Credit Constraints, Political Instability, and Capital Accumulation.

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We investigate the complex interactions between credit constraints, political instability, and capital accumulation using a novel approach based on Kiyotaki and Moore's (1997) theoretical framework. We draw on a unique firm-level data set from Middle-East and North Africa (MENA) and find a large and significant effect of credit conditions on capital accumulation, supporting the view that financial development is key for economic development. The empirical estimations also indicate that political unrest influences economic development via the credit channel. Political instability tightens borrowing constraints, drags capital accumulation, and may thereby adversely affect economic growth.

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I. INTRODUCTION[1]

The importance of borrowing constraints on capital accumulation is largely documented in the empirical literature using (i) the 'investment-cash flow sensitivity' approach (Fazzari et al. 1988) which is viewed as an indirect way of assessing the constraints; and (ii) the 'survey-based' qualitative approach (Kaplan and Zingales 1997) which lacks quantitative rigor. Weak theoretical underpinnings of these empirical methods have cast doubt on their suitability to quantitatively gauge the constraints. A number of studies have questioned the link between the cash flow sensitivity of investment and the presence of borrowing constraints (Chen and Chen 2012; Kaplan and Zingales 1997). In spite of recent empirical advances (Jiménez et al., 2012; Herrala (2013), and references), the challenge to quantify the real economic impact of borrowing constraints in a well-defined theoretical framework still remains.

In this paper, we build on the seminal work of Kiyotaki and Moore (KM, 1997) to empirically assess the quantitative impact of borrowing constraints on capital accumulation. The model is reformulated so that the impact can be tested by a parametric approach. Since the constraints are not directly observable, we apply the novel methodology by Herrala (2013) to estimate them from loan samples. Using the constraint estimates, we then bring the conceptual KM model to data. The estimations shed light on the finance growth–nexus, and also the effects of continued political instability, drawing on a unique firm-level dataset from Middle East and North Africa (MENA), a region where a number of countries are experiencing political turmoil. We believe to be the first to assess the effect of political instability on credit constraints and capital accumulation as well as to investigate the initial conditions that prevail at the onset of unrest.

The estimations indicate that the impact of credit constraints on capital accumulation is economically and statistically significant, with the marginal effect of a change in credit limits on capital accumulation estimated at about 40 percent. The result contrast strongly with some recent findings, based on the cash flow sensitivity approach, of weakened financial frictions in the developed and developing world (Chen and Chen 2012; Andersen et al., 2012; Guariglia and Poncet 2012; Brown and Petersen 2009). Our findings support the view that financial development in MENA countries, as measured by a relaxing of financial constraints, is key for macroeconomic development in the region.

The estimations also document that credit constraints are tightened amid prolonged political uncertainty, highlighting the challenge of maintaining a well-functioning financial system in the midst of significant political instability. The dynamic effects of continued political unrest on capital accumulation, however, are insignificant. Prior to the onset of the revolution, Arab Spring countries enjoyed higher credit limits compared with other countries in the region. The dynamism of their economy, however, did not deviate significantly from the other countries in the region. The findings shed light on the interplay between political instability

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on financial and economic developments. In a previous study, Bloom (2009) has argued that 'uncertainty shocks' caused, for example, by political upheaval have significant but only temporary negative effects on corporate investment and economic growth.

More importantly, the findings suggest that political unrest affects capital accumulation mainly via the credit channel: greater political unrest depresses credit availability which, in turn, hinders capital accumulation. Thus, this paper adds to the debate about economic and political development with a novel insight: finance matters. Previous studies show that economic prosperity spurs democratic development (Lipset 1959, Barro 1999; Persson and Tabellini 2009), while evidence on feedback effects from democratic institutions to economic growth is mixed (see Acemoglu and Robinson 2008; Giavazzi and Tabellini, 2009 and 2005; Papaioannou and Sirouannis, 2008). Our paper contributes to this literature by showing that the ability of a democratic government to deliver advances in economic development crucially depends on financial development. Poor credit availability brought about by, for example, prolonged political unrest after a regime change in aspiration for democracy, is conducive to poor economic outcomes and will likely lead to regression towards an autocratic regime.

Our results can be further extended to provide new insights into the lack of progress in democratization in the Arab region. Many alternative explanations are provided in the literature for the political troubles and apparent lack of democratic development in Arab countries, such as high unemployment and deficiency of political institutions (Faria and McAdam, 2013; Yusef, 2004) and educational systems (Compante and Chor, 2012). Barro (1999) even shows that Muslim religion negatively correlates with democratic development even after controlling for a number of factors. However, no study in the mainstream literature suggests that the region's troubles may be linked to poor credit conditions stemming from religious or cultural aversion towards borrowing. We show that credit availability matters for economic development and, if not resulting from political instability, poor credit conditions may be a by-product of the aversion of economic agents towards the practice of conventional banking.[2] Thus, Arab countries may be prone to a vicious circle that hinders the simultaneous development of democratic and economic institutions.

The remainder of the paper is structured as follows. Section 2 derives the quintessential estimable equations of credit limits and capital accumulation, building on the KM model. Section 3 provides an overview of the key macroeconomic and financial conditions in the MENA region as well as more recent sociopolitical challenges; it also describes the unique data set. Section 4 discusses the estimation results and section 5 conducts robustness checks. Section 6 concludes.

[2] Despite the proliferation of Islamic banking in the MENA region to meet the religious and cultural needs of economic agents in the region, the industry is still at an infant stage; its relative size compared to conventional banking is very small and active secondary Islamic capital markets are virtually non-existent (Ernst and Young, 2012).

II. METHODOLOGY

To estimate the effect of credit constraints on capital accumulation, we reformulate KM's seminal model and estimate it based on a two-stage procedure.

