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High and Persistent Skilled Unemployment In Morocco: Explaining it by Skills Mismatch

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List of Abbreviations:

- AfDB: African Development Bank
- CEDEFOP: European Center for the Development of Vocational Training
- CESCSE – INE: Conseil Économique et Social and Conseil Supérieur de l'Enseignement - Instance Nationale d'Évaluation
- HCP: Haut Commissariat au Plan
- IMF: International Monetary Fund
- Non-STEM: non Science-Technology-Engineering and Mathematics (essentially, Humanities and other Social Science)
- STEM: Science-Technology-Engineering and Mathematics

Abstract

This paper sheds light on the increasing and persistent skilled unemployment in Morocco over the past decade – oscillating around 20% of total unemployment. It identifies and estimates the role and significance of a skill mismatch between Morocco's education system and its labor market, illustrated by the ratio between technical and general university degrees produced by the education system. The paper finds supporting evidence that a skill mismatch does play a significant role in explaining Morocco's increasing skilled unemployment in a context of on-going structural reforms.

High and Persistent Skilled Unemployment In Morocco: Explaining it by Skills Mismatch

1. Introduction: the growing problem of skilled unemployment in Morocco

Since the early 2000s, when labor market data disaggregated by educational level became available, Morocco faces high and persistent skilled labor unemployment (unemployment for individuals with a university degree and above) with rates oscillating between 20 and 28% (as a percentage of total unemployment according to the Haut Commissariat au Plan - HCP). Such high levels of skilled unemployment present an important challenge for social welfare as it hampers the efficiency of resource allocation not only to education, but also to the broader economy. What can explain such high levels of skilled unemployment in a middle-income country (MIC) such as Morocco?

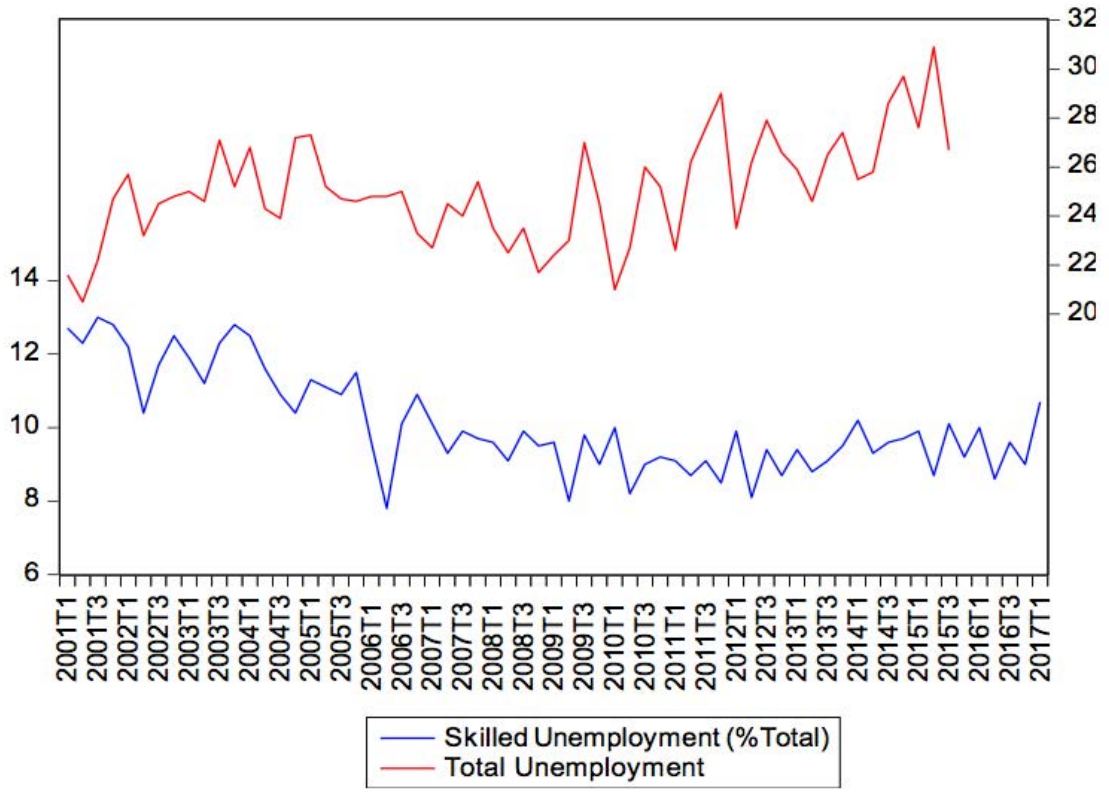
One piece of evidence is the increasing number of students with non-technical[1] university degrees entering the labor market and unable to find employment. This might be the consequence of massive increases in tertiary enrollments over the past decade that seems to have made what was initially a relatively small component of unemployment evolve into a more persistent problem of skills mismatch. This might also be related to the structural transformations of the Moroccan economy with a fiscal consolidation process that decreased formal public sector hiring. While the former entailed shifting to a more diversified and open economy, perhaps it did not materialize fast enough to boost skilled job creation and openings. Thus, the latter might have reduced part of the demand for university graduates.

In theory, skilled labor is considered more employable than unskilled labor and should not constitute a large, and/or growing proportion, of total unemployment. However, there can be instances where structural skilled unemployment remains significantly high. Such levels come as a result of (i) search frictions, (ii) skill mismatches, (iii) structural shifts of the economy, (iv) insider-outsider rigidities in labor market settings, or even (v) wait-and-see behavior by workers or employers amongst other causes. Morocco seems to follow such a pattern, combining certain factors mentioned above with more context-specific labor market and tertiary education challenges.

The stylized facts mentioned above are supported by recent reports[2] and data collected from the HCP quarterly reports. Since the end of the early 2000s, Morocco's general and skilled unemployment have evolved in opposite directions. Graph 1 below illustrates this point. Taking more recent quarterly data, general unemployment has been decreasing from around 13% in 2001, to 9 to 10% in 2016, while skilled unemployment as a percentage of total unemployment has been increasing from around 20 to 22% in 2001 to nearly 26 to 28% in 2015-16.

1. University degrees in less demanded areas such as Humanities and Social Sciences, see below for more details
2. IMF article IV (2016), CEDEFOP 2011, AfDB 2011/3, Ahmed 2015, McKinsey (Dobbs et al. 2012), EFA 2015, IMF 2003/2013/2016

Graph 1: Morocco, Total Unemployment Rate (blue, left scale) and Skilled Unemployed as a Percentage of Total Unemployment (red, right scale)



Source: Author, using World Bank and HCP data, see Annex for details

This paper is organized as follows: first, we provide a descriptive account of skilled unemployment in Morocco, while introducing evidence and data set. Second, we conduct a brief literature review following the evidence and explanations concerning skilled unemployment, with a special focus on Morocco and Middle-Income Countries (MICs) in general. Third, we develop an econometric analysis that identifies the impact of indicators of skill mismatch on skilled unemployment in Morocco. Finally, we analyze our results and conclude with some further research directions.

