

# E-banking and Soundness Indicators for the Banking Network of Iran

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## Abstract

*Development of E-banking has modified the structure of banking business and banking performance, efficiency, risk and challenges which have also been articulately recognized based on the international best practices. E-banking brazenly expedites and streamlines financial transactions via enhancing technology and expanding the bank services in comparison with conventional banking. Accordingly, online access to the banks' products, financial statements, payment services and even credit scoring has considerably improved bank-customer relationships in the context of lending and borrowing practice, deposit composition, investment opportunities, trade finance options as well as account management diversification. The impact of recent E-banking developments on banking is statistically tested for the banking network of Iran using Dynamic Panel Data approach. Results indicate that the ratio of ATMs and Electronic Cards to bank assets positively and significantly influence profitability ratios. Meanwhile, the ratio of online branches and Pin Pads to the banks' assets negatively and significantly affects profitability although the transaction volumes have surged for the banks under study.*

**JEL Classification:** G21, G23, G32, F34

**Keywords:** E-Banking, Risks, Banks' Soundness Indicators

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## 1. Introduction

Electronic Banking (EB) is considered as a new vehicle for banking system to speed up and facilitate financial transactions and communications in both developed and developing economies. This process is drastically accelerated by the internet and the World Wide Web developments despite the global digital gap. The recent communication and electronic innovations tend to enhance ability of the banking industry to augment banking products which are evidently-extensively associated with the virtual financial transactions in order to automate and facilitate the banks-customers' relationship. The E-banking has also complicated the banking pillars which means that these pillars need to be simultaneously and continuously revised through ratifying appropriate rules and regulations, upgrading the supervisory measures and approaches, developing risk management principles, restructuring the bank services and framework as well as training human resources. The E-banking is carried out by different sorts of tools which have constantly been streamlining the institutional network among market agents, customers and financial entities via developing the intelligent electronic devices such as computer, mobile phone and television-based platforms, personal digital assistant (PDA), automated teller machine (ATM), kiosk [Aladwani (2001), Simpson (2002)], P.O.S, as well as virtual teller machines (VTMs) since the mid-1990s (Daniel, 1999; Mols, 1998; Sathye, 1999).

E-banking provides a widespread spectrum of financial products and services to facilitate functional banking operations (corporate banking, commercial banking, investment banking, retail banking, specialized banking, development banking) for the beneficiary individuals and legal entities [Basel Committee Report on Banking Supervision (1998)]. Electronic transactions are technically considered as the most important driving force for the banking systems which expedites financial transactions comprising lending, borrowing, deposit, investment, trade finance, provision of financial advisory services, account management for clients, online accessibility to the financial statements, payment services and even customers and project risk management.

Development of E-banking has modified the structure and definition of performance, efficiency, risk and challenges of the financial and banking system. These subjects are clearly characterized based on the international best practices. Meanwhile, the impact of recent E-banking profound reforms is technically studied for the banking network of Iran via panel data approach

as the relationship between the E-banking indicators and the prudential indices is statistically examined utilizing the macroeconomic variables as control factors for the past few years.

In this study, the E-banking indicators such as value and volume of transactions as well as payment tools (ATM, P.O.S, internet, virtual branches) are periodically evaluated in relation to GDP, broad money, bank deposits, and bank prudential measures (Return on Assets, Return on Equity, Profit Margin, Non-Performing Loans). Although E-banking is empirically and positively assumed to influence macro prudential measures, it should be statistically assessed on the economy of Iran.

The rest of the paper is organized as follows: Section Two reviews the literature about the impact of E-banking on the macro-prudential measures and also bank business vast development. Section Three discusses the comprehensive-complicated reforms over regulation and risk structure along with E-banking enlargement while characterizing the restrictions, advantages and disadvantages. The E-banking historical achievements are empirically presented in section four in the Iranian banking network. The methodology and model estimations are both introduced in the next two sections in order to specify and evaluate the impact of E-banking proxy indices on prudential indicators. Section Seven designates the concluding remarks.

## 2. Literature Review

The global online network development has remarkably accelerated the E-banking and E-commerce capacities in order to flourish the world financial and commercial transactions. This association is associated with an expansion in both volume and size (Harris and Spencer, 2002). Internet banking<sup>1</sup> is practically reflected by the new set of online banking intermediaries such as fund transfers, paying bills, viewing current and savings account balance, paying mortgages, purchasing financial instruments and certificates of deposits and risk management (Singhal and Padhmanbhan, 2008; Ahasanul et al, 2009). In this context, Internet banking also includes

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1. The electronic vehicles which are applied in Internet banking include: E-mail, E-books, SMS, data base and mobile phones (Chaffey et al. 2006). Meanwhile, cell phone banking is potentially considered as a new driver to facilitate and expand future banking services (Fisher – French, 2007; Masocha et al. 2011).

E-banking, E-payment<sup>1</sup>, and Online banking (Ozuru et al, 2010; Singhal and Padhmanbhan, 2008; Beer, 2006; Jun and Cai, 2001; IAMAI, 2006).

Internet banking which streamlines the online access to the bank services in the light of lending/borrowing interest rates, checking and managed account balances as well as loan qualification process is materialized into the real time bill payment, and fund transfer in line with money management services for the institutions (Khan et al. 2009; Singhal and Padhmanbhan, 2008). The E-banking also provides great opportunities to lubricate the bank and customers relationships, while improving the domestic and global online financial transactions safeties, bank procedures, portfolio management timeliness, nimble surveillance, and risk management through availability of the huge valuable data storage and the complicated statistical techniques (Gonzalez et al. 2008; Singhal and Padhmanbhan, 2008; Brodie et al. 2007; Williamson, 2006; Beer, 2006; Cooper, 1997; IAMAI's, 2006 and Joseph et al. 1999).