The capital accumulation equation of main interest is derived first. Consider a time invariant production function G with input K, for 'capital'. In equilibrium, unconstrained firms equate marginal product with marginal cost:

$$G'[K_{i,t}] = R + w_t, \qquad (1)$$

where G' is the first derivative, i denotes firms, t time, R real interest rate, and w opportunity cost.[3] Unless otherwise stated, all variables are in natural logarithms. Under a quadratic Taylor approximation of G around a steady state s, the left hand side of (1) is linear: $G'[K_{it}] \approx \gamma_0 + \gamma_1 K_{it}$, where $\gamma_0 = G'[s] - aG''[s],\ \gamma_1 = G''[s] < 0$. By inserting the approximation of G' into (1), taking first differences across time, and rearranging, we get a dynamic equilibrium condition for unconstrained firms:

$$K_{i,t} = K_{i,t-1} + \frac{\Delta(R+w_t)}{\gamma_1}, \qquad (2)$$

where Δ is change between two periods.

For credit constrained firms, the equilibrium condition is written as (Appendix 1 provides a detailed derivation of equation (3)):

$$K_{i,t} = \varphi_t + CL_{i,t-1}, \qquad (3)$$

where $\varphi_t \equiv ln\left(\frac{aR}{q_t\left(q_t - \frac{1}{R}q_{t+1}\right)}\right) > 0$, a is a parameter between zero and one $(0 < a < 1)$ reflecting output marketability, q is the price of the capital good, and CL is the (unobservable) credit constraint. To interpret, for constrained firms the capital stock is proportional to the credit limit of the previous period by a 'proportionality factor' φ. The proportionality factor, which is only of secondary interest for present purposes, varies with the marketability of output and the real interest rate (these affect the loan service ability of firms), as well as capital goods prices (which affect collateral value).
Total differentiation of (3) across time and solving for K yields:

$$K_{i,t} = K_{i,t-1} + \Delta CL_{i,t-1} + \Delta\varphi[a, R, q_t, q_{t+1}], \qquad (4)$$

Aggregating the equilibrium conditions (equations (2) and (4)) over unconstrained and constrained firms and replacing unobserved variables with estimates (indicated by "hat"), yields the following empirical capital accumulation model:

[3] Equation (1) corresponds with equation (11) in KM in logarithmic form.

$$K_{i,t} = \alpha_K K_{i,t-1} + \alpha_{\Delta CL} \Delta \widehat{CL}_{i,t-1} + \alpha_{\Delta Z1} \Delta Z1_{i,t} + \epsilon_{i,t} \,, \qquad (5)$$

where $\widehat{CL}$ is an estimate of the unobservable credit limit, *Z1* is a vector of other variables to be specified, and the residual ϵ is a normal iid measurement error with zero mean. Based on theory, the capital's own elasticity α_K is expected to be close to unity. The main parameter of interest $\alpha_{\Delta CL}$ represents the marginal effect of credit constraints on capital—in the context of the theoretical model, it can also be interpreted as the proportion of credit constrained firms in the sample, explained by the fact that *CL* has no effect on unconstrained firms (equation (2)) and it affects constrained firms on a one-to-one basis (equation (4)).

The *Z1* vector includes the change in the real interest rate (R) and is expected to have a negative effect on capital accumulation—an extension to KM's assumption of constant interest rate. Three dummies (time, country, and sector) control for changes in opportunity costs, capital goods prices, and marketability of goods across periods, countries, and economic sectors.

To investigate the effect of political unrest, we add to *Z1* dummies that identify Arab Spring countries (Egypt, Syria, Tunisia), and countries experiencing continued political unrest (Bahrain, Iraq, Lebanon, Sudan, and West Bank and Gaza). We employ group dummies instead of indexes of political unrest to avoid imposing an untested quantitative scale on political unrest. Also, we distinguish between Arab Spring countries and countries that experience political unrest because the former did not experience political unrest during our sample period (as the uprising came about in 2011), whereas political unrest has been on-going in other countries for an extended period of time. Further, Gulf Cooperation Council (GCC) countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates) exhibit similarities in terms of economic and socio-political (as of late) characteristics, and we control for them using a *GCC* dummy variable.

We additionally include in *Z1* an estimate of each firm's distance from the credit limit defined as $DL_{i,t} \equiv CL_{i,t} - L_{i,t}$, is included in *Z1* to test a possible deviation from the KM's construct. Under KM, firms only react to binding borrowing or credit constraints (i.e., $DL = 0$). Another trend in the literature (e.g., Stiglitz and Weiss 1981; Bernanke, Gertler, and Gilchrist 1999), however, contends that investment dynamics change in the vicinity of the credit limit *before* the latter becomes binding (i.e., when $DL > 0$), possibly driven by rising borrowing costs as firms get closer to exhausting their credit limits (i.e., DL becomes small) and bankruptcy risk rises. We test for the existence of such a positive 'distance effect' by including $\widehat{DL}$ in *Z1*.

To estimate the unobservable variables of equation (5), namely credit limit (*CL*) and distance from the limit (*DL*), we employ SFA based on the approach that is presented in Herrala (2013). Assume that firms face a borrowing constraint formulated as follows:[4]

[4] Equation (6) corresponds to equation (3) in KM.

$$L_{i,t} \leq \beta_{t,A} A_{t,i} + \beta_{t,R} R_t + \beta_{t,Z} Z2_t + v_{i,t}, \quad (6)$$

where L denotes loans, A firm size, $Z2$ a vector of other variables to be specified, $\beta's$ are parameters to be estimated reflecting credit conditions, and v is a normal iid random variable with zero mean. This borrowing constraint imposes an upper bound on firm borrowing L at the unobservable credit limit which is defined as $CL_{i,t} \equiv \beta_{t,A} A_{i,t} + \beta_{t,R} R_t + \beta_{t,Z} Z2_t + v_{i,t}$. On theoretical grounds, $\beta_{t,A}$ is expected to be positive since assets are generally eligible to be used as collateral and thus likely to raise credit limits, and $\beta_{t,R}$ is expected to carry a negative sign as higher real interest rates are likely to increase the debt service burden of firms and thus reduce credit limits.

