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Sectoral Analysis of Financial Inclusion on Gross Capital Formation: The Case of Selected MENA Countries

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Most governments have firmly taken a stance of promoting financial inclusion in the progressive agenda. Access to financial services is aimed at improving allocation of re- sources across small and medium firms insofar as productivity-related effects may enhance the prospects of catching the next ladder of development. Although mostly empirical literature has quantitatively measured the effects of the financial inclusion on aggregate data such as growth or productivity, we know very little of the aforementioned effects on sectorial variates. The contribution of this paper is the estimation of the effect of financial inclusion on the gross capital formation among high- and low-tech sectors by using a panel of eight MENA countries with data for approximately 38 manufacturing industries over the period 2005 onwards; the data's source is United Nations Industrial Development Organization (UNIDO) that comprises 3-digit level sectoral statistics. We use four measures of financial inclusion: size of commercial bank branches, ATMs, borrowers and depositors. We compare the effects by using a sample of emerging markets. The results suggest that for the MENA region the financial inclusion has a negative effect on the relative volatility of gross capital formation; this suggests that financial inclusion measures are more affecting small and medium industries concentrated in the low-R&D-intensity industries. More specifically the study finds that financial inclusion has a positive statistically significant effect on the size of gross capital formation in sectors such as textiles, leather related products, wood and products of wood and furniture industries. Policy considerations can be directed towards expanding financial services to other low-tech industries including fabricated metal products and to the medium-tech division including repair and installation of machinery and equipment industries which provides higher impact on gross capital formation and thereby economic growth.

Keywords: MENA; Gross Capital Formation; Financial inclusion; R&D intensity sectors.
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1 Introduction

The World Bank (2012) defines financial inclusion as the range, quality, and availability of financial services to the underserved and financially excluded, which is a crucial factor of financial development. Ideally, financial inclusion should ensure that households, corporations, and governments have sufficient financial services to improve individual and overall welfare. Extensive literature has linked financial inclusion with economic growth (see for example, Levine (2005); Beck et al. (2007); Neaime and Gaysset (2018); Sharma (2016) through the former's impact on the creation of deposits, savings, investable funds, capital accumulation, and therefore economic growth. Broadening the availability of financial services improves the allocation of resources across small and medium firms, as productivity-related effects may enhance developing countries' prospect of ascending the ladder of development.

This study focuses on financial inclusion among number of emerging markets (EMs) in the Middle East and North Africa (MENA) region. Despite the fact that the MENA region is a major provider of the world's oil supply, it lacks financial deepening and access to finance. Due to an underdeveloped banking system, financial markets in MENA countries have limited secure transactions and minimal collateral which makes access to finance very limited. Most governments in the region have taken a firm stand in favor of financial inclusion as part of a progressive agenda, and it has been rising on policymakers' list of priorities. While most empirical research on financial inclusion tends to focus on quantifying the impact of financial inclusion on aggregate measures such as economic growth or productivity, minimal attention has been paid to the sectorial impacts of financial inclusion. In this paper we explore such sectorial effects by using a panel dataset of selected MENA countries and EMs over the period 2005-2016 to estimate the effect of financial inclusion on the relative volatility of gross capital formation among on a average of 38 manufacturing industries (per country) covering high- and low-R&D-intensity sectors.

The following research questions drive the analysis: Do different types of financial inclusion indicators affect the relative variance of the gross-capital formation among sectors? Is this effect the same across the MENA region and EMs more broadly? Do financial inclusion measures have different effects on the low versus the high R&D-intensity sectors? The remainder of the paper is divided as follows: Section (2) briefly reviews the literature; Section (3) presents a simple theoretical model; Section (4) describes the data and empirical methodology; Section (5) presents our results; and Section (6) concludes. An appendix appears at the end of the paper including tables of regression outputs.

2 Literature review

A large number of previous theoretical and empirical studies have examined the impact of financial inclusion on economic growth. The study by Levine (2005) explores the transmission channels between financial development and economic growth. The paper summarizes the following channels that promotes significant financial development and thus economic growth: allocating capital more effectively; monitoring investment more professionally; reducing adjustment costs through smoothing demand from both firms and households; providing more insurance to boost innovation; and increasing productivity gains from the financial sector therefore improve overall productivity.

Within the same lines, the study by Kodan and Chhikara (2013) focus on the reduction of income inequality as the channel through which financial inclusion affects economic growth. The study uses three measures of financial inclusion covering depth, availability, and usage of financial services. Findings show that the development of financial inclusion leads to an increase in human development index and per capita net state domestic product (NSDP) and decreasing poverty. Kodan and Chhikara (2013) also find that the depth ratio is the leading contributor among variables in the financial inclusion index. The paper concludes that in the initial stage of financial inclusion development, the income inequality increases, but in later stages, the effect diminishes.

To study the impact of the financial inclusion of enterprises, Dabla-Norris et al. (2014) developed a micro-level general equilibrium model with heterogeneous agents to analyze the economic implications of financial deepening in six developing countries including Uganda, Kenya, Mozambique, Malaysia, Philippines, and Egypt. Their model assumes that financial inclusion affects growth and inequality through three channels. Firstly, developed financial markets allocate more funds to entrepreneurs who therefore increase output. Secondly, efficient financial contracts could prevent the waste of resources from friction, leading to higher growth. Thirdly, efficient allocation of assets in the financial system could increase total factor productivity (TFP). The result shows that financial deepening has a positive impact on economic growth, however its impact on TFP and inequality varies between the six countries depending on the level of financial development and country's characteristics. For instance, the study finds that reducing financial participation cost results in a lower TFP and inequality in all the six countries but relaxing borrowing constraints can either lead to an either positive effect on income inequality (Uganda, Mozambique, and Malaysia) or a negative one.

Kodan and Chhikara (2014) applied the micro-level general equilibrium model from Dabla- Norris et al. (2014) to Colombia's economy. Financial inclusion has played a key role in Colombia's development strategy for many years. Studying the effect of that on growth and inequality could provide guidance for eliminating financial friction which include three broad areas namely participation costs (access), borrowing constraints (depth), and intermediation efficiency. The study finds that financial inclusion has different effects on economic growth and inequality depending on which area of financial inclusion is targeted. More specifically, the study finds that while improving financial depth measures has a positive impact on growth, income inequality is better tackled through improving financial access measures.

Chauvet and Jacolin (2017) examined the relationship between financial inclusion, financial depth, and firm performance in a sample of 79 developing countries and EMs. The study uses the share of firms who have access to bank overdraft facility or to any external source of financing as a measure of financial inclusion and uses bank concentration as a measure of financial depth. Using firm-level and country-level data, they found that the distribution of financial services across firms, or financial access has a positive impact on firm growth, and low bank concentration actually amplifies this effect. Financial inclusion benefits firms of all sizes in both developing and EMs. Lack of financial inclusion, along with low institutional quality, and information asymmetries has a negative impact on firms' performance and thereby detrimental growth effects.

Using system GMM dynamic panel model on yearly data for the period 1965-2016, Emara and Said (2019) use a number of measures of financial inclusion covering the households and the firms access to finance to analyze the relationship between financial inclusion, institutions, and economic growth in selected MENA countries. The study finds that financial inclusion measured by the household's financial access index has a positive and statistically significant impact on economic growth in the MENA region, but requires supervisory and regulatory regimes with backing of the rule of law, judicial independence, contract enforcement, control of corruption, and political stability. The effect firms' access to finance is only significant in the presence of strong institutions.

Neaime and Gaysset (2018) explored the impact of financial inclusion on income inequality, poverty, and financial stability in eight MENA countries over the period 2002-2015. Much like the present paper they use the generalized method of moments (GMM), and generalized least squares (GLS) models. The empirical results show that financial inclusion reduces income inequality, while population size and inflation increase it. The empirical evidence indicates that although financial liberalization and integration leads to financial instability in MENA, financial inclusion promotes financial stability. The study urges policy makers in the MENA region to monitor this trade-off between financial liberalization, integration, and stability in designing their financial development policies to avoid detrimental effects on growth.

A few research studies to date have explored the impact of financial inclusion on gross capital formation or investment. For example, using autoregressive distributed lag (ARDL) model on annual time series data for period 1981- 2015 in Nigeria, Ayoola and Omowunmi (2018) examine the relationship between financial inclusion and gross capital formation. The study uses three criteria for financial inclusion to reflect affordability, accessibility and availability measured by credit to private sector, deposits with commercial banks, and commercial banks' branches con- centration, respectively. The study finds that availability and affordability of financial services have significant positive impact on investment in Nigeria, however, the study recommends that there is a need to enhance the accessibility of these services by encouraging deposits by private individuals. The results of the paper also show that economic growth cannot be achieved with- out sustainable investment guaranteed by sustainable provision of credit to the

private sector and equitable distribution of commercial bank branches between rural and urban areas.