Although the theoretical views are scarce compared to empirical ones, the recent sporadic studies have evidently indicated that the E-banking which is also categorized based on service, information set, communication tool kits and transactional sources has altered the banks' costs and revenue composition so the efficiency and profitability improve more significantly than conventional banking. [Egland et al. (1998), Furst et al. (2000a, 2000b, 2002a and 2002b)].

Sullivan (2000) also observed that electronic banks were somehow associated with higher operating expenses while contemporaneously offsetting with higher fee revenue. In this regard, a significant and positive relationship has been empirically recognized between Internet banks and profitability as the key performance indicator among 105 Italian banks (Hasan 2002) providing that the banking system has been structurally developed based on variety of products and services (DeYoung 2001a, 2001b, 2001c, and 2005). Meanwhile, a sectorial survey on 72 Spanish commercial-multifunctional banks during 1994-2002 which utilize the Internet has reflectively underlined more appropriate commission revenues, larger rate of

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1. E-payment is technologically recognized as a means whereby banking businesses are functionally implemented via electronic processes including personal computers, telephones, fax machines, Internet card payments, cell phones and other electronic devices (Turban et al. 2006; Ozuru et al. 2010).

return on assets and equities and lower expenses albeit the risk structure statistically remained unaffected [Hernando and Nieto, (2005)].

Furthermore, the banking performance has been enhanced significantly by the acceleration of internet services application in the Indian extended banking network [Malhotra, and Singh (2009)] while evidently and steadily overwhelming the Internet banks over the non-Internet ones (Singhal and Padhmanbhan, 2008).

Given the fact that technology development has gently reduced the operational functional cost, the banking network has focused on the computerization and automation in the past three decades as electronic and Online banking deliveries have fulfilled both customers and bankers' expectations in the context of service quality and relationship procedures (Lamb et al, 2002; Larpsiri and Speece, 2004; Durkin and Howcroft, 2003; Ching, 2008; Masocha et al. 2011).

New Information Technology has taken an important place in the future development of financial services, and banking sector transitions are especially affected more than any other financial service provider groups. Increased use of mobile services and use of internet as a new distribution channel for banking transactions and international trading requires more attention towards E-banking security against fraudulent activities. The development and the increasing progress that is being experienced in the Information and Communication Technology have brought about a lot of changes in almost all facets of life. In the banking industry, it has been in the form of online banking, which is now replacing the traditional banking practice. Online banking has a lot of benefits which add value to customers' satisfaction in terms of better quality of service offerings while enabling the banks to gain more competitive advantage over other competitors. This paper discusses some challenges in an emerging economy.

The economies of most developing countries are cash driven; meaning that monetary transactions are basically made through the trade of bank notes and coins for goods and services. However, this trend is now giving way to a modern and sophisticated payment system where the currency and notes are converted to data, which are in turn transmitted through the telephone lines and satellite transponders. This is as a result of rapid technological progress and development in the financial market (Ozuru et al. 2010; Johnson, 2005). There is faster delivery of information from the customer and service provider, thus differentiating Internet enabled electronic banking system from

the traditional banking operation (Singhal and Padhmanabhan, 2008; Salawu et al. 2007). This transfer process makes money to be carried in information storage medium such as cheques, credit cards, and electronic means rather than its pure cash form. E-banking has thus become an important channel to sell products and services; leading to a paradigm shift in marketing practices, resulting in high performance in the banking industry (Christopher et al. 2006; Brodie et al 2007; Singhal and Padhmanabhan, 2008). The banking industry has been undergoing changes since the mid-1990s, in the form of innovative use of information technology and development in electronic commerce (Kalakota and Whinston, 1996). This development made E-banking POS as a threat to the traditional branch operations, despite the fact that electronic commerce is still developing and is rapidly changing (Harris and Spence, 2002; Turbin et al. 2002). According to Ozuru et al. (2010) “The importance of electronic payment system in any country can never be over emphasized, due to the dramatic transformation in technological advancements that is being experienced by the global financial industry”.

### **3. The E-banking Supervision Regulation and Risks**

The Basel committee introduced several prudential requirements to monitored-payments in the global banking network including registration and maintenance of the banking transactions which necessarily include the beneficiary, applicant, consignees and consignors, bank orders, account information, all parties' address, recognition of third parties, and non-banks clients as well as all the suspicious international transactions information based on the Anti-money Laundering and Financing Terrorism Acts.

Electronic banking, which has functionally enhanced bank services, has considerably restructured the risk management procedures and mandates in the banking system compared with conventional banking in the context of risk assessment, control, monitoring as well as resolution. Some specific risks are empirically announced for the E-banking, which are added to conventional risks<sup>1</sup> including risks of transfer, telecommunication, and cyber-attacks along with the international fraud.

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1. Liquidity, credit, operational, legal, systematic, reputation and market risks.

### 3.1. Risk assessment

Risk assessment is basically-individually introduced when the bank's business plan is primarily-articulated provided by the stakeholders in order to recognize the potential risk factors and opportunities which influence the banking operations. Although the risks should be specifically characterized at the beginning of the business, they are quantitatively, statistically and permanently measured in the course of operations in order to compute the expected cost of every single risk which is regularly taken into account through the adequate provisions and buffers.

Recognition of risk factors is empirically discovered by the risk and market analysts based on the historical evidences as well as other bank experiences which are extracted in different episodes and economies. Accordingly, the relative importance of risks is technically depended on the macroeconomic and institutional conditions as well as the frequency of incidence which are obviously varied among different economies and in time lapse. Furthermore, the assessment process determines the banks resiliency against different levels of risks that are constantly exemplified in the context of shocks scenarios to predict adequate buffers as preventive and corrective promulgations. The banks should technically patronize some explanatory indicators to highlight upcoming undesirable incidence along with designation of resolution package for addressing the contingent risks. The risk practitioners would specifically just react to those risks which are empirically recognized beyond the manifestation norms. Henceforth, they are well aware how and when to respond to the undesirable status via mobilizing the bank's resources for mitigating the risks' cost.

