# THE EFFECTS OF INFLATION AND OPERATING CYCLE ON CASH HOLDINGS (LIQUIDITY) OF LISTED COMPANIES IN TEHRAN STOCK EXCHANGE

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## ABSTRACT

*This study aims at testing the relationship between inflation and the cash holdings. Moreover, the existence and the direction of the relationship between operating cycle and cash holdings have also been examined. To this aim, two hypotheses have been developed. The first hypothesis has investigated the shifting of the relationship between inflation and cash holdings of the companies at a certain level of inflation and the second hypothesis has investigated the change the direction between operating cycle and cash holdings in companies at a certain level of operational cycle. To test the hypothesis, using systematic elimination method, a sample of 77 companies, including the companies listed in Tehran Stock Exchange during 2003 to 2013 were selected and multivariate regression model was used to analyze the data. Hypotheses test results showed that the relationship between inflation and cash holdings was reverse at a certain level and from that level on, it shifted direction and this was a direct relationship. On the other hand, the relationship between operating cycle and cash holdings was reversed to a certain degree and from that level on it changed direction and this relationship became direct.*

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**Keywords:** Cash holding, Inflation, Operating cycle, Nonlinear relationship, Multivariate regression, Tehran stock exchange.

## Contribution/ Originality

This study investigated cash holding based on balance theory. This study used a multiple regression analysis. This study investigated inflation and operating cycle's effect on cash holding. The paper used F (Limer) and Hausman tests. The paper found the direction of the relationship between inflation, operating cycle and cash holding.

## 1. INTRODUCTION

Cash holdings Strategy of companies can determine their future destination and perspective. As Keynes (1936) mentions, in an incomplete market, companies tend to collect and preserve cash for future business and risk mitigation. However, maintaining high liquidity increases the cost of lost opportunities, while holding too little can cause the lack of cash costs which has harmful effects on investment.

Oplera *et al.* (1999) and Harford (1999) suggest that the desirable level of cash holding of the company seems to be maintaining a balance between the cost and benefits of cash holdings. At the macroeconomic level, companies

have to respond to changes in the purchasing power caused by inflation and tend to adjust and optimize their cash holdings (Kimjani, 2006).

Inflationary pressure will undoubtedly increase the liquidity effect value, therefore, can affect the balance between costs and benefits of effective cash holdings. In terms of costs and benefits of cash holdings, inflation increase is influential on the government control in Macroeconomics that in turn can affect investment and capital value, directly. In addition, at the microeconomic level, the operating cycle of the companies has a direct relationship with timing and speed of an increase in firm liquidity, which shows that liquidity holding and operating cycle can impact on the costs and benefits of internal liquidity. Considering both economic cycle at its macro level and operational cycle at its micro level, this research aims to expand its knowledge on internal and external factors affecting the company's cash holdings.

In terms of what was mentioned above, our main question is whether inflation and operating cycle will influence the level of firm's cash holdings? If the answer is yes, how is the direction of this influence?

One of the most important duties of managers is to determine the assets configuration and their amounts in different economic and financial situations. In this regard, managers should decide for the amount of cash that companies should maintain (Rasaiian et al., 2011). Generally, factors affecting cash holding in the company, originate from the following five theories.

Trade-off theory states when the benefits and marginal costs of cash maintenance are equal, the amount of liquidity is at the optimal level (Oplera et al., 1999). Based on this theory, factors including growth opportunities and debt maturity (Yeganeh et al., 2011) liquidity of current assets (Izadinia and Rasaiian, 2009) leverage (Ferreira and Vilela, 2004) firm size (García-Teruel et al., 2009) cash flow (Kashanipoor et al., 2010) uncertainty of liquidity (Rasaiian et al., 2011) financial crisis (Oplera et al., 1999) and payment of dividends (Ferreira and Vilela, 2004; Mehrani et al., 2009) are determinant factors of cash holding.