Cavallo et al. (2013) provide evidence of possible transmission mechanisms connecting relative price volatility with sector-level investment allocation and TFP. Using data depicting the performance of 26 manufacturing industries in 65 countries from 1985-2003, they test whether volatility affects the share of sectoral investment in total investment and relative TFPs. The main source of data is the same as our paper, the United Nations Industrial Development Organization (UNIDO). The authors find that relative price volatility has a significant impact on the sectoral allocation of investment and thereby relative TFPs. However, this effect hinges upon each country's degree of price volatility and the level of financial development. More specifically, the study finds that in financially developed advanced economies where volatility is low there is no distortion in the allocation of investment. However, in EMs where financial markets are relatively underdeveloped and volatility is relatively high, there is a positive relationship between relative price volatility and distortion. Interestingly, the study finds that for the case of other developing economies, this relationship price volatility and distortions is insignificant suggesting the presence of other sources of market distortions besides relative price volatility.

Most governments are increasingly recognizing that lack of access to finance in MENA is a severe restriction on gross capital accumulation and thereby economic growth, where improving such access is as a key requirement for job creation for the 20 million young people expected to join the labor force by 2012 (World Economic Forum (WEF) (2019)). The region lags behind EMs and other developing countries on key indicators of financial inclusions especially those related to financing Small Medium Enterprises (SME) which are known for their potential macro- financial benefits (Beck et al. (2008), Ayyagari et al. (2016), Chodorow-Reich (2014), Popov and Rocholl (2016), and Berton et al. (2018)). As per the recent IMF study, it was estimated that relaxing financial constraints to SME access to financing could yield long-term cumulative growth benefits of about five percent in selected countries of the MENA region (International Monetary Fund (2019)).

Against the above background, and despite the recognition of the importance of financial inclusion to economic growth among policy makers, it is evident that the specific mechanism of how financial inclusion affects the relative volatility of gross capital formation among high- and low- tech sectors has not been studied. Our paper seeks to build upon this evidence base. By using different measures of financial inclusion and disaggregated sectorial data, we contribute to the narrow empirical literature that investigates the mechanism through which financial inclusion affects growth. Using different fixed effects panel regression models, our analysis details the effect of financial inclusion on the relative volatility of gross capital formation among high- and low- tech sectors, with a focus on MENA countries and Emerging Markets. Furthermore, based on persistence of gross capital formation found in our regression analysis, we provide policy implications for small and medium sized industries concentrated in the low-R&D-intensity industries.

3 A simple model

In order to show the effects of the financial inclusion on investment, this section shows a simple neoclassical model that relates aforementioned variables with an important nuance of heterogeneity. The inclusion of financial markets into group of countries as MENA has remained relatively shallow; a profound depth of financial markets may be achieved by providing access to capital to financially constrained economic agents. Thus, expansion of that access may be revealed itself as an increase of bank branches or an improvement in the density of ATMs; in our empirical section we use those variables as measure of financial deepening or inclusion[3]. In the following model, by relaxing the credit constraints i.e. financial inclusion, the investment is affected on its two moments: mean and variance. The empirical section will emphasize in the size of effects by making a comparison between low and high R&D-intensity sectors.

A agent in sector j that gather capital (k) in order to produce goods has the below expression for profits,

$$\pi_t = Ak_t^{\alpha} L_t^{1-\alpha} \int_{\underline{u}}^{\bar{u}} e^u f_j(u) du - rB_{t-1} - wL \tag{1}$$

The other input is labor (L) and A is the size of productivity. Symbols r and w are the interest rate and wages respectively. The symbol B indicates the amount of external financing for each producer. All producers are identical excepting by different attitudes against bad outcomes, that is the source of heterogeneity in the model. The former explicitly can be modeled by using a probability density fj that differs among R&D sectors (different j's). We follow the approach in Gul (1991) who extended the standard neoclassical expected utility model and thus rationalized a paradoxical response to bad outcomes[4]. This proper tweak to the neoclassical model produces first-order effects of volatility (presence of new bad outcomes) or merely a response to sectoral heterogeneity. The foregoing setup produces different decisions on the size of capital since shocks (u) are not observable before production. In that sense, it must be noticed that the size of capital is correlated with the R&D intensity; small amount of capital is a characteristic of low R&D-intensity sectors. Informally, those sectors by definition do not fully control the complexities of their markets and are prone to outweigh (and reconsider) bad outcomes in their decisions. Formally, the draws of u for high R&D-intensity sector exhibits (first-order) stochastic dominance over the ones for low R&D-

[3] See Dabla-Norris et al. (2014) for structural parameters that denotes the deep of financial inclusion.

[4] Gul (1991) calls this aversion to disappointment.

intensity sector. A good explanation of this setup can be found in Aizenman and Marion (1999).

Additionally, the below expressions of law of accumulation of capital and the balance-sheet accounting are the constraints;

$$k_t = B_{t-1} + \nu\pi_{t-1} \quad (2)$$

$$k_t = (1-\delta)k_{t-1} + I_{t-1} \quad (3)$$

$$\underline{A} = g\left(\left(\int_j kdk\right)^{\eta_j}\right) \quad (4)$$

The symbol $\nu\Pi$ stands for the amount of retained earnings for each period, δ is the rate of depreciation and ηj is the elasticity of productivity to the whole amount of capital in the sector *j*. The producer chooses *k* each period for production; thus, gross capital formation (*I*) is pre-determined. The credit constraint is as follows.

$$B_{t-1} \leq M_j$$

The first order condition is[5];

$$k_t = \left[\frac{L^{1-\alpha}\alpha\bar{A}\int e^u f_j(u)du}{r+\lambda}\right]^{\frac{1}{1-\alpha}}$$

λ is the Lagrange multiplier for the financial constraint showed above. From above expression if the constraint binds, the size of *k* falls. Also, it must notice that accumulation of capital has an effect of spillover (see expression (4)), i.e. aggregate productivity depends upon the aggregate capital stock, see Aghion and Howitt (2009, Section 2) for details. Also, the producer in the sector *j* chooses a lower *k* since $\exp\int u f j(u)du \leq \exp\int u f j(u)du$ being *j* a high R&D-intensity sector.

The figure (1) depicts the effect of loosen up the financial restrictions. Sectors *j* and *j* are harshly financially restricted and they are characterized by a small choice of investments *kc* and *kc* respectively. Those choices are influenced by the overall financial conditions and also because of the attitude against bad outcomes which is idiosyncratic for low R&D-intensity sectors. Once the financial conditions are relaxed, the aforementioned sectors increase their amounts of capital for production to *k* and *k* . Further effects may be included in the analysis though; for instance, the adverse attitude to bad outcomes can be petered out after financial inclusion and thus a significant and additional boost of the demand for capital can be expected in the economy (the demand curve for capital shifts outward).

[5] ν was fixed to zero; no retained earnings

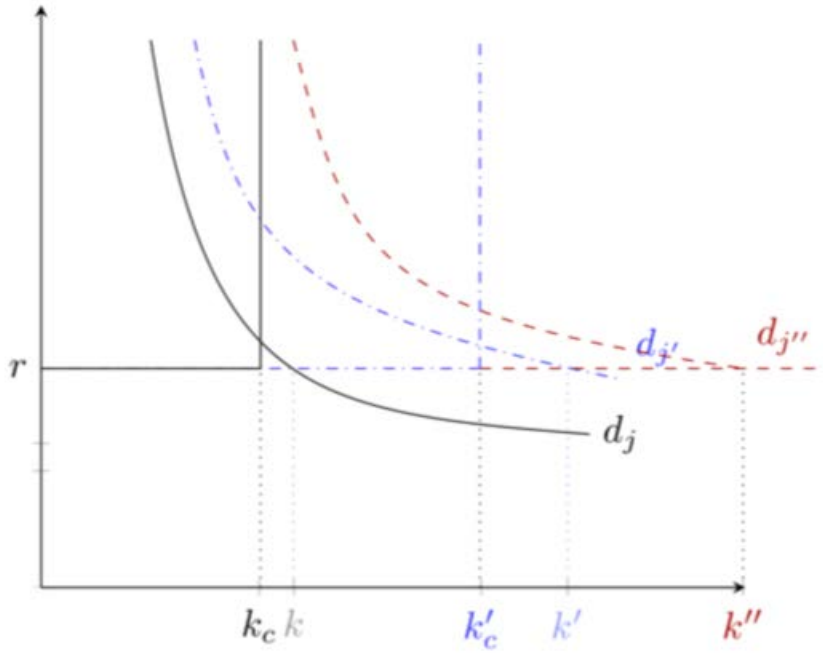

Figure 1: Effect of financial inclusion on the formation of capital (k)

4 Data and empirical methodology

The sample consists of eight MENA countries with data for 180 manufacturing industries over the period 2005 onwards (see table A). The countries are: Algeria, Egypt, Israel, Jordan, Malta, Oman, Saudi Arabia, and Tunisia. The data's source is United Nations Industrial Development Organization (UNIDO) revision 4.0; the information is retrieved considering a three-digit sectorial level. The foregoing sectors are clustered into four groups according to the level of Re- search and Development (R&D) intensity. The foregoing classification calculated for the OECD countries serves as the criterion for ranking and classifying economic activities for the MENA region. The four groups classification and respective breakdown by sub-sectors are taken from Galindo-Rueda and Verger (2016).

