Employment-output elasticities determinants: case of cross-section from AMEE

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Abstract

Employment to production intensity is used as indicator for employment. The aim of this paper is to provide new estimates of employment-output elasticities and assess the effect of structural and macroeocnomic policies and demographic indicators on the employment-intensity of growth. Having a sample of 44 countries taken from AMEE (Africa and Middel East Erea; 20 francophone et 24 anglophone countries) over the priod 2000-2017, we propose linear and non linear specifications to assess the role of considered variables. **Linear** models results in majority do not confirm previous empirical results except that of **Trade** openness saying it contributes to explain cross-country variations in employment elasticities which **tend to be higher in more open economies for Francophone countries.** While for Anglophone countries, elasticities are effected only by 15 to 24 years old participant in active population (Tx1524). With **non linear** specifications (Quadratic, Cubic, and/or Augmented Cubic), Structural Policy variables (Labor market policy, Lmp, and Product market policy, Pmp) have **increasing effect** on **elasticities.** Structural reforms have to be complemented by macroeconomic stability policies (less **GDP volatility**) to maximize the effect of structural policies on employment responsiveness. In addition, macroeconomic policies aimed at promoting Foreign direct investment (**FDI**) have significant and positive impact on employment elasticities.

Key words : Employment to product elasticity, Linear model, Cubic model, Quadratic model, Cross section, Africa and Middel East Erea (AMEE).

Jel classification : E24, J21.

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Table of content

List of Figures

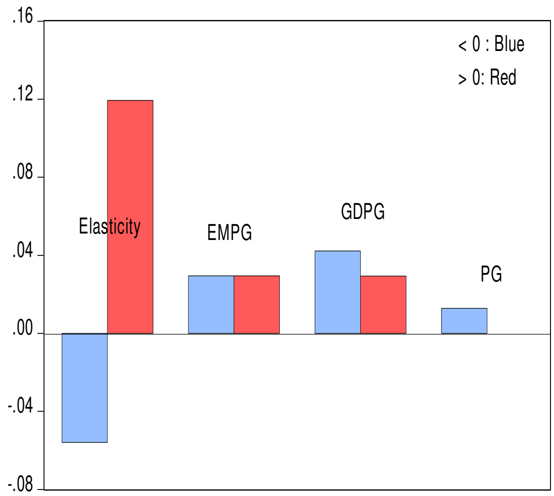
List of Tables

Introduction

Employment-related economic indicators, particularly those that measure the ability of economies to generate sufficient employment opportunities for their populations, often provide valuable insights into economies' overall macroeconomic performance. Among the most widely publicized indicator is the *employment intensity of growth,* or *elasticity of employment with respect to output*.[2] Although researchers have deeply analyzed the impact of real shocks on overall unemployment and the determinants of unemployment ((Bruno & Sachs, 1985); (Blanchard & Wolfers, 2000); (Nickell, Nunziata, & Wolfgang, 2005); (Bernal-Verdugo, Furceri, & Guillaume, 2012a) ; and (Bernal-Verdugo, Furceri, & Guillaume, 2012b) only a few have tried to explain the determinants of employment-output elasticities.

While differences in opinion clearly exist in terms of whether employment-intensive or productivity intensive growth is more desirable from an economic development perspective, (Kapsos, 2005) takes as a central assumption that employment growth and productivity growth *must be jointly pursued* in order to maximize the potential for realizing economic development objectives such as poverty reduction (ILO, 2009). (Kapsos, 2005)'s findings related to determinants of employment elasticities themselves are highly relevant in policy discussions aimed at promoting employment and productivity for economic growth and poverty reduction. In line with Kapsos, our study is an application on N = 44 countries from Africa and Middel East Erea (AMEE). In this sample, we have two group of countries : 20 Francophone countries and 24 Anglophone countries. Period of study is from 2000 to 2017 (T = 18 < N = 44). By OLS technic, we get a cross-section data of elasticities, ε_i, for each country i = 1, …, N. In a first **investigation**, these elasticities (dependent variable ε_i) are grouped on Elasticities for **Francophone** countries and elesticities for **Anglophone** countries. These Elasticities in average, employment growth (EMPG), GDP growth (GDPG), and productivity growth (PG) in average (throw countries) are illustrated at Figure 1 (for Francophone (A) and Anglophone (A) countries).

[2] The most basic definition of this indicator is that it is a numerical measure of how employment varies with economic output; how much employment growth is associated with 1 percentage point of economic growth. Employment elasticities can provide important information about labour markets.

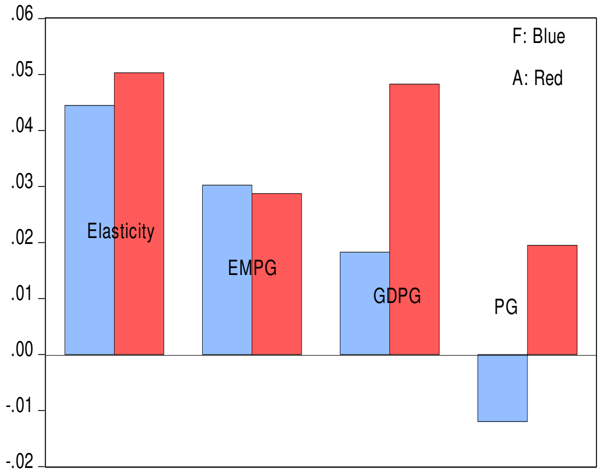


From Figure 1, all averages are positive except productivity growth (PG) for **Francophone** countries. The highest elasticity and GDP growth (GDPG) in average are in **Anglophone** countries where Employment growth (EMPG) is the lowest in average.

Figure 1 : Elasticities, EMPG, GDPG, and PG in average for **A**nglophone (A) and Francophone (F) countries.

An econometric model is then neaded to address why group of countries with negative PG and less GDPG in average have more EMPG and less employment intensity in average ?[3] Or precisely, how Francophone countries **with more EMPG** in mean than Anglophone countries (with **negative PG and less GDPG** in average) have **less** employment intensity in average?

In the second **investigation**, the *employment intensity of growth* (dependent variable ε_i) are grouped on Negative Elasticities and Positive Elesticities. These employment-output Elasticities ε_i, EMPG, GDPG, and productivity growth (PG) in average (**throw countries**) are illustrated at Figure 2.