Based on the previously defined *DL,* the borrowing constraint in (6) can be rewritten without loss of generality as a stochastic frontier model:

$$L_{i,t} = \beta_{t,A} A_{i,t} + \beta_{t,R} R_t + \beta_{t,Z} Z2_t + v_{i,t} - DL_{i,t}. \quad (7)$$

Equation (7) yields two unobserved residual components: v is standard normal, reflecting measurement error or random variation in credit limits across firms; and *DL* or distance from the credit limit has an unknown distribution with a real positive domain. In line with the stochastic frontier literature, we assume that the distribution of *DL* is either half normal, truncated normal, or exponential. In standard panel SFA, the distribution of the inefficiency term *DL* is either fixed over time or it can be made time-varying after imposing a mechanical adjustment to it. Such assumptions are highly suspect in the present context of our estimation as the variable *DL* is likely to vary significantly over time depending on changes in credit conditions and firm investment behavior.

We also assume that the two residual components are independent of each other, of the variable vector, and of sampling probabilities. The SFA's strength is that it is also applicable in non-random firm samples provided that the sampling probabilities are independent of the two defined residuals, and given that distributional parameters vary freely.

Notice that firm size A on the right hand side of the borrowing constraint is endogenous: since loans are often used to obtain assets, A is determined simultaneously with the loan stock L. In the present context, this is intentional. By their nature, collateral policies generate a contemporaneous link between a firm's assets, and the amount that it can borrow. So, the presence of an endogenous variable on the right hand side of (7) does not generate endogeneity bias. It just means that the borrowing constraint is not a causal relationship but, rather, a simultaneous relationship between two mutually dependent variables.

We use a number of alternative indicators of firm size *A*, including total assets book value, equity capital, number of firm employees, and a qualitative indicator for small and medium-sized enterprises (SMEs). We do not consider market-value indicators as our sample includes non-listed firms—arguably, this is not likely to affect the main estimation results given that *Z2* includes time, country, and industry dummies that may control for changes or differences in market prices. The *Z2* vector includes firm age as older firms may face higher credit limits in light of their more established relationships with banks. We also include in Z2 dummies to

control for Arab Spring countries, for other nations experiencing political unrest, and for GCC economies.

In a second-stage dynamic linear regression framework, we use Model (7)'s estimates of *CL* and *DL* as inputs in Model (5). Since we are not interested in firm level heterogeneity, we estimate the models using a series of cross sections rather than a panel to avoid imposing undue restrictions on the residuals. However, we also run panel regressions in the robustness section as well as explore the possible bias caused by estimation error in $\widehat{\Delta CL}$ and $\widehat{\Delta DL}$. Such estimation error may potentially affect inference in the second stage regression, and we address it by correcting standard errors using errors-in-variables regression techniques (Murphy and Topel, 1985).

III. MENA CONDITIONS, DATA SAMPLE, AND DESCRIPTIVE STATISTICS

A. Overview of Key MENA Macroeconomic and Financial Conditions

MENA countries comprise oil-importing (Djibouti, Egypt, Jordan, Lebanon, Morocco, Syria, Tunisia, and West Bank and Gaza) and oil-exporting (Algeria, Bahrain, Iran, Iraq, Kuwait, Lybia, Oman, Qatar, Saudi Arabia, United Arab Emirates, and Yemen) economies. In most oil-importing countries, recent analysis points to widening fiscal deficits, dwindling international reserves, and increasingly subdued foreign direct investments and other portfolio flows (IMF-Middle East and Central Asia Regional Economic Outlook (MCD REO), 2013). In terms of per capita Gross Domestic Product, oil importing MENA countries rank as low to mid income economies. In parallel, oil-exporting countries are classified as mid to high income economies that are heavily dependent on oil revenues, but which have recently increased hard-to-reverse current government expenditures (real wages increases) thereby necessitating better macro-fiscal planning (IMF-MCD REO, 2013).

A common and rising concern across most MENA countries is the impending need to meet pressing social demands, build private sector confidence, and lay the foundations for socially-inclusive growth and jobs. However, private sector development, which is instrumental in meeting this objective, is sluggish in the region. Apart from the large state-owned companies, firms are mostly small family-oriented businesses with limited access to external finance. Domestic equity markets are inefficient, debt markets are underdeveloped, and banks are the main providers of credit to businesses, as is the case in other developing countries with little disintermediation for providing alternative sources of credit.

According to the World Bank Business Environment Survey, financial frictions in the MENA region represent a significant hurdle to corporate growth, and they seriously impede firm access to finance. Only 10 percent of MENA firms make use of bank financing and close to 40 percent identify access to finance as a major obstacle to growth, second only to Sub-Saharan Africa (Ahmed, 2013). Borrowing constraints are also accentuated by prevailing weak financial infrastructures: agency costs of bank screening, loan contracting, and monitoring are quite high; public registries are rare; coverage of private credit bureaus is limited resulting in inefficient credit information sharing systems; and collateral

frameworks and bankruptcy codes are underdeveloped, aggravating moral hazard and adverse selection distortions (Rocha, Arvai, and Farazi, 2011).

Furthermore, the onset of the Arab Spring movement in 2011 has sparkled sociopolitical pressures across the region. A number of countries are going through complex political, social, and economic transitions and face the challenge of maintaining macroeconomic stability amid political turmoil and social unrest (IMF-MCD REO, 2013). The political uncertainty reflects general failures on the part of governments to deal with widening inequality gaps and youth unemployment. The IMF estimates that between 50 and 75 million new jobs are needed over the next decade in MENA to secure social and political stability. Quite alarming is the increase in unemployed people (by more than one million) since the onset of the Arab Spring, with unemployment rates varying between 9 and 15 percent and youth unemployment reaching up to 30 percent in some countries (Ahmed, 2013).

B. Data Sample

We build a unique sample of both publicly-listed and privately-held firms in the MENA region. Based on data, availability, the countries covered are Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, Sudan, Syrian Arab Republic, Tunisia, United Arab Emirates, and West Bank and Gaza. First, we retrieve company information over the period 2007-2010 from the *Orbis* database provided by Bureau Van Dijk, a widely used database covering over 85 million firms from around the world but with limited coverage of the MENA region. As such, we complement *Orbis* database with a more specialized source of information, namely *Zawya*, a leading regional online business intelligence platform that provides detailed quantitative and qualitative profiles on top companies in the MENA region.