The new proposal classification according to Galindo-Rueda and Verger (2016) acknowledge that it is an indicative but insufficient measure of technology. The aforementioned authors argue that ladders of technology can be ordered hierarchically by using not only the plain measure of R&D in the production process but also the indirect and embedded R&D found in the purchases of intermediate inputs. Galindo-Rueda and Verger (2016) assert previous updates were based solely on the direct measure of R&D intensity; it seems that complexity of the method for tailoring a broader definition, lack of harmonization among countries and availability of data of inputs such

as patents, skilled relative level of labor force are the factors behind the focus on a direct measure of R&D reported by the firms. Henceforth, the variable that is used for the sectorial classification is the R&D intensity that is defined as the R&D expenditure to gross value added or gross product (OECD (2015b), OECD (2015a)).

In order to test the hypothesis that financial inclusion is more likely to reduce volatility of the gross capital formation in low R&D intensity sectors, this paper estimates an empirical model that uses information of gross capital formation by country, sector and year. In the process of preparation of data there were some challenges to address: i) aggregation requires to have same sectors for a specific range of years; thus, in order to maximize the number of observations the retrieve of information considered the usual trade-of of number of sectors versus years; ii) in order to maximize the number of observations, the original R&D classification was aggregated to keep only two intensity sectors: high and low, and iii) some sectors in particular countries were not considered because of data holes (see sections A and B for details). The variable of interest in our research is the measure of financial inclusion available by country and year, the source is the World Bank. In this paper four measures are proposed as independent variables in our estimations: i) Commercial bank branches (per 100,000 adults), ii) Automated teller machines (ATMs) (per 100,000 adults), iii) Borrowers from commercial banks (per 1,000 adults) and iv) Depositors with commercial banks (per 1,000 adults).

Regarding the structure of the data. The panel has four dimension i, j, c, t as follows: 3-digits or individual sector (i); R&D intensity classification (j), country level (c) and year (t). The dimension i, j may be considered as one dimension; however, for sake of exposition we keep aforementioned individual distinction or component for the panel structure.

Regarding estimations. We estimate two empirical models with different dependent variables. The first model's dependent variable is the ratio of variances among sectors. The expression $s\{GKF_{i,L}\}_{c,t}$ denotes the standard deviation of the GKF reckoned over sectors indexed by $i = 1, ...I^L$ that are part of the low R&D classification a.k.a. $j = L$. Likewise, the expression $s\{GKF_{i,H}\}_{ct}$ denotes the standard deviation of the GFK reckoned over sectors $i = 1, ...I^H$ that are part of the high R&D classification a.k.a. $j = H$. The index c denotes country and t identifies the year. The empirical model has the following linear form,

$$\frac{s\{GKF_{i,L}\}_{c,t}}{s\{GKF_{i,H}\}_{c,t}} = \beta x_{i,j,c,t} + \gamma F_{c,t-1} + \eta(region \times F_{c,t-1}) + \epsilon_{c,t}$$

$$\epsilon_{c,t} = \epsilon_c + \lambda_t + \nu_{c,t}$$

F denotes the financial inclusion variable and x gathers controls such as productivity for each intensity classification, GDP level and GDP growth. The parameter η measures the

contribution of the covariate *F* for MENA countries (*region* = 1). The error term has a fixed component for country and year. Also other interactive or non-linear effects are added (see regressions in the appendix). Thus, assuming that *x*'s and F variables correlate with the fixed effects, then the above model can be estimated using a standard panel data approach.

The second model is a panel for the GKF level.

$$\frac{GKF_{i,j,c,t}}{\overline{GKF_{c,t}}} = \rho \frac{GKF_{i,j,c,t-1}}{\overline{GKF_{c,t}}} + \beta x_{i,j,c,t} + \gamma F_{c,t-1} + \eta\left(region \times F_{c,t-1}\right) + \epsilon_{c,t}$$

$$\epsilon_{i,j,c,t} = \phi_{i,j} + \rho_i + \varphi_j + \epsilon_c + \lambda_t + \psi_{i,j,c,t}$$

In the following lines we describe the control variables in the vector x. An important determinant of the gross investment is the size of the productivity; thus, for each R&D intensity sector, we calculate the size of labor productivity by taking the total added-value amount and dividing it by the total number of employees. Therefore, the size of labor productivity represents a fixed effect under the dimension□□j, t□ in the panel. The aforementioned size is highly endogenous since gross investment and capital are connected by the rule of capital accumulation. Addition- ally, in the strict sense, individual-sectoral technology (A, see appendix) is influenced by the total size of capital recorded through all individuals in a particular sector. The former setup follows the theoretical lines argued in Aghion and Howitt (2009, Section 2) for instance. We also consider in our regressions the real GDP and growth in our regressions as proxies of welfare and economic boost at time t; those variables separately represent a fixed effect by gathering the country and year dimension (□c, t□ in the panel).

5 Results

The regression outputs are showed in the appendix. The (econometric) panel specifications for the relative gross-capital formation volatility between low and high R&D-intensity sectors are showed on tables 3-6. All specifications include year effects. As showed in table 3, there is statistical evidence that the number of commercial bank branches affects the aforementioned relative volatility. The labor productivity has an important impact through specifications. Specifically, the labor productivity measure in the high-intensity sector for some specifications also is significant; it increases the relative volatility against the low intensity sector. The interaction between the low-intensity productivity and commercial banks (non-linear specification) has the same detrimental effects on the volatility in low-intensity sectors (see specifications 6 and 7); however, the size of the effect is lesser. An important effect is the one indicated by the interaction between the regional dummy (MENA=1, Emerging=0) and the number of commercial bank branches. Regarding the former, last specifications in table show that

in comparison to emerging markets, the MENA region has a higher relative variance of gross-capital formation for the low R&D-intensity sector. The former is not surprising given the different stage of development in comparison to emerging economies. As showed in table 4, there is statistical evidence that the number of ATMs affects the relative
volatility amid R&D-intensity sectors. There are important effects of labor productivity as in the case for commercial bank branches. For this set of regressions, in particular, the interaction between the regional dummy and ATMs does significantly increase the relative volatility through all specifications. In the case of the number of depositors with commercial banks (table 5), the results show that there is a reduction in the relative volatility due to financial inclusion; however, the statistical significance seems to hinge on the inclusion of labor productivity in the high-intensity sector. If the (regression) specification considers the aforementioned productivity variable, there is no contribution to the relative variance when the country or sector belongs to the MENA region. In the case of the number of borrowers from commercial banks (table 6), the regression outputs show no statistical effect of that variable on the relative variance; a result that may be influenced by the limited sample and the former also can be factor driving the results showed in table (5).

The (econometric) dynamic panel specifications for the relative size of gross-capital formation for low R&D-intensity sectors are showed on tables 7-10. All specifications include year effects. The dependent variable's denominator is the total gross-capital formation in the country. As showed in table 7, there no is statistical evidence that the number of commercial bank branches affects the relative size of gross capital formation, this is an indicator that the measure of financial inclusion equally affects to all R&D intensity sectors; however, the significant effect found for the interaction between the regional dummy and the size of financial inclusion indicates that effects are asymmetrical in the spectrum of sectoral investment for MENA region. Also, it must be noticeable that the relative size of gross capital formation has a moderate persistence given by the parameter related to the lag of the dependent variable which is around 0.60 even for all results showed in the remaining tables. The former indicates that there is some room for influencing the dynamic of gross capital formation and it is certainly to be rendered to policy.

