Testing Liquidity Persistence among Firm-specific and Macroeconomic Factors During Periods of Economic Instability in Egypt Using GMM Estimation

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Abstract

The study focuses on measuring liquidity persistence among other internal and external determinants of liquidity for Egyptian non-financial listed firms during the period (2012-2022) using the Generalized Methods of Moments (GMM) to account for potential unobservable heterogeneity and endogeneity problems that might result from including lagged dependent variable among regressors. The results of the study confirmed the strong persistence of liquidity over the sample period. The results also highlighted positive significant effects of profitability, leverage, and growth of sales on liquidity. While inflation is proved to negatively affect liquidity over the sample period. Therefore, the current study further contributes to the existing body of literature though using the GMM estimation to test for the dynamic nature of the model of firm liquidity determinants. The results of the estimated model confirmed the significance of the lagged dependent variable among other firm-specific and macroeconomic determinants of liquidity. This interesting result highlights the impact of past values of liquidity on future values which refers to the ability of the sample firms to maintain stable liquidity levels over time. This outcome is consistent with the principles outlined in the Agency Theory. Moreover, the estimated model took into consideration the effects of external events during the sample period, which were proved to have insignificant effect on the estimated model.

***Keywords**: Liquidity Persistence, Profitability, Liquidity Determinants, The GMM, Egyptian Firms, Economic Instability.*

Introduction

Liquidity plays crucial role in managing business performance and risk. Volatility in liquidity measures needs more focus on robust risk management practices to ensure stability of business and avoid financial difficulty in case of market downturns. This can be done through different tools including diversified portfolios of liquidity sources and hedging tools to ensure the firm can cover its immediate need of liquidity (Doan, Vu, & Nguyen, 2024). This was discussed in the study of (Tripathy & Uzma, 2020) which examined the liquidity determinants of 323 Indian manufacturing companies listed on the Bombay stock exchange over 8 years from 2010 to 2017. Their study emphasized the importance of understanding the mechanism of liquidity levels in emerging economies and the role of similar studies in helping manager better manage firms' cash holdings. Additionally, they highlighted the importance of understanding liquidity mechanisms in emerging economies for firms that operate in imperfect markets, such as the case of Egypt that is considered one of the emerging economies with many economic challenges.

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Many previous studies focused on examining liquidity determinants in USA and Europe, where firms have stable access to fund raising from external debt and equity markets. This is totally different in emerging economies, because of differences in availability of funding sources. Which requires more research efforts in this regard to investigate liquidity determinants in different developing economies (Tripathy & Uzma, 2020). Therefore, the current research will investigate different internal and external factors affecting firm liquidity during periods of economic instability for the period 2012-2022. The results of the current study should help in identifying possible important considerations for firms regarding their liquidity during periods of economic challenges. While comparing the results of the current study to results of previous literature that were mostly conducted in more developed economies will enhance the literature with more insights on different ways of better management of firm liquidity. Finally, the paper will use a dynamic panel data modelling using the Generalized Methods of Moments (GMM) to test the persistent effect of liquidity measures and to account for potential endogeneity problems which will improve the results of the tested model.

Theoretical Background

The Resource-Based Theory discussed the importance of the firm's own resources in shaping its competitive edge, and as discussed by (Amit & Schoemaker, 1993) the theory declared the role of internal factors in organizational success. Also, (Barney, 1991) emphasized the importance of the Resource-Based Theory in explaining the firm's potential of utilizing their resources and capabilities to create and maintain competitive advantages. Likewise, (Demsetz, 1973), (Hoffer & Schendel, 1978), and (Wernerfelt, 1984) confirmed the same view that the main source of firm's improved performance is based on the use of its internal resources to respond to customer needs. They added that firms differ in accordance with their abilities to operate their resources to maintain their competitive advantage which enhances performance and as a result provide better liquidity. Therefore, firms should maintain an effective balance between the utilization of its resources to leverage performance and holding an optimum level of liquidity. The Resource-Based Theory discussed different internal resources and capabilities that firms can balance to improve performance while maintain adequate liquidity. Different previous studies tried to investigate this link between efficient use of internal resources to improve firm performance and the expected impact on liquidity.

The study of (Tripathy & Uzma, 2020) highlighted that capital structure theories that are relevant to firm liquidity include: the Trad-off Theory and the Agency Theory. Where the Agency Theory introduced by (Jensen & Meckling, 1976) discussed the conflict of interest that exists between principals and agents. Where managers (agents) prefer to have more cash at their discretion, as they decide from their own managerial perspective if they need liquidity to cover short-term obligations and decrease risk. However, shareholders (principals) may prefer dividends or other alternative use of cash. Therefore, interests of managers and shareholders regarding firm liquidity may not be the same and this will result in the agency problem and its inherent effect. Therefore, (Pinkowitz, Stulz, & Williamson, 2006) concluded that firms with more agency issues tend to accumulate more cash. (Dittmar & Mahrt-Smith, 2007) agreed with this view, as they highlighted that shareholders perceive a diminishing value of marginal liquidity accumulated by management which increase the agency issue. (Roy, 2018) focused on the role of corporate governance in determining the effect of agency problem on liquidity. They argued that firms with strong governance tend to have lower liquidity, while weak governance mechanism tend to affect liquidity positively.

According to the Trade-off Theory there is a trade-off between costs and benefits of maintaining good performance as discussed by (Quoc, Phan & Hang, 2024). (Njoroge, 2015) considered that holding good liquidity in the form of cash and cash equivalents has a positive effect on the company's performance because of reduced cost of using other less liquid assets to pay obligations. However, excessive liquidity could be linked to reduced returns and lower ability to utilize the company's internal resources to improve operational performances. This implies the need to maintain an optimum level of liquidity which is linked to better performance and enhanced profitability. The ability of a firm to maintain an optimum trade-off be-

tween costs and benefits of maintaining higher liquidity can be linked to a set of different factors that need investigation. This was in the same line with what was discussed by (Niresh, 2012) who highlighted that holding an optimum level of liquidity is linked to better performing firms and higher levels of profitability.

The Trade-Off theory also discussed the balance a firm should maintain regarding some external factors that affect liquidity including external funding sources, interest rate environments and other competitive pressures. Maintaining the required balance is crucial for the business success and sustainable performance. This is evident in many cases where external funding resources provide firms with more liquidity with a positive or negative impact. Where a positive sustainable impact can be found through reducing cost of using other less liquid assets to pay the company's obligations and improve performance. While the impact could be negative in case of having excessive liquidity that will reflect the lack of efficient use of cash resources. Moreover, the negative impact of leverage on liquidity here is more relevant to what was discussed by the Pecking Order theory that highly leveraged firms seek external funding resources when they don't have enough internal funding or liquidity. Therefore, it's expected that leverage is negatively correlated with liquidity (Al-Homaidi, et al., 2020), (Baños-Caballero, García-Teruel, & and Martínez-Solano, 2010), and (Wasiuzzaman & Arumugam, 2013).

