The impact of the determinants of the supply and demand sides on the financial depth of a sample of Arab countries (2014-2021)

أثر محددات جانبي العرض والطلب على العمق المالي لعينة من الدول العربية (2014-2021)

Ilifi Mohamed [1]

University Of Djilali Bounaama, Khemis Milian- Algeria

m.ilifi@univ-dbkm.dz

Belghalem Hamza

University Of Djilali Bounaama, Khemis Milian- Algeria

h.belghalem@univ-dbkm.dz

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Abstract:

In this study, we aim to try to answer the research problem of showing the effect of the variables of supply and demand on the financial depth of a sample of Arab countries for the period 2014-2021, within two main axes, The first deals with the concept of financial depth, while the second seeks to build a standard model using plate models, Based on this, we Based on that, we concluded that openness in its financial and commercial form, the development of financial intermediation activity, and the existence of appropriate economic policies with the availability of regulatory and legislative frameworks (institutional development) positively affect the financial depth.

Key words: Financial depth, financial intermediation, economic policies, financial and commercial openness, administrative corruption.

الملخص:

نهدف في هذه الدراسة إلى محاولة الإجابة على الإشكالية الباحثة في بيان تأثير متغيرات جانبي العرض والطلب على العمق المالي لعينة من الدول العربية للفترة 2014-2021، ضمن محورين أساسيين، يتناول الأول ماهية العمق المالي أما الثاني فنسعى فيه إلى بناء نموذج قياسي باستخدام نماذج بانل، وبناءا على ذلك توصلنا إلى الانفتاح بصوره المالي والتجاري وتطور نشاط الوساطة المالية،ووجود سياسات اقتصادية ملائمة مع توفر الأطر التنظيمية والتشريعية (تطور المؤسساتي) تؤثران بصورة إيجابيا على العمق المالي.

الكلمات المفتاحية: العمق المالي، الوساطة المالية، السياسات الاقتصادية، الانفتاح المالي والتجاري الفساد الإداري.

[1]- *Corresponding author: Ilifi Mohamed, m.ilifi@univ-dbkm.dz.*

1. INTRODUCTION

The Arab countries, as a developing countries, aspire to improve the welfare of their societies and achieve sustainable growth rates, By deepening its financial and banking sectors to be able to mobilize and allocate financial resources efficiently while ensuring that its services and products reach the largest possible segment of customers, relying on reforms that reflect market forces and an appropriate economic and legal structure, It contributes in its entirety to increasing competition and encouraging innovation in the field of financial intermediation, and this is confirmed by the Keynesian theory, which showed that financial depth occurs as a result of sound intervention by the state through expansionary financial policies, McKinnon and Shaw also emphasized that liberalizing the banking and financial sector directly enhances levels of financial depth, in addition to activating the role of financial and banking intermediation and strengthening legislative and regulatory frameworks, also to the existence of economic policies capable of achieving acceptable growth rates and reducing unemployment levels, all of these factors can support decision-makers in the Arab countries to achieve the goal of financial depth, Based on taking into account the factors identified by the supporters of the supply and demand sides that affect the financial depth, we can ask the following main question: What are the determinants of financial depth in the Arab countries within the supply and demand sides for the period (2014-2021)?.

Sub-questions: Based on the main question posed, we can present the following sub-questions:

-What is meant by financial depth, and what are its indicators?;

-Do indicators of the real sector and the external sector in the Arab countries contribute to achieving the objectives of financial depth?;

-How do the economic policies used to address economic phenomena in Arab countries affect the levels of financial depth?;

-What is the trend of financial depth in the Arab countries in light of the development of the activities of their financial institutions?;

-Does institutional development in Arab countries allow the possibility of generalizing financial depth in these countries?;

Hypotheses: To answer the content of the main question, the following hypotheses should be formulated:

-The structure of the real sector, expressed in the per capita GDP indicator, contributes to improving the financial depth in the Arab countries;

-The openness of the external sector in the form of financial and commercial openness contributes positively to enhancing the financial depth in the Arab countries;

-Effective economic policy indicators are positively reflected on the levels of financial depth in the Arab countries;

-The development of financial intermediation activity improves the degree of financial depth in the Arab countries;

-The lack of institutional development that limits the ability of financial institutions to strengthen the financial depth in the Arab countries.

Research importance: The topic of the research is important because the governments of Arab countries, like the rest of the world, seek to build and develop effective strategies that enhance the levels of financial depth. To achieve this, it is necessary, in part, to identify and understand the determinants of financial depth, as this allows us to know the factors that affect the ability of financial institutions to expand the base of providing their financial services (financial depth) .

The aim of the research: Through this research, we aspire to achieve a set of goals, summed up in knowing the theoretical framework of financial depth, and its determinants in the Arab countries, in order to develop effective strategies to enhance financial depth, based on standard models.

The limits of the research: Based on the question posed and the hypotheses formulated in its framework and in view of the importance of this research and in order to achieve the desired goal, the time and spatial framework is determined as follows:

-Spatial framework: pertains to a some of Arab countries: Algeria. Jordan, United Arab Emirates, Sudan, Iraq, Oman, Qatar, Kuwait, Lebanon, Libya, Egypt, Morocco, Mauritania.

- Time frame: The study period extended from 2014 - 2021;

The scientific method: The nature of the research subject requires us to rely on the inductive approach by using statistical and econometric tools to estimate To measure the impact of financial depth determinants in Arab countries.

2. Financial depth between concept and embodiment

Financial depth is a key factor for policy makers, governments and international institutions in achieving the most important sustainable development goals, especially in light of the development in financial technology and what it has brought about due to financial innovations in contributing to the provision and provision of financial services to the community, In light of the above, and to understand the content and determinants of financial depth, we will address the following elements.

2.1 The concept of financial depth

Defining the financial depth is not easy because it reflects the extent of the financial development of the economy, which varies from one country to another (djouadi & dif, 2021, p. 527) , However, it can be defined according to many researchers as follows:

-Financial depth is defined as the increased provision of financial services with a broader range of services directed at all levels of society (Hanna Alrabad & Kharabsheh, 2016, p. 158) ;

-It is the provision of financial services and making them available for use and dealing by sectors of society and enabling them to benefit from financial services, thus contributing to achieving economic and social development (torchi & bouflih, 2016, p. 42), It is also defined as an increase in the ratio of a country's financial assets to its GDP (Moore, 1986, p. 125) ;

-The ability of the individual - the institutions - to access financial services easily through advanced and efficient financial institutions (financial intermediaries) and able to provide financial services at low cost and sustainable returns (Abdel Aal, 2021, p. 1115);

-As the World Bank emphasized in 1932 that financial depth includes increasing the stock of financial assets, from this perspective, financial depth means the ability of financial institutions in general to mobilize financial resources effectively, in order to achieve development (Nzotta & Okereke, 2009, p. 57);

Through the previous definitions, the financial depth can be defined in the extent to which financial institutions are able to mobilize financial resources and invest them in a wide range that meets the different segments of society.