In table 8, the estimation indicates that there is a negative effect stemming from financial inclusion measured by the number of ATMs per 100K adults. The former indicates that large effects on investment are reported in the high R&D-intensity sectors. However, there is a small statistical effect that arises stemming from the interaction between the regional dummy and the number of ATMs. Taking into account the former non-linear effect, the statistical effect is still statistically negative on the relative investment when number of ATMs is used as financial inclusion variable. Also, sectoral labor-productivity effects are found for all specifications. As in the case for number of ATMs, dynamic-regression output shows an overall statistically negative effect of the number of depositors with commercial banks per 1000 adults on the relative size of investment (see table 9). The interaction between region and that financial inclusion variable is

reported to be significant but small. In table 10, the size of the effect that stems from the number of borrowers from commercial banks for MENA region is practically null since the linear effect counterbalances the effect stemming from the non-linear effect. In the last two cases (see table 9 and 10) the labor productivity in low R&D-intensity sectors has a negative effect in the relative size of investment.

6 Conclusions

The panel data regressions with different fixed effects show that there is a strong statistical evidence that the number of commercial bank branches, ATMs and depositors in financial institutions have a statistically significant effect on the relative variance of the gross-capital formation among sectors. Also, regressions show that in comparison to emerging markets, the MENA region has a high (sectoral) volatility of gross-capital formation.

The dynamic panel data specifications -that have the relative size of sectoral investment as dependent variable- indicate that low R&D-intensity sectors in MENA countries have (on average) higher effects on investment in relation to the high R&D-intensity sectors. If we include emerging markets the overall effects seems to be negative for number of ATMs, borrowers and depositors; the foregoing indicates the measure of financial inclusion affects more importantly to high R&D intensity sectors.

Also, it must be noticeable that our regressions show that the relative size of gross capital formation has a moderate persistence; the former indicates that there is still room for influencing the dynamic of gross capital formation and it is certainly to be rendered to policymakers. In terms of policy financial inclusion becomes an important variable in the determination of investment and its relative volatility, the pace and implementation of the process of financial inclusion for other less developing countries is a task that must not be belated to the light of our present work.

Finally, the quantification of the effect of financial inclusion on disaggregated data presented in this paper contributes to a better understanding of the (long) mechanism transmission that explains the sources of the economic growth.

B Sample of sectors by country

Country	Raw number of sectors	Excl. sectors with only 1 obs.	Final data
Algeria	11	11	11
Brazil	65	65	65
Bulgaria	22	22	22
Chile	46	42	42
China	66	66	66
Egypt	42	22	22
Hungary	40	40	40
India	71	71	71
Indonesia	65	65	65
Israel	39	39	39
Jordan	31	31	31
Malta	21	18	16
Mexico	51	51	51
Oman	21	21	15
Poland	52	52	39
Romania	15	8	8
Saudi Arabia	46	46	46
Tunisia	8	8	8
Turkey	51	51	51
Ukraine	66	66	66

Table 1: Sample of countries

Above the number of sectors for each country in the sample. Since information about gross capital formation (GKF) is missing through some sectors and years, it is necessary to maximize the number of observations by getting most of coverage either in years or sectors. Sectors with information for only one year were removed from data. In the final sample, each country has the same range of years of data in order to get the respective value of GKF by adding up sectorial information.

In the raw dataset for MENA countries, 23 sectors were pinpointed with one observation in a time-series range and removed accordingly. Also, 8 sectors were removed since those sectors have less time-series observations in comparison to sectors that display range of years that appears more often -the mode-. Sectors with more observations than the mode are adjusted to match aforementioned particular range of years. Thus, above

table (1) shows the number of observations by sector and R&D intensity classification in raw and final conditions after the foregoing data procedure. As table (1) shows, the final number of sectors for MENA countries is reduced to 188 (23 sectors per country on average). The total number of observations is 5043 for MENA and EM countries.

Sector	ISIC
Professional, scientific and technical activities	69-75X
Textiles	13
Leather and related products	15
Paper products	17
Telecommunications	61
Food products, beverages and tobacco	10T-12
Wearing apparel	14
Fabricated metal products	25 excluding 252
Coke and refined petroleum products	19
Furniture	31
Mining and quarrying	05-09
Wood and products of wood and cork	16
Printing and reproduction of recorded media	18
Publishing of books and periodicals	581

Table 2: Low R&D-intensity sectors, source: UNIDO Rev4.

C Estimation of Labor Productivity

A cobb-Douglas production function showing constant returns to scale is considered for showing the effect of both size of productivity and capital per capita in the formation of gross capital. As it is shows below, the productivity gathers effects of above measures.

$$Y = AK^{\alpha}L^{1-\alpha}$$

$$\frac{Y}{L} = A\left(\frac{K}{L}\right)^{\alpha}$$

where Y , A, K and L are: real value added, total factor productivity, real capital stock and labor respectively.

D Regressions

Table 3: Panel data estimation

VARIABLES	(1) Ratio of Var.	(2) Ratio of Var.	(3) Ratio of Var.	(4) Ratio of Var.	(5) Ratio of Var.	(6) Ratio of Var.	(7) Ratio of Var.
Commercial bank branches per 100K adults (commer) = L,	-0.0779	-0.9259*	-0.9693	-1.3955	-1.4969**	-2.7988***	-4.0759***
	(0.611)	(0.059)	(0.250)	(0.192)	(0.029)	(0.004)	(0.001)
Interaction between labor productivity and commer = L,		0.0532*	0.0556	0.1069	0.0446	0.1727*	0.2516**
		(0.097)	(0.257)	(0.154)	(0.489)	(0.061)	(0.017)
Labor productivity in the high-intensity sector (hlp) = L,		4.7748***	4.7498***	4.6749***			
		(0.000)	(0.000)	(0.000)			
Interaction between MENA region and commer = L,			0.0395	-0.0247		1.4848*	1.3532*
			(0.949)	(0.971)		(0.054)	(0.098)
Growth = L,				-13.8486			-6.3022
				(0.109)			(0.550)
Interaction between hlp and commer = L,					0.0479	-0.0100	0.0495
					(0.457)	(0.885)	(0.518)
Constant	2.9764	-53.7510***	-53.4003***	-53.2081***	7.2029	7.3302	1.5866
	(0.324)	(0.000)	(0.000)	(0.000)	(0.117)	(0.102)	(0.776)
Observations	101	83	83	70	83	83	70
R-squared	0.11	0.49	0.49	0.59	0.18	0.24	0.38
Number of country n	18	14	14	13	14	14	13

pval in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4: Panel data estimation

VARIABLES	(1) Ratio of Var.	(2) Ratio of Var.	(3) Ratio of Var.	(4) Ratio of Var.	(5) Ratio of Var.	(6) Ratio of Var.	(7) Ratio of Var.
ATM per 100K adults (atm) = L,	0.0700	-0.2617**	-0.2091**	-0.3139***	-0.3154*	-0.2067*	-0.3315**
	(0.108)	(0.028)	(0.030)	(0.008)	(0.067)	(0.088)	(0.038)
Interaction between labor productivity and atm = L,		0.0193**	0.0126*	0.0208**	0.0423*	0.0223	0.0273
		(0.028)	(0.075)	(0.019)	(0.070)	(0.174)	(0.154)
Labor productivity in the high-intensity sector (hlp) = L,		5.2691***	2.9162***	3.4334***			
		(0.000)	(0.001)	(0.001)			
Interaction between MENA region and atm = L,			0.5018***	0.3881***		0.6544***	0.6345***
			(0.000)	(0.003)		(0.000)	(0.000)
Growth = L,				-6.2980			1.8783
				(0.381)			(0.816)
Interaction between hlp and atm = L,					-0.0118	-0.0076	-0.0030
					(0.644)	(0.671)	(0.890)
Constant	-0.0421	-63.5372***	-39.9268***	-45.6183***	-0.1989	-6.4024***	-5.4994**
	(0.987)	(0.000)	(0.000)	(0.000)	(0.950)	(0.009)	(0.048)
Observations	96	78	78	66	78	78	66
R-squared	0.15	0.56	0.72	0.73	0.29	0.66	0.65
Number of country n	18	14	14	13	14	14	13