Having streamlined *Orbis* and *Zawya* data for possible duplication in firm coverage, we retain a sample of 860 companies for which financial information is available, and filter an unbalanced panel for a total of 1,483 observations over the period 2007-2010. It should be noted that firm data for MENA is scarce and that firms do not generally have the practice of disclosing financial information, thereby restricting the ability to conduct much needed research on private sector and enterprise development in the region. Furthermore, limited financial reporting seriously hampers the ability of firms to secure lines of credit and other forms of financing from financial intermediaries.

C. Descriptive Statistics

Table 1 displays descriptive statistics for firms in our sample across 15 MENA countries, six of which comprise the Gulf Cooperation Council (GCC).[5]

From Table 1, it is clear that Jordan has the largest number of firms and observations (albeit being behind other countries in terms of the size of those companies), and that Sudan has the smallest coverage. In terms of average firm size, asset values vary between $2 billion in some large GCC hydrocarbon-producing countries (i.e., Qatar, Saudi Arabia, and the UAE) and less than $10 million in Iraq. Leverage in the MENA region is moderate: average debt-to-equity ratio is 66 percent (implying an average equity capitalization of about 60 percent of assets) and current-liabilities-to-equity ratio is 58 percent.

Table 1. Summary statistics by country, 2007-2010

Country	Number of Firms	Number of Observations	Total Assets	Total Debt	Equity Capital	Debt/ Equity	Current Liabilities/ Equity	Fixed Assets
Bahrain	19	29	419,907	122,971	248,803	33.31	26.4	266,699
Egypt	127	192	552,778	262,925	267,549	66.84	64.04	319,514
Iraq	30	30	7,964	1,835	6,130	58.12	57.77	3,625
Jordan	162	294	90,810	25,387	57,662	52.62	47.07	44,632
Kuwait	148	288	645,869	274,829	323,539	73.44	61.32	341,681
Lebanon	4	4	715,075	104,377	527,356	54.44	54.82	81,294
Morocco	52	148	445,301	105,052	170,252	100.88	112.7	154,566
Oman	80	100	129,232	55,988	66,212	93.53	59.72	84,956
Qatar	27	50	2,236,634	1,093,857	1,091,055	71.93	30.57	1,505,652
Saudi Arabia	101	161	2,735,205	1,222,251	1,455,797	68.29	39.85	1,910,990
Sudan	1	1	2,656,134	996,701	1,659,433	60.06	34.66	1,736,297
Syria	5	5	79,004	26,039	52,965	58.01	55.85	23,265
Tunisia	28	71	137,279	41,628	55,259	93.85	144.65	54,377
UAE	54	80	2,536,394	1,168,974	1,226,594	71.85	55.02	1,496,267
West Bank & Gaza	22	30	71,489	19,085	48,420	32.76	26.6	39,516
Total / Average	860	1483	897,272	368,127	483,802	66	58.07	537,555

Source: Authors' calculations based on data from Orbis and Zawya.
Financial data are in thousands of US dollars, except for the debt-to-equity and current-liabilities-to-equity ratios, which are in percent. The last row displays the total number of firms and observations, as well as the average total assets, total debt, equity capital, debt-to-equity ratio, current-liabilities-to-equity ratio, and fixed assets.

Table 2 displays similar statistics grouped by sector of economic activity. Industrial manufacturing has the largest number of observations, followed by real estate. In terms of balance sheet assets, the largest firms in the region belong to telecommunication, followed by companies in the oil and gas and industrial manufacturing sectors.

Table 2. Summary statistics by sector, 2007-2010

[5] Our baseline regressions do not include countries with a very low number of firms with available data (i.e., Lebanon, Sudan, and Syria). However, robustness checks indicate that including them does not affect our results.

Primary Sector	Number of Firms	Number of Observations	Total Assets	Total Debt	Equity Capital	Debt/ Equity	Current Liabilities/ Equity	Fixed Assets
Construction	4	15	386,572	81,007	175,878	72.83	148.00	117,024
Food and Beverages	19	63	559,633	160,700	254,709	80.41	84.01	237,967
Manufacturing	617	703	885,631	419,086	462,424	69.14	53.23	633,636
Oil and Gas	17	59	888,822	353,116	365,236	70.39	63.19	492,906
Real Estate	100	329	779,814	235,591	393,340	50.77	51.59	107,900
Telecommunications	10	36	3,179,679	870,210	1,400,588	54.26	88.77	1,140,480
Transport	24	81	208,880	60,780	103,500	46.48	55.34	78,374
Other Sectors	69	197	226,978	108,316	74,958	124.00	109.00	102,530
Total / Average	860	1,483	889,501	286,101	403,829	70.97	81.62	363,852

Source: Authors' calculations based on data from Orbis and Zawya.
Financial data are in thousands of US dollars, except for the number of firms and the number of observations, as well as the ratios of debt to equity and current liabilities to equity, which are in percent. The last row displays the total number of firms and observations, as well as the average total assets, total debt, equity capital, debt-to-equity ratio, current-liabilities-to-equity ratio, and fixed assets. Other sectors are those sectors that include few observations: Agriculture; Chemicals, Rubber, Plastics, and Non-metallic products; Consumer Goods, Education, Health Care, Information Technology, Leisure and Tourism, Machinery, Equipment, Furniture, Recycling; Media; Metals & Metal Products; Mining and Metals, Power and Utilities, Retail; Services; Wholesale & Retail Trade; and Wood, Cork, and Paper.

In grouping countries by GCC or non-GCC member (Table 3), the sample is almost evenly split across these two sub-samples but firm size differs substantially across the two groups. The statistics on debt-to-equity indicate that firms in the GCC group are more leveraged than firms elsewhere. A test of the difference in mean equity-to-assets ratios across the two groups (not reported) indicates a significant divergence. In all, lower current liabilities-to-equity ratio suggests smaller reliance on short-term debt in GCC; as GCC capital markets are relatively more developed, firms therein are more likely to rely on long-term debt.