Also Pecking-order theory provided by Myers and Majluf (1984) states that firms prefer internal sources to external ones for financing (Drobetz et al., 2010). According to this theory, investment opportunities, liquidity, firm size (Ferreira and Vilela, 2004) and financial crisis (Rasaiian et al., 2011) are determinant factors of cash holding.

The free cash flow theory by Jensen (1986) states that managers do not tend to pay cash (including dividends) and have more incentives to accumulate liquidity to increase resources they control (Rasaiian and Izadinia, 2009). Based on this theory, factors including leverage and investment opportunities (García-Teruel et al., 2009) firm size (Ferreira and Vilela, 2004) and banking relationships (Ozkan and Ozkan, 2004) are determinant factors of liquidity.

According to Agency theory, in larger companies where managers have more freedom, companies with low debt levels and companies with more investment opportunities and more costs of external financing, more cash is held. Some factors including firm size, corporate debt and investment opportunities are including among the determinant factors liquidity in this theory (Dittmar et al., 2003).

Information Asymmetry theory, refers to the cases in which one of the parties in transaction has an information advantage over the other side. In such cases the information is asymmetric. In general, it can be said that information asymmetry has an important impact on cost of external financing (Ahmadpour and Rasaiian, 2007). Based on this theory, companies with a higher level of information asymmetry hold less cash (Lau and Block, 2012).

In addition to the provided theories, Keynes (1936) has explained three main detailed reasons for holding cash; it can be used as a tool for transactions (Transaction Motive);or for dealing with unforeseen financial crisis as well as future status, (Precautionary Motive); or for profitable opportunities in future (Speculative Motive).

## 2. LITERATURE REVIEW

Wanga *et al.* (2014) investigated the influences of inflation and operating cycle on cash holding. Their findings indicated a negative relationship between inflation and firm's cash holdings but at a certain level of inflation, this relationship was reversed and also there existed a (U) form connection between operating cycle and cash holdings of the company and this relationship was affected by changes in the level of inflation .

Gao and Grinstein (2014) studied the relationship between stock returns and liquidity. Their findings indicated a significant positive relationship between the overall volatility and systematic stock returns of American companies, with their amount of cash holding.

Bao *et al.* (2012) studied the effect of cash holding sensitivity to cash flows, whose results showed a greater willingness to hold cash, when the business units cash flows were negative.

Palazzo (2012) examined the relationship between liquidity and risk affecting cash holding policy to indicate that risk taking companies used more external financing and their savings were more desirable. Therefore, precautionary savings motives showed a positive relationship between expected return of stock and cash holdings.

Autukaite and Molay (2011) have examined the relationship between cash value and working capital management. Their findings reveals that excess cash holdings leads to a decrease in the company value, while the impact of working capital on firm value depends on the percentage of debt in the financial structure of the company.

Arabsalehi and Rahrovi (2012) studied factors influencing cash holding levels and cash flow. They found that there was an inverse relationship between the net non-cash components of working capital, growth opportunities, the possibility of financial crises, and the level of firm cash holdings, while the relationship between the ratios of cash flow as well as the industry criteria and companies cash flow was direct. Furethermore, the efficiency of working capital management and the ratio of current liabilities had no effect on firm cash holdings.

## 3. HYPOTHESIS

Based on trade off theory, Wanga *et al.* (2014) introduced two factors affecting amount of liquidity in microeconomic and macroeconomic levels. Therefore, our main question is "whether and how inflation and operating cycle affect firm cash holdings?" Answering the research question, two hypothesis have been formulated. Since firms internal environment is not separated from the external one, several studies have examined the effects of external factors on cash holdings (for example: Zhu and Lu (2009)). Changes and fluctuations in the inflation rate can affect firm performance and its demand for liquidity.

