finding is that interest rate impacts hot money asymmetrically and lagged impact on hot money comes from nearly all the variables. The asymmetric relationship between the variables is evident from the variation in the size of their coefficients.

Estimating Short-Run Model:

The results (Table 6) show that in short-run, the hot-money responsiveness to a 1 % increase in interest rate is rise of 19.1% with a lag, while a response to 1% fall in interest rate is decrease by -14.7%, thus showing that monetary-policy measures concerning the policy rate has considerable

importance in enhancing hot-money. The COVID-19 dummy is also highly significant in short-

Table 6. Short-term Estimates of Hot-Money Model

Variable	Coefficient	Std. Error	t-Statistic
C	28.949	56.493	0.512
LHOT(-1)	-0.701***	0.126	-5.538
RER(-1)	10.413**	4.934	2.110
IRATE_POS(-1)	19.174***	4.972	3.856
IRATE_NEG(-1)	-14.783***	4.277	-3.456
IMPT	0.167	1.781	0.094
EXPT(-1)	11.051***	3.987	2.771
D1(-1)	-5.648***	1.853	-3.046
CPI(-1)	-35.814***	10.401	-3.443
D(RER)	-14.491	9.285	-1.560
D(IRATE_POS)	0.339	3.240	0.104
D(IRATE_POS(-1))	-12.858**	5.381	-2.389
D(IRATE_POS(-2))	-16.619***	5.156	-3.222
D(IRATE_NEG)	-3.989	3.471	-1.149
D(IRATE_NEG(-1))	7.557*	4.097	1.844
D(IRATE_NEG(-2))	5.7694	4.3420	1.328
D(EXPT)	1.803	2.156	0.836
D(EXPT(-1))	-3.643*	1.884	-1.933
D(D1)	-4.240***	1.546	-2.742
D(D1(-1))	2.6186*	1.395	1.876
D(CPI)	-29.909	18.431	-1.622
D(CPI(-1))	19.667	19.648	1.001
D(CPI(-2))	52.334**	20.520	2.550
Coint. Eq(-1)*	-0.701***	0.091	-7.661

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).
HOT: Hot Money IRATE: Policy Rate RER: Real Exchange Rate IMPT: Imports EXPT: Exports CPI: Inflation D1:Covid-19 Dummy

run with a coefficient value of -5.64, implying that COVID-19 negatively affected the hot money in Pakistan. However, COVID-19 long-run impact of -8.05 is more profound than the short-run.

The short-run dynamics are very crucial due to Error Correction co-efficient, which is appropriately negative and significant, showing cointegration between variables. The ECM co-efficient exhibits the adjustment pace of the long-run equilibrium, after experiencing a short-term shock. ECM co-efficient – 0.70 indicates that series is in-explosive, and nearly 70 % of the last year'

disequilibrium in hot-money revert back to long-run equilibrium in the present year.

The asymmetry in the relationship is observable from the size of the coefficients. However, to confirm the asymmetric association between variables, we employ the Wald test. Wald test results (Table-7) indicate that when a long-run relationship exists, it is asymmetrical in nature. The asymmetric effect implies that the interest rate doesn't react in equal proportion to negative and positive change in the long-term.

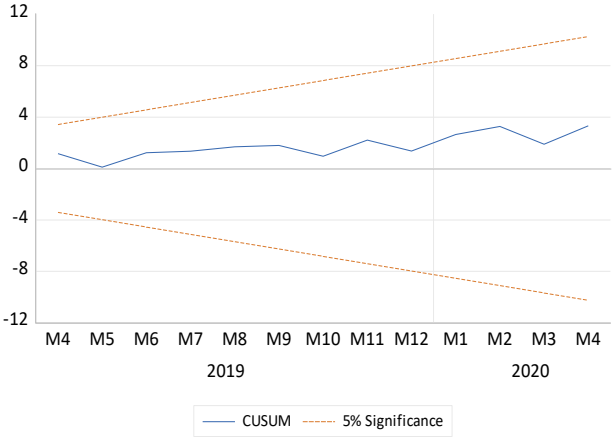
We could say for our study, in accordance with the NARDL model that, when a long-run relationship exists, it is asymmetrical in nature.