### 3.2. Risk control

The risk assessment process underscores the micro and macro-risks outlook for banks which are simultaneously controlled through enhancing safety benchmarks, streamlining the domestic communications, improving the financial products, and strengthening banks' fragility against external service providers including the Internet Service Providers (ISPs). The control mechanism consists of a wide variety of functions such as safeguarding measures, internal controls, domestic surveillance, data trustworthiness, and timely financial reports. The E-banking is apparently exposed to the cyber-attacks which should be protected by the implementation of secured telecommunication network among banks, NTSC, users, and application stores. The security measures are basically introduced at the software and

hardware instruments such as data encryption, digital certificate, firewalls, antivirus controls, using a PIN, and also the regulatory-supplementary procedures. Management and human skills are both considered as crucial triggers to enhance internal and external communications between staffs and customers. In this context, the control departments which include the IT, internal auditing, domestic surveillance, inspections as well as risk management give permanent timely feedback to the CEOs and managers in order to underline the shortcomings and contingent risks in case the communication chart is forcefully lubricated based on the functions and regulations.

### **3.3. Risk monitoring**

The bank financial transactions are practically examined in the context of assets and liabilities articles which should be regularly managed by the Asset/Liability Committee (ALCO) and Risk Committee (RC). The ALCO and RC committees which periodically adopt the risk limits based on the supervisory benchmarks authorize the credit and investment departments to accept the permitted risks while compulsorily monitoring for stakeholders. Meanwhile, the electronic transactions should also be processed based upon the risk limits by the risk management and IT analysts in order to monitor the cyber or accounting errors as well as instant risk position. Furthermore, a server would be established in order to save and categorize all financial statements, transactions, errors, risk reports, customers and markets' information as well as the dissipating financial imbalances for the board members and employees.

### **3.4. Challenges of risk management in E-banking**

Although E-banking enhances the banks' financial and non-financial products and services to a more competitive business environment, it is also influenced by some new sets of challenges which are prominently marginalized in developing economies including digital gap, fraud and cyber-attacks, breaking into the accounts statements, and telecommunication shortcomings. In the meantime, the transactions which have been rapidly escalated in light of size, frequency, volume, and error cost over the past two decades are hardly, effectively and timely examined by the risk and IT analysts. Undoubtedly, the human skills should be remarkably improved to fulfill the new functions of banks.

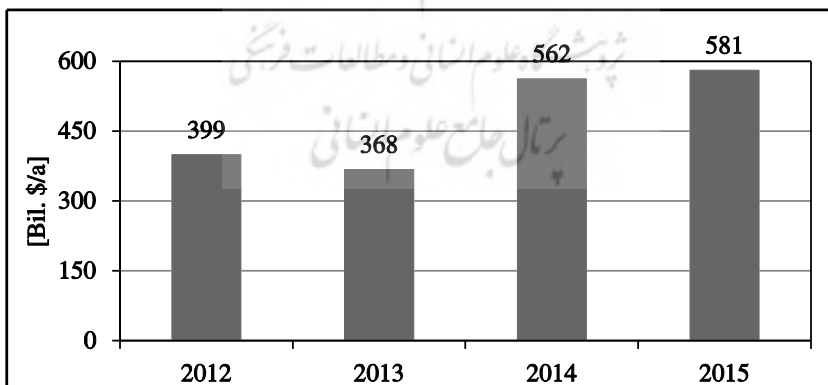


The constant technology development has inevitably necessitated to continuous investing in software, hardware as well as human skills given the fact that the E-banking is technology intensive. Therefore, the banks should forcefully vary the financial and non-financial products and services instead of persistent raising the banks non-shared revenues and fees. Ultimately, the bank which is able to preserve the balance between technology development and innovative products is empirically considered as a vital institution. Otherwise, it unavoidably confront with the huge challenges in a competitive business environment and cost-intensive technology. The E-banking is required to outsource some of the technical utilities which are securely supplied by the Internet Services Providers (ISPs), telecommunication entities, program developers, technology institutions as well as application stores, control interface, and storage companies. The supplier-supplementary entities are functionally and regularly overseen by the supervisory body in the context of license condition, security control, data protection, standard procedures, customer privacy, and other micro prudential rules.

#### 4. Empirical Evidence

The financial transactions which are practically examined by the ATM and E-branches are assumed as a proxy of E-banking in this study regarding the data shortage in the Iran E-banking network.

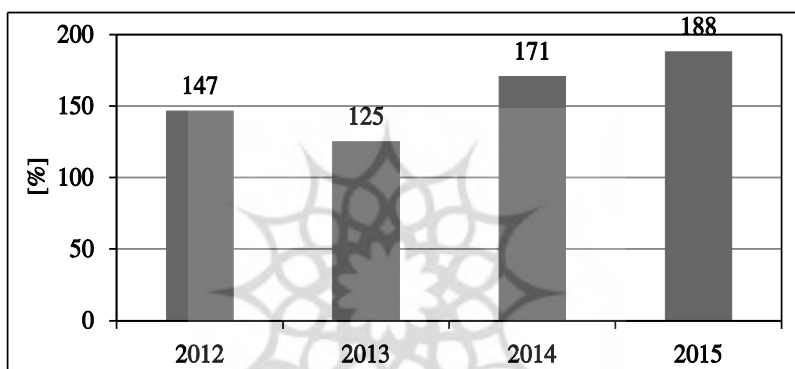
Fig1: Total Annual E-banking Transactions



Source: Central Bank of Islamic Republic of Iran.

