The Impacts of Technical Changes on Banking Economic Indices, Case Study of Iran

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Abstract

Payment systems play a major part in the conduct of a country's monetary policy, financial sector and economic development. The use of technology in mature payment systems has also gained great importance. Electronic banking, mobile phones, smart cards and related technologies has introduced the new instruments for payment. So payment could be in different forms, from the most initial ways to the most advanced electronic one.

In this paper, we have studied the economic effects of a new technology of payments in banking industry by using Iranian bank level panel data.

Electronic payment in banking industry leads to decrease average costs, increase the economic of scale in the attraction deposits more than in the giving loans and finally will affect input demand asymmetric. By using this new technology, the ratio of labour and both materials and physical capital have been decreased.

Keyword: banking industry; electronic payment; banking industry; panel data; mechanism change.

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1- Introduction

In every industry, E-commerce is revolutionizing the way business is conducted. New business models are replacing outdated ones and organizations are rethinking business process designs and customer relationship management strategies. The dramatic effect that e-commerce is having in changing fundamental business processes and strategies cannot be underestimated or ignored. Banks are no exception to this transformation.

Payment systems play a major part in the conduct of a country's monetary policy, financial sector and economic development.

Advances in telecommunications and information technologies are leading to a revolution in the payment industry in the banking arena.

It is necessary to define the electronic banking. So, electronic banking would run the gamut from direct deposits, ATMs, credit and debit cards, telephone banking to electronic bill payments and web-based banking.

In many countries, payment services have gradually changed from paper based giro and check payments to electronic giro and debit card payments.

In Iran, like most countries, did modernization in banking industry especially in payment services in 1990s.

The reasons of banks' tendency to electronic payments are different. One of them is competition and the other one is cost saving. The costs of electronic payment are less than paper-based services and people find the new system, simple, faster, secure and convenient and it is competition aspect which causes to attract more deposits.

In this paper, we have investigated the effects of new technology in payment services of banks on the average costs, scale of properties and input demand in the production of deposits and loans.

There are various aspects about payment services. One may considers payment services as outputs due to the nature of banks behavior. In the other may be as inputs, because payment services generate loans and deposits, so these affect banks' income, but in this survey, we have prevented from this aspect, because it is not possible to disentangle inputs used to produce payment services within banks from inputs used directly in the production of loans and deposits. Therefore, we have considered payment service as an additional input would involve double counting of inputs. It means that Payment services are intermediate inputs produced within banks by the

primary inputs like labour, physical capital and materials, or banks use a clearinghouse and settlement bank to execute the transactions.

We believe that new technology in banking increases the economies of scale in the production of deposits more than in the production of loans.

In this study, we have estimated a cost function included 4 variable inputs like: labour, physical capital, materials and funds, and two output like: the volume of deposits and loans. In order to represent the effects of new technology, we have interred the component included the ratio between the development of electronic payment and total non-cash payment.

This ratio would be calculated by measure in number of transactions. The other component is deterministic trend time added to illustrate the part of changes isn't related to technical change from paper-based to electronic payments.

We have collected 829 observations of the bank-level data of Iran from 2000 to 2007 for estimating the model to analysis the effect of technical changes on economic indices.

Finally, we have concluded that remove toward electronic payment in banking has lead to decrease in average costs, increase in economies of scale in production of deposits more than production of loans. In addition, this technical change in payment services makes an asymmetric effect on inputs and the share of labour in comparison to others like: physical capital, materials has decreased.

2- History of Banking in Iran

Banking operations had been carried out in Iran by temples and princes before the advent of Achaemenid dynasty. In that period, trade boomed in the country, thus giving a boost to banking.

Before a bank in its present form was established in the country, banking operations had been carried out in traditional forms in the form of money changing.

Money changing began to decline with the establishment of New East Bank, an originally British owned bank in the country in 1850.

Bank Sepah was the first bank to be established with Iranian capitals in 1925 under the name of Bank Pahlavi Qoshun, in order to handle the financial affairs of the military personnel and set up their retirement fund. The primary capital of the bank was 388,395 tomans.

In the spring of 1979, all Iranian banks were nationalized and banking laws changed with the approval of the new interest free Islamic banking regulations.

Before a bank in its present form was established in Iran, banking operations had been carried out in traditional form, or in other words in the form of money changing.