Table 7. Wald Test

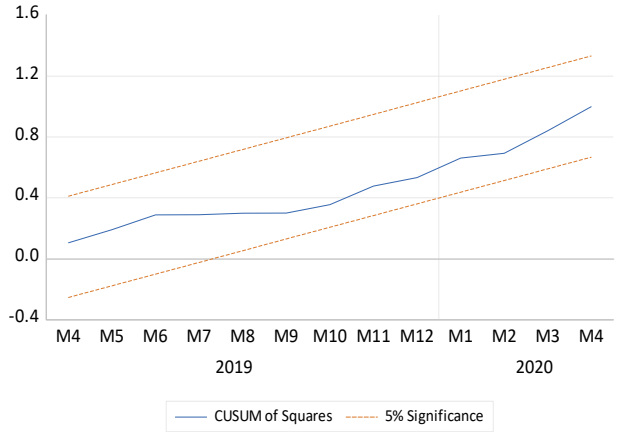
Test Statistic	Value	Df	Probability
t-statistic	1.755097	27	0.0906
F-statistic	3.080366	(1, 27)	0.0906
Chi-square	3.080366	1	0.0792

The CUSUM and CUSUMQ dynamic stability tests are applied after the long-term and short-term co-efficient estimation. The computed parameters turn out to be stable as CUSUM/CUSUMQ line lie within the lower and upper bounds of the graph, hence confirming stability.

(Fig 1-a)



(Fig 1-b)



5. Conclusion

This study investigated the determinants of hot money inflow-outflow in Pakistan, especially the *hot money build-up* in recent years (May 2015 – June 2020), triggered by high incentives for the foreign investors by government & an elevated interest rate by the central bank. Further, the study sheds light on how COVID-19 impacted the hot money and *cooled off the temperature of money and the debt market of Pakistan!* In doing so, the study employed nonlinear autoregressive distributed lag (NARDL) framework for addressing nonlinearities. Through NARDL bounds testing, the cointegration among the variables was examined comprising of exchange rate, interest rate, imports, exports, inflation and hot money.

The findings show that the interest rate is not the only determinant of hot money. Other variables, such as exchange rate, exports and inflation are also important determinants of hot money. The results form the nonlinear autoregressive distributed lag model show that there exists asymmetric impact of interest rate captured by positive and negative changes. These results corroborate with the *invasion of hot money* in Pakistan when the interest rate was jacked up by central bank to 13.25% in July 2019 and *accelerated exit of hot money* due to combined effect of slashing of policy rate and COVID-19.

6. Policy Recommendations

- Hot money is essentially, highly unpredictable, short-term money -that is vulnerable to the risk of flying out, in search of more favorable destinations due to interest rate slashing.
- The pursuit for drawing in hot money at higher rates can harm economic activities as it comes at the expense of discouraged private sector investment and higher interest payments.
- Shocks or crisis (like Covid-19 pandemic) can lead to peculiar situation of hot money drying up due to cutting down of interest rate.

References

Ahmed, A 2020, Lowering interest rates: Foreign Investors Pull out $1.6 billion hot money from Pakistan, NewzTodays, viewed 15 December 2020, https://newztodays.com/lowering-interest-rates-foreign-investors-pull-out-1-6-billion-hot-money-from-pakistan/

Ahmed, K 2020, FED rate cut makes Pakistan more attractive to hot money, Arab News, March 06, viewed 15 December 2020 https://www.arabnews.pk/node/1637651/pakistan

Anoruo, E 2011, Testing for linear and nonlinear causality between crude oil price changes and stock market returns, *International Journal of Economic Sciences & Applied Research*, vol. 4, no. 3, pp. 75–92.

Athukorala, P and Rajapatirana, S 2003, Capital flows and the real exchange rate: A comparative study of Asiaand Latin America, June 27, *The World Economy*, vol. 26, no. 4, pp. 613-637.