Literature Review

Liquidity

Firm's liquidity represents its ability to settle short-term obligations (Masood, Ghauri, & Aktan, 2016), which can be measured as reported by (Doan, Vu, & Nguyen, 2024) using the quick ratio, the cash ratio, and the cash conversion cycle. They used these proxies to measure liquidity of 359 companies listed on the Vietnam Stock Exchange. (Doan, Vu, & Nguyen, 2024) considers the cash ratio that measures cash and cash equivalents as a percentage of the firm's current liabilities as the most conservative measure of liquidity. This is because it considers only cash resources as the main indicator of the firm's liquidity. They stated that this measure is widely used in literature as it gives the same indicator of liquidity for all companies regardless of differences in operations and nature of its current assets. While the quick ratio measures the current assets without considering inventory as a percentage of current liabilities. The ratio indicates the firm's ability to cover its short-term obligations depending on the liquidity provided by its current liabilities without considering the role of inventory in improving liquidity position of the firm.

The cash conversion cycle refers to the firm's ability to generate cash from its operations through three stages, starting with the purchase of inventory and other resources and ending with collecting cash from sales and finalize suppliers' payments. This measure considers the time taken for inventory retention, or the inventory turnover. Then, it adds the average collection period of receivables from sales, and finally it adds average payment period to suppliers for accounts payable. Businesses prefer faster inventory turnover indicated by a smaller number of days for inventory retention, combined with a smaller number of days for receivables' collection, and a smaller number of days for payables' payments. Therefore, smaller numbers of days for the cash conversion cycle are more preferred for businesses that seek higher liquidity (Doan, Vu, & Nguyen, 2024). Moreover, (Muhammad, Rehman, & Waqas, 2016) discussed the importance of maintaining adequate working capital to boost firms' liquidity and have enough cash to improve operational performance. This is because some firms face problems in selling inventory, collecting receivables, and as a result settlement of payables. Therefore, one important measure of firms' liquidity is working capital management which found in previous studies to be strongly correlated with higher profitability performance. Liquidity is measured by the excess of the sum of the firm's receivables and inventory over the firm's payables, the difference is then divided by total assets to account for the firm's size of assets in the calculation (Salah, 2018) and (Hamed, Youssef & El-faham, 2024).

Profitability

One of the most important factors affecting firm liquidity that was intensively considered in previous studies is firm profitability, which can be described as the company's ability to generate income (Hermanson & Edwards, 2004). Moreover, (Aldboush, Almasria, & Ferdous, 2023) added that understanding different interrelationships between profitability and other factors may help in improving the overall firm performance. Additionally, (Aldboush, Almasria, & Ferdous, 2023) stated that different previous studies found varying results for the relationship between profitability and liquidity. Examples include (Nguyen & Nguyen, 2020) and (Serrasqueiro & Nunes, 2008) who reported a positive relationship between profitability and liquidity. Also, (Doan, Vu, & Nguyen, 2024) reported in their results a positive effect of profitability as measured by return on assets (ROA) on cash ratio and quick ratio as two measures of liquidity. This supports the view that more profitable firms have greater ability to generate cash flows from its successful operations and use the accumulated cash flows to build-up better liquidity which reduces their reliance on short-term debt and other funding resources that further improves its profitability.

On the other hand, (Doan, Vu, & Nguyen, 2024) mentioned that there are limited studies in literature investigating the effect of profitability among other factors on firm liquidity. They also argued that there is a clear trade-off between liquidity and profitability, in other words less liquidity can be due to the use of firm's resources to boost operations can usually be linked to higher return. This view is consistent with (Petersen & Rajan, 1997), (Baños-Caballero, García-Teruel, & and Martínez-Solano, 2010) who argued that highly profitable firms make better deals with suppliers in terms of credit facilities, as a result they don't need more liquidity which improves their profitability measures in relation to liquidity. Similarly, (Wasiuzzaman S. , 2018) supported the same negative relationship between profitability and liquidity of Malaysian SMEs. Similarly, (Seissian, Gharios, & Awad, 2018) referred to a negative relationship between liquidity and profitability. Therefore, it can be concluded that the negative relationship between profitability and liquidity can be found when a company maintains good liquidity without planning appropriate investments channels which may reduce profitability.

Internal Factors

Other internal factors that can affect firm liquidity include Growth of sales, financial leverage, firm age, and efficiency. Growth in sales is expected to have a positive impact on firm performance given that a firm can control its expenses to improve profitability and can manage its working capital efficiently to be able to generate enough liquidity in proportion to their sales value. Moreover, growth opportunities are expected to lead firms to expand business through having better access to sources of funding, diversifying revenue sources, improving credit worthiness, and reducing risk. This is evident as more growth in sales helps firms improving their product offerings, cash inflows, and improving their operational efficiency (D'Mello, Krishnaswami & Larkin, 2008) and (Wasiuzzaman & Arumugam, 2013).

The Pecking Order theory discussed the negative effect of leverage on liquidity measures, which is justified because highly leveraged firms seek external funding from creditors when internal funding sources are not enough. Therefore, firms with high debt ratios are expected to have lower liquidity due to the use of internal liquidity for debt payments (Al-Homaidi, et al., 2020), (Baños-Caballero, García-Teruel, & and Martínez-Solano, 2010), and (Wasiuzzaman & Arumugam, 2013). Similarly, (Doan, Vu & Nguyen, 2024) concluded a negative influence of financial leverage on firm liquidity as measured by cash ratio and quick ratio. They argued that highly leveraged firms need to serve their debts with interest and principal payments. Therefore, they prioritise debt repayments over accumulation of cash reserves, especially when they face financial difficulties in providing internal funding resources. This will lead to lower liquidity for companies with high leverage. On the other hand, the positive impact of leverage on liquidity can be explained by the Trade-off theory where external funding resources provide firms with better liquidity which can have a

positive sustainable impact in case of maintaining an optimum balance of liquidity with a positive impact of reducing cost of using other less liquid assets to pay the company's obligations and improve performance.

Moreover, older firms are expected to have well established relationships with external fund providers and they are expected to have higher liquidity as discussed by (Berger & Udell, 1998), (Baños-Caballero, García-Teruel, & and Martínez-Solano, 2010), (Al-Homaidi, et al., 2020), and (Bigelli & Sanchez-Vidal, 2012). Whereas (Fiador, 2016) reported a negative impact of firm age on firm liquidity in Ghana. This is due to the fact the older firms have more stable relationships with customers and suppliers which enable them to work with higher efficiency in managing their working capital with lower levels of liquidity, this view is also consistent with (Wasiuzzaman & Arumugam, 2013). Firm age is measured using the number of years since the firm establishment and up to the year of the current research 2024 (Vu, Truong, & Dinh, 2020).