pval in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Panel data estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Ratio of Var.	Ratio of Var.	Ratio of Var.	Ratio of Var.	Ratio of Var.	Ratio of Var.	Ratio of Var.
Depositors with commercial banks per 1,000 adults (deposit) = L,	0.0006	-0.0092	0.0067	0.0053	-0.1271***	-0.0957***	-0.1083***
	(0.624)	(0.610)	(0.705)	(0.734)	(0.000)	(0.003)	(0.001)
Interaction between labor productivity and deposit = L,		0.0008	-0.0007	-0.0005	-0.0007	-0.0008	-0.0013
		(0.637)	(0.660)	(0.730)	(0.744)	(0.673)	(0.392)
Labor productivity in the high-intensity sector (hlp) = L,		9.2521***	7.9836***	7.1979***			
		(0.001)	(0.002)	(0.006)			
Interaction between MENA region and deposit = L,			0.0237**	0.0264**		0.0175	0.0165
			(0.020)	(0.036)		(0.143)	(0.225)
Growth = L,				-23.5534**			-30.5303**
				(0.038)			(0.011)
Interaction between hlp and deposit = L,					0.0116***	0.0091**	0.0107***
					(0.001)	(0.018)	(0.004)
Constant	1.8447	-109.3119***	-98.2651***	-89.9184***	-1.7813	-4.8439**	-5.4058**
	(0.358)	(0.001)	(0.001)	(0.003)	(0.372)	(0.038)	(0.017)
Observations	49	44	44	39	44	44	39
R-squared	0.24	0.74	0.79	0.87	0.72	0.75	0.87
Number of country n	9 8	8 8	8 8	8			

pval in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6: Panel data estimation

VARIABLES	(1) Ratio of Var.	(2) Ratio of Var.	(3) Ratio of Var.	(4) Ratio of Var.	(5) Ratio of Var.	(6) Ratio of Var.	(7) Ratio of Var.
Borrowers from commercial banks per 1,000 adults (borrow) = L,	0.0029	0.0090	0.0102	0.0150	-0.0000	-0.0045	-0.0031
	(0.670)	(0.750)	(0.731)	(0.552)	(1.000)	(0.929)	(0.969)
Interaction between labor productivity and borrow = L,		-0.0001	-0.0002	-0.0009	0.0362**	0.0351**	0.0300
		(0.973)	(0.940)	(0.670)	(0.038)	(0.042)	(0.260)
Labor productivity in the high-intensity sector (hlp) = L,		10.4849***	10.6261***	10.4900***			
		(0.000)	(0.000)	(0.000)			
Interaction between MENA region and borrow = L,			0.0112	0.0624		-0.0989	-0.0722
			(0.860)	(0.252)		(0.235)	(0.439)
Growth = L,				-42.6094**			-39.4627
				(0.014)			(0.212)
Interaction between hlp and borrow = L,					-0.0350*	-0.0335*	-0.0289
					(0.076)	(0.086)	(0.358)
Constant	2.6336	-135.1764***	-137.6467***	-133.0847***	2.3711	7.6396	5.0509
	(0.290)	(0.000)	(0.000)	(0.000)	(0.478)	(0.172)	(0.395)
Observations	56	42	42	34	42	42	34
R-squared	0.26	0.74	0.74	0.88	0.47	0.51	0.57
Number of country n	12	9 9	7 9	9 7			

pval in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7: Dynamic panel data estimation - Arellano & Bond's estimation

VARIABLES	(1) GKF's share	(2) GKF's share	(3) GKF's share	(4) GKF's share	(5) GKF's share	(6) GKF's share	(7) GKF's share	(8) GKF's share
Share of Gross capital formation = L,	0.5795***	0.6199***	0.5849***	0.5868***	0.5422***	0.6221***	0.5900***	0.5914***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Real percapita GDP	-0.0005	0.0005	-0.0003	-0.0002				
	(0.308)	(0.696)	(0.828)	(0.855)				
Commercial bank branches per 100K adults (commer)	0.0001	-0.0009	-0.0027	-0.0025	0.0003**	-0.0008	-0.0024	-0.0024
	(0.469)	(0.629)	(0.139)	(0.183)	(0.017)	(0.672)	(0.175)	(0.178)
Interaction between labor productivity and commer		0.0001	0.0003	0.0002		0.0001	0.0002	0.0002
		(0.525)	(0.115)	(0.151)		(0.564)	(0.146)	(0.143)
Sectoral labor productivity		-0.0033	-0.0043*	-0.0040		-0.0024	-0.0039	-0.0041
		(0.196)	(0.089)	(0.120)		(0.363)	(0.127)	(0.112)
Interaction between MENA region and commer			0.0007***	0.0007***			0.0007***	0.0007***
			(0.000)	(0.000)			(0.000)	(0.000)
Growth				-0.0173				-0.0174
				(0.582)				(0.580)
Dummy for medium-low intensity sector	0.0047	-0.0008	-0.0009	-0.0010	-0.0082	-0.0000	-0.0003	-0.0011
	(0.449)	(0.674)	(0.615)	(0.579)	(0.247)	(0.992)	(0.881)	(0.548)
Constant	0.0108	0.0376	0.0557	0.0905***	0.0201*	0.0000	0.0000	0.0607
	(1.000)	(0.990)	(0.985)	(0.006)	(0.070)	(.)	(.)	(0.987)
Observations	2,611	2,364	2,364	2,364	2,611	2,364	2,364	2,364
Number of ij	477	410	410	410	477	410	410	410

pval in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 8: Dynamic panel data estimation - Arellano & Bond's estimation

VARIABLES	(1) GKF's share	(2) GKF's share	(3) GKF's share	(4) GKF's share	(5) GKF's share	(6) GKF's share	(7) GKF's share	(8) GKF's share
Share of Gross capital formation = L,	0.5796***	0.6371***	0.6319***	0.6217***	0.5028***	0.6205***	0.6129***	0.6311***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Real percapita GDP	-0.0014***	0.0029**	0.0023	0.0027*				
	(0.001)	(0.036)	(0.102)	(0.060)				
ATM per 100K adults (atm)	-0.0000	-0.0006**	-0.0005*	-0.0004	-0.0001**	-0.0007***	-0.0005*	-0.0004
	(0.185)	(0.011)	(0.058)	(0.150)	(0.012)	(0.007)	(0.060)	(0.116)
Interaction between labor productivity and atm		0.0000**	0.0000	0.0000		0.0001**	0.0000*	0.0000
		(0.026)	(0.115)	(0.289)		(0.011)	(0.099)	(0.195)
Sectoral labor productivity		-0.0063***	-0.0051***	-0.0049***		-0.0039***	-0.0030***	-0.0026**
		(0.000)	(0.002)	(0.003)		(0.000)	(0.007)	(0.021)
Interaction between MENA region and atm			0.0001*	0.0001*			0.0001**	0.0001**
			(0.063)	(0.062)			(0.018)	(0.023)
Growth				-0.0595*				-0.0489
				(0.059)				(0.119)
Dummy for medium-low intensity sector	-0.0021	-0.0011	-0.0011	-0.0011	-0.0029	-0.0018	-0.0021	-0.0007
	(0.747)	(0.541)	(0.552)	(0.539)	(0.669)	(0.456)	(0.393)	(0.699)
Constant	0.0000	0.0758***	0.0687***	0.0678***	0.0383***	0.0000	0.0000	0.0497
	(.)	(0.000)	(0.000)	(0.000)	(0.000)	(.)	(.)	(0.997)
Observations	2,567	2,320	2,320	2,320	2,567	2,320	2,320	2,320
Number of ij	477	410	410	410	477	410	410	410

pval in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9: Dynamic panel data estimation - Arellano & Bond's estimation