From Figure 2, countries with Positive elasticities have the lowest GDP growth (GDPG) and Productivity Growth (PG) null in average. Employment Growth (EMPG) in mean is independent of these considered types of elasticities.

Figure 2 : Elasticities, EMPG, GDPG, and PG in average for **countries** with negative (< 0) and positive (> 0) elasticities.

An econometric model is then neaded to address why group of countries with equal EMPG in average have different economic growth and PG in mean and then substantial difference in their employment intensity. Or equivalently, how group of countries with positive employment-output elasticities (having less GDPG and null PG in average) and countries with negative

[3] Linear model will be used for this case.

employment-output elasticities in mean (having more GDPG and positive PG in average) have the same EMPG in average ?

The first broad objective of this present study is to outline the data and methodological requirements for generating estimates of employment elasticities. Linear and non linear econometric models are then considered.

Linear econometric models are developed to compare group of Francophone and Anglophone elasticity evolutions. While nonlinear (Quadratic, Cubic, and Augmented Cubic) econometric models are developed to compare positive and negative elasticity evolutions.

The second objective is then to form a better understanding of the key determinants of employment-output elasticities themselves. The goal is to pinpoint some of the broad structural, macroeconomic, and demographic factors that might influence employment intensity of growth for each type of considered groups.

This paper is organised as follow. After introduction, in section I, we explain how create cross-section data for employment intensity and Data analysis is presented. In section II, methodology is presented for both linear and non linear model. Section III present empirical application for 44 countries from Africa and Middel East Erea. Finally, we conclude by recommanded politic to promote employment.

I Dependent variable creation and Data Analysis

Having employment (E) and gross production (GDP), we began by estimating elasticity of employment to production ε_i. Hence, for each country i, we regress the following equation

$$\ln(E_t) = \alpha + \beta_i \ln(GDP_t) + u_t, \ t = 1, \ldots, T, \quad (1)$$

by OLS. Then,

$$\varepsilon_i = \beta_i, \ i = 1, \ldots, N, \quad (2)$$

is a point estimator for country elasticity (individual i). Thus, an elasticity of 0.7 implies that every 1 % point of GDP growth is associated with a 0.7 % point increase in employment. An elasticity of 1 implies that every 1% point of GDP growth is associated with employment growth of 1 % points, and so forth.

Most of the variables used in the empirical analysis, including employment and real GDP, are taken from the World Bank Development Indicators (WDI) database. Our study is an application on N = 44 countries from AMEE. In this sample, we have 20 Francophone countries and 24 Anglophone countries. The list of considered countries is given in Table A 1 (see Appendice). Period of study is from 2000 to 2017 (T = 18 < N = 44).[4] The list of OLS point estimates of each employment to product elasticity, ε_i, is given in Table A 2 (see Appendice). Independent variables for cross section data are also built : the average of log of each considered time series.[5] Overall, the point estimates for ε_i typically fall in the -1 to 1 range, with the majority of elasticities ranging between -0,1658475 and 0,691423 (see Figure 3) with the highest estimates is found for **Egypte** and the lowest is found for **Mozambique.**

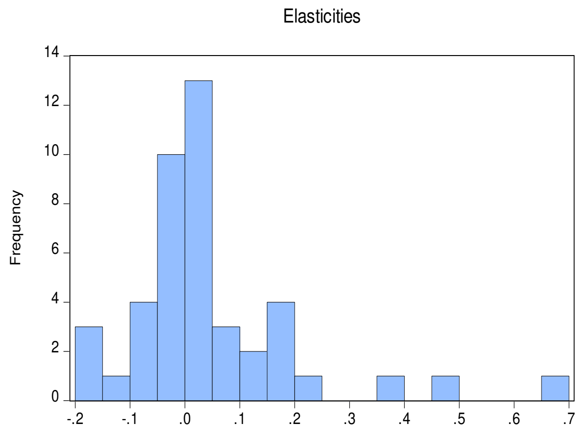


Figure 3. Distribution of Long-Run Employment Elasticities ε_i (Equation (1))

For empirical comparison, these elasticities are grouped **as first investigation** in two classes : (1) class of **Francophone** countries and (2) class of **Anglophone** countries. ε_i for Anglophone countries are more volatil (standard error equal to 0.1857005 > 0.1224894) with also greater average (equal to 0.0503164 > 0.0444785). For **the second case,** elasticities will be grouped in two classes : (1) class of **negative** elasticities and (2) class of **positive** elesticities. Elasticities are from - 0.1658475 to 0.691423 with a positif average of 0.0476628. For negative elastcities, values are from -0.1658475 to -0.0018755 with average equal to -0.0558611, while for positive elasticities, values are from 0.0007784 to 0.691423 with average of 0.1193332 (see Figure B 1 in Appendice). The independent variables are of 3 types : Structural variables: $S = (Lmp,\ Pmp,\ Size)'$, Demographic variables: $D = \left(Pop_{-U}\ , Pop_{-D}\ , Tx1524\right)'$, and Macroeconomic variables: $M = (PIB\_H, Vol\_B, Trade,\ Inflation,\ FDI, VA\_s)'$.

Definition of these variables is given at Table **1**.

[4] Panel Data are balanced annual type.

[5] For each country, we have observations from 2000 to 2017 for each explicative variable.

Table 1 : List of variables : sources and expected signs

Variables	Abreviations	Sources	Expected signs
(D) : Demographic variables			
Urban population	$Pop_{\_U}$	WDI[6]	+/ −
Density of population	$Pop_{\_D}$	WDI	+/−
15-24 year_old participant in active population	Tx1524	WDI	+/−
(S) : Structural and political variables			
Politic of work market	Pmp	EFW[7]	+
Politic of product market	Lmp	EFW	+
Zise of gouvernement (% of PIB)	Size	WDI	+
(M) : Macroeconomic variables			
Openess to trade	Trade	WDI[8]	+
Inflation based on CPI[9]	Inflation	WDI	−
Entries of Foreign Direct Investment (% du PIB)	FDI	WDI	+
Added values for service secteur	Va_s	WDI	+
GDP by capita	$PIB_{\_H}$	WDI	+
Volatility of GDPG	$VOL_{\_B}$	Author calculation	−

All independent variables (in average of log transformations) are significantly uncorrelated, except Trade and $Pop_{\_U}$ (with correlation equal to -0.33). For francophone countries, independent variables are less volatil except for Inflation and Size, see Appendice 2, Table A 3, A 4 and A 5.