2. Evidence of skilled unemployment in Morocco

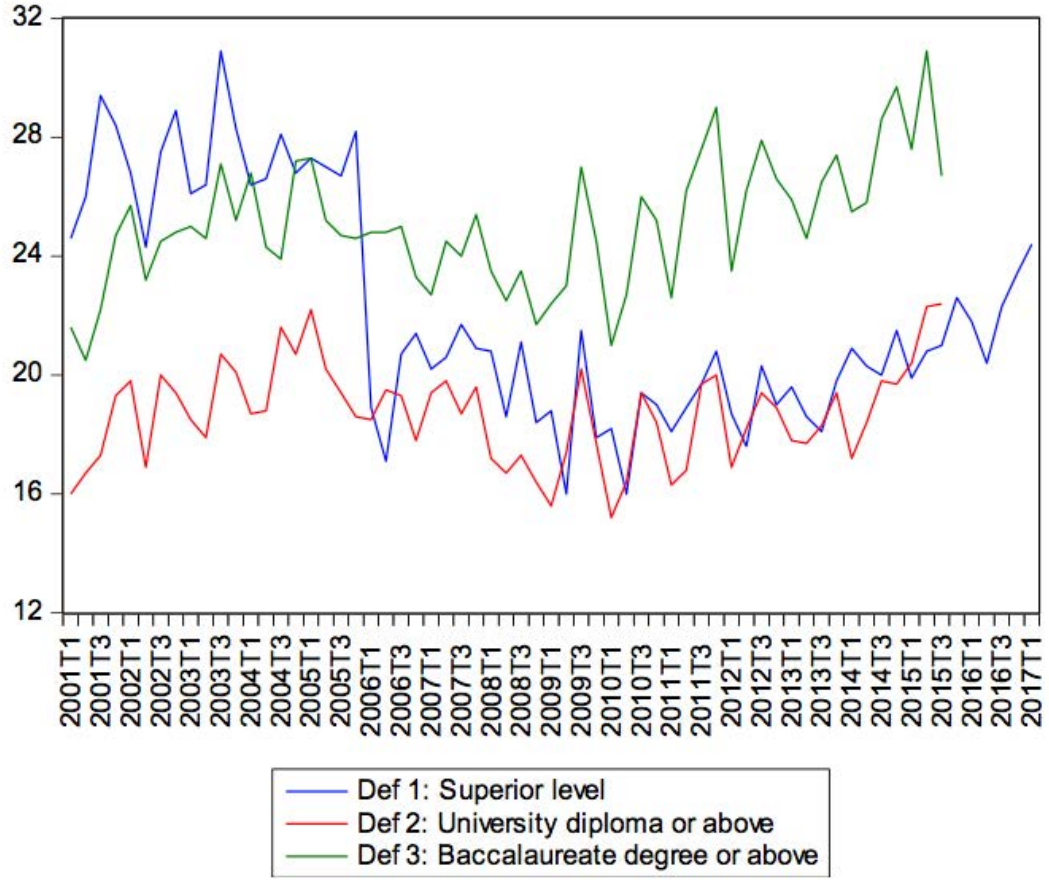
Persistent skilled unemployment in Morocco might come from the following factors: external shocks affecting sectors that employ skilled workers; wait-and-see behavior resulting from past and or existing expectation due to public-sector employment patterns; and high reservation wages that reinforce above-mentioned behavior. In addition, one important factor is what we characterize as an over-supply of non-technical university degrees. This seems to be caused by increased enrollment rates at all levels of education unmatched by the demand for skilled labor. The following section presents specific evidence and literature related to skilled unemployment.

a. A first glance at measures of skilled unemployment in Morocco

First, there are various measures of skilled unemployment in Morocco. Graph 2.a below compares three rate definitions[3] for skilled unemployment as a percentage of total unemployment.

Graph 2.a: Different measures of the shares of skilled unemployment in Morocco (% of total unemployment)

Number of unemployed - by level of diploma – as a percentage of total unemployment by level of diploma according to three definitions of education levels

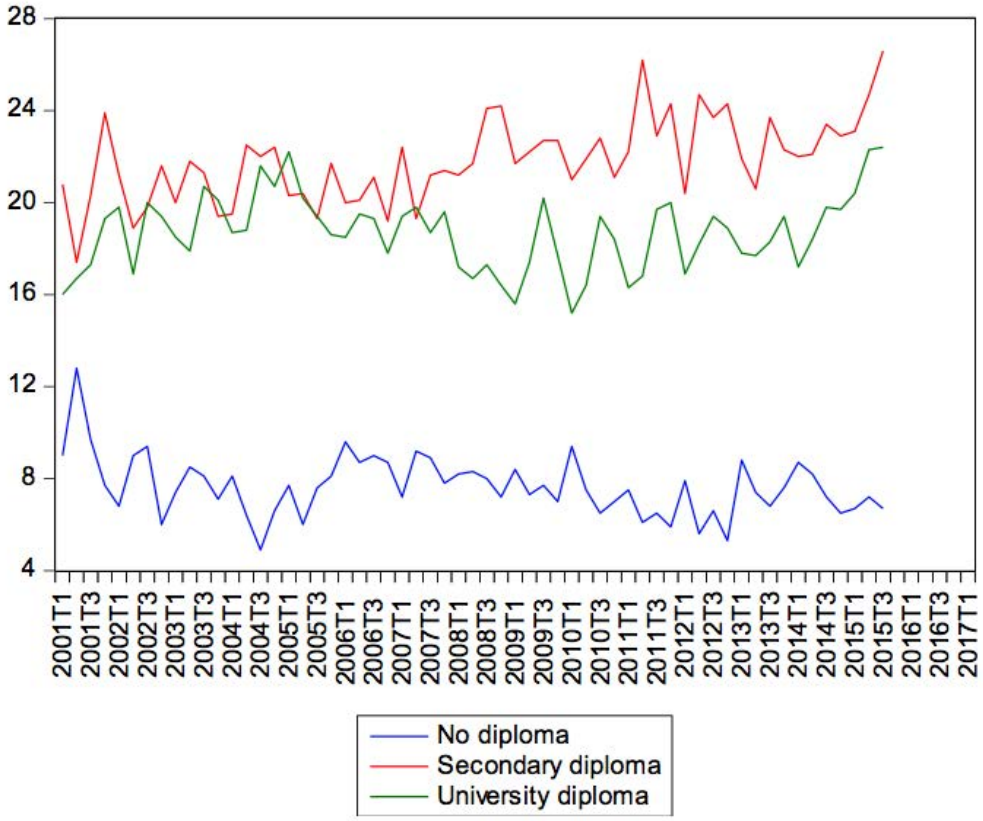


Source: Author, using HCP data

Using definition 2, quarterly data (see below and Annex for details) illustrates the general rising and persistent pattern of skilled unemployment. It confirms a deteriorating trend in recent years. Graph 2.b, below, compares the rates of unskilled (no diploma - green), medium skilled (secondary degree - red), and skilled (tertiary degree - blue) unemployment rates - defined as the number of, respectively, skilled/ medium skilled/unskilled unemployed, as a proportion of the active population aged 15 to 64 (see Annex for definitions). The graph shows that the current labor market conditions in Morocco present a low and decreasing general unemployment rate compared to the high and increasing rates for "medium skilled" and "skilled" parts of the workforce.

3. Definition 1 (blue line in Graph 2.a) appears to suffer from a change in definition as we can see in the breakdown and drop in skilled unemployment between 2005 and 2006. Among all definitions, definition 2 (see Annex) seems to be the most accurate to capture tertiary/university degree level of education and thus skilled unemployment.

Graph 2.b: Share of Unemployed by Level of Education (% of total unemployment) - Definition 2



Source: Author, using HCP data

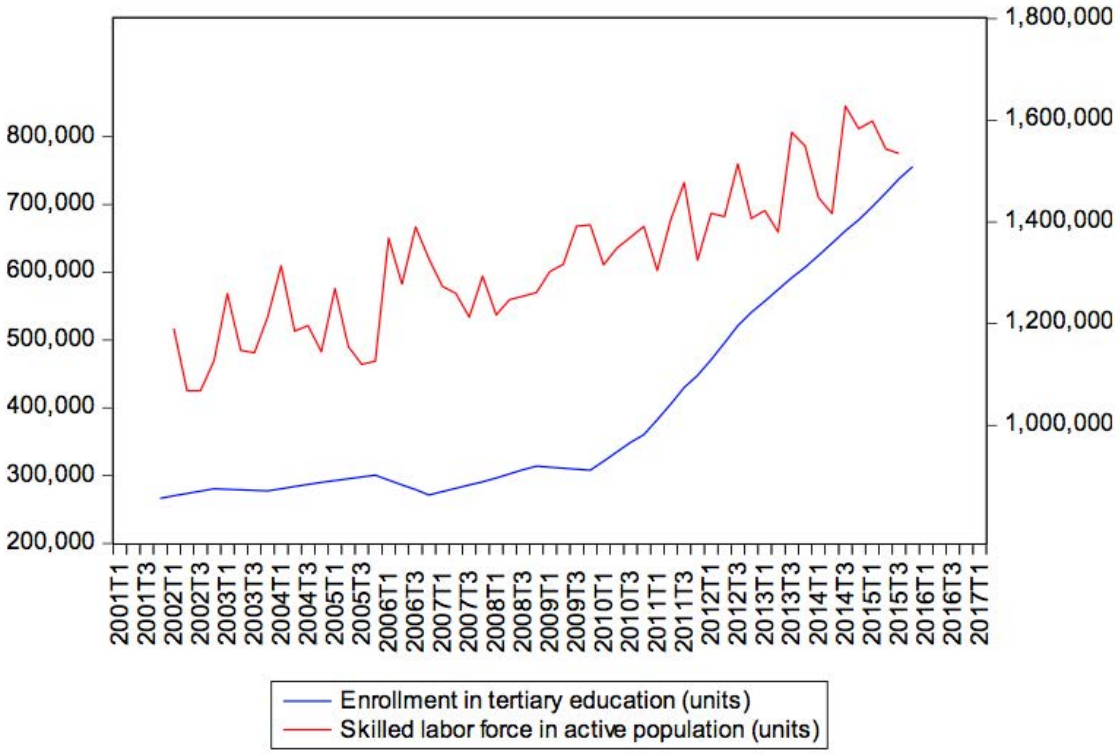
In order to conduct our quantitative analysis, we have constructed a set of quarterly data combining data from the World Bank (WB), the International Monetary Fund (IMF), Morocco's Haut Commissariat au Plan (HCP), and Morocco's Ministère de l'Enseignement Supérieur, de la Recherche Scientifique et de la Formation des Cadres - Statistiques Universitaires. The quarterly data ranges from about 2001 until 2015-2016. For all data on unemployment, we rely on the HCP. However, there are three different measures of skilled unemployment (as a percentage of total unemployment) featured in the HCP reports according to different definitions of educational levels. Regardless of the different definitions characterizing educational levels, unskilled (no school), medium skilled (primary, junior high, secondary school completion), and skilled unemployment (superior/university completion), skilled unemployment remains on the rise, irrespective of the economic cycle.