2.2 Financial Depth Objectives

Financial depth can achieve the following goals (torchi, tergou, & bouflih, 2018, p. 114)

-The increasing number of institutions operating in the financial sector;

-Diversity of financial services available and the amount of funds brokered in all outlets of the financial sector;

- good hedging of risks by creating a wide variety of assets;

- making rational decisions with regard to saving and investment;

-Increased capital imposed by private financial institutions to the private sector instead of direct government lending;

-Improving the financial sector in terms of supervision, regulation and stability, as well as in terms of efficiency and competitiveness;

-Increase the number of clients with access to credit and financial services.

2.3 Theories explaining financial depth

The economic and financial literature has presented theories that explain the financial depth. These theories are:

-Keynesian theory: Keynesian theory asserts that financial depth occurs through the state's adoption of an expansionary fiscal policy, By expanding government spending in order to achieve full employment, Which results in an increase in the effective aggregate demand, As well as increasing income, Which results in an increase in the demand for financial services, and thus increases the degree of financial depth (Gyimah Sackey & Nkrumah, 2012, p. 124);

-Financial Liberation Theory of McKinnon and Shaw: Liberalizing the financial sector contributes to increasing the degree of financial depth and economic growth, because reducing restrictions on the activity of financial institutions and financial markets in the performance of their tasks increases the expansion of their activities, That is, providing financial services more broadly, in addition to increasing domestic savings and attracting foreign capital (i.e. (accumulation of financial assets,

accumulation of physical capital), This theory is also based on the premise that the higher the real interest rate, the greater the degree of financial depth, and the greater the financial savings;

-Financial intermediation theory: Proponents of this theory believe that the higher the level of financial intermediation in the financial sector, the higher the level of savings and investments, which in turn will lead to an increase in economic growth, and an increase in the latter, leads to an increase in demand for financial products and thus Enhance financial depth, Accordingly, according to this theory, financial institutions represent an opportunity to enhance the financial capacity in the economy, by transferring financial resources from savers to borrowers, and thus affecting investment, economic growth, and the degree of financial depth.

2.4 Financial depth indicators

It is not easy to measure the level of financial depth of a particular country, due to the different and multiplicity of indicators used in this, in addition to the stage that these countries have reached in terms of their financial market development, In general, these indicators can be divided into traditional quantitative indicators, structural indicators, in addition to some other qualitative indicators (djouadi & dif, 2021, p. 529):

2.4.1 Quantitative indicators

depend on monetary and credit aggregates, and measure the strength of savings and credit intermediation in an economy. These indicators include the following (djouadi & dif, 2021, pp. 229-231) (Hassoun Al Saadi, 2011, pp. 222-224):

- Domestic Liquidity Ratio (M_2⁄pib): represents the sum of money mass (time deposits, current deposits and liquid money) in proportion to the gross domestic product (Ben Yahia & Talhaoui, 2020, p. 239), Since this indicator reflects the ability of the banking system's activity to mobilize financial resources from the economy, an increase in this indicator leads to an increase in financial depth.

- Ratio of loans granted to the private sector to GDP: This indicator measures the extent to which banking institutions contribute to granting loans and facilities to the private sector (Ben Yahia & Talhaoui, 2020, p. 239), An increase in this indicator indicates the ability of the banking system to provide banking services in the economy. (Satyanarayana, Suresh Kumar, & Mahendra, 2017, p. 144).

- Ratio of total deposits to GDP: This indicator expresses the ability of financial institutions to attract financial resources.

2.4.2 Structural indicators

These indicators depend on the structure of the financial system and determine the importance of its various elements, and include the following:

-The ratio of broad money to narrow money: expresses the ability of the financial system to mobilize financial savings, as a decrease in this ratio means an increase in the ability of financial institutions to expand the provision of banking services (Azzam, 2017, p. 37).

- The ratio of instruments in the stock market to broad money: The more securities are traded in the financial market, the greater the financial depth.

3. Literature Review

Most of the empirical studies that identified the variables affecting the levels of financial depth indicated that they are classified into two groups (Sameer & Bashar A, 2019):

-Demand-side Factors: These variables affect individuals and their demand for financial products. They are summarized in income, education and financial education, age, gender, urbanization, employment, the impact of family decisions on individuals' decisions;

-Supply side Factors: includes all the variables that affect the ability of the financial institution to provide financial services, they are limited to the distance between financial institutions and individuals, regulations and laws, the absence of appropriate products, risks, the provision of electronic and digital services, the size of the bank, interest rates, cost and characteristics Economic, financial and legal state.

The economic environmental factors and the financial, monetary and legal policies of the state also affect the levels of financial depth, according to the results of some empirical studies in this regard, as highlighted in the table below:

real sector :The real sector includes many indicators that affect the degree of financial depth, the most prominent of which is economic growth. According to the theory of demand, economic growth is one of the determinants of financial depth, Where indicated that the development of financial institutions is related to the demand for and supply of financial services, and he explained in the aspect of demand - that the development of financial institutions is linked to the development of investors' demand for the services they provide, that is, the higher the real growth of the domestic product, the higher the demand for projects for Larger amount of funding (alnaqiba, 2021, p. 1118), (maryam haj, Al-Qarso, & zirar, 2020, p. 23) That is, economic growth creates demand for different types of financial services, and the financial system automatically responds to these demands (alqursu, 2018-2018, p. 82), same direction as the study (Stemmer, 2016).

external sector: The growth of the external sector and its indicators contribute to determining the financial depth, whether in developed or developing countries, and among these indicators (trade openness, financial openness):

-Trade openness is one of the determinants of the financial depth of financial institutions (Thi Thuy & Trong, 2021), Because removing restrictions on foreign trade and finding foreign markets for small and medium-sized companies to sell their products leads to an increase in demand for financial services, as seen (Rajan & Zingales, 2003), Simultaneous commercial and financial openness is necessary for financial development, that is, financial depth. Stimulating foreign capital flows and trade openness at the same time leads to an improvement in the development of financial and banking institutions, provided that an appropriate institutional structure is available, gives (Aluko, Fapetu, & Ibitoye, 2021, pp. 279-289) greater importance to commercial openness, and according to them, the increase in financial openness without commercial leads to the existence of a less deep banking sector.

economic policies: The degree of financial depth in any country is affected by the economic policies adopted in managing economic problems, including:

-Inflation: The study (Khan, Senhadji, & Smith, 2001), (Moore, 1986) (nashoor, 2021, p. 17) confirmed that high inflation rates impede the development of financial institutions (financial depth), because high inflation rates are accompanied by imposing a contractionary monetary policy, and thus a decrease in the volume of credit granted The economy, which leads to a decline in the activity of financial institutions from performing their tasks in the economy.

Unemployment: The decline in economic activity in any country leads to high unemployment rates, and this is a result of low consumption and thus low production (malki, 2021, p. 790), Accordingly, the inflation phenomenon results in a decrease in economic growth rates, i.e. a decrease in the per capita GDP, and thus a decrease in the demand for financial services, Accordingly, the adoption of appropriate economic policies to reduce the severity of both inflation and unemployment, leads to the consolidation of financial depth.