From Table 2, maximum values of independent variables (GDP per capita, Trade, FDI, Pmp, Lpm, Tx1524, VA_s, and Size) are for Anglophone countries. Only Max of Inflation and GDP volatility are for Francophone countries. While Min values of these variables are in

[6] World Bank World Development Indicators.
[7] Fraser Institute's Economic Freedom of the World Database.
[8] World Bank World Development Indicators.
[9] CPI : consumer price index.

Francophone countries excetp for Min of Inflation, Min of Pmp, min of Lmp, and Min of VA_s. Anglophone countries are then more stable.

Table 2 : Selected descriptive statistics for Independent variables.

Variable	Max	Country	Min	Country
PIB_{H}	18078,2316	Oman (A)	227,855947	Burundi (F)
Inflation	60,6747081	**Congo, Rép. dém. (F)**	1,07323322	**Zimbabwe (A)**
Trade	144,511791	Lesotho (A)	38,6706056	Burundi (F)
FDI	15,0826601	Mozambique (A)	0,65452242	Burundi (F)
Pmp	8,69086909	Ouganda (A)	3,10636247	**Mozambique (A)**
Lmp	9,75022336	Lesotho (A)	4,98353703	**Zimbabwe (A)**
TX1524	83,1684994	Tanzanie (A)	15,2881668	Comores (F)
VA_s	9,58897848	Rwanda (A)	0,56325717	**Angola (A)**
Vol_{B}	27,0444913	**Madagascar (F)**	1,1849667	Algeria (F)
Size	8,29572653	Libanon (A)	3,99783593	Algeria (F)

1. Francophone vs Anglophone countries analysis

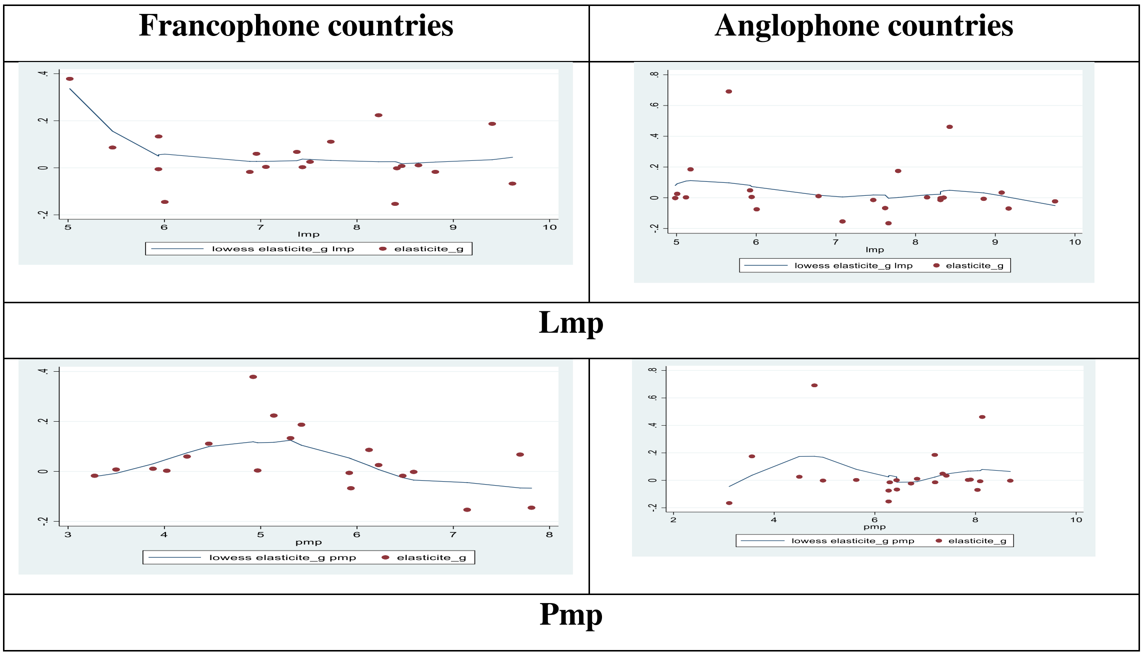
Table 3 present pairwise correlations between the estimated elasticities ε_i and independent variables (the structural and policy variables of interest, and some control variables) for two groups : group of Francophone countries and group of Anglophone countries. Almost all these correlations are not significant except Pop_U for Francophone countries. Looking at Table 3, it emerges clearly that Francophone countries are characterized by **lowe**r flexible labor and product market and **lowe**r government size. Now from Figure 4, there is **linear relationship** between elasticities ε_i and the structural and Lebor market policy variables Lmp for both Francophone and Anglophone countries. While linear relation is less evident between ε_i and Product market policy variable Pmp.These relations can be formally tested by econometrics methods.

Table 3 : Correlation Between ε_i and Structural Policy Variables and other control variables.

Correlations/Countries	**Francophone**	**Anglophone**
$\rho_{(Pmp,\ \varepsilon_i)}$	**−0.293894**(0.2085)	**−0.048305**(0.8268)
$\rho_{(Lmp,\ \varepsilon_i)}$	−0.274937(0.2407)	−0.179925(0.4114)
$\rho_{(Size,\ \varepsilon_i)}$	**−0.124080**(0.6022)	−0.054810(0.8038)
$\rho_{(Tx1524,\ \varepsilon_i)}$	−0.340219 (0.1422)	−0.349185 (0.1024)
$\rho_{(POP\_U,\ \varepsilon_i)}$	**−0.545475 (0.0129)**	−0.016160 (0.9417)
$\rho_{(Inflation,\ \varepsilon_i)}$	**0.073998 (0.7565)**	0.057166 (0.7956)
$\rho_{(Tradee,\ \varepsilon_i)}$	0.219841(0.3807)	0.005625(0.9792)
$\rho_{(VA\_S,\ \varepsilon_i)}$	**0.038704 (0.8713)**	−0.278379 (0.1984)

Note : (.) are p-values.

Figure 4: Nonparametric fit of ε_i on structural and policy variables.