b. Factors contributing to skilled unemployment in Morocco

A first contributing factor to skilled unemployment in Morocco seems to be an oversupply of skilled labor, as depicted in graph 2.c below. We notice a considerable increase in both tertiary enrollments and skilled labor component of the labor force - over the past ten years with. Graph 2.c therefore illustrates the challenges that both the Moroccan labor market and tertiary education system face: how to reduce skilled unemployment, especially when the current outcome of the education system illustrates a growing supply of university graduates? As an example, we note an increase in tertiary enrollments of nearly 200 thousand between 2010 and 2015 compared to an increased in skilled labor force of 500 thousand for the same period. Such trends are unlikely to address and control the rise in skilled unemployment moving forward.

In the absence of skill premia data, and since labor demand is latent and not directly observable, anecdotal evidence could suggest that (i) either demand in the labor market for STEM-type degree holders is higher than that of non-STEM degree holders, or (ii) employers use STEM-type degrees as a cut-off criteria to define minimum levels of qualifications prior to hiring.

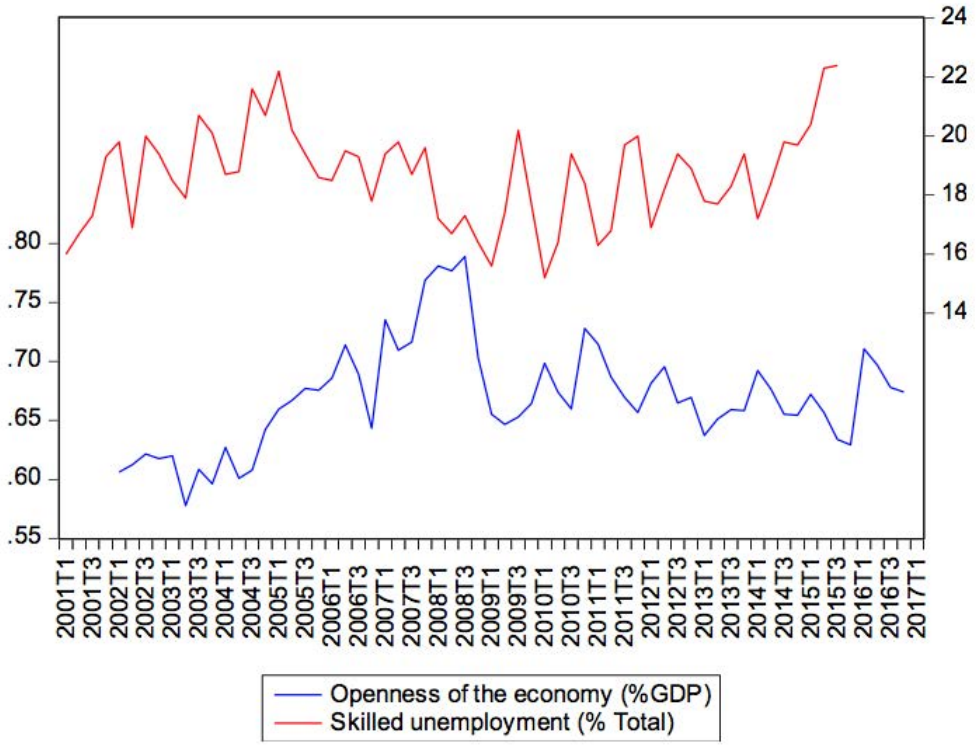
Graph 2.c: Skilled Labor Force (blue, right axis) and Tertiary Enrollments (red, left axis)



Source: Author, calculated using World Bank and HCP data

A second contributing factor that might help in explaining the rise in skilled unemployment in Morocco is the change in the economy's degree of openness, defined as the sum of exports and imports over GDP in Morocco. A reduction in the degree of openness could imply less demand for skilled workers, as depicted in Graph 2.d below. In recent years, trade reforms have contributed to higher economic performance, stimulating competition within local domestic markets, encouraging innovation and creating new jobs. This might be considered one of the main challenges facing the Moroccan economy. The government's current objective is to continue opening its economy to foreign trade while promoting sustainable development - particularly in agriculture. This could allow a further development of rural areas through eco-tourism, for example. This type of trade openness also allows for the economy to increase its competitiveness, facilitate the creation and sustainability of new companies, and therefore, the creation of new formal and high-skilled jobs. However, there might be time-lags before this virtuous process bears fruit.

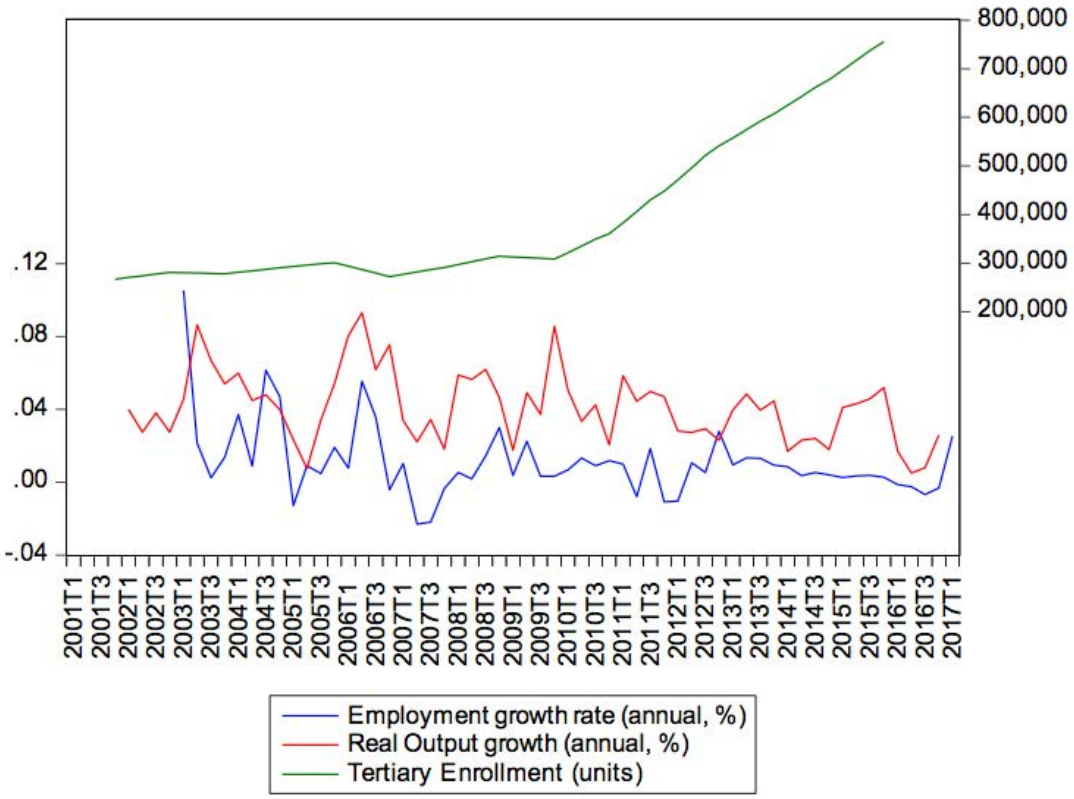
Graph 2.d: Morocco's Structural Shifts, Openness (left axis) and Skilled Unemployment (right axis)



Source: Author, using World Bank and HCP data

A third factor might be related to the skilled-job-creation component of GDP and employment outcomes. Economic activity and output, as shown by Agénor and El Aynaoui (2015), have improved and growth volatility has been reduced in Morocco in recent years (see graph 2.e). Nonetheless, skilled unemployment seemingly continued to increase. This illustrates low levels of skilled-job creation even in the presence of strong and stable growth figures, suggesting that sustainable growth alone is insufficient to reduce skilled unemployment in Morocco.