Brown, R L, Durbin, J & Evans, JM 1975, Techniques for testing the constancy of regression relationships over time, *Journal of the Royal Statistical Society*, Series B (Methodological), vol. 37, no. 2, pp. 149–192.

Celasun, O, Denizer, C and He, D 1999, Capital flows, Macroeconomic management and the financial system: The Turkish case, 1989-1997. World Bank Working Paper.

Chari, VV and Kehoe, PJ 2003, Hot money, *Journal of Political Economy*, vol. 111: no. 6, pp. 1262-1292.

Domowitz, I, Glen, J and Madhavan, A 1997, Market segmentation and stock prices: Evidence from an emerging market, *Journal of Finance*. vol. 52, pp. 1059-1085.

Engle, RF & Granger, CWJ 1987, Co-integration and error correction: Representation, estimation, and testing, *Econometrica*, vol. 55, no. 2, pp. 251–276.

Feldstein, M 2000, Aspects of global economic intergration: Outlook for the future, National Bureau of Economic Research, September, Working Paper 7899

Filer II LH 2004, Large capital inflows to Korea: the traditional developing economy story? *Journal of Asian Economics* vol. 15, pp. 99-110.

Guichard, S 2017, Findings of the recent literature on international capital flows: implications and suggestions for further research.

Henry, PB 2000, Do stock market liberalizations cause investment booms? *Journal of Financial Economics*, vol. 58, pp. 301-334.

Hussain, F 2020, Over $600m of 'hot money' leaves country in 12 days, Dawn. March 13, viewed 15 December 2020, https:// www.dawn.com/news/1540501

Iqbal, S 2020, Hot money inflows soar to $2.9bn, Dawn, February 01, viewed 15 December, 2020, https://www.dawn.com /news/1531819

Kokko, A 1992, Foreign direct investment, host country characteristics and spillovers, Stockholm: The Economic Research Institute.

Markusen, J and Venables, A 1999, Foreign direct investment as a catalyst for industrial development, *European Economic Review*, vol. 43, pp. 335-56.

McKinnon, R 2014, Hot money flows, cycles in primary commodity prices, and financial control in developing countries, IDEAS Working Paper Series from RePEc, St. Louis.

Mishra D, Mody, A and Murshid, AP 2001, Private capital flows and growth, *Finance & Development, vol.* 38, no.2, Intrenational Monetary Fund.

Pesaran, MH, Shin, Y and Smith, RJ 2001, Bounds testing approaches to the analysis of level relationships, *Journal of Applied Econometrics, vol.* 16, pp. 289-326.

Po, WC and Huang, B-N 2008, Tourism development and economic growth–a nonlinear approach, *Physica A: Statistical mechanics and its applications, vol.* 387, pp. 5535-5542

Prasad, ES, Rajan, RG and Subramanian, A 2007, Foreign capital and economic growth, National Bureau of Economic Research.

Sarno, L and Taylor, MP 1999, Moral hazard, asset price bubbles, capital flows, and the East Asian crisis: the first tests, *Journal of International Money and Finance*, vol. 18, pp. 637-657.

Stock, JH and Watson, MW 2012, Disentangling the Channels of the 2007-2009 Recession, National Bureau of Economic Research.

Waheed, H 2020, Pakistan's Monetary Policy Management: Hot Money and High Policy Rate, *Daily Times*, 14 Feb, viewed 15 December 2020**,** https://dailytimes.com.pk/557953/pakistans-monetary-policy-management-hot-money-and-high-policy-rate/

Zhang, Y., Chen, F., Huang, J., & Shenoy, C. (2019). Hot money flows and production uncertainty: Evidence from China. Pacific-Basin Finance Journal, 57, 101070.