-Tax revenues: the state's adoption of a fair and transparent tax policy that contributes to reducing the tax burden on the incomes of individuals and institutions, which means an increase in the volume of savings on their part and an enhancement in the levels of financial depth.

financial intermediation: Financial depth is closely related to the development of financial intermediation activity, as:

-The increase in the balances of non-performing loans with financial institutions affects the volume of their activity, because such loans lead to the freezing of an important part of their assets, as a result of the inability of non-performing clients to pay their dues on the one hand, and on the other hand, the increase in non-performing loans is accompanied by a deflationary credit policy that leads to a decrease in the volume of activity of financial institutions and, accordingly, a decrease in the degree of financial depth;

-The volume of revenues obtained by financial institutions is related to the volume of investment in loans granted by them to various economic institutions, leads to an expansion in the activities of financial institutions, which is positively reflected in an increase in financial depth;

institutional development**:** Depth is affected by institutional development, according to a study (Beji, 2015), (Venegas & Francisco, 2018), (Sanga & Meshach, 2022, pp. 150-164)It concluded that the absence of the legal framework and the low level of institutional development is one of the main reasons that led to the decline in the activity of financial institutions, and vice versa in the case of an appropriate financial infrastructure and institutions and good governance of the government (government effectiveness, rule of law and justice, control of corruption) contribute to Improving and increasing the attractiveness of the investment environment for small and medium enterprises, which leads to an increase in the demand for financial services.

4. Methodology research

The content of this part revolves around searching for the determinants of financial depth based on most of the experimental studies that dealt with the content of financial depth on the one

hand and the most important factors affecting the expansion of the activity of banking institutions in providing financial services on the other hand. Therefore, we will try to build a standard model through which we test the validity of the hypotheses proposed and formulated in this paper.

4.1 The method and tools used

In order to accurately test the hypotheses formulated in the content of this research, it is necessary to identify the sample studied, in addition to determining the method and tools used in the analysis, and clarifying the relationship between the variables of the study, according to the following:

4.1.1 Sample and study period

The study population consists of a total of 22 Arab countries, and we have tried to collect the largest possible number of Arab countries that provide us with statistics on Indicators of financial depth and its determinants, The method of data inventory and sample selection is to use the non-random sampling method by selecting certain countries to be included in the sample on the grounds that they represent the well-studied community, and the judgmental or intentional sample was extracted due to the availability of data for some Arab countries. This sample is represented by: Jordan, United Arab Emirates, Algeria, Sudan, Iraq, Oman, Qatar, Kuwait, Lebanon, Libya, Egypt, Morocco, Mauritania, for the period from 2014 to 2021.

4.1.2 Determining the study variables

study variables are determined based on the multiple regression method as a model for economic measurement on the one hand, and on what was stated in the empirical studies on the other hand within the following table:

Table 1. Standard study variables.

symbol	index	variables
	dependent variable	
y	Amount of domestic credit /GDP	financial depth
	independent variables	
$\mathbf{x_1}$	Economic growth	real sector
$\mathbf{x_2}$	trade openness	external sector
$\mathbf{x_3}$	Financial openness	
$\mathbf{x_4}$	inflation	economic policies
$\mathbf{x_5}$	unemployment	
$\mathbf{x_6}$	tax revenue	
$\mathbf{x_7}$	The amount of credit granted to the economy	financial mediation
$\mathbf{x_8}$	non-performing loans	
$\mathbf{x_9}$	using the Internet	
$\mathbf{x_{10}}$	rule of law	
$\mathbf{x_{11}}$	Administrative corruption	institutional development

Source: *Prepared by researchers*

4.1.3 Statistical analysis of the study variables

Before starting to estimate and analyze the model, it is necessary to describe the data of the study variables and clarify its main features using descriptive analysis, such as calculating the mean, standard deviation, coefficient of variation, highest value, lowest value, Depending on the descriptive statistical values of the study variables shown in Appendix No. (1) and using graphic figures for the average values of the variables, we summarize the following:

-Y: It expresses financial depth expressed with an index Amount of domestic credit /GDP, where Domestic private sector credit refers to financial resources provided by financial institutions to the domestic sector and companies in the form of loans, Where we notice that the average values of Y were confined between the lowest average estimated at 8.47 for the State of Sudan and the highest average estimated at 104.12 for the State of Lebanon, with a general average estimated at 54.26, while the coefficient of variation was estimated at 0.63.

-X1 :It falls within the category of real sector variables and is expressed in economic growth, as the latter refers to the increase in gross domestic product that occurs during a certain period of time (belhouchet & gaboussa, 2020, p. 341) , Where we notice that the average values of X1 were confined between the lowest average estimated at 1.63 for the State of Sudan and the highest average estimated at 41.97 for the State of Emirates, with a general average estimated at 13.96, while the coefficient of variation was estimated at 1.09.

- X2: It falls under the category of the external world sector and is expressed as the degree of commercial openness, Where trade openness expresses the complete removal of restrictions imposed on foreign trade and exchange rates, according to a number of procedures and measures established by the World Trade Organization (Mellal, 2017, p. 164), Where we notice that the average values of -X2 were confined between the lowest average estimated at 19.70 for the State of Sudan and the highest average estimated at 168.07 for the State of Emirates, with a general average estimated at 81.66, while the coefficient of variation was estimated at 0.44, This shows that there is little fluctuation in the average X2 values for these countries;

-X3 It falls under the category of the external world sector and is expressed as the degree of financial openness, whereby an economy is considered financially open if it enjoys complete freedom in the movement of capital across international borders, i.e. if the local population can freely exchange their financial assets with the external population (taiba, Tahrat, & belgacem, 2019, p. 468), Where we notice that the average values of X3 were confined between the lowest average estimated at -2.94 for the State of Iraq and the highest average estimated at 5.70 for the State of Lebanon, with a general average estimated at 1.96, while the coefficient of variation was estimated at 1.19, which explains the strong fluctuation of the average values of X3 for these countries;

-X4 It falls within the category of economic policies and is expressed in inflation rates, as the latter is known for the rise in prices during a certain period of time (Oner, 2010) ,Where we notice that the average values of X4 were confined between the lowest average estimated at -0.04 for the State of Qatar and the highest average estimated at 50.31 for the State of Sudan, with a general average estimated at 7.24, while the coefficient of variation was estimated at 1.82.

-X5 It falls within the category of economic policies and is expressed as unemployment rates, The International Labor Organization defines the unemployed as persons of working age who are capable of it, and who accept it at the prevailing wage, but do not find it (rahimi, qarqadi, & aleayibi, 2014, p. 144), Where we notice that the average values of X5 were confined between the lowest average estimated at 2.06 for the State of Qatar and the highest average estimated at 17.63 for the State of Libya, with a general average estimated at 9.10, while the coefficient of variation was estimated at 0.59.