In periods of inflation, firms need more money to purchase the same amount of raw materials and other goods, thus taking up more of their working capital, while they also generate less money through their operating cycles. Therefore, it is expected that when inflation rate increases, firms purchase raw materials to prevent an increase in the costs in one side, and exchange their liquidity with some other real estate and gold, whose values will increase as inflation rate increases, to prevent a decrease in purchasing power on the other side, which, in turn, lead to a decrease in firms cash holding (Friedman, 1977). On the other hand, a continuous increase in inflation rate leads government to regulate macroeconomics through monetary policies including an increase in deposit reserve rate, an improvement in interest rate as well as the control of credit scale in commercial banks. Implementing the exact condition required for lending, banks will bring about some external financing constraints for firms (Stiglitz and Weiss, 1981). These factors cause changes in the company's liquidity level in these circumstances, the assets of the company has changed and firms converted their assets to cash which increases cash holdings of the companies, accordingly, it can be expected that the relationship between inflation and cash holdings is not fixed and may change direction on a spot (Wanga *et al.*, 2014). Thus, we set up our first hypothesis:

H1: the relationship between inflation and cash holdings, changes direction at a certain level of inflation.

Firm's operating cycle is influenced by some industrial factors, the firm's methods in business and its management efficiency. From the demand perspective, firms with a shorter operating cycle take up less time for their purchase, production, and sale process, as they hold much liquidity for their transactions in accordance with their transactions motive. From the supply perspective, a shorter operating cycle implies a reduction in obtaining inventory, selling and regaining cash process, which in turn, lead to an increase in cash holding . Internal capital accumulation is then more efficient, the amount of current capital taken up by inventory and accounts receivable declines, and the firm's own cash supply increases, with a subsequent increase in internal cash holdings. Conversely, firms with a longer operating cycle take up longer for purchasing raw materials and producing products. From the demand perspective, the period of continuous investment in production and operation is extended accordingly, which reduces average cash holdings. From the supply perspective, a longer operating cycle means a slower turnover of cash flow, inventory sales, and recovery of accounts receivable. More cash is frozen in current assets for a longer time, which decreases the firm's own cash supply and reduces its cash holdings. The capital chain cannot meet the firm's normal production needs, and operational demands and good investment opportunities may be lost. Investigating the impact of liquidity risk and cash holding financing capacity, Oplera et al. (1999) suggest that firms suffer from their capital reduction, thus they tend to take a high risk of holding more cash. Considering the management and investment requirements consistent with the precautionary motive theory of cash holdings, Once the operating cycle reaches a certain point, firms can prevent bankrupting through an increase in their cash holdings (Wanga et al., 2014).

An increase in inventory turnover, accounts receivable collection as well as cash flow will result in a shorter product operating cycle, which in turn, causes an increase in cash holdings. On the other hand, facing with some difficulties while collecting firm's accounts receivable and selling the products will increase cash follow as well as operating cycle can cause lack of liquidity. In such conditions, firms start financing (loans with collateral, selling the accounts receivable, financing with mortgaging inventories, etc.) to eliminate the risks and threats and increase their cash holdings (Stephen et al., 2011). Our second hypothesis is thus set as follows:

H2: the relationship between operating cycle and cash holdings, changes direction at a certain level of operational cycle.

## 4. METHODOLOGY

### 4.1. Multiple Variables Linear Regression Model

Multiple regressions model was used to test the hypotheses. In this study to diagnosis panel data from pool and to diagnosis fixed effects data from random effects, the "chow" and "Hausman" tests were used respectively. to test the hypotheses, multivariate regression model, provided by Almeida et al. (2004) has been used as model (1).

$$\Delta Cash_{i,t} = \beta_0 + \beta_1 CPI_{i,t} + \beta_2 CPI^2_{i,t} + \beta_3 Cycle_{i,t} + \beta_4 Cycle^2_{i,t} + \beta_5 CF_{i,t} + \beta_6 Tobinq_{i,t} + \beta_7 Lnasset_{i,t}$$
$$+ \beta_8 \Delta NWC_{i,t} + \beta_9 \Delta SDebt_{i,t} + \beta_{10} Risk_{i,t} + \varepsilon_{i,t} \qquad (1)$$

### 4.2. Data Sample

The data were collected from Rahavard Novin information bank software and some informational web sites such as "The management of research, development and Islamic studies Securities and Exchange Organization"[1], "The Securities and Exchange Organization[2]" and "Central Bank of the Islamic Republic of Iran[3]". The time period of this research included 2003 to 2013.