Appendex-I

Table A-1: Unit Root Test Results at Level								
		LHOT	**RER**	**IRATE**	**IMPT**	**EXPT**	**D1**	**CPI**
With Constant	t-Statistic	-4.4016	-1.5124	-1.5622	-1.8742	-2.5054	-0.3592	-4.9568
	Prob.	0.0004	0.5247	0.4993	0.3437	0.1162	0.9118	0.0001
		***	n0	n0	n0	n0	n0	***
With Constant & Trend	t-Statistic	-4.934	-2.1797	-2.4649	-3.1224	-2.5378	-1.3149	-4.3676
	Prob.	0.0004	0.4969	0.3451	0.105	0.3097	0.8803	0.0033
		***	n0	n0	n0	n0	n0	***
Without Constant & Trend	t-Statistic	-0.5129	-2.2863	-0.7375	0.1562	-0.1287	0	9.0226
	Prob.	0.4929	0.0219	0.3955	0.73	0.6377	0.6811	1
		n0	**	n0	n0	n0	n0	n0
	At First Difference							
		d(LHOT)	**d(RER)**	**d(IRATE)**	**d(IMPT)**	**d(EXPT)**	**d(D1)**	**d(CPI)**
With Constant	t-Statistic	-18.5294	-8.1576	-5.0292	-8.089	-13.155	-12.1244	-9.1882
	Prob.	0	0	0	0	0	0	0
		***	***	***	***	***	***	***
With Constant & Trend	t-Statistic	-18.4673	-8.1419	-5.0341	-8.0572	-13.1013	-12.2303	-9.8112
	Prob.	0	0	0.0003	0	0	0	0
		***	***	***	***	***	***	***
Without Constant & Trend	t-Statistic	-18.5899	-7.7415	-5.024	-13.4153	-13.2011	-12.083	-3.6898
	Prob.	0	0	0	0	0	0	0.0003
		***	***	***	***	***	***	***
Notes:(*) Significant at the 10%; (**)Significant at the5%; (***) Significant at the 1% and (no) Not Significant								

Table A-2 Nonlinear ARDL Estimation Results				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***
LHOT(-1)	0.298	0.126582	2.361412	0.0236
RER	-14.49	9.285219	-1.56072	0.1271
RER(-1)	24.90	9.265795	2.687836	0.0107
IRATE_POS	0.33	3.240216	0.104766	0.9171
IRATE_POS(-1)	5.97	4.660792	1.282215	0.2077
IRATE_POS(-2)	-3.76	4.609863	-0.81571	0.4199
IRATE_POS(-3)	16.61	5.156485	3.222928	0.0026
IRATE_NEG	-3.98	3.471708	-1.14903	0.2579
IRATE_NEG(-1)	-3.23	5.321924	-0.60853	0.5466
IRATE_NEG(-2)	-1.78	5.440934	-0.32864	0.7443
IRATE_NEG(-3)	-5.76	4.342047	-1.32875	0.1921
IMPT	0.16	1.781028	0.094268	0.9254
EXPT	1.80	2.156735	0.836104	0.4085
EXPT(-1)	5.60	1.824709	3.071665	0.004
EXPT(-2)	3.64	1.884803	1.933147	0.0609
D1	-4.24	1.546236	-2.74262	0.0093
D1(-1)	1.21067	1.577986	0.767224	0.4478
D1(-2)	-2.61868	1.395226	-1.87689	0.0684
CPI	-29.9097	18.43107	-1.62279	0.1131
CPI(-1)	13.76273	28.68667	0.47976	0.6342
CPI(-2)	32.66645	29.61311	1.103108	0.2771
CPI(-3)	-52.3341	20.5203	-2.55036	0.015
C	28.9449	56.49391	0.512354	0.6114
R-squared	0.631376	Mean dependent Var		12.34547
Adjusted R-squared	0.412195	S.D. dependent Var		1.019294
S.E. of Regression	0.781477	Akaike info criterion		2.627977
Sum squared Resid.	22.59612	Schwarz criterion		3.430809
Log likelihood	-55.8393	Hannan-Quinn Criteria		2.942009
F-statistic	2.88061	Durbin-Watson stat		2.546537
Prob (F-statistic)	0.00219			