VARIABLES	(1) GKF's share	(2) GKF's share	(3) GKF's share	(4) GKF's share	(5) GKF's share	(6) GKF's share	(7) GKF's share	(8) GKF's share
Share of Gross capital formation = L,	0.6096***	0.6384***	0.6055***	0.6049***	0.5806***	0.6374***	0.6070***	0.6070***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Real percapita GDP	-0.0005	0.0025	-0.0010	-0.0014				
	(0.506)	(0.304)	(0.691)	(0.599)				
Depositors with commercial banks per 1,000 adults (deposit)	0.0000	-0.0002***	-0.0003***	-0.0003***	-0.0000	-0.0002***	-0.0002***	-0.0002***
	(0.999)	(0.009)	(0.000)	(0.000)	(0.967)	(0.002)	(0.000)	(0.000)
Interaction between labor productivity and deposit		0.0000***	0.0000***	0.0000***		0.0000***	0.0000***	0.0000***
		(0.009)	(0.000)	(0.000)		(0.002)	(0.000)	(0.000)
Sectoral labor productivity		-0.0187***	-0.0220***	-0.0222***		-0.0183***	-0.0220***	-0.0221***
		(0.001)	(0.000)	(0.000)		(0.001)	(0.000)	(0.000)
Interaction between MENA region and deposit			0.0000***	0.0000***			0.0000***	0.0000***
			(0.000)	(0.000)			(0.000)	(0.000)
Growth				0.0213				0.0140
				(0.631)				(0.739)
Dummy for medium-low intensity sector	0.0108*	-0.0011	-0.0011	-0.0011	0.0869***	-0.0006	-0.0013	-0.0014
	(0.061)	(0.649)	(0.641)	(0.649)	(0.000)	(0.803)	(0.580)	(0.572)
Constant	0.0007	0.1889***	0.2618***	0.2679***	-0.0438***	0.2377	0.2748	0.2751
	(0.947)	(0.004)	(0.000)	(0.000)	(0.000)	(0.982)	(0.979)	(0.979)
Observations	1,565	1,402	1,402	1,402	1,565	1,402	1,402	1,402
Number of ij	281	240	240	240	281	240	240	240

pval in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 10: Dynamic panel data estimation - Arellano & Bond's estimation

VARIABLES	(1) GKF's share	(2) GKF's share	(3) GKF's share	(4) GKF's share	(5) GKF's share	(6) GKF's share	(7) GKF's share	(8) GKF's share
Share of Gross capital formation = L,	0.4741***	0.4681***	0.4027***	0.4025***	0.4088***	0.4698***	0.4238***	0.4240***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Real percapita GDP	-0.0007	-0.0006	-0.0051*	-0.0052*				
	(0.139)	(0.832)	(0.096)	(0.090)				
Borrowers from commercial banks per 1,000 adults (borrow)	-0.0000	-0.0001*	-0.0001**	-0.0001**	-0.0000	-0.0001*	-0.0001*	-0.0001*
	(0.398)	(0.062)	(0.020)	(0.020)	(0.389)	(0.056)	(0.066)	(0.070)
Interaction between labor productivity and borrow		0.0000*	0.0000***	0.0000***		0.0000*	0.0000**	0.0000**
		(0.086)	(0.008)	(0.008)		(0.077)	(0.034)	(0.033)
Sectoral labor productivity		-0.0030	0.0005	0.0003		-0.0034**	-0.0031**	-0.0033**
		(0.251)	(0.853)	(0.902)		(0.028)	(0.039)	(0.042)
Interaction between MENA region and borrow			0.0001***	0.0001***			0.0001***	0.0001***
			(0.000)	(0.000)			(0.000)	(0.000)
Growth				0.0303				0.0203
				(0.671)				(0.776)
Dummy for medium-low intensity sector	0.0117**	0.0036	0.0050*	0.0050*	0.0581***	0.0034	0.0033	0.0033
	(0.046)	(0.186)	(0.064)	(0.064)	(0.000)	(0.180)	(0.193)	(0.195)
Constant	0.0200**	0.0586	0.0481	0.0524	-0.0201*	0.0604	0.0488	0.0502
	(0.025)	(0.998)	(0.999)	(0.998)	(0.052)	(0.998)	(0.998)	(0.998)
Observations	1,399	1,224	1,224	1,224	1,399	1,224	1,224	1,224
Number of ij	287	236	236	236	287	236	236	236

pval in parentheses

*** p<0.01, ** p<0.05, * p<0.1

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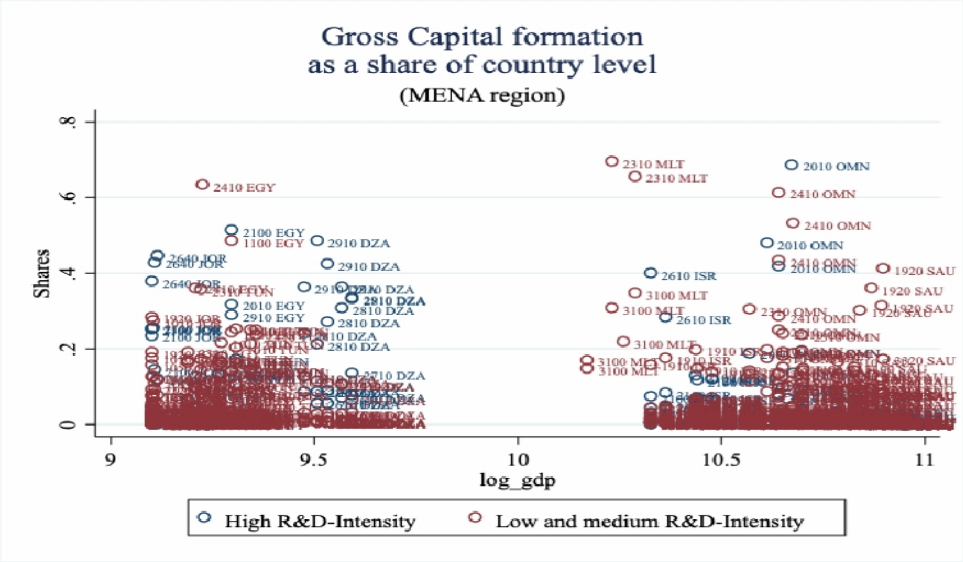