Additionally, Efficiency is a measure of the firm's ability to utilise its assets efficiently in generating revenues. This is a very important indicator of financial performance as lower efficiency rates will have an adverse effect on many indicators of financial performance including liquidity. It's expected that liquidity performance is inversely related to asset efficiency levels. This is because higher levels of cash are linked to less tendency to better utilize firms' assets. This view explains the manager's motive to hold more liquidity with lower efficiency, which helps in reducing the inherent risk of lower efficiency (Ferreira & Vilela, 2004) and (Bigelli & Sanchez-Vidal, 2012). This is consistent with the Agency Theory where managers with higher levels of liquidity tend to invest more in less efficient projects which decreases efficiency rates and increase agency costs (Jensen & Meckling, 1976).

On the other hand, (Ehikioya & Qin, 2007) and (Aldboush, Almasria, & Ferdous, 2023) discussed the positive expected effect of asset utilization on liquidity based on the idea of favourable effect of better utilization of firms' assets on performance, profitability, and increased level of liquidity. In models that test liquidity and the effect of different factors on liquidity, efficiency could be measured using a more relevant proxy which is receivables' turnover ratio. This ratio helps in measuring the effect of more efficient management of the firm's receivables on liquidity measures, especially working capital measures. Accounts receivable turnover is measured by sales revenues divided by outstanding accounts receivable in the studies of (Sadeghi & Zareie, 2015), (Cuong & Ha, 2018), and (Hamed, Youssef, & El-faham, 2024) to refer to the firm's ability to better manage its accounts receivable to improve financial performance.

External Factors

External factors are expected to have significant effects on firm liquidity, in this regard, there are two types of external factors that can be considered. The first type are macroeconomic factors such as GDP growth, inflation rates, and interest rates, in addition to external events that are related to the context of the study. Egypt witnessed many external challenges during the past decade including the Egyptian Revolution, the Pandemic, and the Egyptian Currency Devaluation. It can be commonly found that growth of GDP is used to measure the level of economic activity in a country now and in future periods. Since expectations of continuous growth of macroeconomic performance results in increased consumption which will be reflected on increased sales and profitability of firms (Pervan, Pervan & Ćurak, 2019). The increased level of economic activity affects the purchasing power of customers which is expected to better improve firm profitability and cash flows (Bui, Tran, Hoang, Pham, & Tran, 2020). Therefore, there is an expected positive effect of GDP growth on firm liquidity. Similarly, inflation rate is expected to reflect the macroeconomic conditions, and it is expected to have a negative effect on firm performance and cash flows through the effect of increased costs and the decreased value of money. In addition to the indirect effect through increased interest rates (Cooper, 1983), (Demir, 2009), (Pattitoni, Petracci, & Spisni, 2014), (Dalci, 2018), and (Forte & Tavares, 2019). On the other hand, (Modigliani & Cohn, 1979) discussed the possible positive impact of increased inflation rates through the high pricing power of firms that can pass it to final consumers

which will result in improved firm performance and liquidity. This case is closer to the Egyptian market with high pricing power of firms that can be passed on to final consumers.

It is worth mentioning here that interest rates showed major fluctuations in Egypt during the last decade due to increased inflation rates and the accompanies tightening of monetary policy in Egypt to control inflation (Elfaham & Abdelmaksoud, 2024). It has been discussed in previous literature that higher interest rates are inversely related to firm liquidity. Since firms will hold less cash in case of having better opportunities to invest it with higher interest rates (Tobin, 1956). This view was discussed in (Ysmailov, 2021) with a reported negative relationship between interest rates and liquidity due to the existence of opportunity cost for holding more liquidity with higher interest rates. Finally, Egypt witnessed some major economic challenges during the sample period 2012-2022 including the Egyptian Revolutions (2012-2014), the COVID-19 Pandemic (2020-2022) and the Devaluation period (2017-2019). While 2015 and 2016 are considered years of relative economic stability in Egypt. Considering the previously mentioned events in the analysis is required to control for their potential effects on the tested model.

Literature Gap and Hypotheses Development

It can be found that previous studies discussed factors affecting firm liquidity in different contexts. However, most of them discussed these relationships in countries with more stable market conditions and better access to liquidity by firms with lower transaction costs. Testing liquidity models in stable funding environments is expected to have different results than testing them in less stable markets with growth potential that are greatly affected by economic and political instability. Egypt is a good example of developing economies that went through many challenges in the past decade with many adverse effects in all sectors. One of the most important areas that deserves investigation is liquidity measures and how firm liquidity in Egypt was affected by different periods of hardships and the effect of different internal and external determinants of firm's performance. Understanding the results of these models in different environments with varying market conditions in developed and developing countries should help in better understanding of liquidity issues to find more recommendations for firms to improve their liquidity to help improving their overall performance and mitigating inherent risks. The current study will build on the results of previous studies to assess firm liquidity and different internal and external factors that affect liquidity while considering the effects of different challenges that faced the Egyptian market in the last decade. Based on recommendations of previous studies, the outcome of the current study will help in filling this gap of testing liquidity determinants in developing countries facing external challenges. Table (1) presents research hypotheses that will be tested to help in answering the main research question which is how different internal and external factors affect firm liquidity for Egyptian listed non-financial firms during periods of economic challenges.

Table (1): Research Hypotheses

H1: It is expected that there is a positive significant impact of past values on current values of liquidity.
H2a: It is expected that there is a negative significant impact of profitability on liquidity.
H2b: It is expected that there is a positive significant impact of profitability on liquidity.
H3: It is expected that there is a positive significant impact of sales growth on liquidity.
H4a: It is expected that there is a positive significant impact of financial leverage on liquidity.
H4b: It is expected that there is a negative significant impact of financial leverage on liquidity.
H5a: It is expected that there is a negative significant impact of firm age on liquidity.
H5b: It is expected that there is a positive significant impact of firm age on liquidity.
H6a: It is expected that there is a negative significant impact of efficiency on liquidity.
H6b: It is expected that there is a positive significant impact of efficiency on liquidity.

H7: It is expected that there is a positive significant impact of GDP Growth on liquidity.
H8a: It is expected that there is a negative significant impact of inflation rate on liquidity.
H8b: It is expected that there is a positive significant impact of inflation rate on liquidity.
H9: It is expected that there is a negative significant impact of interest rate on liquidity.