Table 3. Summary statistics by region, 2007-2010

Region	Number of Firms	Number of Observations	Total Assets	Total Debt	Equity Capital	Debt/ Equity	Current Liabilities/E	Fixed Assets
GCC	429	708	1,369,500	614,444	700,788	73.9	51.69	879,794
Non-GCC	431	775	277,579	107,081	136,898	64.78	66.17	140,428
Total /Average	860	1483	823,540	360,762	418,843	69.34	58.93	510,111

Source: Authors' calculations based on data from Orbis and Zawya.
The GCC countries include Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates.
The last row displays the total number of firms and observations, as well as the average total assets, total debt, equity capital, debt-to-equity ratio, current-liabilities-to-equity ratio, and fixed assets.

As background information on credit availability in the MENA region, Table 4 shows the ratio of domestic credit provided by the banking sector across countries. The figures indicate that, on average, banks provide to the private sector more credit in non-GCC than in GCC countries, as a percent of GDP.

Table 4. Domestic credit to private sector provided by the banking sector (% of GDP)

Country	2007	2008	2009	2010
Bahrain	56.46	67.27	84.56	75.22
Egypt	84.15	77.7	75.11	69.42
Iraq*	3.86	4.08	6.57	9.21
Jordan	114.32	110.97	104.61	99.92
Kuwait	68.84	65.33	86.81	66.01
Morocco	91.03	98.64	100.75	105.97
Oman	32.73	29.09	41.27	37.68
Qatar	50.83	51.67	76.23	70.38
Saudi Arabia	17.4	-3.99	0.6	-0.15
Tunisia	64.35	65.57	68.32	73.8
UAE	60.14	73.19	97.53	92.29
GCC	47.73	47.09	64.5	56.9
Non-GCC	71.54	71.39	71.07	71.67

Source: International Financial Statistics

IV. ESTIMATION RESULTS

A. Credit Constraints in MENA

We follow a two-step procedure to estimate KM's theoretical model. We first use the SFA of equation (7) to obtain estimates of *CL* and *DL*. The change in the predicted values of these variables $\widehat{\Delta CL}$ and $\widehat{\Delta DL}$, where hat denotes estimated values, are then used as inputs in equation (5) to quantify the effect on credit limits on capital accumulation.

The main estimation results of the SFA of credit limits and distance from the limit following equation (7) are presented in Table 5.

In all models, the regressed variable is total debt in natural logarithms. The benchmark model *CL1* includes firm equity capital, the real rate of interest (defined as the difference between the average lending rate and the inflation rate), dummy variables for Arab Spring countries, other economies experiencing political unrest, GCC countries, and sector of economic activity. In Model *CL2*, we add firm age as determining credit constraints. In Models *CL3* and *CL4*, we incorporate alternative indicators of firm size, the number of employees, and a dummy variable for small and medium-sized enterprises (SMEs). All regressions include year dummies and a constant term (not reported).

Since the distributional assumptions imposed on DL imply a negatively skewed residual term, we test for the presence of such negative skew as a model validation criterion. The last two rows in Table 5 show the tests results of skewness, pointing to the presence of a significant negative skew in the underlying loan distributions. The economic intuition is that, by imposing an upper bound on firm borrowing, credit limits generate a negative skew in the loan distribution.

The marginal effect of equity capital on credit limits is positive and highly significant in models *CL1-CL4* as predicted by theory. The coefficient is slightly above unity across all specifications, consistent with the hypothesis of positive scale economies presence in credit markets. One way to interpret the result is that MENA banks tend to discriminate against firms with a smaller equity base in extending credit.

Contrary to expectation, the effect of the real interest rate on credit limit is positive and significant. A possible explanation for this finding is that, from a supplier's perspective, an increase in loan rates may induce banks to supply more credit. This result can also be due to the absence of harmonized interest-rate data series for the MENA countries.

Table 5. Credit constraints models

Variables	Model *CL1*	Model *CL2*	Model *CL3*	Model *CL4*
Equity Capital	1.039***	1.043***	1.051***	1.015***
	[0.0205]	[0.0208]	[0.0226]	[0.0219]
Real Interest Rate	0.0267***	0.0269***	0.0211**	0.0249**
	[0.0103]	[0.0103]	[0.0105]	[0.0103]
Political Unrest	-0.398**	-0.374**	-0.522***	-0.265
	[0.161]	[0.162]	[0.190]	[0.168]
Arab Spring	0.349***	0.354***	0.282***	0.331***
	[0.100]	[0.101]	[0.107]	[0.101]
GCC	0.298***	0.302***	0.305***	0.281***
	[0.0946]	[0.0960]	[0.0954]	[0.0947]
Manufacturing Industry	-0.696***	-0.724***	-0.254**	-0.671***
	[0.109]	[0.110]	[0.113]	[0.109]
Transportation	-0.781***	-0.796***	-0.352**	-0.752***
	[0.156]	[0.156]	[0.159]	[0.157]
Real Estate	-0.946***	-0.966***	-0.489***	-0.889***
	[0.114]	[0.115]	[0.117]	[0.116]
Food and Beverages	-0.521***	-0.532***	-0.0604	-0.516***
	[0.175]	[0.176]	[0.179]	[0.175]
Telecommunications	-0.956***	-0.982***	-0.531**	-0.924***
	[0.221]	[0.222]	[0.222]	[0.222]
Construction	-0.359	-0.382	0.00668	-0.343
	[0.317]	[0.316]	[0.316]	[0.316]
Oil and Gas	-0.526***	-0.548***	-0.131	-0.493***
	[0.187]	[0.187]	[0.186]	[0.187]
Firm Age		-0.000377		
		[0.00189]		
Employees			1.90e-05**	
			[8.46e-06]	
SME				-0.376***
				[0.124]
Observations	1,533	1,501	1,422	1,533
Negative skewness test of residuals	-14.35	-14.36	-13.97	-14.31
Significance	0	0	0	0