Figure 2

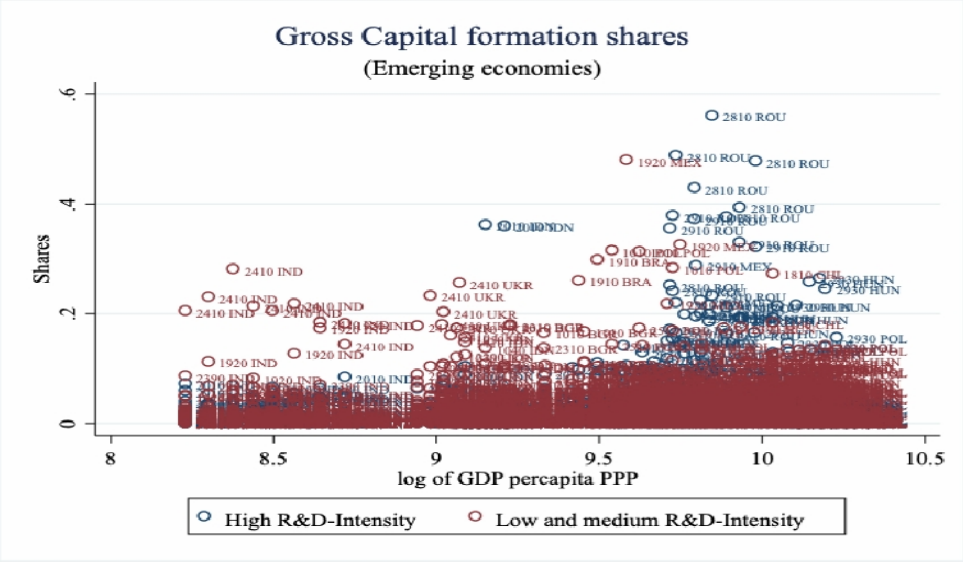

Figure 3

Figure 4: Gross Capital Formation (GKF) in the low

R&D-intensity sector

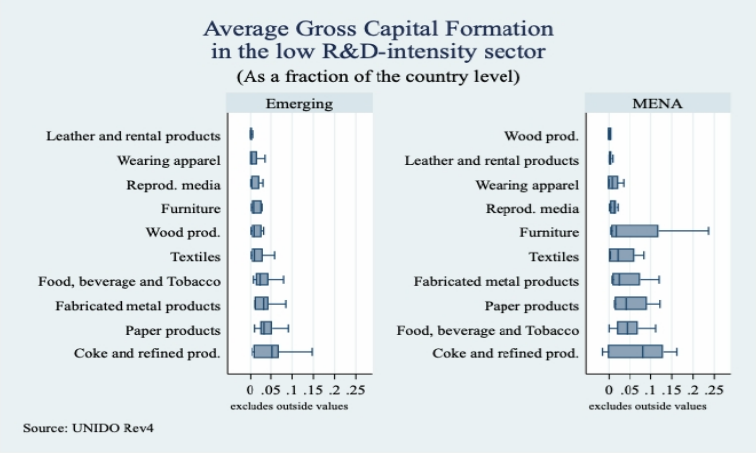

Figure 4: Gross Capital Formation (GKF) in the low

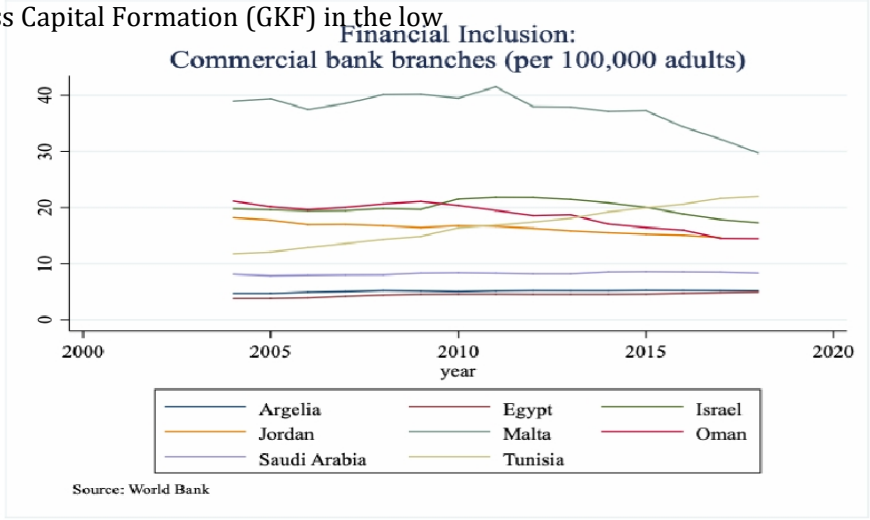

Figure 5: Commercial bank branches (per 100 000 adult)

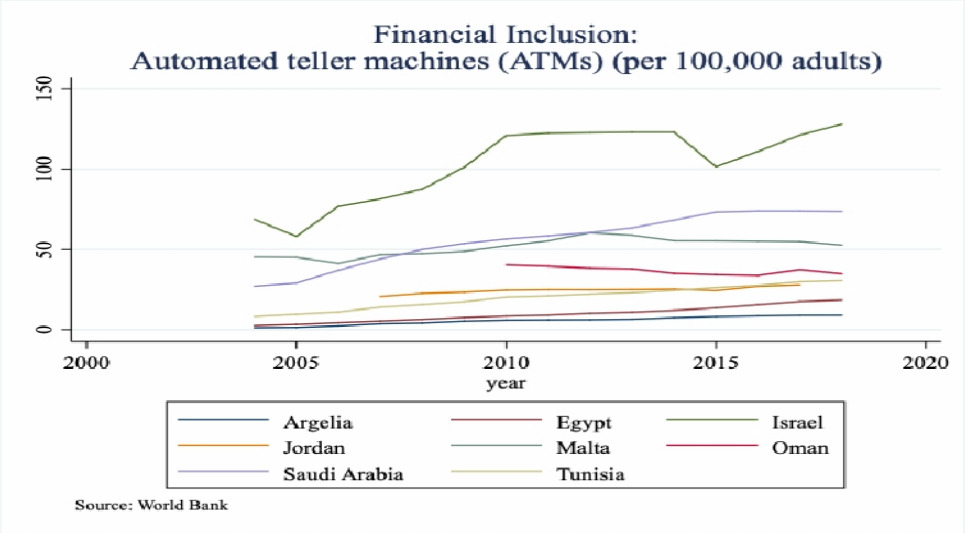

Figure 6: Automated teller machines (ATMs) (per 100,000 adults)

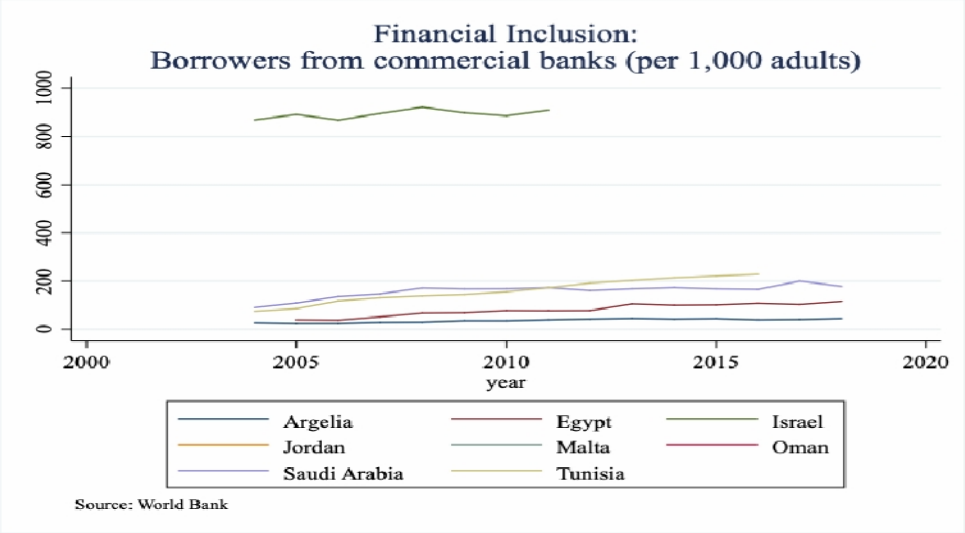

Figure 7: Borrowers from commercial banks (per 100,000 adults)

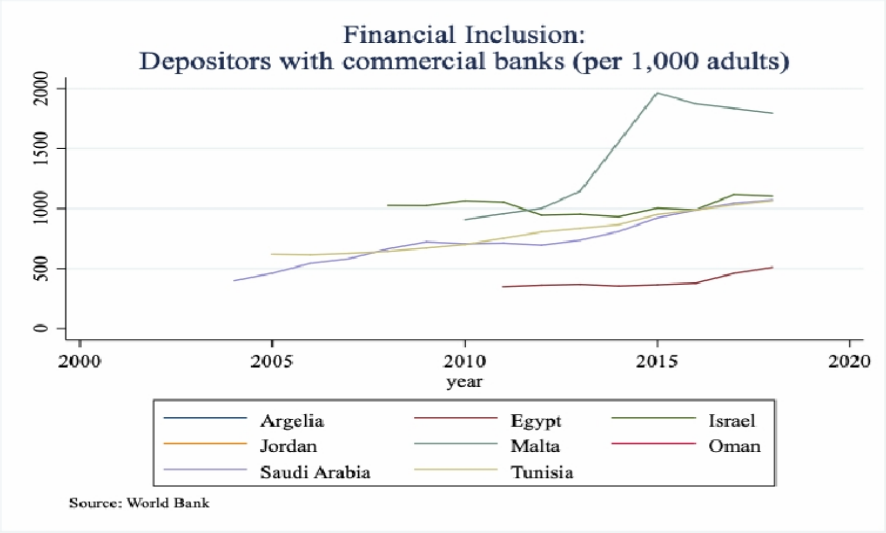

Figure 8: Depositors with commercial banks (per 100,000 adults)