-X6 It falls under the category of economic policies and is expressed in tax revenue, and it expresses the amounts collected by governments through taxes, Where we notice that the average values of X6 were confined between the lowest average estimated at 2.83 for the State of Kuwait and the highest average estimated at 71.14 for the State of Sudan, with a general average estimated at 33.41, while the coefficient of variation was estimated at 0.75, which explains the strong fluctuation of the average values of X6 for these countries;

-X7:It falls under the category of banking mediation and is expressed in the volume of loans directed to the economy, and the latter is defined by the trust that the bank generates in a person, whether this person is natural or legal, as it puts at his disposal an amount of money, for a specific period agreed upon by the two parties, at the end of which the borrower pays commitments (rays, 2009, p. 67), Where we notice that the average values of X7 were confined between the lowest average estimated at 1.45 for the State of Mauritania and the highest average estimated at 305.69 for the State of Emirates,

-X8: It falls under the category of banking mediation and is expressed in the size of non-performing loans, which are defined as those loans that no longer generate interest income for the bank or loans that the bank finds itself forced to schedule in accordance with the current conditions of the bank (butawrat, 2015, p. 111) ,Where we notice that the average values of X8 were confined between the lowest average estimated at 1.70 for the State of Qatar and the highest average estimated at 23.36 for the State of Mauritania, with a general average estimated at 8.46, while the coefficient of variation was estimated at 0.77, which explains the strong fluctuation of the average values of X8 for these countries;

-X9 :It falls under the category of banking intermediation and is expressed in the digital infrastructure in banks, Where we notice that the average values of X9 were confined between the lowest average estimated at 18.19 for the State of Mauritania and the highest average estimated at 96.40 for the State of Qatar, with a general average estimated at 56.40, while the coefficient of variation was estimated at 0.48.

-X10: It falls under the category of institutional development and is expressed by the rule of law indicator which means It is the subjection of everyone, individuals, institutions and authorities, to the rule of law, Where we notice that the average values of X10 were confined between the lowest average estimated at -1.76 for the Libya and the highest average estimated at 0.83 for the State of Qatar, with a general average estimated at -0.45, while the coefficient of variation was estimated at -1.76, which explains the strong fluctuation of the average values of X10 for these countries;

-X11: It falls under the category of institutional development and is also expressed in administrative corruption, Administrative corruption means that administrators use the functional authority associated with filling their roles in achieving certain personal gains (hafnawi, 2019, p. 110), Where we note that the average x11 values were confined between the lowest average estimated at -1.60 for to the state of Libya and the highest average estimated at 1.14. for a state United Arab Emirates, And on average It is estimated at -0.48, while the coefficient of variation is estimated at -1.66.

4.1.4 Correlation analysis between the dependent variable and the independent variables

Through the results of Appendix No(2). we find that there is a positive relationship between each of the financial depth index and the independent variables (Economic growth, unemployment, tax revenue, The amount of credit granted to the economy, non-performing loans, using the Internet, rule of law, Administrative corruption), and there is an inverse relationship between the financial depth index and the other independent variables (trade openness , Financial openness, inflation).

As a result of the existence of the correlation between the variables, we will perform the variance inflation coefficient test to detect the existence of the problem of multicollinearity or not, Where the problem of multicollinearity appears when there is a linear relationship between the variables of the study, If its value is Vif > 10, then this indicates that there is a problem of multicollinearity (cherougui & toumi, 2019, p. 347) (Shadi, Bouguerra, & mansouri, 2022, p. 217) , Through the results of the variance inflation coefficient (Vif) test found in Appendix No (3)., whose results indicate that the value of the variance inflation coefficient for the independent variables does not exceed the value 10, and this confirms that these variables are not linked to each other by a linear relationship.

4.1.3 Data and tools of the study

The data for the study variables were collected from the Arab economies competitiveness report issued by the Arab Monetary Fund, as well as the adoption of World Bank data and their unloading within the program (stata.15), in order to build a standard model that shows the nature of the relationship between the variables of the multiple regression model for a sample of During the specified time period from 2014-2021, we resorted to using panel models.

4.2 Presentation and analysis of results

In this regard, based on the method and tools used in the empirical study, we seek to extract and analyze the results of the optimal panel model as shown below:

4.2.1 differences between the panel models

there are three models well used which are the aggregative model, the fixed model and the random model, so it is necessary to start building the panel model for each of the three types using the program (stata.15) as shown in the table 2.

Table 2. Estimation results of the panel model.

explanatory variables	Pooled Regression Model (PME)	Fixed Effects Model (PEM)	Random Effects Model (REM)
x_1	-0.1973538 (0.404)	-0. 2003635 (0.280)	-0. 0508117 (0.791)
x_2	0. 3286105 (0.000)	-0. 1594206 (0.071)	-0. 0729559 (0.370)
x_3	0. 9441973 (0.149)	-0. 1200988 (0.719)	-0. 0579245 (0.879)
x_4	-0.2243347 (0.072)	0.0121857 (0.839)	-0. 0034527 (0.960)
x_5	0. 505198 (0.299)	-0. 1228922 (0.751)	-0. 1173768 (0.777)
x_6	-0.0878369 (0.403)	0.0304498 (0.664)	-0.0442943 (0. 545)
x_7	0.0118218 (0.802)	0.3767367 (0.000)	0.2830149 (0.000)
x_8	-0.549348 (0.157)	0.1492425 (0.671)	-0.0747627 (0.837)
x_9	1.029774 (0.000)	0.0733627 (0.559)	0.260237 (0.040)
x_{10}	23.38154 (0.027)	-0.7877602 (0.921)	0.5773918 (0.942)
x_{11}	-33.94948 (0.001)	-1.474033 (0.866)	-5.246023 (0.527)
Constant (c)	-32.06068 (0.036)	37.33209 (0.004)	27.43211 (0.042)
Number of obsevation	104	104	104
R-squared	0.7906	0.9687	-
Adjusted R-squared	0.7655	0.9597	-
Prob (F-Stat)	0.0000	0.0000	0.0000

Source: *Prepared by researchers based on the results of the program (stata.15), Appendix 4*

In order to choose the appropriate panel model for our study (the differentiation between the three models), we conduct a set of the following necessary binary tests:

- Breusch and Pagan test: we use it to compare between the Pooled Regression Model and therandom effects model. The hypothesis of this test is formulated as follows:

$$\begin{cases} H_0: \text{no randam effect (Pooled Regression Model)} \\ H_1: \text{There is a random effects model (REM)} \end{cases}$$

This test within the program (stata.15) leads to the calculation of both chibar2 (01) and Prob>chibar2, the results of which are summarized in the following table:

Table 3. Breusch and Pagan test results

chibar2(01)	31.03
Prob > chibar2	0.0000

Source: *Prepared by researchers based on the results of the program (stata.15), see Appendix No5.*

We note from the table that the value of Prob> chibar2 is statistically significant, i.e. less than 5%, so we accept the alternative hypothesis (H1) which indicates the presence of random effects, meaning that we choose the a random effects model (Badr chahda, 2020, p. 23).