Methodology

Sampling and Data Collection

Data used in this paper is collected for 53 non-financial firms listed on the Egyptian Stock Exchange. The sample was chosen based on availability of consistent data throughout the sample period that extends for ten years from 2012 to 2022. Panel data modelling will be used for analysis purposes, which is needed to have valid results that can answer research questions and test research hypotheses. Panel data modelling helps in accounting for different heterogeneity problems that exist in data analysis (Hitt, Gimeno, & Hoskisson, 1998). The sample period was selected because Egypt faced some economic challenges during this period. However, previous studies produced different results regarding how these challenges affected different dimensions of firm performance, which indicates the need for further investigation. Data was collected from a variety of sources to be able to measure different internal and external factors affecting firm liquidity. The selected sample included the most active 100 firms listed in the Egyptian stock exchange, then the sample excluded financial firms due to differences in activity and reported performance that will be irrelevant to the main research question. Sources of data included firm-specific variables collected from financial statements of the sample firms accessible through Egypt for Information Dissemination (EGID) that is the institution responsible for data dissemination for Egyptian listed firms under the supervision of the Egyptian Financial Regulatory Authority. In addition to other sources including Refinitiv Database, Egyptian Ministry of Planning Database, and International Financial Statistics Database.

Description of Variables

Firm liquidity is the main dependent variable in the current study, which is measured using multiple proxies in previous studies as discussed in the literature section. However, (Muhammad, Rehman & Waqas, 2016) mentioned that measuring liquidity using working capital is an important measure since firms may find difficulties selling their inventory, collecting cash and using proceeds to settle payables. Therefore, liquidity is measured by the excess of the sum of firm's receivables plus inventory over the firm's payables, the difference is then divided by total assets to account for the firm's size of assets (Salah, 2018) and (Hamed, Youssef & El-faham, 2024). Moreover, profitability is one of the main measures in assessing firm liquidity and it can be found in many previous studies that profitability is measured using a variety of indicators. A negative relationship between liquidity and profitability was supported by (Wasiuzzaman, 2018) and (Seissian, Gharios, & Awad, 2018). While (Serrasqueiro & Nunes, 2008), (Nguyen & Nguyen, 2020), and (Doan, Vu, & Nguyen, 2024) reported a positive relationship between profitability and liquidity. Profitability will be measured using return on assets following, (Salah, 2018), (Vu, Truong, & Dinh, 2020), (Dalci, 2018), (Elfaham & Abdelmaksoud, 2024), and (Hamed, Youssef & El-faham, 2024).

The second factor that will be tested for its effect on firm liquidity is firm growth of sales which will be measured using change in annual sales following (D'Mello, Krishnaswami, & Larkin, 2008) and (Wasiuzzaman & Arumugam, 2013). They argued that firms with better growth opportunities should be able to report higher levels of liquidity implying a positive impact of growth of sales on liquidity. While leverage is another variable that is expected to have a negative effect on firm liquidity as discussed by (John, 1993), (Baños-Caballero, García-Teruel, & and Martínez-Solano, 2010), (Borhanuddin & Ching, 2011), (Islam, 2012), (Wasiuzzaman & Arumugam, 2013), (Ha & Tai, 2017), and (Al-Homaidi, et al., 2020). They highlighted that firms with high debt ratios will use most of their liquidity for debt repayments resulting in low liquidity lev-

els. Leverage will be measured using total debt to total assets ratio following (Dalci, 2018), (Hamed, Youssef, & El-faham, 2024), and (Elfaham & Abdelmaksoud, 2024). Firm age will be measured using the number of years since firm establishment and is expected to affect liquidity either positively or negatively. Moreover (Berger & Udell, 1998), (Baños-Caballero, García-Teruel, & and Martínez-Solano, 2010), (Al-Homaidi, et al., 2020), and (Bigelli & Sanchez-Vidal, 2012) discussed the positive effect of firm age on liquidity. They argued that older firms are expected to have well established relationships with fund providers and therefore, more access to liquidity. On the other hand, (Fiador, 2016) and (Wasiuzzaman & Arumugam, 2013) claimed that older firms' need for liquidity will be less due to their efficient management of working capital and well-established relationships with customers and suppliers. Efficiency in managing firm's assets is another internal factor that will be tested in the estimated model. Views of negative relationship between efficiency and liquidity are based on a conclusion of the Agency Theory, that is managers with more liquidity tend to invest more in less efficient projects ending up with lower efficiency. This view was adopted by (Ferreira & Vilela, 2004) and (Bigelli & Sanchez-Vidal, 2012). While a positive effect is reported by (Ehikioya & Qin, 2007) and (Aldboush, Almasria, & Ferdous, 2023) based on the idea of better ability to invest more liquidity to improve efficiency performance.

External factor plays a role in determination of firm liquidity as found in previous literature. GDP growth as an important factor of a country's economic activity is expected to affect firm liquidity positively since increased economic activity affects consumption positively and is expected to improve firm's profitability and liquidity (Bui, Tran, Hoang, Pham, & Tran, 2020). On the other hand, inflation is expected to have the opposite effect through its adverse effect on costs, value of money, and as a result on consumption. In addition to the indirect negative effect of inflation on consumption through increased interest rates (Cooper, 1983), (Demir, 2009), (Pattitoni, Petracci, & Spisni, 2014), (Dalci, 2018), and (Forte & Tavares, 2019). Therefore, the effect of interest rates is expected to be negative on liquidity for similar reasons related to decreased consumption. In addition to the decreased tendency to hold more liquidity in case of increased interest rates with the existence of opportunity cost of holding more cash over investing it in higher interest rates which is consistent with the discussions of (Tobin, 1956) and (Ysmailov, 2021). Moreover, dummy variables will be used to test for the potential impact of external events on the estimated model. This should include dummy variables for the period of the Egyptian Revolutions (2012-2014), the COVID-19 Pandemic (2020-2022) and the Devaluation period (2017-2019). While 2015 and 2016 are considered years of relative economic stability in Egypt. The following table provides a summary of the variables that are used in the study, along with their measures and expected effects on liquidity.

Table (2): Summary of Research Variables

Dependent Variable			
Variable	**Measure**	**Previous Studies**	
Liquidity	(Receivables + Inventory - Payables) / Total Assets	(Salah, 2018) and (Hamed, Youssef & El-faham, 2024)	
Firm-Specific Independent Variables			
Variable	**Measure**	**Previous Studies**	**Expected Effect**
Profitability	Net Income /Total Assets	(Salah, 2018), (Vu, Truong & Dinh, 2020), (Dalci, 2018), (Elfaham & Abdelmaksoud, 2024), and (Hamed, Youssef & El-faham, 2024)	+/-
Growth of Sales	New Sales-Old Sales / Old Sales	(D'Mello, Krishnaswami, & Larkin, 2008) and (Wasiuzzaman & Arumugam, 2013)	+
Financial Leverage	Total Debt / Total Assets	(Dalci, 2018), (Hamed, Youssef & El-faham, 2024), and (Elfaham & Abdelmaksoud, 2024)	-
Firm Age	Number of Year Since Establishment	(Berger & Udell, 1998), (Baños-Caballero, García-Teruel & and Martínez-Solano, 2010), (Bigelli & Sanchez-Vidal, 2012), (Fiador, 2016), (Al-Homaidi et al., 2020) and (Vu, Truong & Dinh, 2020)	+/-