The E-banking transactions have significantly-annually increased by 13.3 percent as the transactions value reached 581 billion USD in 2015 compared with 399 billion USD in 2012 (Fig 1) which highlights the key role of E-banking in the macroeconomic financial and non-financial transactions as well as families' life style. In this context, the ratio of E-banking transactions to GDP also improves from 147 percent to 188 percent during 2011-15 (Fig 2) while it is contemporaneously-positively expected to accelerate GDP growth too due to the synergy between E-banking and output growth.

**Fig 2. The Ratio of E-banking Transactions to GDP**

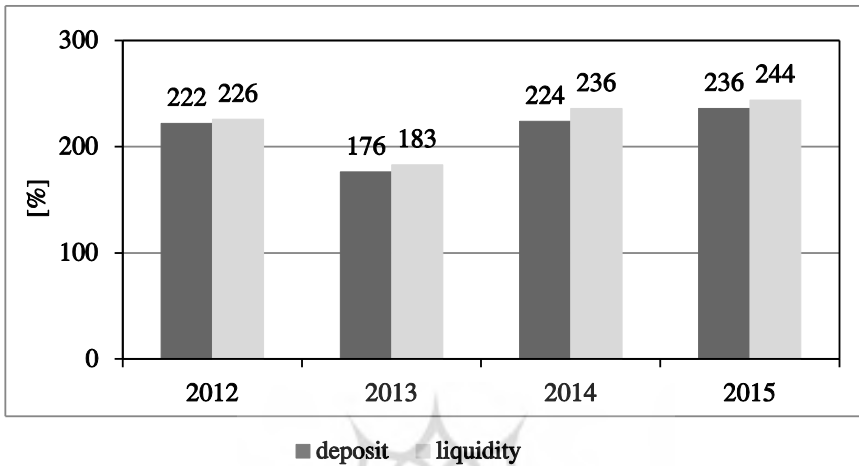


*Source:* Central Bank of Islamic Republic of Iran.

Similarly, the ratio of E-banking transactions to bank deposits and broad money are respectively boosted to 236 and 244 percent in 2015 (Fig 3) which simultaneously-consequently leads to an upsurge in banks earnings given the stability of banks soundness indicators.

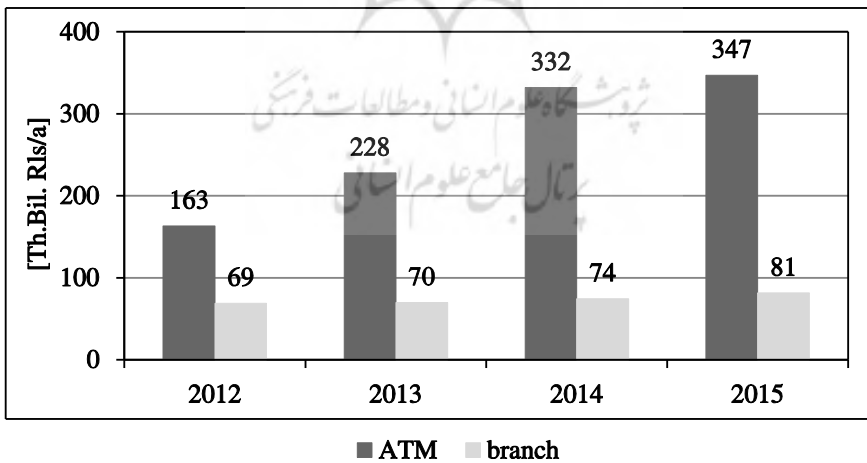
Figure 4 underscores ATM annual transactions in the same period boosting to 347 trillion Rials in 2015 owing to the diversification of the ATM options while contemporaneously motivating people to use Telephone-banking, Internet-banking, Mobile-banking, POS, and Pin pad instead of going to the branches. Besides, the branches-station transactions slowly-annually rises from 69 to 81 trillion Rials by about 5.5 percent increase during 2012-15 as well.

**Fig 3. The Ratio of E-Banking Transactions to Liquidity & Deposits**

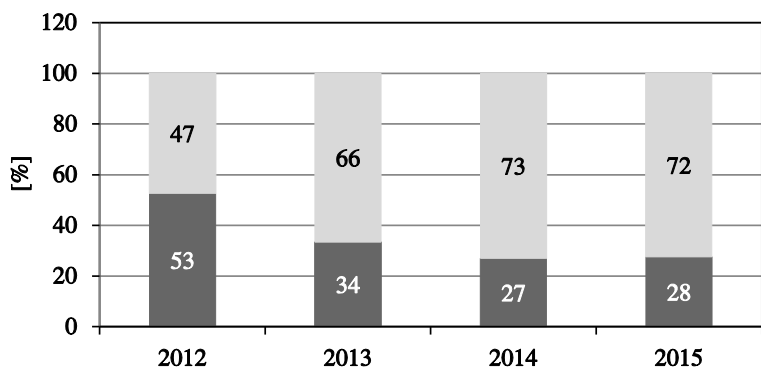


Source: Central Bank of Islamic Republic of Iran.

**Fig 4. The Annual ATM and Branches Transactions**

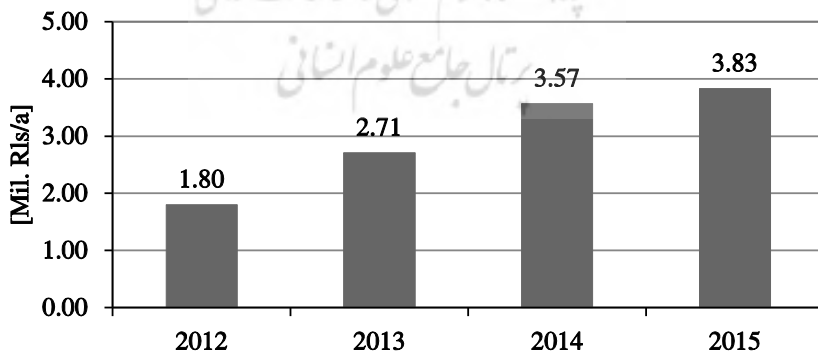


Source: Central Bank of Islamic Republic of Iran.