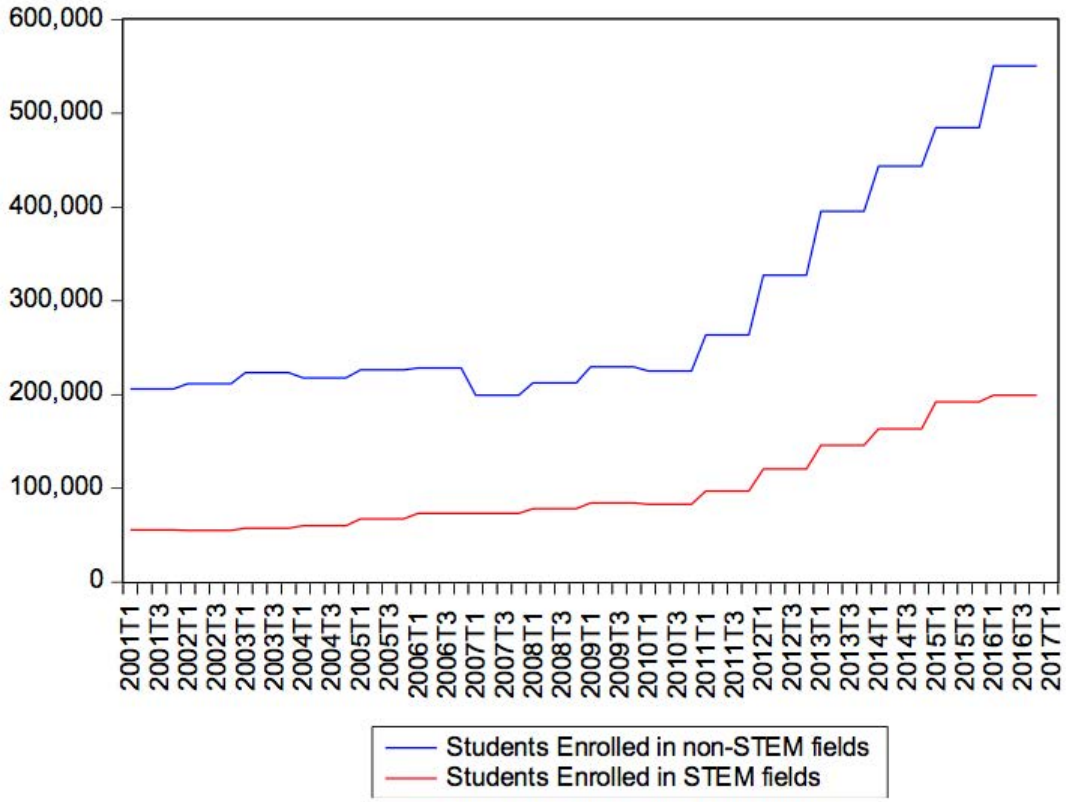
Graph 2.e: Tertiary Enrollment (units, right scale), annualized employment and GDP growth rates (%, left scale)



Source: Author, using World Bank and HCP data

A fourth contributing factor of skilled unemployment is the composition of the skilled graduates. We use the Ministry of Education's data to divide university graduates (which we shall consider as skilled labor) into two groups: Science-Technology-Engineering and Mathematics (or STEM) and non-STEM (or other, essentially Humanities and other Social Sciences) for the sake of assessing skills that are more or less demanded by the labor market. More detail on the different definitions is provided in the Annex. In the absence of additional data on specific skill premia and wage differentials, a reasonable assumption explaining skilled unemployment in Morocco seems to be a mismatch in the composition of skilled workers: "too many" graduates are leaving the education system with non-STEM (humanities and other social sciences) degrees in contrast to "too few" STEM-type degrees (Graph 2.f).

Graph 2.f: Comparison of total tertiary students enrolled in STEM versus non-STEM areas (units)



Source: Author, using World Bank, Ministry of Education and HCP data

3. Literature Review - Skilled Unemployment

These fours contributing factors to skilled unemployment can be related to the literature. There, the traditional explanations for high levels of skilled unemployment are: (a) search frictions, mismatches, and (low) quality of the overall education system; (b) labor market rigidities and skilled worker behavior; (c) shifts in technology and in the productive structure of the economy, as well as external shocks; and (d) an oversupply of (specific) university degrees or skilled labor.

a. Search frictions, mismatches, and low quality of education

Skilled unemployment can be explained by asymmetric and imperfect information during job searching and matching processes carried out by job seekers and firms, as in Pissarides and Diamond (2011, 2013). This approach focuses on unemployment as resulting from a search-and-match-enabling process that defines equilibrium in the labor market. Diamond (2013) also finds that labor markets do not always clear as others might have previously assumed, predicting that there are unemployed individuals in search of work in parallel to firms in search of such workers. This can create a matching unemployed-vacancy setup that does not necessarily find equilibrium. Sahin et al. (2014) find that these occupational mismatches have become more pronounced in the US for college graduates, for example.

These types of mismatches also arise from low-performing primary and secondary education systems that do not fully prepare and equip students with the proper skills needed to suitably transition into universities

and then the labor market. According to the World Bank[4] (2012), Moroccan students are not only scoring low in international tests, but also showing high dropout rates, with 72% of students exiting lower levels of the education system without proper qualifications. According to the IMF (2016 – Article IV), evidence of specific skills mismatch (in undiversified economies and in Morocco specifically) are tied to the rapid increase in enrollment ratios for education systems ill-prepared to maintain the same level of quality for much larger cohorts of students.

b. Labor market rigidities and skilled worker behavior

Agénor and El Aynaoui (2015) identify traditional labor market distortions in Morocco leading to insider-outsider problems, in particular, due to the presence of influential labor unions and a complex regulatory and institutional framework, which tend to be more binding in the formal labor market. These factors could also affect skilled unemployment specifically, as well as total unemployment. Angel Urdinola et al. (2016) also find a rigid regulatory framework that deters job creation with costly hiring and dismissal regulations. Graph 1 above shows a deterioration of skilled unemployment while general unemployment decreases. This suggests that labor market rigidities in Morocco tend to more negatively affect skilled over unskilled workers since the latter can also rely on the informal labor market, given it is less subject to complex regulatory frameworks and elevated hiring and dismissal costs.

Skilled unemployment can also be influenced by workers' job-search-behavior. A "wait-and-see" attitude can depend upon unemployment insurance, benefits and reservation wages. Sánchez-Páramo (2002) studies the effects of unemployment insurance and social assistance payments in the Slovak Republic. Unemployment and its duration appear to be affected by changes in quantity and length of unemployment benefits over time. On the one hand, these benefits seem to facilitate a more active search for employment, serving as a "subsidy for the search process". On the other hand, recipients of such safety programs also show more selective preferences for future jobs, as do university graduates in Morocco[5]. In this case, "wait-and-see" attitudes can be less related to such benefits and more to family support and/or higher reservation wages that might also support such a high and persistent skilled unemployment rates.

Expected wage differentials between public and private sector jobs can play a significant role in workers' search-behavior, affecting skilled unemployment. Over the past decade, university graduates have perhaps found jobs more easily with humanities and social sciences degrees. Even in a more difficult environment, they might have also opted, upon completion of tertiary education, to remain unemployed – waiting for job openings in the public sector. The latter has traditionally offered better pay, higher benefits, and greater job security.

For example, Boudarbat (2006) examines reservation wages in studying the evolution of the determinants of unemployment, status of employment, and wages in Morocco. He finds a deterioration in employment of educated workers after 1983. According to his paper, the data indicate a contraction in skilled employment opportunities, which he believes was meant to trigger increases in self-employment initiatives – an alternative solution to skilled unemployment. Nonetheless, as suggested above, he also explains that university graduates sometimes chose to remain unemployed (even in long-term unemployment) due to preferences towards highly-demanded and selective public formal sector work that offer better wages and benefits.

4. Kingdom of Morocco: Promoting Youth Opportunities and Participation
5. Moroccan students show preference for long term unemployment in order to search and match with a job in the public formal sector.

Similarly, the African Development Bank's report (2013) confirms that Moroccan university graduates still favor prolonged unemployment in part due to high expectation of public sector hire, where wage and benefits are traditionally still better than those of the private sector.

c. Shifts in technology and/or in the productive structure of the economy, structural reforms and external shocks

The CESCSE - INE[6] report recognizes that the Moroccan labor market structure is least favorable for graduate degree holders, due to a weak demand for skilled jobs. Skilled workers are most affected by unemployment as job creation is primarily directed to unskilled workers, resulting in a context where an overwhelming majority of jobs are informal jobs with little, if any, benefits or formal contracts.