The estimations follow equation (7). The dependent variable is firm debt measured in natural logarithm. *Equity Capital* is firm equity also in logarithm. *Real Interest Rate* is the difference between the lending rate and the inflation rate. *Political Unrest* and *Arab Spring* are dummy variables for countries in which there is political unrest and where Arab Spring took place, respectively. *GCC* is a dummy variable equal to 1 if the country belongs to the GCC. Omitted sectors include Agriculture; Chemicals, Rubber, Plastics, and Non-metallic products; Consumer Goods, Education, Health Care, Information Technology, Leisure and Tourism, Machinery, Equipment, Furniture, Recycling; Media; Metals & Metal Products; Mining and Metals, Power and Utilities, Retail; Services; Wholesale & Retail Trade; and Wood, Cork, and Paper. *Firm Age* is the age of the firm since its establishment; *Employees* denote the number of employees; and *SME* is a dummy variable for firms with less than $5 million in sales. All models assume a truncated normal distribution for the residuals. Year effects and a constant term are included in all regressions but not reported. *, **, and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

The results in Table 5 point to lower credit limits in countries that experience severe political unrest. Interestingly, the Arab Spring dummy is positive and highly significant implying that, ceteris paribus, Arab Spring countries enjoyed on average higher credit limits than other firms in the region prior to the start of Arab Spring. The result may be surprising, but seems consistent with Acemoglu and Robinson's (2012) "virtuous circle" hypothesis of revolutions. According to the authors, the most likely candidates for revolutions are not the poorest countries; rather, a shift from an oppressive regime towards democracy is more likely to occur following globalization and the opening up of markets, as motivation by the elite to maintain a repressive regime diminishes. Our finding that Arab Spring countries enjoyed higher credit limits prior to uprisings suggests that political institutions in these countries may have become less "extractive" and that "inclusive" institutions may have started to emerge, thus paving the way for economic success.

The estimations also indicate that firms in the GCC countries enjoy better credit conditions than elsewhere in the region. We find only small variation in credit limits over time (year dummies are not reported), suggesting that credit conditions in the MENA region remained relatively stable over the study period despite the global financial turmoil.

We also observe sectoral effects in Table 5, indicating significant differences in credit constraints across sectors. The negative sign on the coefficients of the various key industries indicate low borrowing constraints relative to the 'benchmark' category, consisting of industries for which sector dummies are not included. This benchmark category spans diverse industries for which there are few observations.[6] Comparing the magnitude of the estimated coefficients, we note that, among the reported sectors, credit limits are lowest for companies in telecommunication, while firms in the construction sector enjoy significantly higher credit limits relative to other sectors, corroborating the optimism and boom that the real estate sector witnessed recently, especially in Kuwait and the UAE.

Models *CL2*-*CL4* include additional firm-level controls. From Model *CL2*, age differences are insignificant across firms, probably because the latter already comprise a select group of creditworthy borrowers. Models *CL3* and *CL4* provide further evidence of scale economies in borrowing. Firms with a larger number of employees are likely to enjoy higher credit limits compared to firms which employ a smaller number. Also, in line with survey-based evidence provided by Rocha, Arvai, and Farazi (2011), SMEs in the MENA region appear to be more financially constrained compared to larger companies. We also estimated the models with current profitability, but the coefficient is insignificant and is therefore not shown; it could be that profits are already accounted for in firm equity capital as retained earnings.

[6] The benchmark group includes agriculture; chemicals, rubber, plastics, and non-metallic products; consumer goods; education; health care; information technology; leisure and tourism; machinery, equipment, furniture, and recycling; media; metals and metal products; mining and metals; power and utilities; retail; services; wholesale and retail trade; and wood, cork, and paper.

Finally, we compute the credit limits estimates using the stochastic frontier *CL1* regression results of Table 5. We report descriptive statistics on the ratio of total-debt-to-credit limit estimates by country (Panel A), and by sector (Panel B) in Table 6.

Table 6. Descriptive statistics, ratio of total debt to credit limits (in %)

Panel A: By country

Country	Mean	Median	Minimum	Maximum	Standard Deviation
Bahrain	66.69	64.54	37.41	92.57	18.71
Egypt	61.65	58.57	24.96	99.66	19.73
Iraq	56.65	52.19	21.8	99.31	21.73
Jordan	67.63	68.83	21.77	99.62	20.33
Kuwait	61.95	58.95	21.85	99.42	21.94
Lebanon	55.04	60.09	30.28	69.7	17.69
Morocco	55.93	50.35	21.06	99.85	22.87
Oman	58.56	55.29	24.64	99.42	20.82
Qatar	62.12	67.29	29.38	91.54	19.17
Saudi Arabia	63.42	63.69	24.05	99.9	20.44
Syrian Arab Republic	62.76	60.69	39.65	88.74	18.34
Tunisia	59.4	52.65	25.36	99.68	21.17
United Arab Emirates	59.53	57.36	26.98	95.13	19.62
West Bank & Gaza	69.97	74.61	51.48	79.2	12.63
Average	*61.52*	*60.36*	*28.62*	*93.84*	*19.66*

Panel B: By sector

Primary Sector	Mean	Median	Minimum	Maximum	Standard Deviation
Construction	56.93	55.43	37.93	84.63	14.44
Food and Beverages	62.21	60.1	21.06	99.78	21.11
Industrial Manufacturin	61.36	59.67	21.8	99.85	20.26
Oil and Gas	61.87	62.85	26.87	99.42	21.2
Real Estate	63.39	63.38	21.77	99.8	22.81
Telecommunications	61.08	59	27.83	99.54	20.53
Transportation	60.77	57.28	25.36	99.68	19.95
Other Sectors	56.78	56.26	37.36	74.37	12.72
Average	*60.55*	*59.25*	*27.5*	*94.63*	*19.13*

Table 6 illustrates the scale and distribution of credit limits in MENA, indicating that firm debt amounts on average to about 60 percent of credit limits. This ratio varies between 55 (Lebanon) to 70 percent (West Bank and Gaza) but exhibits lower variability across industries. The same remark can be made when using median values, suggesting a limited role for possible outliers. There is, however, larger variation between the minimum and maximum debt to credit limits ratio across firms, suggesting heterogeneity in the use of financing.