**Fig 5. Share of ATM and Branches in the Transactions**

Source: Central Bank of Islamic Republic of Iran.

In this vein, the share of ATM in the transactions has mounted to 72 percent in 2015 by about 15 percent constant increase which remarkably viaducts the E-branches' transactions as well (Fig 5). Furthermore, the average E-banking transactions rise by about 29 percent which obviously overpasses inflation (19 percent). In other words, the average E-banking transactions which upturns from 1.8 million Rials in 2012 to 3.8 million Rials, also underscores that the transaction volumes have been bigger than values (Fig 6).

**Fig 6. The Average Annual E-banking Transactions**

Source: Central Bank of Islamic Republic of Iran.

Eventually, although the direct impact of E-banking on the bank benefits is hardly characterized by the current data capacity, the efficiency of instruments has been enhanced considerably over the past few years.

## 5. Methodology and Data

E-banking is empirically expected to improve bank profitability. Henceforth, E-banking indicators are taken into account as explanatory variables to illustrate bank profit margin model. Four key E-banking indicators are applied in the banks' profitability regression model including the ratio of ATMs, pin pads, online branches, and bank electronic cards to total assets which are supplemented by the other macroeconomic explanatory variables such as output growth, foreign exchange rate and stock price index. In this context, Dynamic Panel Data Model is utilized to estimate the impact of macroeconomic variables and E-banking indicators on the banks' profitability.

The variables utilized in the equation (1) are described in the table (1).

The financial statements data which constitute 248 samples to estimate model entail 31 different banks from 2006 to 2013. The information set is extracted from the unbalanced data base of Iran Banking Institute. Equation (1) is introduced as a regression model. Meanwhile, the impact of lagged explanatory variables is required to apply the dynamic relation approach as well. Furthermore, the Sargan test is also conducted to examine the over-identification restriction and the correlation between the residual terms and instrumental variables.

$$\begin{aligned}
 PMAR_{it} = & C + \beta_1 PMAR_{it-1} + \beta_2 PMAR_{it-2} + \beta_3 ROA_{it} + \beta_4 NPLE_{it} + \beta_5 LATA_{it} + \beta_6 \\
 & LATA_{it-1} + \beta_7 LATD_{it} + \beta_8 LATD_{it-1} + \beta_9 LATD_{it-2} + \beta_{10} ATMA_{it} + \beta_{11} ATMA_{it-1} + \\
 & \beta_{12} ATMA_{it-2} + \beta_{13} PIPA_{it} + \beta_{14} PIPA_{it-2} + \beta_{15} OBA_{it} + \beta_{16} OBA_{it-1} + \beta_{17} OBA_{it-2} + \\
 & \beta_{18} POSA_{it-1} + \beta_{19} POSA_{it-2} + \beta_{20} BCA_{it} + \beta_{21} GDP_{it} + \beta_{22} GDP_{it-1} + \beta_{23} GDP_{it-2} + \beta_{24} ST_{it} + \\
 & \beta_{25} ST_{it-1} + \beta_{26} ST_{it-2} + \beta_{27} EXR_{it} + \beta_{28} EXR_{it-1} + \beta_{29} EXR_{it-2} + \varepsilon_{it}
 \end{aligned}
 \tag{1}$$

A summary of E-banking statistics is shown in table (2) which includes the mean, maximum, minimum, and standard deviation of ATMs and Pin Pad transactions on total assets ratio, as well as the share of online branches and branch cards on total assets. While the average of Profit Margin Ratio (PMAR) and the ratio of Return on Total Assets (ROA) both indicate a positive yield, the higher PMAR illustrates higher revenue-assets ratio and

consequently assets return. The higher average ratio of branch cards underlines the customers' behavioral pivot from ATM, Pin Pad, and online branches towards the promoted-virtual payments via POS and wallet instruments.

**Table 1. Description of Variables**

| Variable Name | Definitions  |
|---------------|--|
| PMAR          | Ratio of Banks' Profit to Earning Assets           |
| Roa           | Return on Assets Ratio                             |
| NPLE          | Ratio of Nonperforming Loans to Equity             |
| LTD           | Total Loans to Total Deposits Ratio                |
| LATA          | Liquid Assets to Total Assets Ratio                |
| LATD          | Liquid Assets to Total Deposits Ratio              |
| ATMA          | Ratio of Number of ATMs to Total Assets            |
| PIPA          | Ratio of Number PIN PAD to Total Assets            |
| OBA           | Ratio of Number of Online Branches to Total Assets |
| BCA           | Ratio of Number of Branch Cards to Total Assets    |
| POSA          | Ratio of Number of POS to Total Assets             |
| GDP           | Gross Domestic Products Growth Rate                |
| ST            | Stock Market Price Growth Rate                     |
| EXR:          | Foreign Exchange Rate                              |

*Note:* Digits 1 and 2 added to some of the variables denote the first and second lag of the variables.

**Table 2. Summary Statistics**

| Variable | Min   | Max    | Mean | Std. Dev. |
|----------|-------|--------|------|-----------|
| PMAR     | -0.07 | 0.14   | 0.02 | 0.03      |
| ROA      | -0.06 | 0.11   | 0.01 | 0.02      |
| NPLE     | 0     | 17.06  | 1.46 | 1.89      |
| LATA     | 0     | 0.72   | 0.14 | 0.12      |
| LATD     | 0.15  | 232.37 | 4.97 | 20.8      |
| ATMA     | 0     | 0.16   | 0.02 | 0.02      |
| PIPA     | 0     | 0.39   | 0.04 | 0.07      |
| OBA      | 0     | 0.09   | 0.01 | 0.02      |
| BCA      | 0     | 727.23 | 95.2 | 149.5     |

Source: Authors' calculations.