2. Positive vs Negative elasticities analysis

Table 4 present pairwise correlations between the estimated elasticities ε_i, When elasticities are grouped as the second case « whether countries have positive or negative elasticity », and independent variables (the structural and policy variables of interest). Almost all these correlations are not significant execpt for Size (at 10%) for countries with negative $\boldsymbol{\varepsilon_i}$. Again, looking at Table 4, it is clear that countries with positive $\boldsymbol{\varepsilon_i}$ are characterized by **lowe**r flexible labor and product market, and **lowe**r government size. Countries with **negative** elasticities are characterized by **more** volatil GDPG and less population density. While when elasticities are

positive, more elasticity is caracterized by less 15 to 24 years old participant in active population (see Table 5). Again, from Figure 5**,** we conclude that linear relation betwen ε_i and Lmp is evident. While no linear relation is more evident for Pmp and ε_i. More again, these relations can be formally tested by econometrics methods.

Table 4 : Pairwise correlation between ε_i and Structural Policy Variables.[10]

Correlations/Elasticities	$\boldsymbol{\varepsilon_i < 0}$	$\boldsymbol{\varepsilon_i > 0}$
ρ(**Pmp**, ε_i)	**0.128818**(0.6105)	−**0.030709**(0.8816)
ρ (**Lmp**, ε_i)	**0.091021**(0.7195)	−0.151772(0.4592)
ρ(**Size**, ε_i)	**0.407962**(0.0928)	−**0.266282**(0.1885)

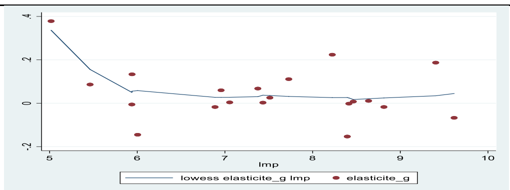
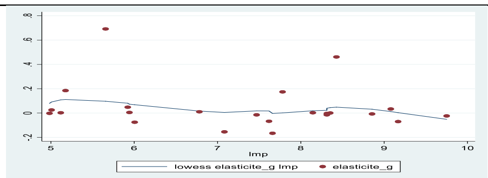
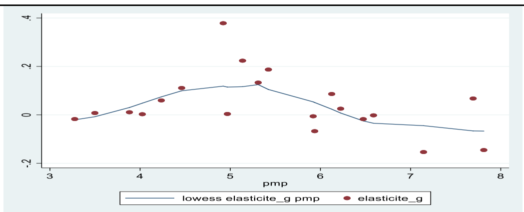
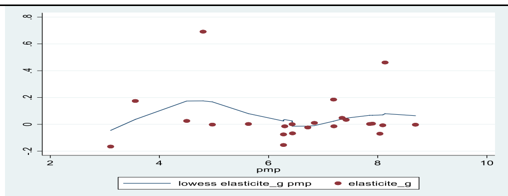
$\boldsymbol{\varepsilon_i < 0}$	$\boldsymbol{\varepsilon_i > 0}$
	
Lmp	
	
Pmp	

Figure 5 : Nonparametric fit of Elasticities on structural and policy variables.

Table 5 : Some significant pairwise correlations between ε_i *and some control variables.*

Correlations/Elasticities	$\boldsymbol{\varepsilon_i < 0}$	$\boldsymbol{\varepsilon_i > 0}$
Volatility	0.469655 (0.0492)	
POP_D	−0.478534 (0.0445)	
TX1524		−0.383895(0.0529)

[10] Note : (.) are p-values.

II Methodology

Once long-term elasticities are estimated, we try to explain their cross-country variations by regressing those estimates on a broad set of explanatory variables that the literature has found to be related to labor market outcomes and employment intensity of growth. For this purpose, the following general model is considered

$$\varepsilon_i = F(\overline{S}_i, \overline{M}_i, \text{and/or} \overline{D}_i)$$

Where F is a **linear or non linear** function, $\overline{S}_i$, $\overline{M}_i$, and $\overline{D}_i$, are respectively vectors of **average** for respectively Stuctural, Macroeconomic, and Demographic variables (noted respectively by S, M, and D) .[11] Precisely, the first group is the structural and political variables

$$S = (\text{Pmp} \quad, \text{Lmp} \quad, \text{Size} \quad)'.$$

The second group is the macroeconomic variables :

$$M = (\text{Trade}, \text{Inflation}, \text{FDI}, \text{VA}_{\_s}, \text{PIB}_{\_H}, VOL_{\_B})'.$$

And, the third group is the demographic one

$$D = (\text{POP}_{\_U}, \text{POP}_{\_D}, \text{Tx1524})'.$$

More precisely, all these abbreviations are defined as follow : For **Structural and political variables (S),[12]** Pmp is Product market Politic, Lmp is Labor market Politic, and Size is Size of government (% of GDP).

For **Macroeconomic variables (M),[13]** Trade is economic openess, Inflation is based on Consumer Price Index (CPI), FDI is Entries of Foreign Direct Investment (% of GDP), Va_s is Added values for service sector, PIB_H is GDP by capita , and Vol_B is Volatility of GDPG.[14] For **Demographic variables (D),[15]** we use Urban population (Pop_U), Density of population

[11] All the regressors have been averaged over the sample time period.

[12] See (Nickell S. , 1998), (Elmeskov & Pichelmann, 1993), (Bassanini & Duval, 2009), (Blanchard & Wolfers, 2000), and (Nunziata, 2002).

[13] See (Ramey & Ramey, 1995), (Padalino & Vivarelli, 1997), (Judson & Orphanides, 1999), (Furceri, 2010) , (Bruno & al., 2001), (Mourre, 2004), and (Imbs, 2007).

[14] The **average annual inflation rate** variable is chosen as control variable to identify whether uncertainty regarding prices impact the labour market to a greater or lesser extent than overall output. Following from (Bruno & al., 2001), the variable Trade corresponding with **economic openness is** chosen to identify whether measures of external balance appear to have any measurable impact on employment intensity.

[15] See (La Porta, Silane, A., & Vishny, 1998).

(Pop_D), and 15-24 years old participant in active population (Tx1524). All these variables are defined in Table 1.