B. Capital Accumulation

Using the standard method by Jondrow et al. (1982), we compute the estimates $\widehat{CL}_{i,t-1}$ and $\widehat{DL}_{i,t-1}$ for each stochastic frontier specification *CL1-CL4* from Table 5. We insert these derived values into equation (5), estimate respective models *K1-K4* by dynamic pooled OLS regression models, and present the estimation results for the capital accumulation equation (5) in Table 7.

Table 7. Capital accumulation models

Variables	Model *K1*	Model *K2*	Model *K3*	Model *K4*
Fixed Assets, Lagged	0.994***	0.995***	0.995***	0.994***
	[0.0351]	[0.0351]	[0.0356]	[0.0353]
Real Interest Rate, Change	0.00824	0.00822	0.00672	0.00806
	[0.00565]	[0.00564]	[0.00568]	[0.00564]
Credit Limit, Lagged Change	0.392**	0.400**	0.395**	0.402**
	[0.185]	[0.184]	[0.190]	[0.177]
Distance from Limit, Lagged Change	-0.0235	-0.028	-0.0225	-0.0268
	[0.0306]	[0.0305]	[0.0314]	[0.0312]
Political Unrest	0.469	0.458	0.461	0.462
	[0.366]	[0.367]	[0.366]	[0.364]
Arab Spring	0.107	0.108	0.122	0.093
	[0.0797]	[0.0799]	[0.0871]	[0.0799]
GCC	-0.312***	-0.302**	-0.315***	-0.315***
	[0.118]	[0.118]	[0.119]	[0.118]
Manufacturing Industry	0.135*	0.122	0.119	0.138*
	[0.0782]	[0.0775]	[0.0803]	[0.0784]
Transportation	0.0917	0.0789	0.0913	0.0866
	[0.0747]	[0.0737]	[0.0766]	[0.0756]
Real Estate	-0.338**	-0.351**	-0.348**	-0.334**
	[0.152]	[0.151]	[0.158]	[0.151]
Food and Beverages	-0.0395	-0.0505	-0.0554	-0.0394
	[0.0647]	[0.0640]	[0.0655]	[0.0648]
Telecommunications	0.12	0.106	0.104	0.12
	[0.133]	[0.133]	[0.132]	[0.133]
Construction	0.580**	0.563**	0.574**	0.577**
	[0.240]	[0.239]	[0.241]	[0.240]
Oil and Gas	0.228**	0.211**	0.220**	0.226**
	[0.103]	[0.103]	[0.101]	[0.103]
Observations	382	381	370	382
Adjusted R2	0.89	0.89	0.89	0.89
F-Statistic	214.98	214.88	205.8	213.51
Log Likelihood	-541.81	-540.51	-530.23	-541.5

The estimations follow equation (5). The dependent variable is *Fixed Assets* in natural logarithms. *Real Interest Rate* is the difference between the lending rate and the inflation rate. *Credit Limit* and *Distance from Limit* are estimated from equation (7). *Political Unrest* and *Arab Spring* are dummy variables for countries in which there is political unrest and where Arab Spring took place, respectively. *GCC* is a dummy variable equal to 1 if the country belongs to the GCC. Omitted sectors include Agriculture; Chemicals, Rubber, Plastics, and Non-metallic products; Consumer Goods; Education; Health Care; Information Technology; Leisure and Tourism;

Machinery, Equipment, Furniture, and Recycling; Media; Metals & Metal Products; Mining and Metals; Power and Utilities; Retail; Services; Wholesale & Retail Trade; and Wood, Cork, and Paper. A constant term is included in all regressions but not reported. Robust standard errors are reported in brackets. *, **, and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

In Table 7, the regressed variable is the firm's fixed assets, used as proxy for capital. All four models *K1* to *K4* include as explanatory variables lagged fixed assets, the change in the real rate of interest, the lagged change in credit limits (CL) and the distance from the credit limit (DL). We also incorporate dummy variables for Arab spring countries, other countries with political unrest, the GCC region, and sector of economic activity.

In line with theoretical prediction, the marginal effect of lagged capital is very close to unity in magnitude across all models. Of main interest is the positive and highly significant marginal effect of the lagged change in credit limits—its magnitude is also economically large, ranging between 0.4 and 0.48. We interpret these coefficients in two ways: one, the results imply that between 40 to 48 percent of firms in MENA are credit constrained;[7] and two, a change in credit limits by one unit is likely to contribute between 40 and 48 percent increase in capital accumulation in the following year. The estimations therefore support the view that improvements in credit conditions may significantly contribute to firm growth and more broadly to economic development in the region.

Table 7 results also show that $\alpha_{\Delta DL}$ is insignificant across all models, in line with the predictions of KM that investment conditions are not affected by credit constraints unless the latter are binding. Therefore, any unused portion of the credit limit (positive domain for *DL* in our model) is not a binding financial constraint and has no effect on capital accumulation. The alternative view by Stiglitz and Weiss (1981) and Bernanke, Gertler, and Gilchrist (1999) contends that, in efficient and well-functioning credit markets, the interest rate charged on the debt would rise as *DL* falls (since higher leverage depicted by getting closer to the credit limit pushes firms closer to bankruptcy), thereby exerting a pressure on firms to curtail investments. The results suggest that interest rates on loans may be insensitive to bankruptcy risk in MENA, probably due to poor credit risk assessment mechanisms that would otherwise require risk premiums that are commensurate with the credit quality of borrowers. Indeed, the MENA region lags behind in terms of judicial enforcement, coverage of credit bureaus and public registries, and availability of historical financial data on companies (Rocha, Arvai, and Farazi, 2011).

The parameter estimates for political unrest and Arab Spring countries are both insignificant in the capital accumulation models implying that the dynamics of capital accumulation are not directly affected by continued political instability in MENA in line with Bloom (2009). However, since these two variables are significant determinants in the credit limit regressions of Table 5, changes in political unrest and Arab spring have a significant effect on credit limits and, consequently, on capital accumulation. The results therefore suggest that the

[7] This interpretation is not at variance with Table 6, since the estimates of *DL* for individual firms are expected values.

effect of political instability on economic developments operates mainly through the 'credit channel' by influencing firms' access to credit.