The correlation matrix generally highlights the linear association between E-banking and performance variables. Table (3) generally indicates low correlation between two sets of explanatory variables including E-banking indicators and banks' performance variables. It is evidently observed that the E-payment drivers are stringently correlated mainly because of the supplementary features. Besides, bank financial indicators' correlation confirms the empirical evidence. For instance, there are positive correlations between return on assets ratio with profit margin, loans to assets ratio, and loans to deposits ratio. Ironically, the relationship between NPLs and profit margin is negatively correlated as it was expected based on literature survey.

**Table 3. Correlation Matrix**

|      | PMAR  | ROA   | NPLE  | LATA  | LATD  | ATMA | PIPA | OBA  | BCA |
|------|-------|-------|-------|-------|-------|------|------|------|-----|
| PMAR | 1     |       |       |       |       |      |      |      |     |
| ROA  | 0.93  | 1     |       |       |       |      |      |      |     |
| NPLE | -0.35 | -0.35 | 1     |       |       |      |      |      |     |
| LATA | 0.55  | 0.68  | -0.24 | 1     |       |      |      |      |     |
| LATD | 0.06  | 0.09  | -0.11 | 0.04  | 1     |      |      |      |     |
| ATMA | -0.31 | -0.32 | 0.25  | -0.14 | -0.09 | 1    |      |      |     |
| PIPA | -0.29 | -0.32 | 0.21  | -0.18 | -0.07 | 0.9  | 1    |      |     |
| OBA  | -0.32 | -0.34 | 0.24  | -0.21 | -0.1  | 0.83 | 0.84 | 1    |     |
| BCA  | -0.31 | -0.32 | 0.31  | -0.14 | -0.11 | 0.89 | 0.76 | 0.69 | 1   |

Source: Authors' calculations.

## 6. Model Estimation Results

The results indicate that the ratio of ATMs and Electronic Cards transactions to bank assets positively and significantly influence the profitability as we expected [Table (4)]. The ratio of online branches and Pin Pads transactions to the bank assets negatively and significantly affects the profitability owing to the rapid increase in the NPLs and loan/loss expenses which have consequently shrunk Shared Revenues over the past eight years. Accordingly, a set of bank products which are functionally supplied at the counter of online branches would increase maintenance- and consequently- branch cost considerably. Meanwhile, given the fact that the Pin Pads transactions are technically accomplished at the branch counters, the branches should face overheads which mitigate profit margin via higher maintenance and operational costs.

In this regard, the impact of output growth, stock price index and nominal exchange rate stimulate the profit margin in accordance with the empirical evidence<sup>1</sup>. In other words, an upturn in economic growth and stock price index streamline macroeconomic flow of funds positively while reducing NPLs and loan/loss expenses which consequently inspire profit margin. Nonetheless, exchange rate depreciation weakens profit margin due to positive impact of exchange rate depreciation on NPLs, loan/loss expenses, and subsequently, higher provision requirement. In this regard, banks should be committed mandatorily to surge provisions as cushion buffer in case the economy might confront a downturn in GDP growth, a dip of the stock market price, or depreciation at the foreign exchange market.

The Sargan test rejects over-identification hypothesis which simultaneously enhances the reliability of the instrument variables as well.

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1. Bastanzad, H., Valipour Pasha, M., and Heidari, H. (2015), "The Impact of Real and Financial Indicators on the NPLs", Policy Note, 25th Annual Conference on Monetary and Exchange rate Policy.



**Table 4. Arellano-Bond Dynamic Panel Estimation Results**

| PMAR  | Coef.       | Std. Err. |
|-------|-------------|-----------|
| PMAR1 | -0.05**     | 0.02      |
| PMAR2 | -0.06***    | 0.01      |
| ROA   | 0.46***     | 0.06      |
| NPLE  | -0.00002*** | 0.00006   |
| LATA  | -0.034***   | 0.005     |
| LATD  | -0.003***   | 0.0002    |
| ATMA  | 0.12***     | 0.01      |
| PIPA  | -0.05***    | 0.009     |
| OBA   | -0.21***    | 0.03      |
| BCA   | 0.00001***  | 0.000028  |
| GDP   | 0.0009***   | 0.00006   |
| ST    | 0.00006***  | 0.00007   |
| EXR   | -0.00002*** | 0.00008   |
| LATA1 | -0.11***    | 0.01      |
| LATD1 | 0.002***    | 0.0006    |
| LATD2 | 0.004***    | 0.0004    |
| ATMA1 | -0.07***    | 0.01      |
| ATMA2 | -0.33***    | 0.01      |
| PIPA2 | 0.05***     | 0.004     |
| OBA1  | 0.16***     | 0.04      |
| OBA2  | 0.004       | 0.02      |
| POSA1 | 0.0002**    | 0.0001    |
| POSA2 | 0.001***    | 0.0001    |
| GDP1  | 0.0005***   | 0.00006   |
| GDP2  | 0.0008***   | 0.00005   |
| ST1   | -0.00003*** | 0.00006   |

| PMAR                | Coef.       | Std. Err. |
|---------------------|-------------|-----------|
| ST2                 | 0.0001***   | 0.0009    |
| EX1                 | -0.00001*** | 0.00007   |
| EX2                 | 0.0001***   | 0.0007    |
| _cons               | 0.01***     | 0.001     |
| No. of Observations | 248         |           |
| No. of Banks        | 31          |           |
| No. of Instruments  | 36          |           |
| <b>Sargan test</b>  |             |           |
| Chi2(6)             | 4.35        |           |
| Prob>chi2           | 0.62        |           |

*Note:* Standard errors are in parentheses; the significant parameters are indicated with \*\*\*, \*\*, \* indicating significance at 1%, 5% and 10% levels.