Simultaneous with promotion of trade and business in the country, more people chose money changing as their occupation. Exchanges of coins and hard currencies were also common in Iran.

Before the advent of the Achaemenid dynasty, banking operations had been carried out by temples and princes and seldom had ordinary people been engaged in this occupation.

During the Achaemenid era, trade boomed and subsequently banking operation expanded to an extent that Iranians managed to learn the banking method from the people of Babylon.

Following a boost in trade and use of bank notes and coins in trade during the Parthian and Sassanian eras, exchange of coins and hard currencies began in the country.

Some people also managed to specialize in determining the purity of coins. Bank notes and gold coins were first used in the country following the conquest of Lidi by Achaemenid king Darius in 516 B.C. At that time, a gold coin called Derick was minted as the Iranian currency.

During the Parthian and Sassanian eras, both Iranian and foreign coins were used in trade in the country. However, with the advent of Islam in Iran, money changing and use of bank notes and coins in trade faced stagnation because the new religion forbade interest in dealing.

In the course of Mongol rule over Iran, a bank note which was an imitation of Chinese bank notes was put in circulation. The bank notes, called Chav bore the picture and name of Keikhatu. On one side of the bank notes there was the following sentence: "Anybody who does not accept this bank note, will be punished along with his wife and children." The face value of the bank notes ranged from half to 10 dirhams.

Besides Chav, other bank notes were used for a certain period of time in other Iranian cities and then got out of circulation. These bank notes were called `Shahr-Rava' which meant something that was in use in cities.

Before the printing of first bank notes by the Bank Shahanshahi (Imperial Bank), a kind of credit card called Bijak had been issued by money dealers. It was in fact a receipt of a sum of money taken by money dealers from the owners of Bijak. The credence of the Bijak depended on the creditability of the money dealer who had issued it.

As mentioned before, money changing got out of fashion with the advent of Islam under which usury is strictly forbidden. At that time, only a few persons with weak religious faith continued their occupation as money dealers. It was the same persons who promoted usury even during the post-Islamic era. They offered various excuses to justify their unlawful act.

With a boost in trade during the rule of Safavid dynasty, particularly during the reign of Shah Abbas the Great, money changing brisked again and wealthy money dealers started their international activities by opening accounts in foreign banks. Major centers for money changing at that time were Tabriz, Mashhad, Isfahan, Shiraz and Boushehr.

Money changing continued until the establishment of New East Bank in 1850. With the establishment of the bank, money changing actually came to a standstill.

The New East Bank was in fact the first banking institute in its present form established in Iran. It laid the foundation of banking operations in the country. It was a   British bank whose headquarters was in London. The bank was established by the British without receiving any concession from the Iranian government.

The bank opened its branches in the cities of Tabriz, Rasht, Mashhad, Isfahan, Shiraz and Boushehr. Of course, at that time, foreigners were free to engage in economic and trade activities in the country without any limitations.

For the first time, the New East Bank allowed individuals to open accounts, deposit their money with the bank and draw checks. It was at this time that people began to draw checks in their dealings.

In order to compete with money dealers, the bank paid interest on the fixed deposits and current accounts of its clients. The head office of the bank in Tehran issued five `qeran' bank notes in the form of drafts. These drafts were used by people in their everyday's dealings and could be changed into silver coins when offered at the bank.

According to a concession granted by the Iranian government to Baron Julius De Reuter in 1885, Bank Shahanshahi (Imperial Bank) was established. This bank purchased the properties and assets of the New East Bank, thus putting an end to the baking operations of the former.

The activities of Bank Shahanshahi ranged from trade transactions, printing bank notes, and serving as the treasurer of the Iranian government at home and abroad in return for piecework wage.

In return for receiving this concession, Reuter obliged to pay six percent of the annual net income of the bank, providing that the sum should not be less than 4,000 pounds, and 16 percent of incomes from other concessions to the Iranian government.

The legal center of the bank was in London and it was subject to the British laws but its activities were centered in Tehran.

In 1209 (lunar hejira), the right of printing bank notes was purchased from Bank Shahanshahi for a sum of 200,000 pounds and ceded to the Bank Melli of Iran.