External shocks, common in MICs, structural reforms, and the collateral effects of macroeconomic adjustment processes might also have amplified unemployment trends (particularly for youth and skilled workers). As an example, Chaudhuri (2011) describes skilled unemployment in India as the result of an external shock affecting specific sectors highly exposed to global economic downturns and the weakening in external demand for such non-traded goods (e.g. India's IT sector). Although the frequency of shocks in MICs is known to produce growth volatility, the Middle-East and North Africa (MENA) region has managed to obtain strong and stable levels of growth. The region has, however, found it much more difficult to sustain them, illustrated by high growth volatility (IMF 2003). Real per capita GDP growth volatility has been double that of developing countries average. That characteristic implies that agents have a low propensity to invest in the long term, often leading to high levels of unemployment – including skilled unemployment. Despite high levels of growth over the past ten years, job creation in Morocco has not been sufficient and appropriate as can be seen by the large level of "educated" unemployment (IMF 2013). The International Labor Organization (ILO) report - in partnership with the Ministry of Labor and the Spanish Agency for International Cooperation for Development (2014) conclude that growth alone will not and cannot solve unemployment and job creation dilemmas in Morocco.

Structural and other efficiency-related reforms usually aim to improve economic performance by reducing the size of the public sector and its tendency to grow as the "employer-of-last-resort". But, if other structural reforms in labor markets do not complement this process, temporary higher skilled unemployment might arise. Reforms might change the role of the public sector and its social and welfare programs (Dalal 2009). This process might lead to an unequal redistribution of cost and benefits, creating new pressure on both the education and labor markets. Youth unemployment is therefore affected partly by the aftermath of such reforms, but also by the students' soft and hard skill weaknesses, in turn negatively affecting their employability.

Bougroum et al. (2002) note that the restructuring of the Moroccan economy and the reduction of the role of the state as a formal job creator were conducted in parallel to increasing public policies to favor employment. Nonetheless, overly-diverse approaches aimed at substituting the role of the state as employer of last resort were pursued to push graduates into the labor market. This had too little success. Instead, we note an increasing gap between the number of graduates and the vacancies they should fill.

6. Conseil Économique et Social and Conseil Supérieur de l'Enseignement - Instance Nationale d'Évaluation (CESCSE/INE) Employabilité des Jeunes : Les Voies et les Moyens, 2011

d. Over-supply of university graduates with inadequate skills

The outcome of the tertiary education system does not always match labor market demands. This points to what seems to be our skill mismatch, an over-supply of university graduates with generic education but not necessarily the skills that are demanded by hiring firms. This may be compounded by the lack of adequate technical and vocational training programs. Such an over-supply will hamper the employment of skilled workers and the formalization process in Morocco's labor market (EFA 2015).

Pathway (1994) explains the rise in skilled unemployment rates as a result of this kind of over-supply, linked somehow to a decrease in educational costs attributed to ill-targeted government subsidies. He explains that the increasing numbers of "educated" workers juxtaposed to wage rigidities has resulted in the production of what is labelled "too much education" (or, in better terms, an inadequate set of skills). While positive economic progress has magnified the amount of youth cohorts entering the education stemmata's put further pressure on the labor market, increasing the number of skilled job seekers to levels exceeding the economies' absorptive capacity (IMF 2003).

More specifically, the IMF 2013 Selected Issues[7] (IMF 2013) notes that there are, among highly-educated first-time job seekers, unmatched and increased expectations resulting from an unbalanced distribution of specific and more technical degrees demanded by the labor market.

Finally, and once more, Molina et al. (2014) describe a university system that tends to produce graduates mostly in humanities and social sciences[8], which makes them less equipped to secure jobs in the current labor market. Market demand puts the curriculum for such fields as more suitable for academic work and not for corporate jobs. This creates substantial distortions, with shortages of students with more technical, scientific and professional backgrounds.

4. Model for skilled unemployment

In this section, we explain and model skilled unemployment in Morocco, using some of the variables identified previously and present in the literature review, controlling for other cycle-related variables. We pay special attention to relate skilled unemployment to proxy variables representing what we call the mismatch of skills in the labor market. We look specifically into the change in the composition of skilled labor by type of degree – STEM vs. non-STEM-- as a good proxy for the imbalanced supply of skilled workers in Morocco.

As stated above, our main assumption is that educational outcomes in recent years in Morocco seems to have favored an increase in the supply of students with a set of skills that did not match labor market requirements. One way of measuring this is to look at generic university non-STEM degrees (e.g., in general areas of Humanities and Social Sciences) as opposed to more Science-Technology-Engineering and Mathematics degrees (or STEM). This breakdown can also be a criteria that employers use as a minimum

7. Inclusive growth in Morocco: Stylized Facts and Policies, Morocco Selected Issues, May 2013

8. The bias toward choosing non-technical degrees, i.e., humanities and social sciences, could be partially caused by a combination of factors. Our assumption is that a low quality secondary education does not prepare students for STEM-type degrees and selection criteria. These incoming university students therefore choose non-STEM degrees, sometimes aware of the existence of prolonged unemployment risks. Even with such increases in skilled unemployment, students still hope to find public sector employment opportunities (given the State's former role as employer of last resort). Many argue students also follow these types of non-technical degrees as a result of a low quality or often absent TVET system. In sum, our view is that, in some case, the non-STEM degree option is a "choice of last resort" for many Moroccan students that have not benefitted from high quality primary and secondary schooling.

requirement for hire. Therefore, the supply of this specific set of "skilled" labor exceeded labor market demand and made what initially was a frictional addition to unemployment into a structural problem of mismatch of skills for this economy. Hence, our exercise will model skilled unemployment as depending on variables derived from our literature review (e.g., structural shifts in the economy, changes in the openness of the economy measured by the share of exports and imports in GDP), controlling for the economic cycle (e.g., real growth and output gap). Finally, we will test the role and significance of several indicators of the above-mentioned mismatch (e.g., several measures representing an "inadequate supply" of skills in the labor market). Therefore, we test the relationship between skilled unemployment and variables representing the business cycle Yt (GDP growth, output gap, etc.), other control variables Xt (structural shifts in the economy, etc.) and Mt represent our various indicators of mismatch (see Table 1):

$$eq\ (r\_unp\_sk_t) = \alpha\ (Y_t) + \gamma\ (X_t) + \delta\ (M_t) + \beta$$

5. Results

Table 1 below summarizes our results. As expected from the literature review, our results confirm that skilled unemployment[9] is explained by: (i) the economic cycle and activity; (ii) structural shifts in the economy; (iii) the openness of the economy; (iv) structural adjustments (proxied by shifts in the gap in government expenditures); and (v) external shocks (such as fluctuations in the price of phosphate). Moreover, skilled unemployment is also affected by several of our indicators of skill mismatch (e.g., measures representing an "inadequate supply" of skilled labor). They play a significant role in explaining the persistent and increasing levels of skilled unemployment in Morocco. In more detailed fashion, the economic cycle measured by the output gap and or real GDP growth is significant in all our equations. Increases in economic activity reduce skilled unemployment. This is consistent with the idea that -although insufficient- economic growth is necessary for job creation and thus to bring down skilled unemployment.

Structural shifts in the economic structure are also significant in all our equations. These shifts can be proxied by either the employment structure (the industrial sector over the agricultural sector), the production structure (valued-added of non-agricultural sectors over GDP), or the degree of openness (the sum of exports and imports over GDP). All three proxies affect skilled unemployment with the expected sign. As the employment (respectively production) structure shifts away from the agricultural sector into more skills-demanding sectors, skilled unemployment decreases. Similarly, bigger openness of the economy requires more skilled workers and pushes skilled unemployment down.

We also consider a proxy for the fiscal adjustment process under way in Morocco. In the absence of specific figures on public sector employment, we used the deviation of government consumption vis-à-vis, its estimated Hodrick–Prescott trend as a proxy for structural adjustment (e.g. fiscal consolidation). We found that a deviation from the HP trend is significant and leads to an increase in skilled unemployment in all but two of our equations.

We also test the effect of a commodity price boom on Morocco. Earlier we mentioned a negative and cyclical shock affecting specific sectors highly exposed to global economic downturns (India's IT sector, for example). For Morocco, we use the price of phosphate in local currency (MAD) to proxy a variable summarizing an external shock. This variable is significant with a negative sign: as the price of phosphate increases, skill

9. For this exercise, we use definition 2 of skilled unemployment (see Annex). We use quarterly data and correct for seasonal effects using dummies.

unemployment decreases. Given that phosphate is one of Morocco's main export products, its price has an overall positive wealth effect on the economy, due to its effect on government revenue and spending. Phosphate prices also seem to display a residual effect given the model already controls for economic activity. Consequently, this specific commodity price has a negative effect on skilled unemployment.

Then we test our assumption of the relationship of skilled unemployment vis-à-vis our variables of mismatch.