- Hausman test: It is used to compare between the fixed effects model and the random effects model, within two hypotheses:

$$\begin{cases} H_0 : \text{Random Effects Model (REM)} \\ H_1 : \text{Fixed Effects Model (PEM)} \end{cases}$$

This test is based on a differentiation tool by calculating chi2(10) and Prob>chi2, which were results using the program (stata.15) in the table below:

Table 4. Hausman test results

chi2(11)	31.65
Prob>chi2	0.0009

Source: *Prepared by researchers based on the results of the program (stata.15), Appendix No6.*

It is evident from the value of Prob>chi2 in the above table that the probability value of the test is statistically significant at 5%, which leads us to accept the alternative hypothesis (H_1) and consider the fixed-effects model to be preferable compared to the random-effects model.

-Constrained Fisher test: It represents a test to compare between the pooled regression model and the fixed effects model, by verifying the presence of individual effects within the following:

$$\begin{cases} H_0 : \text{No Fixed Effects Mode (Pooled Regression Model)} \\ H_1 : \text{There is a fixed effects model} \end{cases}$$

Table 5. Results of the restricted Fisher test.

F(12, 80)	37.91
Prob> F	0.0000

Source: *Prepared by researchers based on the results of the program (stata.15).*

It is clear from the results of this test that the value of F(12, 80) which is equal to 37.91 is significant at the level of significance 5% (because: Prob> F = 0.0000 < 0.05), So the constant fixed effects model is the best model compared to the Pooled Regression Model.

4.2.2 Examine the validity of the optimal model

Through the results of previous tests, the optimal model reflecting the relationship between the study variables is the fixed effects model, but before adopting its results, it should be ensured that it is free of standard problems, both of the problems of self-association of errors and of the problem of heteroskedasticity:

- **Wooldridge test**: The autocorrelation of errors measures the degree of correlation between values for the same variable during a specified period of time where the results of this test were as follows:

```
xtserial y x1 x2 x3 x4 x5 x6 x7 x8 x9 x10 x11
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      12) =     48.468
    Prob > F =      0.0000
```

Source: *Prepared by researchers based on the results of the program (stata.15)*

The results of the test to detect the autocorrelation problem within the Wooldridge test showed that the probability value is less than 0.05, so we can reject the null hypothesis and accept the alternative hypothesis (the presence of an auto-correlation problem).

-**Modified Wald test**: It aims to find out the heterogeneity of the variance, by the command (xttest3) in the program (stata.15), as indicated the command results below:

```
xttest3
Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model
H0: sigma(i)^2 = sigma^2 for all i
chi2 (13)  =    6082.70
Prob>chi2 =      0.0000
```

Source*: Prepared by researchers based on the results of the program (stata.15)*

We conclude from the results of the Modified Wald test that the random effect model has the problem of heterogeneity of variance, given that the statistical significance Prob> F is less than 5% (rejecting the null hypothesis and accepting the alternative hypothesis).

4.3 The estimated model and analysis of the results

Through the results of tests, we find that the fixed effects model suffers from standard problems (the problem of autocorrelation of errors and the problem of homogeneity), and to address these problems in the optimal model, we use the error correction method, or what is known as the method of correcting errors. (xtpcse) (Danie, 2007, p. 285), If the cross-sectional data chain is greater than the number of time periods, we turn to it:

```
xtpcse y x1 x2 x3 x4 x5 x6 x7 x8 x9 x10 x11
Linear regression, correlated panels corrected standard errors (PCSEs)
Group variable:   ind                         Number of obs     =       104
Time variable:    YEAR                        Number of groups  =        13
Panels:           correlated (balanced)       Obs per group:
Autocorrelation:  no autocorrelation                        min =         8
                                                            avg =         8
                                                            max =         8
```

```
Estimated covariances      =        91          R-squared         =     0.7906
Estimated autocorrelations =         0          Wald chi2(11)     =    3223.75
Estimated coefficients     =        12          Prob > chi2       =     0.0000
------------------------------------------------------------------------------
             |           Panel-corrected
           y |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          x1 |  -.1973538   .3334149    -0.59   0.554    -.8508351    .4561275
          x2 |   .3286105   .0628383     5.23   0.000     .2054497    .4517714
          x3 |   .9441973   .4212578     2.24   0.025     .1185472    1.769847
          x4 |  -.2243347   .1027075    -2.18   0.029    -.4256377   -.0230318
          x5 |    .505198   .4087199     1.24   0.216    -.2958783    1.306274
          x6 |  -.0878369   .1136886    -0.77   0.440    -.3106624    .1349886
          x7 |   .0118218   .0558648     0.21   0.832    -.0976712    .1213147
          x8 |   -.549348   .2440234    -2.25   0.024    -1.027625   -.0710709
          x9 |   1.029774   .1649514     6.24   0.000     .7064754    1.353073
         x10 |   23.38154   7.064852     3.31   0.001     9.534687     37.2284
         x11 |  -33.94948   7.565094    -4.49   0.000    -48.77679   -19.12217
       _cons |  -32.06068   13.72083    -2.34   0.019    -58.95301   -5.168348
------------------------------------------------------------------------------
```

Source: *Prepared by researchers based on the results of the program (stata.15)*

5. RESULTS AND DISCUSSION

On the basis of most of the previous statistical tests and after addressing the problems of errors autocorrelation and heterogeneity of variance the optimal model can be formulated as follows:

$$y = 32.06 - 0.197x_1 + 0.328x_2 + 0.944x_3 - 0.224x_4 + 0.505x_5 - 0.087x_6 + 0.011x_7 - 0.549x_8 + 1.029x_9 + 23.381x_{10} - 33.949x_{11}$$

We find that the financial depth, which is measured by the volume of domestic credit granted / GDP, is affected by indicators of economic policies (financial and monetary) and legal and institutional development with a coefficient of determination of 0.7906, where:

-The results of the regression equation showed that the first hypothesis is incorrect, because the economic structure in the Arab countries depends on a specific economic sector to achieve wealth (the petroleum and tourism sector), which makes the real sector not affect the degree of financial depth from a statistical point of view, This contradicts the hypothesis of demand theory confirmed by the study of both (alqursu, 2018-2018), (Stemmer, 2016), The reason for this is due to the degree of development of the real sector in the developed countries than in the Arab countries;

- The results of the regression equation allowed us to support the second hypothesis, i.e. the commercial and financial openness of the outside contributes to enhancing the financial depth in the Arab countries, as the increase in trade openness by one unit leads to an increase in the financial depth by 0.328 units, which is what was found by both the study (Touny, 2014, pp. 152-153), (Kim, Lin, & Suen, 2010), (Huang & Temple, 2015),And the rise in financial openness by one unit to the rise in financial depth by 0.944 units, which is what one study found (Asongu, 2012), Accordingly, we find that simultaneous commercial and financial openness is necessary for financial development, that is, financial depth. Stimulating foreign capital flows and trade openness at the same time leads to an improvement in the development of financial and banking institutions, in terms of providing financial services with the condition that an appropriate institutional structure is available (Aluko, Fapetu, & Ibitoye, 2021, pp. 279-289)

The results of the studied model also confirmed the acceptance of the third hypothesis, as the existence of effective economic policies (financial and monetary) in the Arab countries contributes to achieving an appropriate level of prices, which is positively reflected on the degree of financial depth, Whereas, the decrease in inflation by one unit leads to a rise in the degree of financial depth by 0.224 units, which is in agreement with both the study (Khan, SenhadjiI, & Smitih S, 2001), (Moore, 1986)**.**

- It is clear from the results of the regression equation that the fourth hypothesis is correct, as the more reasons that impede the activity of financial institutions (reducing non-performing loans) are avoided, the more the activity of the latter expands to provide more financial services, This ultimately leads to an increase in the degree of financial depth by 0.549, Moreover, the financial institutions' endeavor to use information and communication technology in providing financial services enhances their profitability due to the reduction of operational costs, and facilitates access to financial services at the lowest cost, which leads to an increase in the demand for financial services and thus increases the degree of financial depth of financial institutions.