Efficiency	Sales / Accounts Receivable	(Sadeghi & Zareie, 2015), (Cuong & Ha, 2018) and (Hamed, Youssef & El-faham, 2024)	+/-
Macroeconomic Independent Variables			
Variable	**Measure**	**Previous Studies**	**Expected Effect**
Real GDP Growth	Difference from the previous year divided by the real GDP of the previous year	(Mathuva, 2014), (Mun & Jang, 2015), and (Dalci, 2018),	+
Inflation	Consumer Price Index	(Pattitoni, Petracci, & Spisni, 2014), (Rehman & Wang, 2015) and (Dalci, 2018)	-
Interest Rate	Overnight Deposit Rate	(Waleed, Soliman & Elfaham, 2024)	-

Model Specifications

The current study will use panel data modelling to test the relationship between the dependent variable and different independent variables. Panel data modelling takes into consideration both the timeseries and the cross-sectional dimensions of data. Estimating multiple regression for panel data might be challenging with the existence of issues related to unobservable heterogeneity and endogeneity. Unobservable heterogeneity might result when differences between companies are not part of the independent variables but included in the error term which might create an endogeneity issue. This is because such unobservable heterogeneity might be correlated with independent variables, this will result in biased coefficient estimates in regression. Similarly, endogeneity exists when the estimated model suffers from any other sort of omitted variable bias. This happens when some variables of interest are not included in the list of the independent variables. Moreover, endogeneity bias might also exist in case of having a persistent effect of the dependent variable in the tested model, which means that the dependent variable is affected by its own past values. Reverse causality is another important case where endogeneity appears, this is case when the dependent variable influences explanatory variables. This two-way relationship will result in biased estimations as well (Roodman, 2009).

Therefore, classical linear regression estimation models such as the pooled ordinary least squares, fixed effects, and random effects estimators might suffer from biased results. The GMM estimation is used in similar cases to account for potential endogeneity problems in panel data. This is done using instrumental variables to correct for potential bias. Instrumental variables are created using the lagged values in levels and in differences for the dependent and independent variables that might suffer from endogeneity problems. The GMM originally developed by (Arellano & Bond, 1991) has two approaches to deal with potential endogeneity problems. They started with the difference GMM that uses lagged values of the endogenous variables as instruments for the differenced equation. While the system GMM developed by (Arellano & Bover, 1995) and (Blundell & Bond, 1998) employs a system of equations to account for potential bias by using lagged values of the endogenous variables as instruments for the differenced equation, in addition to using lagged differences of the endogenous variables for the equation in level, which increases the number of valid instruments. The system GMM is widely used to account for potential endogeneity problems especially with models with small T and large N. The system GMM estimator is considered more efficient due to its use of more instruments which better accounts for heteroskedasticity and other forms of misspecification in the variance structure of the moment conditions, especially when variable are more persistent. The following model will be estimated using GMM to test the potential dynamic relationships of the model of interest. This will be done in Stata using the xtabond2 command developed by David Roodman (Roodman, 2009).

The symbols used in this equation are related to the estimated model for the 53 companies that are used in the analysis. Where ***i*** is the number of cross-sectional panel members (firms), ***t*** is the number of periods, and are the coefficients. Y is the dependent variable represented by at time for firm , where = 1,..., N, t= 1, ..., T, while is the constant term. is a one-period lagged dependent variable. are the firm specific variables, while are the macroeconomic variables, and is the disturbance term with being the unobservable firm-specific effects, and is the random disturbances that change over time.

Hansen's test for overidentifying restrictions that was developed by (Hansen, 1982) will be used to test the null hypothesis that there no correlation between instruments and the error term, meaning that the moment conditions are valid. Insignificant J-statistic of the test means rejecting the null hypothesis, which means that there is no overidentifying restrictions. Similarly, (Pervan, Pelivan, & Arnerić, 2015) mentioned that Sargan test for overidentifying restrictions is also used to validate the estimated GMM model. The test is for the null hypothesis that there is no relationship between the instrumental variables and the error term. When accepting the null hypothesis, this indicates the validity of the model and that there is no evidence of overidentifying restrictions, which means that the instrumental variables are valid. Moreover, (Pervan, Pelivan, & Arnerić, 2015) referred to the need to test for the first order and the second order autocorrelation between residual differences. The test is for the null hypothesis of the independence of the first residual differences. Rejecting both the first order and second order test hypotheses means independence of residual differences. However, the moment conditions will be valid in case of not rejecting the second order autocorrelation AR (2) test hypothesis only. Rejecting the null hypothesis of the first order autocorrelation AR (1) might not represent a problem for validating the moment conditions (Saona, 2016).