We use first the share of non-STEM students (students pursuing social science degrees) over the amount of skilled employed. Our assumption is confirmed given that the increase in Social Science degree holders as a share of skilled employed pushes skilled unemployment up (Eq.7).

Then, we test the assumption of a "massification" of education that occurred faster than the labor market was capable to absorb: the variable is the share of tertiary enrolled students over the skilled labor force. As it increases, so does skilled unemployment (Eq. 8).

Similarly, as the amount of STEM students as a proportion of total university students increases, skilled unemployment decreases (Eq. 9). This result confirms a mismatch between education system outcome and the labor market capacity: a shortage of STEM students entering the labor market and the oversupply of generic degrees (non-STEM or social science).

Furthermore, we find that increases in the amount of recent STEM degree holders as a percentage of total enrollments brings down skilled unemployment (Eq 10), confirming our assumption that there is a shortage of such degrees in comparison with more "generic" non-STEM degrees offered by higher education institutions.

Finally, in equation (11), using as our "mismatch variable" recent STEM degrees university graduates (those who graduate every year) over the total stock of student enrolled and pursuing non-STEM degrees, we notice a significant reduction in skilled unemployment.

Therefore, our results confirm the sensitivity of skilled unemployment to all the variables listed in our literature review and to our initial assumption of a skill mismatch proxied by a series of such indicators. One of the main drivers of skilled unemployment in Morocco seems to be an oversupply of non-STEM graduate students attempting to enter the labor market. That leads to prolonged and high levels of skilled unemployment (as a percentage of the total unemployment rate). A growing increase in the supply of students with too generic university degrees (non-STEM) made what could have been initially a frictional addition to unemployment evolve into a structural problem of mismatch of skills in a context of an on-going structural transformation of the Moroccan economy.

Table 1. Estimation for the Rate of Skilled Unemployment

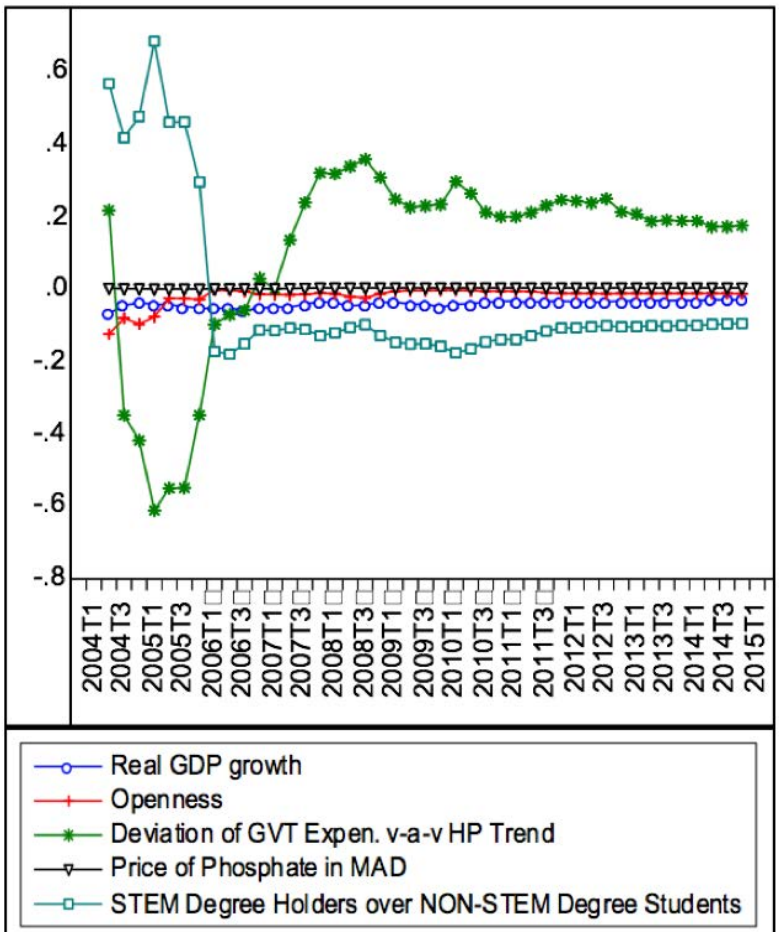
Explanatory variables	Dependent Variable Name: Rate of Skilled Unemployment										
Name	**Eq (1)**	**Eq (2)**	**Eq (3)**	**Eq (4)**	**Eq (5)**	**Eq (6)**	**Eq (7)**	**Eq (8)**	**Eq (9)**	**Eq (10)**	**Eq (11)**
Control Variables (X)											
Lagged Dependent Variable	0.738197 ***	0.6976 ***	0.4755 ***	0.4703 ***	0.3058 ***	0.2992 **					
(standard error)	0.084815	0.08775	0.114	0.12789	0.136	0.1159					
Output Gap		-0.0403 ***	-0.041222 **	-0.02977 **	-0.04812 **	-0.04948 *	-0.05022 **	0.0833 ***	-0.0584 ***		
(standard error)		0.0228 ##	0.021545 ##	0.013909 ##	0.022825 ##	0.2679 ##	0.0215	0.03	0.0255		
Real GDP Growth	-0.0449 ***									-0.0314 **	-0.0332 **
(standard error)	0.01489 ##									0.0166	0.0174
Employment Structure (Industrial/Agricultural)			-0.02389 ***	-0.013835 **	-0.01602 **	-0.01452 **	-0.02352 ***	-0.0289 ***	-0.0129 *		
(standard error)			0.00659	0.006745	0.00773	0.0071	0.00638	0.00618 ##	0.0075 ##		
Production Structure (Non-Agricultural/Total GDP)			-0.0435 **								
(standard error)			0.0182 ##								
Production Structure (Openness)				-0.013705 **	-0.02206 ***	-0.01629 **	-0.01559 **	-0.019 ***	-0.0155 ***	-0.015 ***	-0.0164 ***
(standard error)				0.00628 ###	0.23079 #	0.006446	0.00661	0.0067	0.0063 ##	0.0053	0.0054
Structural Adjt: Deviation of Govt. Cons. v-a-v HP trend					0.2307 **	0.1776 *	0.2908 ***	0.1792	0.1023	0.1539 **	0.1715 ***
(standard error)					0.08725 #	0.1047 ##	0.0877 #	0.1122	0.09	0.0765 ####	0.0796 ####
External Shock (Price of Phosphate in MAD)						-9.59E-05 **	-0.000114 **	-8.17E-05 **		-0.00018 ***	-0.00016 ***
(standard error)						4.59E-05 #	4.55E-05 #	4.47E-05 #		3.43E-05 #	3.68E-05 #
Variables indicating Skills Mismatch/Oversupply (M)											
Non-STEM students over Employed Skilled Labor							0.009696 **				
(standard error)							0.004074 #				
Tertiary Enrollment over Skilled Labor Force								0.00417 *			
(standard error)								0.0025 ##			
STEM students over total students									-0.0536 **		
(standard error)									0.0182 #		
STEM degree holders over Tertiary Enrollment										-0.01701 ***	
(standard error)										0.0264	
STEM degree holders/Non STEM degree students											-0.0984 ***
(standard error)											0.0166
Constant (Yes/No)	Y	Y	Y	Y	Y	Y	Y				
Seasonal Dummy (Yes/No)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
R-Squared	0.6535	0.6139	0.7412	0.7531	0.6339	0.7415	0.6797	0.7713	0.8052	0.8034	0.7865
Adj R-Squared	0.6253	0.5823	0.7067	0.72028	0.58512	0.69455	0.6288	0.7199	0.7672	0.7668	0.7468
Durbin-Watson Stat	1.9118	1.7685	2.156	1.9793	1.8541	1.8075	1.7358	1.5482	1.5051	1.7528	1.6217
Number of observations	54	54	52	54	52	53	52	50	50	52	52

Note: Data estimation period was taken from 2001 to 2015, on a quarterly basis. The dependent variable is the skilled unemployment. The source of the variable Robust standard errors in parentheses.*, **, *** indicate significance at 10%, 5% and 1% level in the first stage regression respectively. Source: Author, using World Bank and HCP data. (#) lagged - 1; (##) lagged - 2; (###) lagged - 3.

Source: Author

As illustrated by graphs 5.a and 5.b, starting around 2005/2006, the explanatory variables (economic cycle and activity; structural shifts in the economy; the openness of the economy; structural adjustments - proxied by shifts in the gap in government expenditures; and external shocks) and our mismatch variable (proxied by the stock of STEM degree holder over non-STEM enrolled students) gained structural significance over time. The stability in our mismatch variable reflects that as the amount of STEM degree holders increases in comparison to the proportion of university students enrolled and pursuing non-STEM curricula, skilled unemployment decreases. Graph 5.a therefore reiterates and confirms our assumption of mismatch between the education system and the labor market. This specific mismatch also shows a structural behavior as the recursive behavior stabilizes.