-As for the fifth hypothesis, it is correct: because an increase in the rule of law by one unit leads to an increase in the degree of financial depth by 23.38 units, and a decrease in the administrative corruption index by one unit leads to an increase in the degree of financial depth by 33.94 units, and accordingly we find that the institutional development through the presence of An effective legal system and good governance ultimately lead to reducing the phenomena of bribery, fraud, embezzlement, mediation, nepotism and administrative laxity in the economic sectors, especially financial and banking, and this ultimately enhances confidence in financial and banking institutions and expands the volume of individuals and institutions' interaction with their services and products, which is what A study found (Téllez-León, 2019), And vice versa, in the absence of an effective legal system and the absence of good governance in financial institutions, fraud, embezzlement, mediation, and nepotism prevail, which leads to the formation of a negative image in dealing with these institutions, Thus, the degree of financial depth decreases.

6. CONCLUSION

The majority of financial institutions in the Arab countries face several challenges that affect the expansion and growth of their services Achieving the requirements of their societies, especially the poor ones, of reducing unemployment and poverty levels, raising the standard of living of individuals and improving income distribution, which can be summed up in a basic objective of the current Arab economic policies, This will not be achieved according to many bodies, international organizations and various empirical studies except by achieving financial depth within a set of factors that have been studied in a sample of Arab countries, The results of the regression equation between it and the financial depth led to:

-The economic structure in the Arab countries does not help in enhancing the degree of financial depth, due to the weak economic diversification that characterizes the Arab countries;

- The foreign trade policy and financial openness help to enhance the financial depth in the Arab countries;

-The economic policies in the Arab countries are characterized by effectiveness on the side of aggregate demand, that is, controlling the general level of prices within the target limits, which is the goal that serves the financial depth in the Arab countries;

- As a result of the limited activity of financial intermediation in the Arab countries focused on granting loans, The development of financial depth becomes dependent on the soundness of credit for Arab banks, the study sample, Which results in the expansion of loans and a decrease in the volume of non-performing loans;

- The Arab Spring revolutions were positively reflected in creating an environment to combat administrative corruption and impart the rule of law, especially in financial institutions, which positively affected the expansion of financial services, and this is what led to the consolidation of financial depth in the Arab.

- The level of efficiency of the regulatory and judicial bodies (institutional development) in the Arab countries contributes to the development of plans and strategies that include standards of transparency and accountability.

Looking at the previous results, we offer the following set of recommendations aimed at upgrading the determinants affecting the financial depth in the Arab countries as follows:

-Liberalizing private investment in sectors generating economic growth, especially in renewable energies and the agricultural sector, With the promotion of the creation of start-up enterprises;

-Strengthening higher education and supporting research and development in sectors with high growth, in order to activate the contribution of human potential to economic diversification;

-Achieving regional integration between Arab and African countries to facilitate trade exchange, including coordination of various technological standards and systems (reform of the customs and border control system), in order to enhance the business climate;

- Establishing a judicial body specialized in the banking field that works to enhance the role of banks in reaching a point of safety that would make them able to expand credit directed to the private sector with a low degree of risk;

- Encouraging the establishment of start-ups in the field of financial and banking technology that provide smart services and work on improving mechanisms for attracting customers, faster processing of transactions and reducing costs;

- Concluding agreements between startups specialized in the field of financial technology and Arab banks to provide innovative banking products to a larger segment of customers;

-Providing tax incentives to encourage long-term investments and savings from small investors to bring additional funds into the financial markets;

-Work to raise the level of efficiency of the regulatory and judicial bodies in the Arab countries, and grant them sufficient powers to enable them to develop strategic plans that include standards of transparency and accountability.

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8. Appendices

Appendix 1: Descriptive statistics of the study variables

Country	y	x1	x2	x3	x4	x5	x6	x7	x8	x9	x10	x11
Jordan	73.66	3.85	90.33	3.48	0.44	16.40	61.15	29.65	5.09	61.99	0.31	0.16
United Arab Emirates	84.59	41.97	168.07	3.26	0.87	2.50	49.19	305.69	5.96	94.84	0.79	1.14
Algeria	23.96	4.28	55.44	0.65	4.76	9.74	41.34	39.70	12.36	46.01	-0.83	-0.64

Sudan	8.47	1.63	19.70	2.03	50.31	16.90	71.14	5.21	4.87	26.30	-1.17	-1.48
Iraq	8.86	5.34	41.60	-2.94	0.97	10.93	4.63	17.64	9.56	28.13	-1.59	-1.36
Oman	60.59	16.44	96.99	2.94	0.59	3.13	9.26	50.08	2.43	61.10	-0.35	-0.43
Qatar	85.24	41.38	92.29	-0.31	-0.04	2.06	20.60	101.27	1.70	96.40	0.83	0.83
Kuwait	91.97	32.17	93.43	0.11	2.89	2.53	2.83	118.67	2.07	90.04	0.10	-0.24
Lebanon	104.12	7.60	75.06	5.70	2.53	6.24	7.35	51.34	8.66	76.57	-0.82	-1.02
Libya	26.87	6.23	105.34	0.12	12.23	17.63	3.89	9.39	21.00	20.59	-1.76	-1.60
Egypt	27.32	2.79	42.79	2.43	14.80	11.54	60.34	85.25	5.47	47.71	-0.51	-0.64
Morocco	88.33	3.15	82.37	2.37	1.19	9.70	59.98	95.10	7.53	65.33	-0.12	-0.21
Mauritania	21.41	5.53	98.20	5.67	2.54	9.06	42.68	1.45	23.36	18.19	-0.72	-0.81
mean	54.26	13.26	81.66	1.96	7.24	9.10	33.41	70.03	8.46	56.40	-0.45	-0.48
standard deviation	33.96	14.42	35.68	2.33	13.20	5.39	24.94	77.64	6.56	26.86	0.79	0.80
coefficient of difference	0.63	1.09	0.44	1.19	1.82	0.59	0.75	1.11	0.77	0.48	-1.76	-1.66
Minimum	8.47	1.63	19.70	-2.94	-0.04	2.06	2.83	1.45	1.70	18.19	-1.76	-1.60
Maximum	104.12	41.97	168.07	5.70	50.31	17.63	71.14	305.69	23.36	96.40	0.83	1.14