Analysis and Discussion

Analysis Results

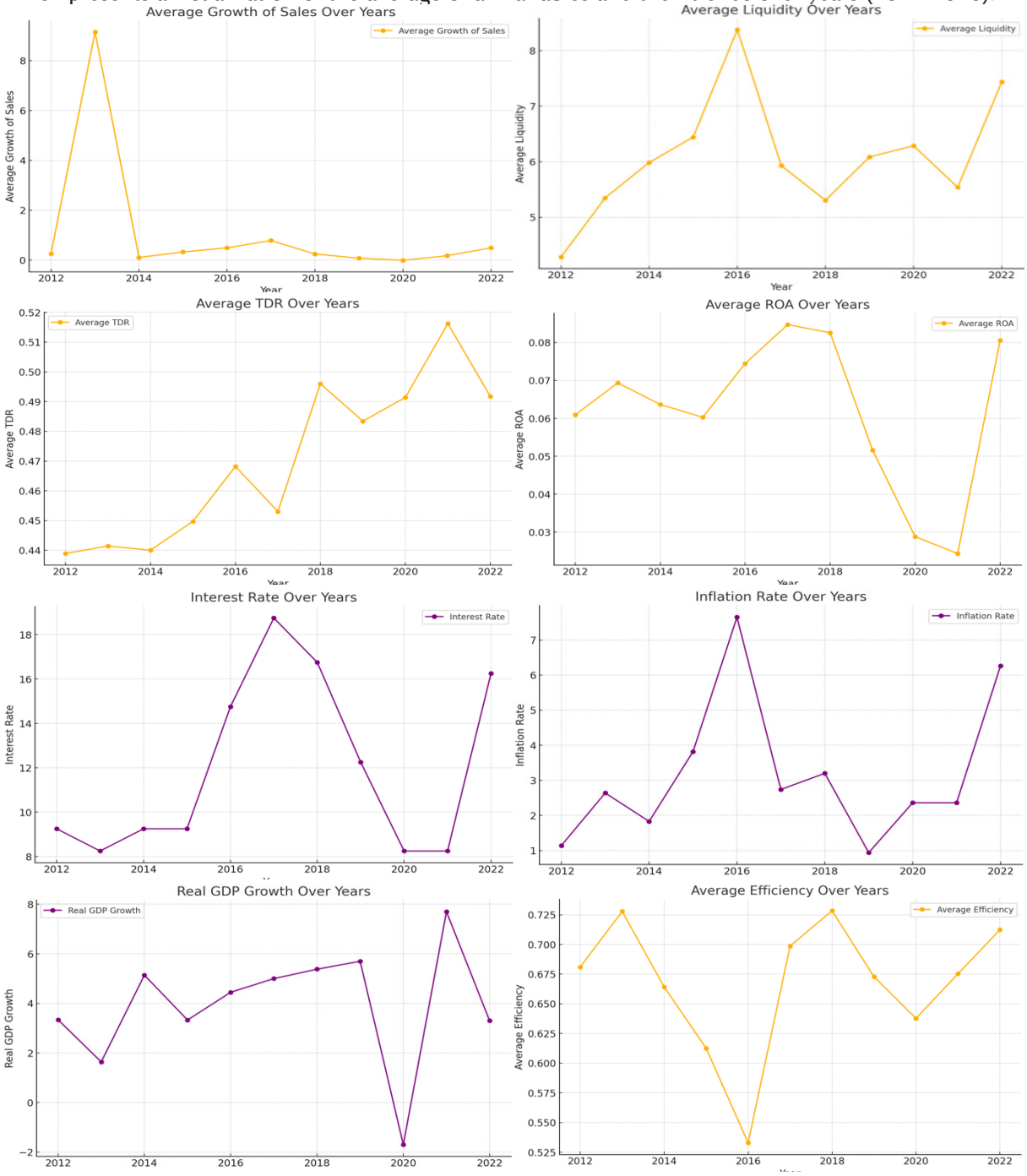
Descriptive statistics and correlation analysis for the variables of interest help in presenting data and describing movements over years, in addition to investigating the preliminary relationships between variables and their expected direction. Table (3) presents the descriptive statistics of the variables used in the current study. The main results of the table refer to consistent liquidity levels with an average liquidity of 30% that lies almost in the middle of the maximum and minimum values and a standard deviation of 22%. An average ROA of 6% with a standard deviation of 12% from the average reveals a bit high variability in firm profitability throughout the sample period. Leverage values have a wide range reflecting major differences among sample firms with a large standard deviation of 29%. Firm age ranges from 5 years to 168 year reflecting major differences among sample firms with a standard deviation of more than 28 years. While growth of sales showed major variability with standard deviation of 19.74 times and extreme maximum and minimum values. Similarly, efficiency levels showed great variability with standard deviation of 67%. Macroeconomic indicators showed different results with the GDP growth rate showing average variability of 2.34% for an average of 3.93%. While interest rate and inflation rate showed great variability with standard deviation of the interest rate variable of 3.80% and a minimum and maximum values of 8.25% and 18.75%, respectively. On the other hand, inflation rate showed similar deviation with a standard deviation of 1.97%. Volatility exists in the descriptive statistics of all variables over years which is expected in unstable developing economies like Egypt, especially during peri-

Table (3): Descriptive Statistics

Variable	Mean	Median	Max	Min	Std. Dev.
Liquidity	0.30	0.29	0.99	-0.31	0.22
ROA	0.06	0.05	0.48	-1.45	0.12
TDR	0.47	0.46	3.39	0.00	0.29
Firmage	46.19	39.00	168.00	5.00	28.35
Growthofsales	1.11	0.12	472.50	-0.97	19.74
Efficiency	0.67	0.53	4.49	0.00	0.67
RealGDPGrowth	3.93	4.45	7.70	-1.70	2.34
InterestRate	11.93	9.25	18.75	8.25	3.80
InflationRate	3.18	2.64	7.65	0.94	1.97

Source: Author's Analysis using Stata

ods of economic challenges. This volatility is further highlighted through graphs presented in figure (1), which presents a visualization of the average of all variables and their trends over years (2012-2020).



Source: Author's Analysis using Research Data

Figure (1): Trends in Financial Performance and Macroeconomic Indicators Over the Sample Period

Moreover, correlation analysis shows the expected relationships between the variables of interest without clear indication of the cause-and-effect relationships that will be investigated further in the regression analysis. Perfect strong correlation is reflected by a value of (1), and no correlation exists with a value of (0) with the correlation between variables that can be positive or negative. It can be noted that all explanatory variables show either insignificant correlation or weak significant correlation between each

other with a maximum correlation coefficient of (0.6) between explanatory variables. However, the dependent variable shows a positive significant effect with total debt and efficiency ratios. The positive correlation with leverage ratio contradicts previous literature that reported negative effect of financial leverage on liquidity because firms with more leverage need their cash holdings to pay back their debt obligations and end up with lower liquidity. However, this can be explained through the views of the Trade-Off theory that discussed the effect of the balance a firm can maintain between the costs of external debt and the benefits associated with providing better liquidity. Maintaining the required balance is crucial for the business success and sustainable performance. Firms that can make the correct balance will enjoy reduction in the cost of using other less liquid assets to pay the company's obligations and improve performance. Moreover, the positive correlation between liquidity and efficiency is consistent with the views in previous studies that linked higher liquidity levels with better ability to manage assets efficiently through better investment of available liquidity. Table (4) presents a summary of the correlation analysis that is produced by analyzing the research data in Stata. The overall conclusion regarding multicollinearity is that there is no significant correlation with high coefficients between independent variables.

Table (4): Correlation Analysis

Variable	Liquidity	ROA	TDaR	Firmage	Growthofsales	Efficiency	Real GDP-Growth	InterestRate	InflationRate
Liquidity	1.00								
ROA	-0.05	1.00							
TDR	0.29	-0.57	1.00						
Firmage	0.03	0.01	-0.17	1.00					
Growthofsales	-0.02	-0.02	-0.02	-0.03	1.00				
Efficiency	0.13	0.19	0.05	-0.17	-0.04	1.00			
RealGDPGrowth	0.01	0.02	0.02	0.01	-0.04	0.01	1.00		
InterestRate	-0.01	0.12	0.01	0.03	-0.03	0.01	0.29	1.00	
InflationRate	-0.04	0.07	0.01	0.03	-0.01	-0.04	-0.04	0.46	1.00

Source: Author's Analysis using Stata

Moreover, the classical linear regression assumptions are tested before estimating the main research model. The results of relevant tests confirmed the validity and reliability of diagnostic tests with some concerns regarding heteroscedasticity and autocorrelation that will be accounted for during the analysis. Linearity tests using the augmented component-plus-residual plots indicated valid linear relationships between variables of interest. Regarding the residuals of data, testing for residual normality was done using histograms, which showed that residuals are approximately normally distributed with no issues regarding normality. In addition to testing for the existence of Heteroscedasticity using the Modified Wald Test for groupwise heteroscedasticity that rejected the null hypothesis of homoscedasticity, indicating the existence of heteroscedasticity suggesting that the variance of the error term is not constant across observations. Moreover, Wooldridge test for autocorrelation indicated the existence of autocorrelation or serial correlation among the residuals. Finally, the Variance Inflation Factor (VIF) was used to test for the existence of any issues regarding multicollinearity among explanatory variables. Tests showed no major problem of multicollinearity among the independent variables which confirms the results discussed earlier in the correlation analysis. All predictors showed values of VIF below the maximum threshold which is (10) with an average VIF among variables of (1.29) indicating no major problems of multicollinearity among variables as shown in Table (5) below.