Bank Shahanshahi continued its activities until 1948 when its name was changed into Bank of Britain in Iran and Middle East. The activities of the bank continued until 1952. In 1269 (l.h.), a Russian national by the name of Jacquet Polyakov, received a concession from the then government of Iran for establishment of Bank Esteqrazi for 75 year. Besides, banking and mortgage operations, the bank had an exclusive right of public auction. In 1898 the Tzarist government of Russia bought all shares of the bank for its political ends. Under a contract signed with Iran, the bank was transferred to the Iranian government in 1920. The bank continued its activities under the name of Bank Iran until 1933 when it was incorporated into the Bank Keshavarzi (Agriculture Bank).

Bank Sepah was the first bank to be established with Iranian capitals in 1925 under the name of Bank Pahlavi Qoshun, in order to handle the financial affairs of the military personnel and set up their retirement fund. The capital of the bank was 388,395 tomans (3.88 million rials).

With Bank Sepah opening its branches in major Iranian cities, the bank began carrying financial operations such as opening of current accounts and transfer of money across the country. The Iran-Russia Bank was formed by the government of the former Soviet Union in 1926 with an aim of facilitating trade exchanges between the two countries.

The headquarters of the bank was in Tehran with some branches being inaugurated in northern parts of the country. The bank dealt with financial affairs of institutes affiliated to the government of the former Soviet Union and trade exchanges between the two countries. The activities of this bank, which were subject to Iranian banking regulations, continued until 1979. In that year, this bank along with 27 other state-owned or private banks were nationalized under a decision approved by the Revolutionary Council of the Islamic Republic of Iran.

The proposal to establish a national Iranian bank was first offered by a big money dealer to Qajar king Nasereddin Shah before the Constitutional Revolution. But the Qajar king did not pay much attention to the proposal. However, with the establishment of constitutional rule in the country, the idea of setting up a national Iranian bank in order to reduce political and economic influence of foreigners gained strength and at last in December 1906 the establishment of the bank was announced and its articles of association compiled.

In April 1927, the Iranian Parliament gave final approval to the law allowing the establishment of Bank Melli of Iran. But, due to problems arising from preparing a 150 million rial capital needed by the bank, the Cabinet ministers and the parliament's financial commission approved the articles of association of the bank in the spring of 1928. The bank was established with a primary capital of 20 million rials, 40 percent of which was provided by the government. The bank was formally inaugurated in September 1928.

The Central Bank of Iran was established in 1928, tasked with trade activities and other operations (acting as the treasurer of the government, printing bank notes, enforcing monetary and financial policies and so on). The duties of the CBI included making transactions on behalf of the government, controlling trade banks, determining supply of money, foreign exchange protective measures (determining the value of hard currencies against Rial) and so on.

In June 1979, Iranian banks were nationalized and banking regulations changed with the approval of the Islamic banking law (interest free), and the role of banks in accelerating trade deals, rendering services to clients,

collecting deposits, offering credits to applicants on the basis of the CBI's policies and so on was strengthened.

3- Electronic Banking in Iran

The Shetab (Interbank Information Transfer Network) system is the only electronic banking clearance and automated payment system used in Iran. The system was introduced in 2002 with the intension of creating a uniform backbone for the Iranian banking system to handle ATM, POS and other card-based transactions.

Prior to its introduction, some Iranian bank were issuing card that only worked on the issuing banks ATMs and POS machines. Since the introduction of Shetab, all banks must adhere to its standard and be able to connect to it. Furthermore, all issued credit or debit cards must be Shetab capable.

And of the end of 2003, the Shetab system had 2926 ATMs and 16070 POS units connect to it.

In 2002, when this system was introduced there were at approximately 2.8 million domestic debit cards in circulation, of those approximately 530000 were capable of using the Shetab system. In 2005, the government obliged the Central Bank of Iran and the Iranian banks, mostly state owned, to set up all the necessary infra structure (regulatory, hardware and software) for fully launching e-money in Iran by March 2005. While this plan has not yet fully materialized local debit/ credit cards are now commonplace and have remove the main obstacle to growth of e-commerce (in the national scale) as well as the full roll out of e-government initiatives. By 2010, it is expected that 12 million cards would be issued, all of which work with the Shetab system. The Agricultural bank is the first Iranian bank connected to Shetab system.