3. Linear specification and **fixed** Marginal effects

If function F in

$$\varepsilon_i = F(\overline{S}_i, \overline{M}_i, \text{and/or} \overline{D}_i)$$

is linear, we can then propose to study the following specifications :

$$M3: \ \varepsilon_i = \alpha + \delta' \overline{S}_i + v_i \ , \ (3)$$

$$M2: \ \varepsilon_i = \alpha + \theta' \overline{M}_i + v_i \ ,$$

$$M1: \ \varepsilon_i = \alpha + \mu' \overline{D}_i + v_i \ ,$$

i=1, ..., N, where v_i is an error (WN), $\alpha, \ \mu', \ \theta', \ and \ \delta'$ are real uncknown parameters, and where

$$\bar{S} = (\overline{\text{Lmp}}, \ \overline{\text{Pmp}}, \ \overline{\text{Size}})'$$
$$\bar{M} = (\overline{\text{PIB}}_{\text{\_H}} \ , \ \overline{\text{Trade}}, \ \overline{\text{Inflation}}, \ \overline{\text{VOL}_\text{B}}, \ \overline{\text{FDI}}, \ \overline{\text{VA\_s}})'$$

and

$$\bar{D} = \left(\overline{\text{POP}}_{\text{\_U}} , \overline{\text{POP}}_{\text{\_D}}, \overline{\text{Tx1524}} \right)',$$

denote empirical averages. Each parameter in vectors $\mu', \ \theta', $ and δ' measure **marginal effect** of corresponding variable on elasticities. In these linear specifications, each effect is then a **fixed Marginal effect**.

We consider also, different specification for different combinaisons of these independent variables as follow : M1.2: $\varepsilon_i = \alpha + \mu' \overline{D}_i + \theta' \overline{M}_i + v_i$, M1.3: $\varepsilon_i = \alpha + \mu' \overline{D}_i + \delta' \overline{S}_i + v_i$, M2.3: $\varepsilon_i = \alpha + \theta' \overline{M}_i + \delta' \overline{S}_i + v_i$, and M1.2.3: $\varepsilon_i = \alpha + \mu' \overline{D}_i + \theta' \overline{M}_i + \delta' \overline{S}_i + v_i$, i=1, …, N.

In this section, ε_i will be grouped in two groups : one for Francophone countries and a second for Anglophone countries to see if these groups may have different elasticity evolutions. This hypothesis will be investigated in section III.

4. Non linear specifications

In this section, two groups are considered: one for countries with **negative** elasticities and a second for countries with **positive** elasticities to see if these groups may have different elasticity evolutions. If in

$$\varepsilon_i = F(\bar{S}_i, \bar{M}_i, \text{and/or} \bar{D}_i)$$

F is not linear, different specifications can then be proposed. Non linearity can take different forms. In this paper, we consider Quadratic and cubic form for the effects of **structural and political variables** on employment elasticities ($\bar{S}_i$). Macro-economic variables ($\bar{M}_i$,) and Demographic variables ($\bar{D}_i$) are considered as control variables.

A. Quadratic Model

Quadratic functions are used quite often in applied economics to capture decreasing or increasing marginal effects of independent variables. If relation F is quadratic, we propose to estimate the following equation

$$\varepsilon_i = \alpha + \beta X_i + \gamma X_i^2 + \theta D_i + u_i \quad (4)$$

where,

$$D_i = \begin{cases} 1 & \text{if } \varepsilon_i > 0 \\ 0 & \text{if } \varepsilon_i \leq 0, \end{cases}$$

X_i is the average of **Pmp or Lmp** by t for each i, D_i is a dummy variable indicating if country i has a positive or a negative elasticity. **Marginal effect** of X is then equal to

$$\frac{\Delta \varepsilon_i}{\Delta X_i} = \beta + 2\gamma X_i.$$

It is important to say that β does not measure the change in ε_i with respect to X_i. The slope of the relationship between X_i and ε_i depends on the value of X_i. If the coefficient β **is positive** and the coefficient γ (on X_i^2) is **negative**, the quadratic has a **parabolic shape**. A **U-shape** arises in equation (4) **when β is negative and γ is positive**.

Estimated effect of X_i on *elasticities* can be biased because the functional relationship between X_i and ε_i in equation (4) is not entirely correct (may be rather cubic) or because we have controlled for no other factors (as macroeconomic factors **FDI** and Volatility of **GDP growh**, etc, or demographic factors, etc). In these cases, we have to use rather augmented Quadratic model, or Cubic model, or Augmented Cubic model, etc.

B. Cubic Model

If relation F is cubic, we propose to estimate the following specification

$$\varepsilon_i = \alpha + \beta X_i + \gamma X_i^2 + \delta X_i^3 + \theta D_i + u_i \quad (5)$$

where,

$$D_i = \begin{cases} 1 & \text{if } \varepsilon_i > 0 \\ 0 & \text{if } \varepsilon_i \leq 0, \end{cases}$$

and again X_i is the average of Pmp or Lmp by t for each i. **Marginal effect** of X_i is equal to

$$\frac{\Delta \varepsilon_i}{\Delta X_i} = \beta + 2\gamma X_i + 3\delta X_i^2.$$

Then, there is two positive values of X_i where the effect of X_i on elasticities is null :

$$X_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a},$$

where

$$\begin{cases} a = & 3\delta \\ b = & 2\gamma \\ c = & \beta. \end{cases}$$

Again, both Parabolic shape and U-shape arises in equation (5). The slope of the relationship between X_i and ε_i depends on the value of X_i and X_i^2.

We can propose more general model; the **Augmented** Cubic specification :

$$\varepsilon_i = \alpha + \beta X_i + \gamma X_i^2 + \delta X_i^3 + \theta D_i + \rho Vol\_B_i + \pi FDI_i + u_i \quad (6)$$

where X_i, **Volatility, and FDI** are in average by t for each i.

III Empirical results

The results presented in this section are based on long-term elasticities obtained with country-specific time series regressions. For each country, ε_i is a point estimate from OLS on regression (1) for T observations of country i, i = 1, …, N as explained in section II.

We seek to see how linear or nonlinear evolution of elasticities of considered groups of countries are different.