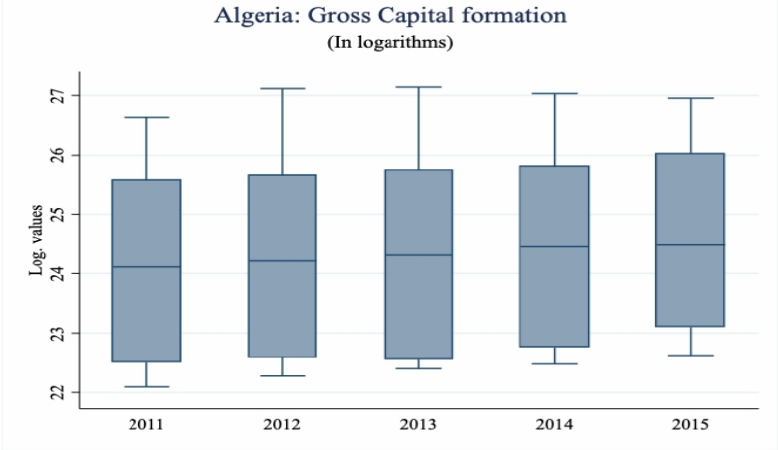

Figure 9: Size of the Gross Capital Formation

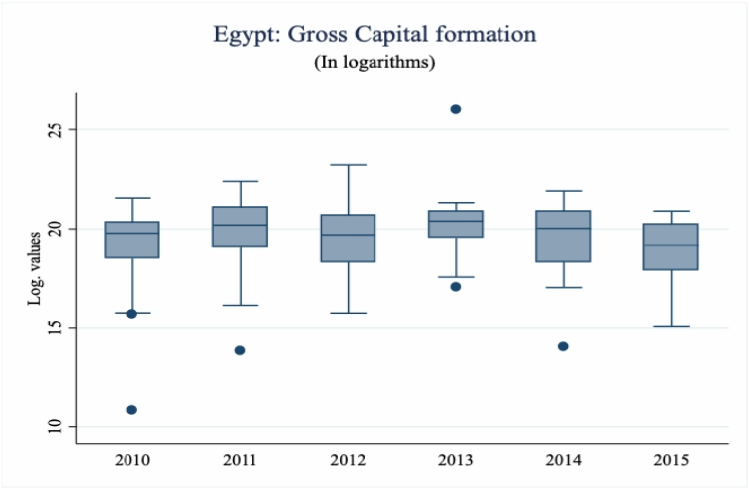

Figure 10: Size of the Gross Capital Formation

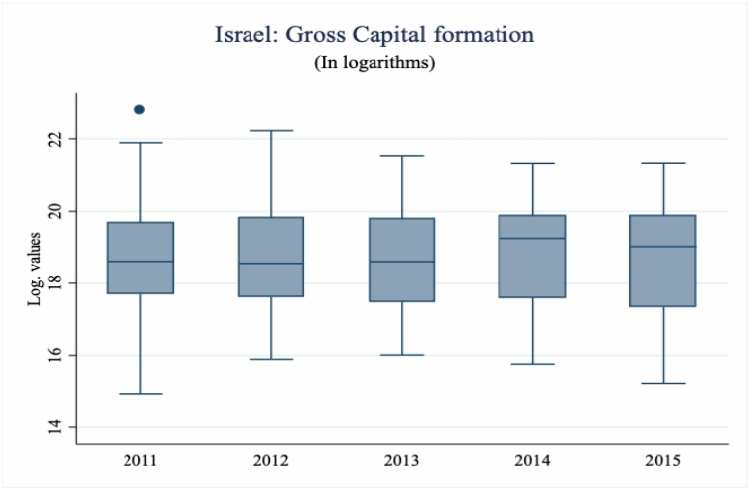

Figure 11: Size of the Gross Capital Formation

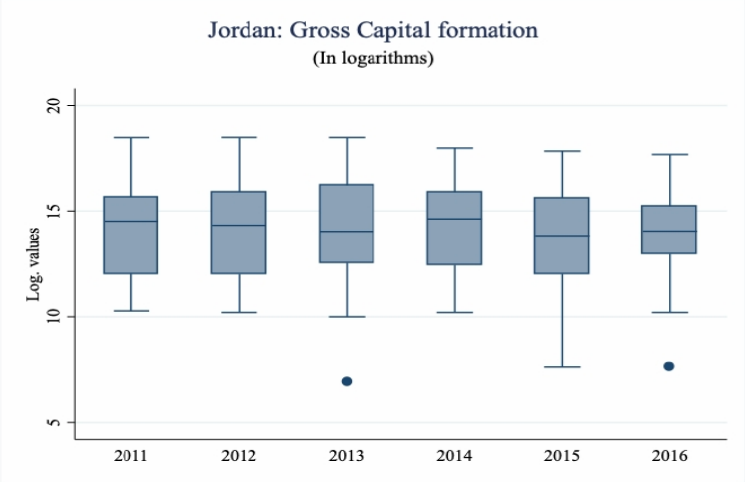

Figure 12: Size of the Gross Capital Formation

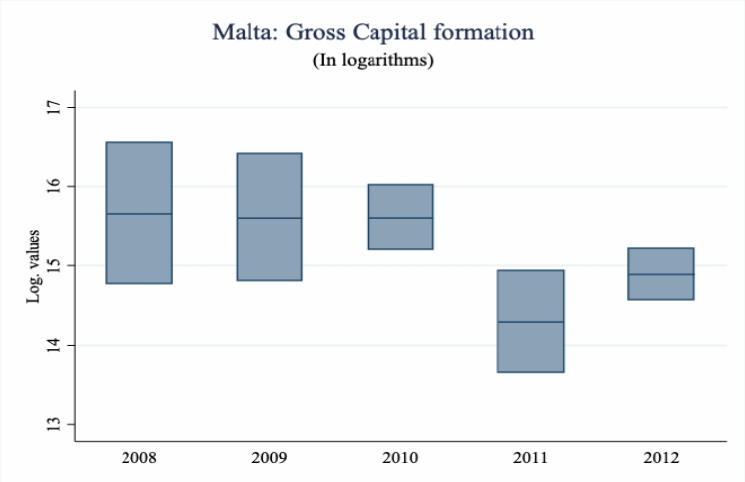

Figure 13: Size of the Gross Capital Formation

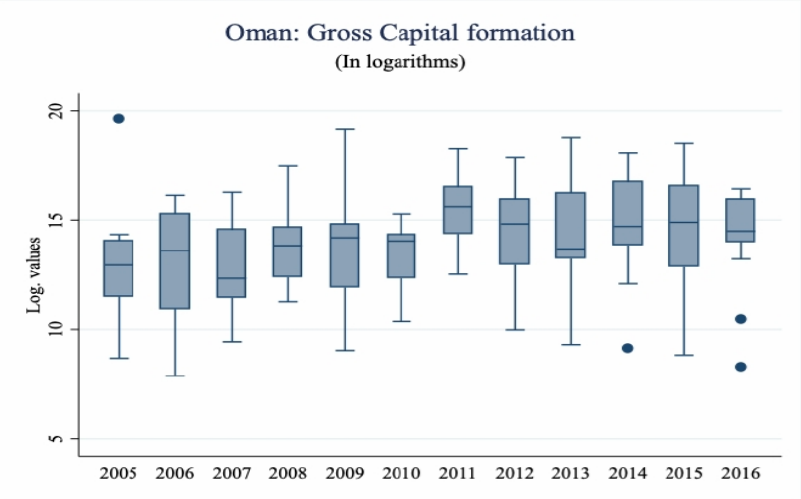

Figure 14: Size of the Gross Capital Formation

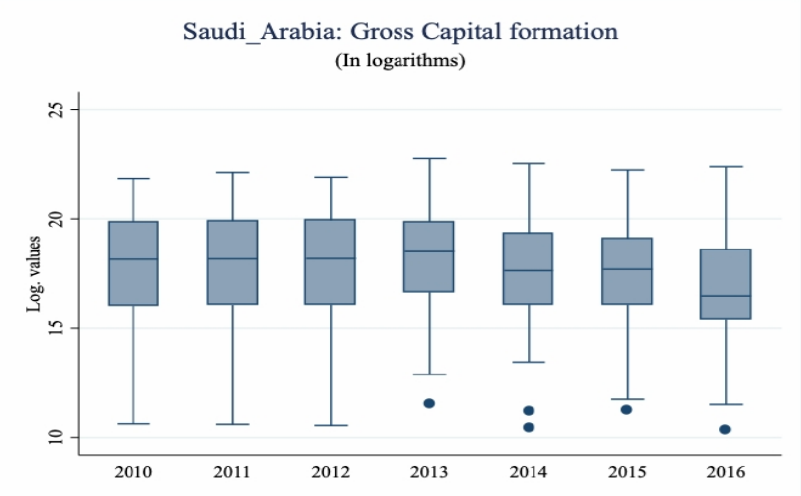

Figure 15: Size of the Gross Capital Formation

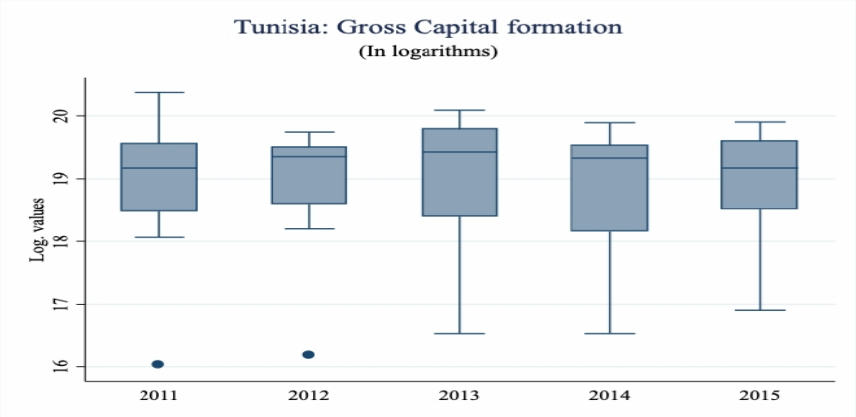

Figure 16: Size of the Gross

Capital Formation

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