As of 2006, Iran was still very much cash based society. It was expected that a unified clearance system, such as Shetab, will provide significantly greater efficiency, reduce crime, reduce money printing costs, and improve tax collection amongst other benefits. It is also expected to improve the quality of life of citizen whom, once the system is fully operational, would no longer be required to spend large amount of time organizing things in person and would consequently be able to conduct activities immediately over the phone or the internet. The impact of the

system is already being felt as corporations establish e-commerce, supply chains, online banking and retailing system. Iran's electronic commerce will reach 10000 billion rials by March 2009.

4- Literature review

Christensen et al. (1971, 1973) for the first time used translog cost function for investigating the effects of technical changes in payment services on economic indices.

Shaffer (1998) found that the translog form introduces a U-shaped average cost curve, when the average cost is decreasing.

Lindquist (2001) studied the effects of new technology in payment services on banks' intermediation within a multiple-output framework using Norwegian bank level panel data.

Koskenkylä (2001) said that in many OECD-countries, particularly in the Nordic area, payment services in banking have shifted gradually from paper-based giro and check payments to electronic giro and debit card payments.

Allen, Engert and Ying Liu (2006) compared the efficiency of Canada's largest banks with U.S. commercial banks over the past 20 years.

Humphrey and Berger (1990) found that electronic payments cost banks much less to produce than paper-based payments.

Humphrey, Willesson and Lindblom (2005) used an "output characteristics" cost function to identify payment sources of technical change in European banking and estimate associated benefits.

Humphrey, Vale (2003) demonstrated the importance of using a flexible cost function specification when analyzing economies of scale and estimating the cost effect of banking mergers.

Böhle (2002) focused integration of payment systems into B2C Internet commerce.

Hamidi zade, Gharechi and Abdolbaghi (2008) focused on study of factors, challenges and obstacles of electronic banking in Iran.

Goudarzi and Zobeydi (2009) studied the effect of electronic banking development on the Iranian commercial banks.

5- Data and Modeling

All of the data for studying the effects of electronic equipment arrival on banking in Iran were collected from the library of Central Bank of Iran in Tehran (Mirdamad branch). For studying the effects of technical change in payment services on the economic indices, we can use translog cost function as a quadratic approach of a continuous function which satisfied linear homogeneity in price. For the first time, this model was introduced by Christensen, Jorgensen and Lau at 1971 and 1973 and then was followed by the others such as Timme and Yang (1990), Shaffer (1998) and etc. We can make the model more flexible by assumption of heterogeneity in coefficients approach. We have considered coefficient randomly. It means that we have assumed all banks have same weight and there isn't any classification between banks with different sizes. By virtue of this, we have repaired incompletion of translog form.

Our model as a tarnslog cost function with 4 inputs and 2 outputs is given by equation (1). Labour, physical capital, materials and funds are considered as inputs and deposits and loan as outputs.

$$\ln C_f = \alpha_{0f} + \sum_i \alpha_{if} \ln P_{if} + 1/2 \sum_i \sum_j \beta_{ij} \ln P_{if} \ln P_{jf} + \sum_m \gamma_m \ln X_{mf} \qquad (1)$$

$$+ 1/2 \sum_m \sum_n \gamma_{mn} \ln X_{mf} \ln X_{nf} + \sum_i \sum_m \gamma_m \ln P_{if} \ln X_{mf} + \gamma_E \ln EP$$

$$1/2 \gamma_{EE} (\ln EP)^2 + \sum_i \gamma_{iE} \ln P_{if} \ln EP + \sum_m \gamma_{mEF} \ln X_{mf} \ln EP + \gamma_\tau \ln \tau + u_{Cf}$$

$$i, j = W, K, M, F; m, n = D, L$$

$$C_f = \sum_i P_{if} V_{if} \qquad i = W, K, M, F$$

$i =$ Inputs
$W =$ Labour
$K =$ Physical capital
$M =$ Materials
$F =$ Funds
$C_f =$ Total operating costs plus interest expenses of bank f
$P_{if} =$ The bank specific price of inputs
$X_{Df} =$ Volume of deposits in bank f
$X_{Lf} =$ Volume of loans in bank f

EP = Share of electronic payments in total non-cash payments

τ = Deterministic trend variable to illustrate the part of changes isn't related to technical change from paper-based to electronic payments.

u_{Cf} = Disturbance component

V_{if} = Quantity of input i used by bank f

6- Empirical results

In this part, we have represented the empirical results of estimating translog cost function in equation (1). For estimating this equation, we have used bank-level panel data from Iran. These data included 829 annual observations from 2000-2007.