5. Fixed Marginal Effect case : Francophone vs Anglophone countries

Now, we presents the econometric results obtained by estimating equation (3) under different specifications and sets of controls. Each specification is estimated for all countries, for Francophone countries, and for Anglophone countries. Table 6 sum up all **sigificant variables** (at 5% or 10%) in each considered model. From Table 6, we can conclude that :

(i) For **all countries** (44), starting with labor market policies (**Lmp**), it can be noted that the indicator is able to explain about 3 percent of the cross-country variation in employment elasticities. The labor market indicator is found to have a significant and **negative** impact across all specifications. Employment intensity of growth tends to be **higher** in countries with a **smaller** service sector (**VA_s** have **significant negative** effects); these results do not confirm previous empirical evidence ; see (Crivelli, Furcer, & Touja, 2012)).[16] The results show also that employment elasticities vary with demographic characteristics. 15 to 24 years old participant in active population is **negatively** correlated with employment-output elasticities (**Tx1524** have **significant negative** effects).

(ii) For **Francophone** countries (20), some results also do not confirm previous empirical evidence. Indeed, Product market policie indicator (**Pmp**), **Tx1524**, and **Pop_U** have significant **negative** effects and **Inflation** have significant **positive** effects on employment elasticity to production. But, **employment elasticities tend**

[16] The determinants of employment intensity within the European context are explored by (Döpke, 2001). Döpke finds that a greater share of services leads to higher employment intensity and that in most of the countries under examination, there is a significant, **negative** relationship between **real labour costs** and employment elasticity. He posits that in general more labour market **flexibility** leads to more employment-intensive growth, but the related empirical findings are not robust. (Mourre, 2004) discusses employment performance in the Euro-area economies and finds that the job intensity of growth has been highest in the service sector. His findings regarding labour tax rates support the notion of a negative correlation between the rate of labour taxation and long-run employment generation.

to be higher in more open economies.[17] **Trade** openness in Francophone countries contribute then to explaining cross-country variations in employment elasticities**.**[18]

(iii) For **Anglophone** countries (24), only **Tx1524** has a **negative** and significant effect on employment elasticity to production.

We conclude that with linear models, some results do not confirm previous empirical evidence. It is important so to see if non linear specifications can give more intuitive results.

Table 6: Significant variables for different Models for **Francophone, Anglophone, and all 44 countries.**

Countries	**Froncophone countries**					**Anglophone**	**All countries**		
Model/variables	**Tx1524**	**Pop$_U$**	**Inflation**	**Trade**	**Pmp**	**Tx1524**	**Va-s**	**Tx1524**	**Lmp**
M1	−0.00227 (0.085)					−0.0035 (0.072)		−0.028 (0.009)	
M2			0.00217 (0.092)	0.0032 (0.088)			−0.018 (0.094)		
M1.2		−0.004 (0.073)							
M1.3	−0.00263 (0.024)	−0.002 (0.0471)			−0.0397 (0.023)	−0.0049 (0.091)		−0.00316 (0.0071)	
M2.3			0.00224 (0.035)		−0.0466 (0.072)				
M1.2.3		−0.004 (0.077)						−0.00222 (0.047)	−0.028 (0.093)

Note : (.) is the p-value.

[17] The interaction between inflation, labour market institutions and employment performance is investigated in (Loboguerrero & Panizza, 2011). Inflation can both encourage responsiveness of employment to changes in output (via its effect on reducing downward wage rigidity) and can decrease responsiveness (by increasing uncertainty of relative prices). The authors find that in industrialized economies, inflationary effects tend to have the former effect. Thus, all else equal, inflation in this context would be associated with higher employment elasticities.

[18] (Bruno & al., 2001) investigate whether there are linkages between economic openness and labour demand elasticity. They argue that economic openness can allow firms to use more capital equipment in production, which may ultimately lead to a reduction in the responsiveness of labour demand to economic growth. However, they do not find any statistically significant relationship between trade openness and labour demand elasticity. (Freeman, 2000) also discusses the potential impact of trade and exchange rate fluctuations on labour markets. He argues that exchange rate volatility and international capital flows play a far more important role than trade in developing-country labour markets.

6. Unfixed Marginal effect case : Positive vs Negative Elasticities.

For non linear specification, two group of countries are considered : group of countries with **positive** elasticities and group of countries with **negative** elasticities. We give estimation results of equation (4) for quadratic specification, of equation (5) for cubic specification, and of equation (6) for augmented cubic model. Two choice for variable X are considered; Labor market policies indicator (Lmp) and Product market policies indicator (Pmp).

In all cases, dummy variable D (=1 if elasticity is positive and Zero if not) is significant. **Positive** Elasticity evolution is different from **negative** one.[19]

C. Marginal effects of Lmp

In order to assess the role of Labor market policies (Lmp), equation (4), (5), and (6) has been estimated using as explanatory variable the component of labor market policie described in the previous section, respectively in a quadratic specification, Cubic specification, and augmented cubic specification. With **Quadratic** model (equation (4)), marginal effect of Lmp is equal to

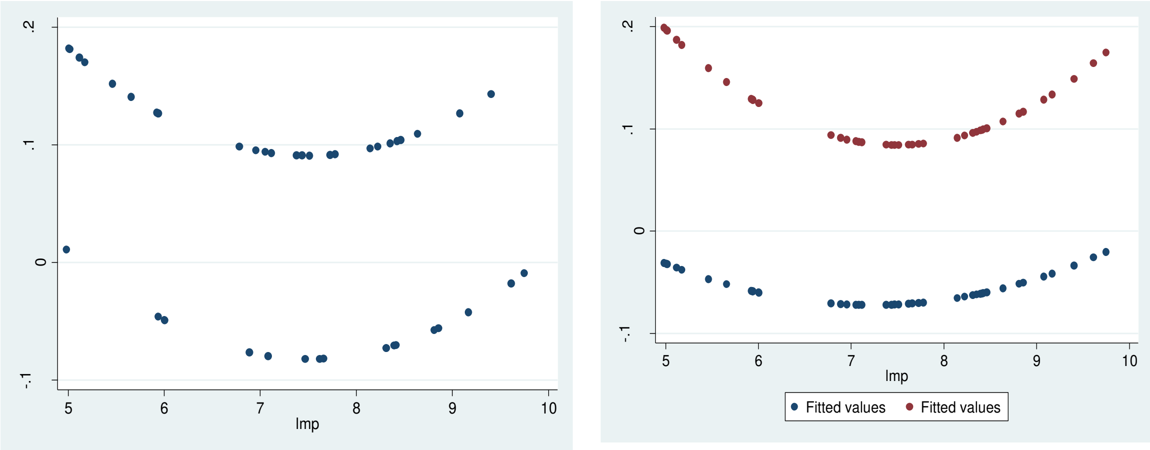
$$\frac{\Delta\ \varepsilon_i}{\Delta Lmp_i} = \beta + 2\,\gamma\, Lmp_i.$$