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[1]- www.rdis.ir

[2]- www.seo.ir

The screening method was used for limiting the population and making the sample. So the sample includes all companies in the Stock Exchange in Tehran that pursue all following conditions:

1. The end of firm fiscal year should be the end of Iranian year (19 March).
2. Have not change their fiscal year during the research period (2003- 2013)
3. Company's name should been accepted before 2003 at Tehran Stock Exchange and should not been removed until the end of 2013 from the list of these companies.
4. The main operations of firm should not include the operation of banks, investment, leasing and insurance companies had not been.
5. All required information for running the research model, should be available.

According to these limitations, 77 firms were selected from companies in Tehran Stock Exchange.

### 4.3. Variables

### 4.3.1. Dependent Variables

- Δ cash

The dependent variable here is changes in cash (Δcash). Following the study of Wanga *et al.* (2014) changes in firm's cash is an index for cash holding calculated as difference of cash and short-term investment between year t and year t-1, divided by total assets.

### 4.3.2. Independent Variables

Following Wanga *et al.* (2014) independent variables in this study are as described in table 1:

**Table-1.** Independent variables definitions

| Variable | Symbol | How to measure |
|---|---|---|
| Inflation | CPI | Consumer Price Index (extracted from the central bank[4]) |
| Operating cycle | CYCLE | Inventory turnover period + Accounts receivable period |

**Source:** Wanga *et al.* (2014)

Calculation of accounts receivable period and inventory turnover period are as model (2) and (3):

$$\text{Accounts receivable period} = \left( 365 \times \frac{\text{average of accounts receivable}}{\text{sales revenue}} \right) \qquad (2)$$

$$\text{Inventory turnover period} = \left( 365 \times \frac{\text{average inventories}}{\text{operating cost}} \right) \qquad (3)$$

In order to consider scaling effects, both of indices have been divided to 1000.

### 4.3.3. Control Variables

Following Wanga *et al.* (2014) some other variables that could affect company's cash-holdings entered in model as control variables as described in table 2.

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[3]- www.cbi.ir

[3]- www.cbi.ir

**Table-2**. Control variables definitions

| Variable | Symbol | Definition |
|---|---|---|
| Cash Flow | CF | Operating cash flow divided by total assets |
| Investment growth opportunities | TobinQ | Ratio of market value to book value of assets |
| Firm Size | Lnasset | Logarithm of total assets |
| Changes in net working capital | NWC$\Delta$ | The difference in net working capital between year t and year t - 1, divided by total assets in year t |
| Changes in short-term loans received | SDebt$\Delta$ | The difference in short-term loans received between year t and year t _ 1, divided by total assets in year t. |
| Risk | Risk | Ratio of covariance of returns per share and market return to variance market return |

**Source:** Wanga *et al.* (2014)

## 5. EMPIRICAL RESULTS

In this study panel data technique is used. The chow (F- limer) test was used for determining data type. The results provided in table 3 indicate that the data are pooled.

**Table-3.** Summary results F-Limer test for regression estimation method (1)

| Type of test | Statistic | P-Value | Result |
|---|---|---|---|
| F-Limer | 1.1378 | 0.2067 | pooled data |

**Source:** Research findings

We used the generalized least squares (GLS) method with cross-sectional weights and Coef Covariance Method White Cross-section. So the heteroscedasticity problem will be discounted. Also results in table 4 indicate Durbin-Watson value is between the critical values 1.5 and 2.5, so we can ignore autocorrelation problem. The multicollinearity problem also had been discounted due to use the panel data method (Mehregan and Ashrafzadeh, 2008). A P-value obtained for the F statistic is equal with 0.00, so the regression is significant in sum.