Table (5): Multicollinearity Testing Using VIF of Explanatory Variables

Variable	VIF
ROA	1.63
TDR	1.6
Interest Rate	1.45
Inflation Rate	1.32
Real GDP Growth	1.14
Efficiency	1.11
Firm Age	1.07
Growth of Sales	1.01

Source: Author's Analysis using Stata

Additionally, selecting the appropriate model estimation method was done through multiple steps starting with the F-test to test for the validity of Pooled OLS estimation versus fixed effects, then the Breush Pagan LM Test to compare the validity of the Pooled OLS estimation versus random effects estimation. This was followed by running the Hausman Test for Fixed Versus Random Effects estimators. The choice of the final model that most suits the model of interest in

the current study is proved to be the fixed effects estimation. However, after running the fixed effects estimation method, the results showed that the model has low explanatory power, which implies a lack of clear relationships in the fixed effects framework. These results required the need to invesitage more efficient estimation methods to improve the validity and reliability of the model. This was done by adding the lagged dependent variable, to test for the potential persistence effect of the dependent variable, in addition to using instrumental variables to improve the validity of the model. This modidifcation in the model implied the need to use the system GMM estimaton method to account for the resulting endogeneity problems associated with the use of lagged dependent variable, ommitted variable bias, and reverse causality issues. The final model to be tested using the system GMM estimation can be represented by the following equation.

The results of the system GMM estimation is presented below in Table (6) which reports a p-value of (0.150) for the Hansen's test for overidentifying restrictions. This means that instruments used in the estimation are valid and uncorrelated with the error term. This is also confirmed by the significant value of the Sargan test (p=0.007) meaning that the chosen instruments are robust. Moreover, the Arellano-Bond test for AR (1) showed a significant value of (p=0.000) which means that first-order autocorrelation exists. However, the test for the second order autocorrelation showed an insignificant p-value of (0.104) referring to the result of no second-order autocorrelation. According to (Saona, 2016), the Arellano-Bond tests here are for the null hypothesis of the independence of the first residual differences. However, the moment conditions will be valid in case of not rejecting the second order autocorrelation AR (2) test hypothesis only, while rejecting the null hypothesis of the first order autocorrelation AR (1) might not represent a problem for validating the moment conditions.

Moreover, the results of the system GMM estimation show that the lagged dependent variable is strongly significant confirming the dynamic nature of the model and the strong persistence of liquidity over time which a high coefficient of (0.76). This result emphasizes that liquidity of the sample firms is affected by its own past values and that highly liquid firms continue to have high liquidity over time. According to the reviewed literature, this result was not discussed in previous studies while it can be explained in relation to the theoretical background. The Agency theory discussed the effect of having strong corporate governance on increasing liquidity levels. This means that firms with strong corporate governance mechanism can enjoy stable liquidity levels over time as long as there are no major changes in their corporate governance practices.

The impact of ROA is proved to be significant and positive on liquidity of the sample firms as declared by the significant p-value of (0.049) with a positive coefficient of (0.43). Similarly, leverage and growth of sales variables showed a positive significant effect on liquidity with a p-value of (0.003), and (0.0006), respectively. This means that profitable highly leveraged firms that have growing sales enjoy increased liquidity over time in our sample. The only variable that showed significant negative impact on firm liquidity is inflation with a p-value of (0.049) and a negative coefficient of (-0.018). However, the remaining variables estimated in the model showed insignificant effect on liquidity of the sample firms over the sample period. It can be concluded that the

Table (6): Results of the Estimated Model Using GMM

Variable	Coefficient	Std. Error	t-value	P>|t|
Liquidity (L1)	0.76	0.09	8.74	0.000
ROA	0.43	0.21	2.02	0.049
TDR	0.31	0.10	3.12	0.003
Firmage	0.00	0.00	1.45	0.153
Growthofsales	0.00	0.00	9.19	0.000
Efficiency	-0.01	0.02	-0.58	0.563
RealGDPGrowth	0.00	0.00	-0.54	0.593
InterestRate	0.01	0.00	1.42	0.161
InflationRate	-0.02	0.01	-2.02	0.049
Dummy1	-0.04	0.04	-1.13	0.265
Dummy3	0.03	0.02	1.25	0.217
Dummy4	0.00	0.02	-0.26	0.794
_cons	-0.11	0.06	-1.78	0.080
Test	**Statistic**	**P-value**		
Arellano-Bond AR(1)	-3.71	0.000		
Arellano-Bond AR(2)	1.62	0.104		
Hansen's Test	36.86	0.150		
Sargan's Test	36.86	0.007		

Source: Author's Analysis using Stata

results of the GMM estimation was proved to be robustly addressing the issues linked to unobservable heterogeneity and endogeneity. The results also confirmed the dynamic nature of the model indicating the strong persistence of liquidity measure. Furthermore, the model highlighted the strong positive role of profitability, leverage, and growth of sales in predicting firm liquidity. In addition to highlighting the negative effect of inflation on liquidity of the sample firms over the sample period that witnessed major changes in inflation rates in Egypt.

Hypotheses Testing

The reported results of the estimated GMM model refers to accepting the first hypothesis presented in Table (1). The first hypothesis (H1) tests the significant positive effect of past values of liquidity on its current values of the sample firms. This result is consistent with the Agency theory that discussed the conflict of interest between managers and shareholders. Where managers might prefer higher liquidity for improving operational efficiency or payment of debt obligation which decreases the competitive pressures on managers. However, owners might prefer more dividend payments or more long-term use of financial resources to improve performance. Therefore, it is expected that firms with strong corporate governance will suffer less from any agency issues and will enjoy more stable liquidity levels over time. This is consistent with the discussion of (Roy, 2018) who focused on the role of corporate governance in determining liquidity, where firms with strong governance tend to have lower liquidity over time, while weak governance mechanism tend to affect liquidity positively. Therefore, if the sample firms enjoy good governance they will enjoy stable low liquidity levels over time, while the opposite holds true.