A U-shape arises in equation (4) since β is significant **negative** and γ is significant **positiv**e, see Figure 6 (a).[20] Minimum value correspond to Lmp* = 0.21864209/ (2*0.01455553) **= 7.5106193.** The estimation results show that Lmp has **no significant** effect on employment-output elasticities, while in the augmented Cubic model, **FDI has positive significant effect on elasticities. For more details on these results see Appendice.[21]**

[19] For the effects of structural variables, respectively Lmp and Pmp on employment elasticities, estimation results are presented at Table 7 and Table 8.

[20] Predicted elasticities (fitted values) are from min= - 0.082177 to max = 0.1820548 with average of 0.0476628. See Table 7 first colum.

[21] Resuls are presented in Table 7 : for Cubic specification (equation (5) in column 2) and for the Augmented Cubic model (equation (6) in column 3).



(a) : for all $\varepsilon_i = F(\text{Lmp})$

(b) : for each group of $\varepsilon_i = F(\text{Lmp})$; blue line for $\varepsilon_i < 0$ and red line for $\varepsilon_i > 0$

Figure 6: Qudratic Model results.

Table 7 : Marginal Effects of **Lmp** in Quadratic model (4), Cubic model (5), and Augmented Cubic model (6).

Variable	and Coefficient	Quadratic (4)	Cubic (5)	Aumented Cubic (6)
Lmp	β	**−0.21864209***	−0.66825266	−0.62119743
Lmp^2	γ	**0.01455553***	0.07739982	**0.07035205**
D	θ	**0.17311454*****	**0.17152265*****	**0.17269767*****
Lmp^3	δ		−0.00286267	**−0.00252184**
Vol_B	ρ			−0.00506277
FDI	π			**0.0029938****
cons	α	.73886614	1.785074	1.6887987
N		44	44	44
R^2		0.33635961	0.33806998	0.364613

Note : * p<.1; ** p<.05; *** p<.01. Results are based on Robust OLS method. $D_i = \begin{cases} 1 & \text{if } \varepsilon_i > 0 \\ 0 & \text{if } \varepsilon_i \leq 0. \end{cases}$

D. Marginal effects of Pmp

In order to assess the role of product market policies, equation (4), (5), and (6) has been estimated using as explanatory variable the component of product market policies, Pmp, described in the previous section, respectively in a quadratic specification, Cubic specification, and augmented cubic specification.

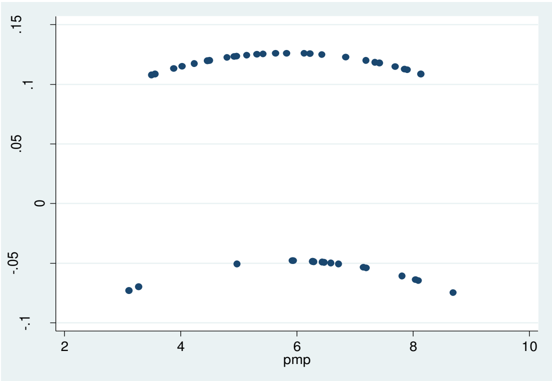
For **Quadratic** model (equation (4)), marginal effect of Pmp is equal to

$$\frac{\Delta\ \varepsilon_i}{\Delta \mathrm{Pmp}_i} = \beta + 2\,\gamma\ \mathrm{Pmp}.$$

Since the coefficient on Pmp is **positive** and the coefficient on Pmp^2 is **negative (**see Table 8 first column),[22] the quadratic has **a Parabolic shape** with **maximum** value correspond to a positive value of Pmp* = 0.0386532 / (2*0.0033059)) = **5.8460933**.[23] Before this point, Pmp has a positive effect on elasticities, and after this point, Pmp has a negative effect on easticities.

This quadratic relationship is illustrated in Figure 7 (c) for the two groups (group of countries with $\varepsilon_i > 0$ and group with $\varepsilon_i < 0$). Estimated equation (4) implies that Pmp has a **diminishing** effect on elasticities if Pmp is around Pmp*= **5.8460933**.[24]

It is possible that the effect of Pmp really becomes negative at some point, but it is hard to believe that this happens at 5.8460933 of Pmp ($\beta\ and\ \gamma\ are\ not\ significant$). A more likely possibility is that the estimated effect of Pmp on *elasticities* is biased because we have controlled for no other factors, or because the functional relationship between Pmp and ε_i in equation (4) is not entirely correct.



(c) for : $\varepsilon_i = F(\mathrm{Pmp})$

Figure 7: Qudratic Models

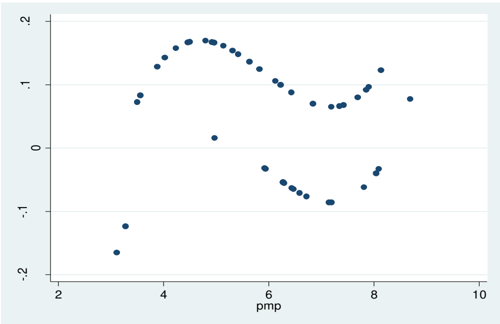
[22] Both are not significant.

[24] Predicted elasticities (fitted values) are from min = -0.0747462 to max = 0.1260679 with an average of 0.0476628.