Further, the GCC dummy in Table 7 is negative and significant across all models, indicating that the dynamics of capital accumulation differ among GCC and other regional countries. Whereas investment in the oil and gas sector requires substantial real capital, the less-diversified GCC economic base may account for the negative sign on the GCC dummy variable. We also find that investment is higher in the oil and gas and construction sectors relative to other sectors, followed by a marginally more pronounced investment in the industrial manufacturing sector. Investment in real estate is less intensive than in other sectors, probably due to the real estate bubble that some MENA countries experienced in 2008.

V. Robustness Checks

We check for the sensitivity of our results to a number of alternative specifications.[8] We first investigate the robustness of the results by including additional lags in real capital, higher order terms, individual country effects, as well as additional explanatory variables such as the change in consumer prices. Our results are robust to these alternative specifications.

We also confirm the robustness of our results to alternative credit limit estimates by assuming different distributions for *DL* (truncated normal, exponential, or half normal), including higher-order terms for our main variables of interest, and considering variable effects of equity capital across sectors and countries. We use short-term debt as an alternative endogenous variable, consider alternative indicators of firm size (total assets) and short-term interest rates, control for firm profitability, and replace the GCC dummy with individual country dummies. Our main findings are maintained.

Further, we explore the impact of estimation error in *CL* and *DL* in the second stage regression results using standard errors-in-variables techniques (Murphy and Topel, 1985). The qualitative results are not affected by the change in estimation method. In errors-in-variables regressions, the quantitative impact of credit constraints on capital accumulation is even larger than in the baseline regression.

Finally, the results are robust to including countries and sectors with few firms and observations.

VI. Conclusions

This paper investigates the complex interactions between credit constraints, political unrest, and capital accumulation. We estimate the seminal dynamic model of capital accumulation of Kiyotaki and Moore (1997) by means of a novel two-step empirical approach and using a unique data set on firms from the MENA, a region with a number of countries experiencing

[8] The tabulations of the robustness checks are available upon request from the authors.

political instability. We first employ the SFA methodology to estimate credit limits and then quantify the effect of these limits on capital accumulation.

Three main findings stand out. First, credit conditions exhibit a significant and economically large impact on capital accumulation. Our estimate of the marginal effect of a change in credit limits on capital accumulation is about 40 percent, suggesting that improved financing conditions are likely to be key for macroeconomic development in the region. Second, political upheaval has a significant negative effect on credit constraints and thereby indirectly on capital accumulation. Third, the analysis of our firm-level sample that ends right before the onset of the Arab Spring suggests that political unrest may more likely to erupt after some level of financial development has been reached.

This paper documents a channel through which political development may affect economic growth. Political turmoil related to regime change tightens credit constraints. In the absence of conducive financial systems, countries inevitably fail to deliver the economic outcomes that are expected of them. Further economic declines fuel social and political unrest, driving the financial and economic systems deeper into trouble and increasing the probability of reestablishing an autocratic government. In light of recent major political and socio-economic changes, it is of paramount importance to target financial inclusion in the MENA region and relax firm financing constraints as a means to foster private sector development, thereby paving the ground for democratic development.

Appendix

Capital accumulation for credit constrained firms in Kiyotaki and Moore (1997)
This appendix derives a dynamic capital accumulation equation for credit constrained firms, using equilibrium conditions for 'farmers' as in Kiyotaki and Moore (1997). For ease of comparison, we use KM's notation and then map equations to our own notation at the end. The variables are: k=capital; q=capital price; b=borrowing; R=real interest rate; a=traded output. Equilibrium values are denoted by *.
The borrowing constraint is characterized (page 218 eq 3) by:

$$b_t < \frac{q_{t+1}}{R} k_t \qquad \text{(A1)}$$

The equilibrium is characterized (page 220, around eq 7) by:

$$\begin{aligned} b_t * &= \frac{q_{t+1} k_t}{R} \\ k_t * &= \frac{1}{q_t - \frac{1}{R} q_{t+1}} [(a + q_t) k_{t-1} - R b_{t-1}] \end{aligned} \qquad \text{(A2)}$$

where the denominator $q_t - \frac{1}{R} q_{t+1}$ is taken to be positive. Define credit limit $cl_t \equiv \frac{q_{t+1}}{R} k_t$, which is binding under (A2) as appropriate under Kiyotaki and Moore (1997). The equilibrium relationship between capital and the credit limit can be derived by manipulating the lower part of (A2). First insert b* into k* and simplify:

$$\begin{aligned} k_t * &= \frac{1}{q_t - \frac{1}{R} q_{t+1}} [(a + q_t) k_{t-1} - R b_{t-1}] \\ &= \frac{1}{q_t - \frac{1}{R} q_{t+1}} \left[(a + q_t) k_{t-1} - R \frac{q_t}{R} k_{t-1} \right] \\ &= \frac{a}{q_t - \frac{1}{R} q_{t+1}} k_{t-1} \end{aligned}$$

Then divide and multiply the rightmost expression by $\frac{R}{q_t}$, and insert cl:

$$\begin{aligned} k_t * &= \frac{a}{q_t - \frac{1}{R} q_{t+1}} \frac{R}{q_t} \frac{q_t k_{t-1}}{R} \\ &= \frac{aR}{q_t \left(q_t - \frac{1}{R} q_{t+1} \right)} cl_{t-1} \end{aligned} \qquad \text{(A3)}$$

In the body of the text, we use capital K=ln(k) and the credit limit CL=ln(cl) in logarithmic form. Equation (A3) then becomes:

$$K_t * = \varphi_t + CL_{t-1} \qquad \text{(A4)}$$

where $\varphi_t \equiv ln \left(\frac{aR}{q_t \left(q_t - \frac{1}{R} q_{t+1} \right)} \right)$. Interpreting this result, the proportionality factor □ between the capital stock and the credit limit varies in time with capital goods prices.

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