*Source:* Authors' calculations.

## 7. Conclusions

The recent communication and electronic technological development enhance banking business environment and augment banking services which have simultaneously led to an expansion in the virtual financial transactions in order to streamline banks-customer relationships. Electronic banking which is empirically supported by the internet, the World Wide Web development, and technological advances, is considered as a new innovation in banking industry to speed up financial and banking transactions, and to diversify bank products. Besides, Near Field Communication development accelerates the E-banking development through synchronizing internet with payment tools such as online branches, ATM, Telephone, Mobile, POS, Pin Pad, kiosk, television-based platforms, personal digital assistant (PDA), and virtual teller machines (VTMs) in both developed and developing economies despite the significant global digital gap. E-banking development has also been associated with an improvement in banking pillars including ratifying a new consistent set of prudential regulations, upgrading the supervisory measures, developing risk

management principles, restructuring bank service framework and also introducing the new business models.

Accordingly, E-banking which is noticeably carried out by different sorts of tools has been constantly streamlining the communication network among market agents, customers and credit institutions at the competitive business industry while consequently allowing individual banks to access new opportunities and geographical horizons. Furthermore, E-banking delivers a new set of services to overcome the modern financial development junctures via facilitating domestic and overseas wireless transactions in the context of corporate banking, commercial banking, investment banking, retail banking, specialized banking, and development banking.

Electronic banking has accelerated Iranian banking transactions considerably, as the value of transactions boosted to 581 billion USD with 13.3 percent constant annual growth during 2012-15. The ratio of E-banking transactions to GDP reached a record of 188 percent in 2015, which ironically led to an improvement in GDP growth as well. Likewise, the ratio of E-banking transactions to broad money rose to 244 percent in 2015 which underscores the penetration of E-payment in the social and economic environment. Accordingly, transactions through the ATM as a user-friendly vehicle of the annual banking transactions mounted to 347 trillion Rials in 2015 which expresses both dominant increasing role of virtual transactions and diminishing significance role of branches in the E-banking.

The findings underscore that the ratio of ATMs and Electronic Cards transactions to assets influences profitability of the banks in our sample positively and significantly. Moreover, the ratio of online branches and Pin Pads transactions to the assets affects profitability negatively and significantly due to increase in the loan capacity and rise in the outstanding loans. Out of balance-sheet variables such as GDP and stock market price have a positive influence on the profit margin while the nominal exchange rate adversely influences the profit margin for the banks under study. The negative influence of the exchange rate causes negative balance-sheet effects that increase the volume of both foreign exchange non-performing loans and loan-loss provisions.

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## Appendices

### Appendix 1. Summary Statistics

| Variable |         | Mean     | Std. Dev. | Min       | Max      | observations    |
|----------|---------|----------|-----------|-----------|----------|-----------------|
| pmar     | overall | .0224265 | .0305625  | -.07      | .14      | N = 136         |
|          | between |          | .0329655  | -.04      | .11      | n = 28          |
|          | within  |          | .0168263  | -.0275735 | .1124265 | T-bar = 4.85714 |
| roa      | overall | .0156021 | .0223966  | -.06      | .11      | N = 191         |
|          | between |          | .0221762  | -.024     | .09      | n = 31          |
|          | within  |          | .012594   | -.0203979 | .0696021 | T-bar = 6.16129 |
| nple     | overall | 1.462151 | 1.899957  | 0         | 17.06    | N = 186         |
|          | between |          | 1.41945   | .0033333  | 6.118    | n = 30          |
|          | within  |          | 1.344197  | -4.385849 | 12.40415 | T-bar = 6.2     |
| lata     | overall | .1468493 | .1276566  | 0         | .72      | N = 146         |
|          | between |          | .0985613  | .05       | .5516667 | n = 30          |
|          | within  |          | .077083   | -.0948174 | .5593493 | T-bar = 4.86667 |
| latd     | overall | 4.970993 | 20.83345  | .15       | 232.37   | N = 151         |
|          | between |          | 19.42014  | .19       | 107.8133 | n = 30          |
|          | within  |          | 14.37636  | -98.87234 | 129.5277 | T-bar = 5.03333 |
| atma     | overall | .0209948 | .0290835  | 0         | .16      | N = 191         |
|          | between |          | .0235134  | 0         | .09625   | n = 31          |
|          | within  |          | .0146859  | -.0452552 | .0847448 | T-bar = 6.16129 |
| pipa     | overall | .044104  | .0716494  | 0         | .39      | N = 173         |
|          | between |          | .0565601  | 0         | .27      | n = 31          |
|          | within  |          | .0335628  | -.165896  | .164104  | T-bar = 5.58065 |
| oba      | overall | .0185484 | .0238132  | 0         | .09      | N = 186         |
|          | between |          | .021564   | 0         | .07625   | n = 31          |
|          | within  |          | .0049501  | -.0077016 | .0322984 | T-bar = 6       |
| bca      | overall | 95.21451 | 149.5773  | 0         | 727.23   | N = 193         |
|          | between |          | 113.3002  | .12       | 379.3462 | n = 31          |
|          | within  |          | 89.73507  | -199.5917 | 502.1682 | T-bar = 6.22581 |