**Table-4**. Empirical results of Model 1

$$\Delta Cash_{i,t} = \beta_0 + \beta_1 CPI_{i,t} + \beta_2 CPI_{i,t}^2 + \beta_3 Cycle_{i,t} + \beta_4 Cycle_{i,t}^2 + \beta_5 CF_{i,t} + \beta_6 Tobinq_{i,t} + \beta_7 Lnasset_{i,t} + \beta_8 \Delta NWC_{i,t} + \beta_9 \Delta SDebt_{i,t} + \beta_{10} Risk_{i,t} + \varepsilon_{i,t}$$

| Variable name | Variable symbol | Coefficient | T-statistics | P value |
|---|---|---|---|---|
| Intercept | $\beta_0$ | -0.003112 | -0.185568 | 0.8528 |
| inflation | CPI | -0.001046 | -2.236300 | 0.0256 |
| Square inflation | $CPI^2$ | 0.000025 | 2.290458 | 0.0222 |
| operating cycle | Cycle | -0.076250 | -3.868004 | 0.0001 |
| Square operating cycle | $Cycle^2$ | 0.114382 | 5.240187 | 0.0000 |
| Operating Cash Flow | CF | 0.129791 | 11.100680 | 0.0000 |
| Investment growth opportunities | Tobinq | -0.001591 | -0.548968 | 0.5832 |
| Firm size | Lnasset | 0.001092 | 0.518582 | 0.6042 |
| Changes in net working capital | NWC$\Delta$ | 0.119538 | 10.213800 | 0.0000 |
| Changes in short-term loans received | SDebt$\Delta$ | 0.126548 | 11.042680 | 0.0000 |
| Risk | Risk | 0.000787 | 0.755579 | 0.4051 |
| $R^2$ | 0.182649 | | F- statistic significance | 0.000000 |
| F- statistic | 18.681650 | | Durbin-Watson | 2.32 |

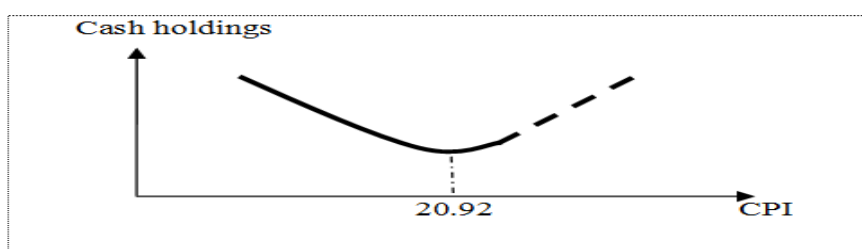**Source:** Research findings

**Note:** Indicate significance at the 5% level.

## 6. DISCUSSION

The goal of this study was to see if the direction of relationship among inflation and cash holdings changes at a certain level of inflation and whether the direction of relationship between operating cycle and liquidity changes at a

certain level of the operating cycle. In this context, two hypotheses were presented and tested. The first hypothesis meant to investigate the direction changing of the relationship between inflation and firm cash holdings at a certain level of inflation. Friedrich (1982) states that, when a variable is used with its squared, variable coefficient does not provide meaningful information and we should consider the coefficient of squared variable. If the coefficients of an independent variable and the square of it contain different signs, there should be a recursive point for the independent variable. This leads to creating a U-shaped or inverted U-shape relationship between the dependent and independent variables (Wooldridge, 2014). Table (4) indicates that the CPI and CPI2 coefficients are both significant and are negative and positive respectively. This means that an increase in the amount of CPI, will lead to a reduction in cash holdings to a minimum point, and then, this effect will turn from negative to positive. In other words, the relationship between inflation and liquidity is of U-shaped. So the first hypothesis is not rejected. To calculate the minimum point for the relationship between CPI and cash holdings, we have to derive to CPI and equalize it to zero.