The panel is unbalanced. For doing this estimation, we have applied unbalanced panel data method by STATA software.

We have been a problem for estimating the translog cost function. The wages of labour between various banks are different, and these affected the education and years of work. Hence, we have assumed that the prices of labour are exogenous. The other inputs prices of banks are also exogenous.

We have estimated the translog cost function and the results of this have represented in table 1.

It is necessary to mention that some of bank data don't exist in Iranian banking industry so complete implementation of estimation would be possible. Therefore, some of coefficients haven't represented in table 1 due to data shortage.

Finally, in order to choose the convenient method through fixed effects and random effects, we have used Hausman test and F-test. According to results of them, we have decided to apply fixed effect method.

Table1: The result of estimation of translog cost function.

Coefficient	Estimate	t*	Coefficient	Estimate	t*
α_0	8.451	10.488	γ_{FD}	0.003	1.411
α_W	0.851	1.85	γ_{FL}	0.038	1.701
α_K	0.302	2.125	γ_{EE}	-0.115	-1.745
α_M	-0.112	-2.001	γ_{WE}	0.121	2.002
α_F	-0.045	-1.98	γ_{KE}	-0.0021	-0.0890
γ_D	0.702	3.45	γ_{FE}	-0.002	-1.800
γ_L	-0.422	-2.25	γ_{LE}	-0.980	-1.450
γ_E	-1.02	1.998	γ_{τ}	-0.121	-1.991
γ_{DD}	0.098	1.840	β_{WM}	0.101	2.002
γ_{LL}	0.112	2.020	β_{WK}	-0.001	-1.584
γ_{WD}	0.001	1.65	β_{WF}	-0.128	-2.011
γ_{WL}	-0.101	-1.821	β_{KK}	0.004	1.808
γ_{KD}	-0.028	-1.384	β_{FF}	0.012	2.01
γ_{KL}	-0.011	-1.724	γ_{DE}	-1.001	-1.61
Hausman-test		32.571(0)**	F-test		21.904(0)**
$\overline{R}^2 = 0.97$					

Source: search results.

* The calculated values of t-test are reported in these columns and show the significance at 5 percent confidence level.

** Shows the probability of the null-hypothesis acceptance.

It is necessary to recall some of coefficients haven't reported in table1, because the bank data don't exist in Iran briefly.

Nearly all of the coefficients are according to theorem basis except γ_{WD} and one of calculated values of t-test aren't valid at 5 percent confidence level.

According to the results of table (1), the coefficients α_i are as expected. α_W, α_K are positive which imply that the bank operating costs increase when the price of labour and physical capital increase and α_M, α_F are negative which imply by increasing the material and fund, the bank operating cost decrease. The coefficients γ_D, γ_L are as expected. γ_D is

positive. It means that the bank operating costs increase as the volume of deposits increase, but γ_L is negative and the interpretation of it is vice versa.

The other coefficient is γ_E. It is negative that shows by increasing in the ratio of electronic payments to total non-cash payments, the bank costs decrease.

The coefficients γ_{mn} m,n=D,L are positive which indicate increasing in volume of deposits and loans means to increase in bank costs.

The coefficients γ_{mE}, m=D, L, are both negative, which shows that the economies of scale in the production of both deposits and loans increases when the share of electronic payments increases. The effect on the production of deposits is larger than on the production of loans, since payment services are more closely connected to deposits than to loans.

7- Conclusion

In this paper, we have investigated the effect of new technology on the banking economic indices. For this, we have estimated the translog cost function with 4 inputs and 2 outputs for Iranian annual bank level panel data over the period 2000-2007. The inputs are labour, physical capital, material and funds and the outputs are deposit and loan. For making the model more flexible, we have used random coefficient approach which considered same weights for all banks with different size.

The results show that Mechanism change toward electronic payment in banking industry leads to decrease average costs, increase the economic of scale in the attraction deposits more than in the giving loans and finally to affect input demand asymmetric. By using new technology, the ratio between labour and both materials and physical capital have decreased.

Then we have applied Hausman test and F-test for choosing the convenient procedure between fixed effects and random effects. The results imply the fixed effects method is more suitable than random effects method.

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