### Appendix 2. Correlation Matrix

|      | pmar    | roa     | nple    | lata    | latd    | atma   | pipa   | oba    | bca    |
|------|---------|---------|---------|---------|---------|--------|--------|--------|--------|
| pmar | 1.0000  |         |         |         |         |        |        |        |        |
| roa  | 0.9395  | 1.0000  |         |         |         |        |        |        |        |
| nple | -0.3502 | -0.3527 | 1.0000  |         |         |        |        |        |        |
| lata | 0.5577  | 0.6816  | -0.2441 | 1.0000  |         |        |        |        |        |
| latd | 0.0644  | 0.0946  | -0.1158 | 0.0461  | 1.0000  |        |        |        |        |
| atma | -0.3145 | -0.3259 | 0.2508  | -0.1419 | -0.0960 | 1.0000 |        |        |        |
| pipa | -0.2949 | -0.3224 | 0.2106  | -0.1804 | -0.0796 | 0.9113 | 1.0000 |        |        |
| oba  | -0.3299 | -0.3481 | 0.2456  | -0.2124 | -0.1014 | 0.8334 | 0.8400 | 1.0000 |        |
| bca  | -0.3109 | -0.3203 | 0.3192  | -0.1422 | -0.1128 | 0.8918 | 0.7635 | 0.6982 | 1.0000 |

### Appendix 3. Arellano-Bond Dynamic Panel Estimation Results

| Arellano-Bond dynamic panel-data estimation |           | Number of obs    | =      | 35       |                      |           |
|---|-----------|------------------|--------|----------|----------------------|-----------|
| Group variable: <b>id</b>                   |           | Number of groups | =      | 13       |                      |           |
| Time variable: <b>year</b>                  |           |                  |        |          |                      |           |
|   |           | obs per group:   | min =  | 1        |                      |           |
|   |           |                  | avg =  | 2.692308 |                      |           |
|   |           |                  | max =  | 5        |                      |           |
| Number of instruments =                     |           | 36               |        |          |                      |           |
|   |           | wald chi2(29)    | =      | 13047.83 |                      |           |
|   |           | Prob > chi2      | =      | 0.0000   |                      |           |
| One-step results                            |           |                  |        |          |                      |           |
| pmar  | Coef.     | Std. Err.        | z      | P> z     | [95% Conf. Interval] |           |
| pmar  |           |                  |        |          |                      |           |
| L1.   | -.0524772 | .0253275         | -2.07  | 0.038    | -.1021182            | -.0028361 |
| L2.   | -.0689633 | .0132998         | -5.19  | 0.000    | -.0950305            | -.0428961 |
| roa   | .4681921  | .0620488         | 7.55   | 0.000    | .3465787             | .5898055  |
| nple  | -.0002907 | .0000657         | -4.43  | 0.000    | -.0004194            | -.0001619 |
| lata  | -.0346696 | .0051586         | -6.72  | 0.000    | -.0447803            | -.0245588 |
| latd  | -.0032695 | .0002465         | -13.26 | 0.000    | -.0037526            | -.0027864 |
| atma  | .1247288  | .0156239         | 7.98   | 0.000    | .0941066             | .155351   |
| pipa  | -.0582695 | .0098004         | -5.95  | 0.000    | -.0774779            | -.0390611 |
| oba   | -.219978  | .0395093         | -5.57  | 0.000    | -.2974149            | -.1425412 |
| bca   | .0000113  | 2.84e-06         | 3.95   | 0.000    | 5.67e-06             | .0000168  |
| gdp   | .0009391  | .000064          | 14.67  | 0.000    | .0008136             | .0010645  |
| st  | .0000694  | 7.07e-06         | 9.82   | 0.000    | .0000556             | .0000833  |
| exr   | -.0000223 | 8.19e-06         | -2.72  | 0.006    | -.0000384            | -6.27e-06 |
| lata1                                       | -.1132125 | .0100857         | -11.23 | 0.000    | -.13298              | -.0934449 |
| latd1                                       | .0027463  | .0006022         | 4.56   | 0.000    | .0015659             | .0039266  |
| latd2                                       | .0040626  | .0004974         | 8.17   | 0.000    | .0030878             | .0050374  |
| atma1                                       | -.0786571 | .0112068         | -7.02  | 0.000    | -.1006221            | -.0566922 |
| atma2                                       | -.3320151 | .0187601         | -17.70 | 0.000    | -.3687841            | -.295246  |
| pipa2                                       | .059004   | .0049936         | 11.82  | 0.000    | .0492168             | .0687913  |
| oba1  | .1613621  | .0410153         | 3.93   | 0.000    | .0809736             | .2417506  |
| oba2  | .0044467  | .0273954         | 0.16   | 0.871    | -.0492473            | .0581407  |
| posal                                       | .0002453  | .0001016         | 2.41   | 0.016    | .0000461             | .0004445  |
| posa2                                       | .0012876  | .0001599         | 8.05   | 0.000    | .0009742             | .0016011  |
| gdp1  | .0005246  | .000067          | 7.83   | 0.000    | .0003933             | .0006559  |
| gdp2  | .0008214  | .0000599         | 13.71  | 0.000    | .000704              | .0009389  |
| st1   | -.0000346 | 6.30e-06         | -5.49  | 0.000    | -.0000469            | -.0000222 |
| st2   | .0001332  | 9.25e-06         | 14.39  | 0.000    | .000115              | .0001513  |
| exr1  | -.0000225 | 3.71e-06         | -6.07  | 0.000    | -.0000298            | -.0000152 |
| exr2  | .0001327  | 7.79e-06         | 17.03  | 0.000    | .0001174             | .0001479  |
| _cons                                       | .0128016  | .0011451         | 11.18  | 0.000    | .0105573             | .0150459  |

### Appendix 4. Sargan Test Results

Sargan test of overidentifying restrictions  
H0: overidentifying restrictions are valid

chi2(6) = 4.357464  
Prob > chi2 = 0.6284