The second hypothesis (H2b) tests the positive effect of profitability on liquidity of the sample firms is also accepted. This is consistent with the results of (Serrasqueiro & Nunes, 2008), (Nguyen & Nguyen, 2020), and (Doan, Vu, & Nguyen, 2024). They argued that more profitable firms have greater ability to generate cash flows from its successful operations and use the accumulated cash flows to build-up better liquidity. The cumulative effect of this process helps in reducing firms' reliance on short-term debt and other funding resources which further improves profitability. Moreover, firm with higher profitability are usually expected to show more efficient financial management practices with stable earnings and better creditworthiness. Which helps them in better planning for cash collections and payments resulting in improved liquidity over time. Also, the third hypothesis (H3) referring to the positive significant impact of sales growth on liquidity is accepted. This is consistent with the results of (D'Mello, Krishnaswami, & Larkin, 2008) and (Wasiuzzaman & Arumugam, 2013) who argued that growth opportunities lead firms to expand business through having better access to sources of funding, diversifying revenue sources, improving credit worthiness, and reducing risk. This is evident when growth in sales helps firms in improving their product offerings, cash inflows, and improving their operational efficiency.

The fourth hypothesis (H4a) testing the positive significant impact of financial leverage on liquidity is also accepted. According to the reviewed literature, the expected effect of leverage on liquidity is negative. However, the positive effect here can be explained by the Trade-off theory where a positive sustainable impact of external funding resources can be achieved through maintaining an optimum balance of liquidity that enables firms to reduce cost of using other less liquid assets to pay for the company's obligations and ultimately helps in improving performance. The last accepted hypothesis is (H8a), which tests the negative significant impact of inflation rate on liquidity. Accepting this hypothesis is consistent with previous studies like (Cooper, 1983), (Demir, 2009), (Pattitoni, Petracci, & Spisni, 2014), (Dalci, 2018), and (Forte & Tavares, 2019). They discussed the negative effect of inflation on firm liquidity in the light of its adverse effects on costs, value of money, and as a result on consumption. In addition to the indirect negative effect of inflation on consumption through increased interest rates as a result of the monetary policy that

would be adopted in inflationary periods. This finding contradicts the pricing power view that refers to the firm's ability to pass on inflationary effects to final consumers, as discussed in (Modigliani & Cohn, 1979). However, all other research hypotheses reported in Table (1) are rejected with no significant effects of other variables on liquidity of the sample firms during the sample period.

Conclusion and Recommendations

This study focuses on measuring liquidity performance of Egyptian non-financial firms during periods of economic instability throughout the period 2012-2022, during which Egypt witnessed many economic challenges including the Arab Spring, Egyptian Pound Devaluation, and the 2020 Pandemic. It can be found that previous studies focused on measuring firm liquidity using different proxies including current ratio, quick ratio, cash ratio and working capital measures. Where the current study utilized the measure of working capital calculated as the percentage from total assets for the difference between the sum of inventory and receivables on one hand and accounts payable on the other hand. Many factors are proved to be correlated with firm liquidity in previous literature, some factors are firm-specific and other factors are macroeconomic ones. The theoretical background that is relevant to determinants of firm liquidity is related to several theories including Resource-Based Theory, Agency Theory, Trade-off Theory, Picking Order Theory, and the Pricing Power Theory. The Resource-Based Theory highlighted the importance of internal factors in improving liquidity performance by focusing on the firm's ability to utilize their internal capabilities to improve performance and maintain a competitive edge. While the Trade-off Theory discussed the balance that needs to be maintained regarding some external factors that affect liquidity, such as external funding sources, interest rate environments, and other competitive pressures. Also, the Agency Theory is relevant here as less agency problems are associated with stable liquidity. Moreover, the Pecking Order Theory linked highly leveraged firms with low levels of liquidity, which is explained by their choice of resorting to external funding in case they have inadequate liquidity.

Therefore, different internal and external factors were tested for their potential effect on firm liquidity for a sample of 53 non-financial firms listed on the Egyptian Stock Exchange. Taking into consideration the effect of the economic challenges faced by the Egyptian market during the same period. Internal factors used include firm profitability as measured by the ROA, along with firm leverage as measured by the debt ratio. In addition to firm age, growth of sales, and efficiency as measured by the management of receivables. External factors used include real GDP growth, inflation rate, and interest rate. The statistical analysis involved multiple steps to test the variables of interest for their potential effect on liquidity including descriptive statistics, correlation analysis, and testing the classical linear regression assumptions (Normality, Linearity, Heteroscedasticity, Multicollinearity & Autocorrelation). In addition to running different tests to choose the most suitable regression model. However, all potential model failed their validation tests except the GMM estimation. While running the GMM estimation, the dynamic nature of the model was considered by introducing lagged dependent variable among regressors. The use of GMM estimation helps to account for potential bias of endogeneity and unobservable heterogeneity. Also, validity tests proved the validity of all moment conditions and the used instrumental variables.

The main analysis results confirmed the strong persistence of liquidity over time with the reported highly significant lagged dependent variable. In addition to the positive significant impact of profitability, leverage, and growth of sale, while inflation reported a significant negative effect on liquidity. All other variables including the dummy variables used to account for external events reported insignificant effect on liquidity. The results suggest the need for more investigation of the effect of past values of liquidity on current values. Which might be explained by the effect of corporate governance mechanism that ensures the stability of liquidity management. Therefore, regulators and firms should pay attention to this import-

ant result by trying to maintain sound corporate governance practices to ensure stability of their liquidity. Moreover, balancing the use of firm resources to maintain profitability and liquidity is of major importance for Egyptian firms that suffer from their need for more external funding sources to maintain liquidity. Therefore, focusing on different internal factors that help improve firms' profitability and hence liquidity will help in reducing firms' reliance on more debt. Growth of sales is directly linked to enhanced profitability which means that the sample firms can make better use of their increased sales to enhance liquidity through better management of their working capital. While the adverse effect of inflation on liquidity needs further investigation of better risk management practices that can mitigate the negative effect of increased prices on firm liquidity.

Limitations and Future Research

Transparency and reporting standards in Egypt limit the ability of academic research to generalize research results to smaller companies that represent a major part of the Egyptian market. Therefore, it is recommended for future research to try getting access to more data for firms that are not publicly traded to be able to generalize the results. In addition to trying to include measures for corporate governance practices which is assumed to have an important role in maintaining stable liquidity levels. This was observed during the analysis stage through reporting significant lagged dependent variable among independent variables.

Moreover, it is recommended for future research to further investigate the effects of external economic and political events to identify their potential effects. This is important to learn from experience and investigate better ways for dealing with future challenges. The research was unable to report any significant effect of the major economic challenges that occurred during the accounting period because of external events, which might be due to limited access to more comprehensive dataset that might have given more in-depth insights. Therefore, access to more comprehensive dataset could enhance future research results.

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