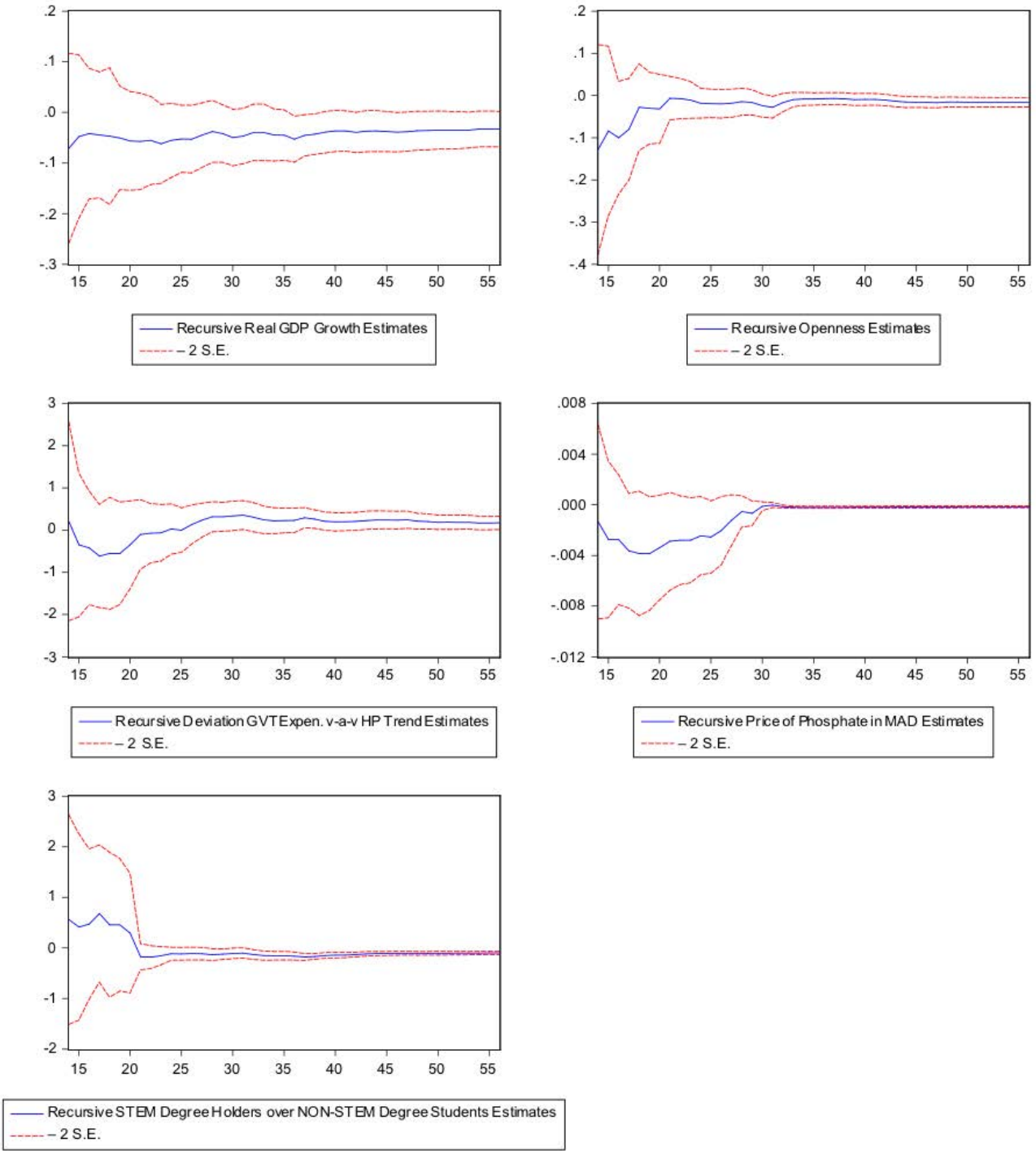
Graph 5.a: Recursive Beta Analysis Over Time



Source: Author

In addition, the below figures show recursive coefficients obtained using an algorithm that (i) considers the first ten observations, (ii) stores the coefficients, and (iii) runs the regression using observations 1–11, observations 1–12, and so on, to then finish with a regression using all observations. Unlike a conventional regression, in which case the number of observations is held constant, a recursive regression holds the starting point fixed and increases the number of observations.

Graph 5.b: Recursive Analysis of the Different Explanatory and Mismatch Variable(s) Betas



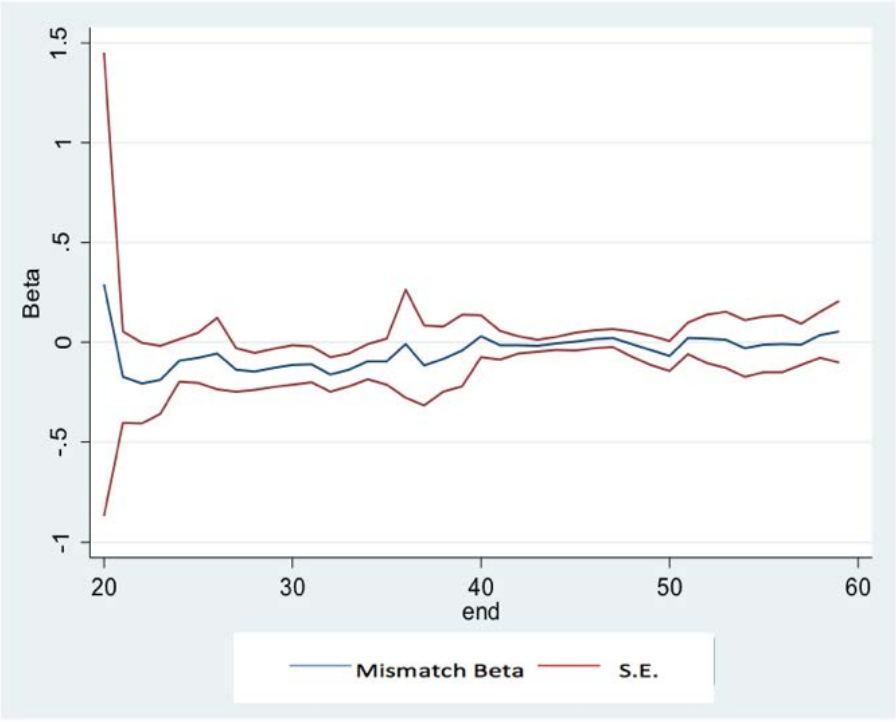
Source: Author

This view enables us to trace the evolution of estimates for our various beta coefficients as more and more of the sample data is used in the estimation. Also shown are the two standard error bands around the estimated coefficients. If the coefficients display significant variation as more data is added to the estimating equation, it is a strong indication of instability. If the coefficients display a smoothing out effect, then it shows stronger stability. In the above representation of eq. 11 (see Table 1), we conclude that the explanatory variables from our model show strong stability. Therefore, it reinforces our assumption that skilled unemployment is explained by (i) the economic cycle and activity; (ii) structural shifts in the economy; (iii) the openness of the economy; (iv) structural adjustments (proxied by shifts in the gap in government

expenditures); and (v) external shocks (such as fluctuations in the price of phosphate). Finally, and more importantly, our mismatch variable - proxied by the stock of STEM degree holder over non-STEM enrolled students - remains within the confidence interval even though the weight slightly decreases towards the end of the period. This confirms the idea that our mismatch variable does contributes to explaining a persistent and increasing levels of skilled unemployment in Morocco.