Appendix 2: correlation matrix

Correlations

		y	x1	x2	x3	x4	x5	x6	x7	x8	x9	x10	x11
y	Pearson Correlation	1	,537**	,501**	,202*	-,369**	-,546**	-0.157	,550**	-,440**	,828**	,669**	,614**
	Sig. (2-tailed)		0.000	0.000	0.040	0.000	0.000	0.113	0.000	0.000	0.000	0.000	0.000
x1	Pearson Correlation	,537**	1	,587**	-0.119	-,240*	-,697**	-,285**	,738**	-,379**	,677**	,629**	,670**
	Sig. (2-tailed)	0.000		0.000	0.227	0.014	0.000	0.003	0.000	0.000	0.000	0.000	0.000
x2	Pearson Correlation	,501**	,587**	1	0.188	-,414**	-,443**	-0.169	,640**	0.074	,426**	,503**	,596**
	Sig. (2-tailed)	0.000	0.000		0.056	0.000	0.000	0.086	0.000	0.453	0.000	0.000	0.000
x3	Pearson Correlation	,202*	-0.119	0.188	1	0.029	-0.045	,231*	0.039	0.156	0.087	,195*	0.129
	Sig. (2-tailed)	0.040	0.227	0.056		0.768	0.649	0.018	0.693	0.113	0.382	0.047	0.193
x4	Pearson Correlation	-,369**	-,240*	-,414**	0.029	1	,410**	,295**	-,214*	-0.026	-,318**	-,275**	-,342**
	Sig. (2-tailed)	0.000	0.014	0.000	0.768		0.000	0.002	0.030	0.797	0.001	0.005	0.000
x5	Pearson Correlation	-,546**	-,697**	-,443**	-0.045	,410**	1	,332**	-,555**	,407**	-,648**	-,553**	-,559**
	Sig. (2-tailed)	0.000	0.000	0.000	0.649	0.000		0.001	0.000	0.000	0.000	0.000	0.000
x6	Pearson Correlation	-0.157	-,285**	-0.169	,231*	,295**	,332**	1	0.083	-0.075	-0.058	,221*	0.189
	Sig. (2-tailed)	0.113	0.003	0.086	0.018	0.002	0.001		0.400	0.448	0.560	0.024	0.055
x7	Pearson Correlation	,550**	,738**	,640**	0.039	-,214*	-,555**	0.083	1	-,367**	,684**	,657**	,734**
	Sig. (2-tailed)	0.000	0.000	0.000	0.693	0.030	0.000	0.400		0.000	0.000	0.000	0.000
x8	Pearson Correlation	-,440**	-,379**	0.074	0.156	-0.026	,407**	-0.075	-,367**	1	-,598**	-,528**	-,451**
	Sig. (2-tailed)	0.000	0.000	0.453	0.113	0.797	0.000	0.448	0.000		0.000	0.000	0.000

x9	Pearson Correlation	,828**	,677**	,426**	0.087	-,318**	-,648**	-0.058	,684**	-,598**	1	,836**	,804**
	Sig. (2-tailed)	0.000	0.000	0.000	0.382	0.001	0.000	0.560	0.000	0.000		0.000	0.000
x10	Pearson Correlation	,669**	,629**	,503**	,195*	-,275**	-,553**	,221*	,657**	-,528**	,836**	1	,841**
	Sig. (2-tailed)	0.000	0.000	0.000	0.047	0.005	0.000	0.024	0.000	0.000	0.000		0.000
x11	Pearson Correlation	,614**	,670**	,596**	0.129	-,342**	-,559**	0.189	,734**	-,451**	,804**	,841**	1
	Sig. (2-tailed)	0.000	0.000	0.000	0.193	0.000	0.000	0.055	0.000	0.000	0.000	0.000	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix 3: results of the variance inflation coefficient (vif) test.

```
 .vif
    Variable |       VIF       1/VIF
-------------+----------------------
         x10 |      9.22    0.108460
         x11 |      9.03    0.110745
          x9 |      5.97    0.167612
          x7 |      5.00    0.200199
          x1 |      4.81    0.207704
          x2 |      3.45    0.289487
          x6 |      2.95    0.339372
          x5 |      2.79    0.357978
          x8 |      2.55    0.392897
          x4 |      1.73    0.578891
          x3 |      1.56    0.639644
-------------+----------------------
    Mean VIF |      4.46
```

Appendix 4: Estimate of the three panel models

Pooled Regression Model

```
egen ind =group( pay )
reg y x1 x2 x3 x4 x5 x6 x7 x8 x9 x10 x11
      Source |       SS           df       MS      Number of obs   =       104
-------------+----------------------------------   F(11, 92)       =     31.57
       Model |  100757.585        11   9159.7805   Prob > F        =    0.0000
    Residual |  26690.1572        92  290.110404   R-squared       =    0.7906
-------------+----------------------------------   Adj R-squared   =    0.7655
       Total |  127447.743       103  1237.35673   Root MSE        =    17.033
------------------------------------------------------------------------------
           y |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          x1 |  -.1973538   .2355264    -0.84   0.404    -.6651296    .2704219
          x2 |   .3286105   .0844105     3.89   0.000      .160964    .4962571
          x3 |   .9441973   .6482873     1.46   0.149    -.3433573    2.231752
          x4 |  -.2243347    .123193    -1.82   0.072    -.4690066    .0203371
          x5 |    .505198   .4834874     1.04   0.299    -.4550498    1.465446
          x6 |  -.0878369    .104463    -0.84   0.403    -.2953095    .1196357
          x7 |   .0118218   .0471041     0.25   0.802     -.081731    .1053745
          x8 |   -.549348   .3848582    -1.43   0.157     -1.31371    .2150135
          x9 |   1.029774   .1417809     7.26   0.000     .7481849    1.311363
         x10 |   23.38154   10.37801     2.25   0.027     2.769916    43.99317
         x11 |  -33.94948     9.7784    -3.47   0.001    -53.37023   -14.52873
       _cons |  -32.06068   15.09811    -2.12   0.036    -62.04683   -2.074522
------------------------------------------------------------------------------
```