$$-0.001046 + \left( 2 \times 0.000025 \, CPI_{i,t} \right) = 0 \qquad CPI_{i,t} = 20.92$$
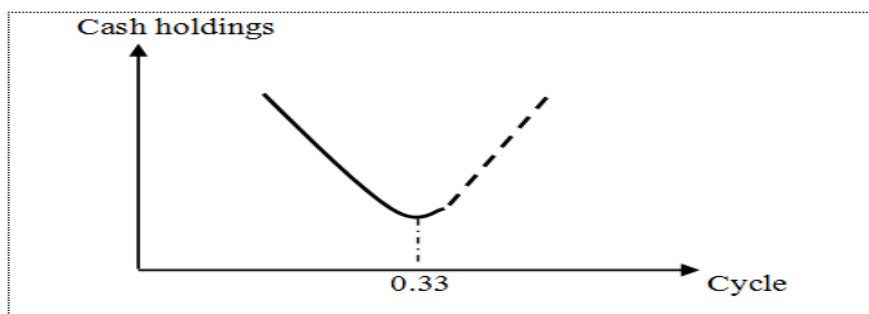


**Figure-1.** U-shaped curve of the relationship between CPI and cash holdings
**Source:** Research findings

This result means that in our sample and in the period of this study, the point of 20.92 is the minimum point of impact of inflation on cash holdings. While before of this point, there has been a decreasing effect of inflation on liquidity and after this point an increasing effect of inflation on cash holdings. This relationship is illustrated in Figure (1). In other words, there is a U-shape relationship between inflation and liquidity.

The second hypothesis was about to investigate changing the direction of the relationship between Cycle and firm cash holdings at a certain level of Cycle. According to Table (4) the Cycle and Cycle2 coefficients are both significant and are negative and positive respectively. These results lead to a U-shape relationship between Cycle and cash holdings. By increasing the amount of Cycle, cash holdings will reduce and arrives to a minimum point, and then, this effect will turn from negative to positive. So the second hypothesis is not rejected. The minimum point for relationship between Cycle and cash holdings is obtained as follow:

$$-0.076250 + \left( 2 \times 0.114382 \, Cycle_{i,t} \right) = 0 \qquad Cycle_{i,t} = 0.33$$



**Figure-2.** U-shaped curve of the relationship between operating cycle and cash holdings
**Source:** Research findings

This result means that in the sample and in the period of our study, the point of 0.33, is the minimum point of impact of Cycle on cash holdings. While before this point, there is a decreasing effect of Cycle on liquidity and after this point an increasing effect of Cycle on cash holdings. This relationship is provided in Figure (2). In other words, there is a U-shape relationship between inflation and liquidity.

## 7. CONCLUSION

In this study, it was tried to identify the influence of inflation and operating cycle on liquidity. In addition, existence and direction of relationship between inflation, operating cycle and liquidity were tested. The research results showed, the relationship between inflation and liquidity was reversed to a certain level of inflation and after that point the direction is changed to a direct relationship. In other words, there is a U-shaped relationship between inflation and liquidity. On the other hand, the relationship between operating cycle and liquidity is also reverse to a certain level of operating cycle and, the direction is changed to a direct relationship. This means that there is a U-shaped relationship between operating cycle and liquidity. Based on these results, it's recommended to the researchers and the capital market analysts maintain a constant direction about the relationship between inflation and liquidity as well as the relationship between operational cycle and liquidity cannot always be correct and the U-shaped relationship is important to be considered in their analysis. The above results can be summarized and interpreted as follows: the operating cycle has been affected by the period of accounts receivable collection and the period of cash flow collection. If accounts receivable collection period is longer, the company's products would have a longer operating cycle, the flowing of cash is slower, and will lead to reduce cash holdings. In these conditions, firms tend to finance activities to avoid the risk of bankruptcy and this leads to increased cash holdings. In a macro level perspective, in high inflation conditions, companies replace cash by assets that their values increase with inflation, in order to prevent rising costs and declining purchasing power. This leads to decreased cash holdings.

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