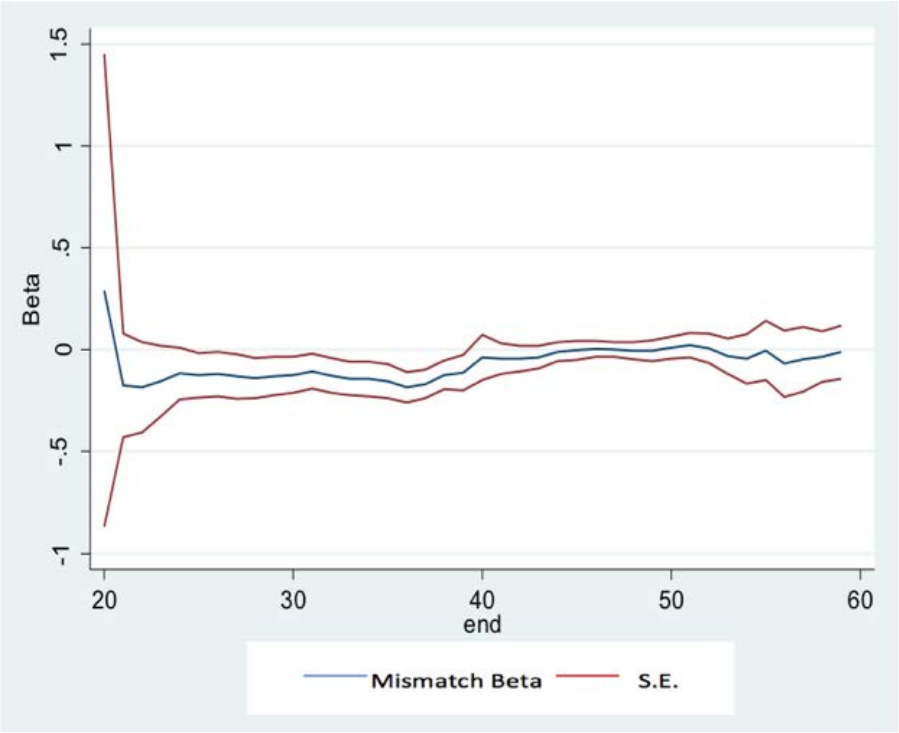
When performing a rolling regression (a regression with a rolling time window of 16 quarters, and then 20 quarters), the results seem to support our hypothesis that the mismatch variable - proxied by the stock of STEM degree holder over non-STEM enrolled students – does play a role in explaining the persistent and increasing skilled unemployment (Graphs 5.c & 5.d). This is true for the first 60 quarters of our sample. Indeed, the value (and variation) of the related coefficient decreases significantly as the end date moves from the 16th quarter to the 20th, and remains more or less stable until the 40th quarter. It significantly loses its unemployment reducing tendency as the coefficient values jump to around 0,9 by the 60th quarter. This observation comes to moderate the conclusions obtained from the recursive regression, and may indicate the influence of the observed jobless growth that occurred since 2011 (see graphs 5.c & 5.d).

Graph 5.c: Mismatch Variable Rolling Regression Window (using 16 quarters)



Source: Author

Graph 5.d: Mismatch Variable Rolling Regression Window (using 20 quarter)



Source: Author

6. Final Remarks and Further Research Directions

In this paper, we have revisited the explanations common in the literature that are relevant to explain skilled unemployment in Morocco. We have also tested the role of new additional variables applicable to Morocco that we believe are significant: mismatches between the outcome of the tertiary education system and the demand coming from the labor market. We did so by creating variables that are proxies for skills mismatches.

First, we show that, as expected, economic cycles (e.g., real GDP growth and the output gap) impact skilled unemployment. Second, structural shifts in the economy (we use employment in the industrial sector compared to the agricultural sector as a proxy and the degree of openness) does reduce skilled unemployment. Third, our proxy for structural adjustment (deviation of government consumption vis-à-vis its HP trend) also impacts skilled unemployment negatively. Fourth, we find that external shocks also positively affect skilled unemployment (e.g., the price of phosphate). Fifth and finally, the rapid growth of tertiary enrollment and seemingly insufficient planning in the composition of university outcomes (skills proxied by the STEM versus non-STEM degrees) have led to a rapid increase in the skilled labor force.

This suggests a skills mismatch between the current outcome of the tertiary education system and the type of demand for skills in the labor market. This hypothesis is confirmed by our estimates and points to the need for a rebalancing of skills produced by the tertiary education system. Such a rebalancing could come from either the traditional academic system or a technical vocational education training system. The latter has shown to be more effective when carefully thought out. More than an issue of STEM versus non-STEM degrees, our results point to a need for better skills-need identification and acquisition prior to entering the tertiary university system. This finding is consistent with previous research on Morocco's

growth strategies and challenges.

Our analysis has been conducted focusing on quantities in the education and labor market structures for skilled unemployment. This is due to the limited amount of data on prices (e.g., wages and skill premia). Naturally, further research using wages by categories of skills would allow for further and more detailed analysis of the skills shortage hypothesis. More detailed data on wages would also permit the study and analysis of skill premia and wage determination in the Moroccan labor market. In turn, this would lead to a better understanding of the various shifts in demand for specific skills. This is a future direction for research.

In addition, to better understand the friction and matching mechanisms between the tertiary education system and the labor market, further research on labor market segmentation and rigidity effects on unemployment (general and skilled) would be warranted. With the recent two-year precautionary and liquidity line (PLL) supported by the IMF and the assistance provided against external shocks (while supporting efforts to strengthen fiscal sustainability), policy-makers could reinforce the focus of public policies on skilled unemployed to raise productivity gains. That would implicate further reflections on the quality of the education system, and could also lead to additional understanding of deficiencies within the education system (early childhood, primary, secondary education, and Technical and Vocational Education Training programs).

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Annex: Data Sources and Definitions

We used the following data sources for our quarterly dataset:

- The Haut Commissariat au Plan (HCP)
- Conseil Supérieur de l'Enseignement – Instance Nationale d'Évaluation du Système d'Éducation et de Formation (Rapport Annuel – 2008)
- Ministère de l'Enseignement Supérieur, de la Recherche Scientifique et de la Formation des Cadres - Statistiques Universitaires
- World Bank Database[10]
- International Monetary Fund (IMF) – IFS (International Financial Statistics) database
- International Labor Organization (ILO)

Total Unemployment Data from of the HCP quarterly report on "Activity, Employment, and Unemployment" (Table 3):

The total unemployment rate is the ratio of unemployed individuals (actively searching for employment and unable to find work) divided by the number of individuals in the labor force. The number of unemployed divided by the labor force aged 15 and over is found in Table 3 of the report while the unit count of unemployment can be found in Table 1.

Skilled Unemployment Data:

The HCP report identifies three types of definitions that characterize unemployment disaggregated by education level. All definitions give the skills subcategories by education level as a share of total unemployment.

The first of these definitions (Table 3) identifies the shares of non-skilled, mid-skilled, and skilled but do

10. http://data.worldbank.org/country/morocco (Tertiary enrolment rate)

not add up to 100%. The data by quarter in definition 1 of skilled unemployment also displays a major jump between 2005T4 and 2006T1 perhaps due to a change in definition.

The second of these definitions (Table 3) identifies the shares of no-education, primary-level education, junior high school education, high school education, and university (or skilled) education level.

The third of these definitions (Table 3) identifies the shares of no-diploma, medium-level diploma, and superior-level (or skilled) diploma. Regarding the definition of skills (medium or superior level of skills), the HCP reports uses the definitions below:

- Medium-level: Certificates of fundamental qualifications, qualifications or professional specialization.[11]
- Superior-level: Baccalaureate, diplomas of middle management and education diplomas (Faculties, Grandes Écoles and Instituts).[12]

Economic Activity, Production Structure and External Shocks Data:

All these variables were either directly extracted from the IMF (International Monetary Fund) IFS (International Financial Statistics) database, or extracted from the "HCP Comptes nationaux : Série des comptes, Base 1998 Croissance sectoriels - Ressources et emplois de biens et services(cvs)" report.[13] The output gap is the deviation of real GDP growth vis-à-vis its HP trend. Openness is the sum of exports and imports divided by GDP. The government consumption gap is the deviation vis-à-vis its HP trend.

Skill Mismatch Variables:

Data for the total number of tertiary diploma holders (yearly between 1999 and 2016) was extracted from the Conseil Superieur de l'Enseignement – Instance Nationale d'Évaluation du Système d'Éducation et de Formation (Atlas du Système d'Éducation et de Formation Volume 3 2008) and the "Ministère de l'Éducation Nationale" (Ministry of National Education). The data is disaggregated by degree category. The total unit count is the sum of these different categories for each year.

Two categories were extracted: the enrolled student unit count (by degree category – STEM or non-STEM) and the recent university diploma holders (STEM and non-STEM)

STEM: Science-Technology-Engineering and Mathematics

This includes the following curriculum categories: Sciences, Sciences & Technology, Medicine & Pharmacy, Dental Medicine, Engineering, Technology.

Non-STEM: Essentially Humanities and other Social Sciences

This includes the following curriculum categories: Original Studies, Law, Social Sciences, and Economics, Humanities, Literature, Business Management, Science of Education, and Translation.

11. Niveau moyen : Certificats de l'enseignement fondamental, diplômes de qualification ou de spécialisation professionnelle
12. Niveau supérieur : Baccalauréat, diplômes de cadres moyens et diplômes de l'enseignement supérieur (facultés, grandes écoles et instituts).
13. http://www.hcp.ma/Comptes-nationaux-Serie-des-comptes-Base-2007-Base-1998_a1560.html

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