Fixed Effects Model

```
. xtreg y x1 x2 x3 x4 x5 x6 x7 x8 x9 x10 x11, fe
Fixed-effects (within) regression               Number of obs     =       104
Group variable: ind                             Number of groups  =        13
R-sq:                                           Obs per group:
```

```
     within  = 0.4670                                        min =         8
     between = 0.2275                                        avg =       8.0
     overall = 0.2389                                        max =         8
                                                 F(11,80)          =      6.37
corr(u_i, Xb)  = -0.2431                         Prob > F          =    0.0000
------------------------------------------------------------------------------
           y |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          x1 |  -.2003635   .1841786    -1.09   0.280    -.5668907    .1661636
          x2 |  -.1594206   .0871383    -1.83   0.071    -.3328313    .0139902
          x3 |  -.1200988   .3327653    -0.36   0.719    -.7823227    .5421252
          x4 |   .0121857   .0596851     0.20   0.839    -.1065914    .1309628
          x5 |  -.1228922   .3854691    -0.32   0.751    -.8900001    .6442158
          x6 |   .0304498   .0698114     0.44   0.664    -.1084793     .169379
          x7 |   .3767367   .0692224     5.44   0.000     .2389797    .5144936
          x8 |   .1492425   .3501167     0.43   0.671    -.5475119    .8459968
          x9 |   .0733627   .1250479     0.59   0.559    -.1754905    .3222159
         x10 |  -.7877602   7.956681    -0.10   0.921    -16.62206    15.04654
         x11 |  -1.474033   8.705857    -0.17   0.866    -18.79924    15.85117
       _cons |   37.33209   12.44741     3.00   0.004     12.56096    62.10322
-------------+----------------------------------------------------------------
     sigma_u |  32.089747
     sigma_e |  7.0636147
         rho |  .95378612   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(12, 80) = 37.91                     Prob > F = 0.0000
. areg y x1 x2 x3 x4 x5 x6 x7 x8 x9 x10 x11 , absorb ( pay )
Linear regression, absorbing indicators          Number of obs     =        104
                                                 F(  11,     80)   =       6.37
                                                 Prob > F          =     0.0000
                                                 R-squared         =     0.9687
                                                 Adj R-squared     =     0.9597
                                                 Root MSE          =     7.0636
------------------------------------------------------------------------------
           y |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          x1 |  -.2003635   .1841786    -1.09   0.280    -.5668907    .1661636
          x2 |  -.1594206   .0871383    -1.83   0.071    -.3328313    .0139902
          x3 |  -.1200988   .3327653    -0.36   0.719    -.7823227    .5421252
          x4 |   .0121857   .0596851     0.20   0.839    -.1065914    .1309628
          x5 |  -.1228922   .3854691    -0.32   0.751    -.8900001    .6442158
          x6 |   .0304498   .0698114     0.44   0.664    -.1084793     .169379
          x7 |   .3767367   .0692224     5.44   0.000     .2389797    .5144936
          x8 |   .1492425   .3501167     0.43   0.671    -.5475119    .8459968
          x9 |   .0733627   .1250479     0.59   0.559    -.1754905    .3222159
         x10 |  -.7877602   7.956681    -0.10   0.921    -16.62206    15.04654
         x11 |  -1.474033   8.705857    -0.17   0.866    -18.79924    15.85117
       _cons |   37.33209   12.44741     3.00   0.004     12.56096    62.10322
-------------+----------------------------------------------------------------

         pay |         F(12, 80) =     37.911   0.000          (13 categories)
```

Random Effects Model

```
. xtreg y x1 x2 x3 x4 x5 x6 x7 x8 x9 x10 x11, re

Random-effects GLS regression                    Number of obs     =        104
Group variable: ind                              Number of groups  =         13

R-sq:                                            Obs per group:
     within  = 0.4245                                        min =         8
     between = 0.4145                                        avg =       8.0
     overall = 0.4150                                        max =         8

                                                 Wald chi2(11)     =      66.92
corr(u_i, X)   = 0 (assumed)                     Prob > chi2       =    0.0000

------------------------------------------------------------------------------
           y |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
```

```
------------+----------------------------------------------------------------
          x1 |  -.0508117   .1919164    -0.26   0.791     -.426961    .3253376
          x2 |  -.0729559   .0814078    -0.90   0.370    -.2325123    .0866004
          x3 |  -.0579245   .3795098    -0.15   0.879    -.8017501     .685901
          x4 |  -.0034527   .0683818    -0.05   0.960    -.1374786    .1305732
          x5 |  -.1173768   .4136326    -0.28   0.777    -.9280817    .6933281
          x6 |  -.0442943    .073108    -0.61   0.545    -.1875833    .0989947
          x7 |   .2830149   .0595077     4.76   0.000      .166382    .3996477
          x8 |  -.0747627    .364498    -0.21   0.837    -.7891657    .6396404
          x9 |    .260237   .1267751     2.05   0.040     .0117625    .5087116
         x10 |   .5773918   7.913009     0.07   0.942    -14.93182    16.08661
         x11 |  -5.246023   8.302822    -0.63   0.527    -21.51925    11.02721
       _cons |   27.43211   13.46773     2.04   0.042     1.035839    53.82839
-------------+----------------------------------------------------------------
     sigma_u |  15.198263
     sigma_e |  7.0636147
         rho |  .82236427   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Appendix 5: Trade-off between a Pooled Regression Model and a Random Effects Model

```
. xttest0
Breusch and Pagan Lagrangian multiplier test for random effects
        y[ind,t] = Xb + u[ind] + e[ind,t]

        Estimated results:
                         |       Var     sd = sqrt(Var)
                 ---------+-----------------------------
                       y |   1237.357       35.17608
                       e |   49.89465       7.063615
                       u |   230.9872       15.19826

        Test:   Var(u) = 0
                                 chibar2(01) =    31.03
                               Prob > chibar2 =   0.0000
```

Appendix 6: Trade-off between a Fixed Effects Model and a Random Effects Model

```
. hausman fe re
                 ---- Coefficients ----
              |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
              |       fe           re         Difference          S.E.
------------+----------------------------------------------------------------
          x1 |   -.2003635    -.0508117       -.1495518                .
          x2 |   -.1594206    -.0729559       -.0864646        .0310782
          x3 |   -.1200988    -.0579245       -.0621742                .
          x4 |    .0121857    -.0034527        .0156383                .
          x5 |   -.1228922    -.1173768       -.0055154                .
          x6 |    .0304498    -.0442943        .0747441                .
          x7 |    .3767367     .2830149        .0937218        .0353635
          x8 |    .1492425    -.0747627        .2240051                .
          x9 |    .0733627      .260237       -.1868744                .
         x10 |   -.7877602     .5773918       -1.365152        .8325026
         x11 |   -1.474033    -5.246023        3.771989        2.618223
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg
    Test:  Ho:  difference in coefficients not systematic
                  chi2(11) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                           =        1.07
                 Prob>chi2 =      0.9999
                 (V_b-V_B is not positive definite)
```

```
. hausman fe re, sigmamore
                 ---- Coefficients ----
              |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
              |       fe           re         Difference          S.E.
--------------+----------------------------------------------------------------
           x1 |   -.2003635    -.0508117       -.1495518        .0932593
           x2 |   -.1594206    -.0729559       -.0864646        .0596999
           x3 |   -.1200988    -.0579245       -.0621742        .0677926
           x4 |    .0121857    -.0034527        .0156383        .0102566
           x5 |   -.1228922    -.1173768       -.0055154        .1683396
           x6 |    .0304498    -.0442943        .0747441        .0345909
           x7 |    .3767367     .2830149        .0937218        .0537608
           x8 |    .1492425    -.0747627        .2240051        .1779555
           x9 |    .0733627      .260237       -.1868744        .0701125
          x10 |   -.7877602     .5773918       -1.365152        4.728237
          x11 |   -1.474033    -5.246023        3.771989        5.726236
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg
    Test:  Ho:  difference in coefficients not systematic
                 chi2(11) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       31.65
               Prob>chi2 =      0.0009
```