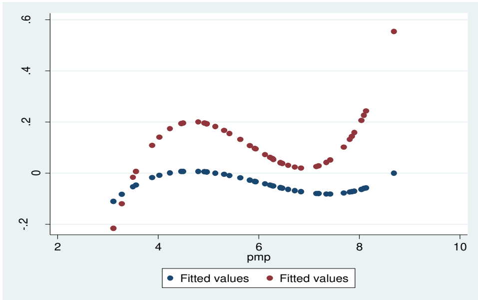
For Cubic model (Equation (5), results given in Table 8 second column**),**[25] now there is two positive values of Pmp where the marginal effect of Pmp on elasticities is nul;

$$\begin{cases} \text{Pmp}_1^* = 4.6977913 \\ \text{Pmp}_2^* = 7.1823003 \end{cases}.$$

This estimated equation implies that Pmp has a **diminishing** effect on elasticities if Pmp is around $\mathbf{Pmp_1^*=4.6977913}$ and an **increasing** effect on elasticities if Pmp is around $\mathbf{Pmp_2^*= 7.1823003}$. This Cubic relation is illustrated at Figure 8 (a) for the two groups (group of countries with $\varepsilon_i > 0$ and group with $\varepsilon_i < 0$).[26]



(a) For all $\varepsilon_i = F(\text{Pmp})$



(a') : for each group of $\varepsilon_i = F(\text{Pmp})$

Figure 8: Cubic model

Politics depend then on the starting value for Pmp. It means that if any countrie starts from Pmp less than 4.6977913, it has to acheave this value to gain maximum of elasticitie. If it starts from 7.1823003, it can improuve its elasticy by either greater or lesser Pmp (till 4.6977913). If it starts at a point value between 4.6977913 and 7.1823003, having more (less) Pmp decrease (increase) elasticies. So goverments have to be vigilent.[27] The same conclusion is true if Cubic model is considered for each group a part; see Figure 8 (a').

For an Augmented Cubic model (Equation (6), *Results reported in Table 8 column 3*),[28] now there is two other positive values for Pmp where the marginal effect of **Pmp** on elasticities is null;

[25] All coefficients are significant.

[26] Fitted values are from -0.1653368 to 0.1694609.

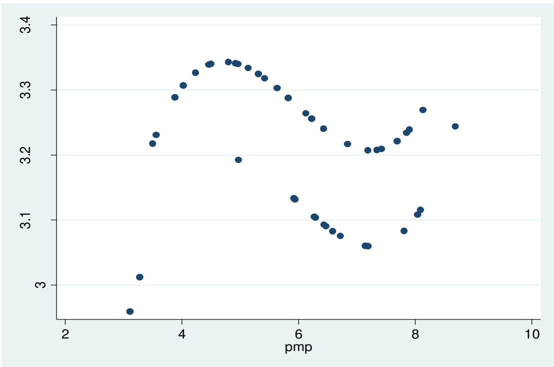
[27] If we take each group a part, there is two other positive values of Pmp where the marginal effect of Pmp on elasticities is zero. If $\varepsilon_i < 0$, $\begin{cases} Pmp_1^* = 4.6495109 \\ Pmp_2^* = 7.3787904 \end{cases}$. While if $\varepsilon_i > 0$, $\begin{cases} Pmp_1^* = 4.6994641 \\ Pmp_2^* = 6.916789 \end{cases}$; see Figure 8 (a').

[28] Fitted values are from 2.959229 to 3.343042. All coefficients are significant.

$$\begin{cases} Pmp_1^* = 4.7186128 > 4.6977913 \\ Pmp_2^* = 7.2479261 > 7.1823003 \end{cases};$$

see Figure 9 (a). We analyze now whether the effect of structural policies on employment elasticities is a function of macroeconomic Factors. The results show that **GDP volatility (Vol_B) and Foreign direct investment (FDI)** are important factors in shaping the response of employment elasticities to structural variables (see Table 8 column 3).

In particular, the results suggest the **lower** the level of **economic volatility** in the economy is, the **larger** the structural policies effects tend to have on employment elasticities. This implies that in order to maximize the effect of structural policies on employment responsiveness, structural reforms have to be complemented by macroeconomic policies aimed at **increasing macroeconomic stability.** Since **FDI** has positive and significant effects, then macroeconomic policies aimed at promoting Foreign direct investment have a significant positive impact on employment elasticities.



(a) for $\varepsilon_i = F(Pmp, FDI, Vol\_B)$

Figure 9 : Augmented Cubic models.

Table 8 : Marginal Effects of Pmp in model (4), (5) and (6)[29]

Variable	and Coefficient	Quadratic (4)	Cubic (5)	Aumented Cubic (6)
Pmp	β	.03865325	**1.3874443****	**1.73019****
Pmp²	γ	−.00330591	**−0.24425759****	**−0.30269431****
D	θ	**.17406153*****	**0.15069993*****	**0.14725153*****
Pmp³	δ		0.01370683**	**0.01686337****
Vol_B	ρ			**−0.00861058****
FDI	π			**0.00433102*****

[29] Note : * p<.1; ** p<.05; *** p<.01. $D_i = \begin{cases} 1 & \text{if } \varepsilon_i > 0 \\ 0 & \text{if } \varepsilon_i \leq 0. \end{cases}$

_cons	α	−.16097736	−2.5291408**	−3.1416902**
N		44	44	44
R^2		0.3048658	0.37734602	0.43753772

Conclusion

This paper contributes to the literature by providing new set of employment-output elasticities for an unbalanced panel of 44 countries (from AMEE) over the period 2000–2017. Point estimates of elasticities typically fall in the [-1, 1] range, with the majority ranging between -0.1534659 and 0.3784868.

Having a sample of 20 francophone (with lower employment-output elasticities, more EMPG, and negative PG in average) and 24 anglophone countries (with less EMPG and positive PG in average), we assess the role of structural and policy variables, macroeconomic, and demographic determinants in affecting these elasticities within these two groups in **a linear specification**.[30] Elasticities are effected differently across groups (francophone vs anglophone countries). The main findings of **linear models** can be summarized as follows:

- For Francophone countries, macroeconomic policies aimed to **prome *trade*** have a significant and positive impact on employment elasticities. So results suggest that employment elasticities tend to be higher in more open economies**.** Structural policies aimed at *increasing product market flexibility* have a significant and **negative** impact on employment elasticities. *Francophone* coutries, *are in plus effected **positively** by Inflation and volatility of GDP (Vol_B) and **negatively** effected by 15-24 years old participant in active population and urban population (Pop_U).*
- For Anglophone coutries, only *15-24 years_old participant in active population (Tx1524) have negative and significant effect on elasticities.*

and

- For both of groups, structural policies aimed at increasing *Labor market* flexibility (Lmp) have negative effect on employment elasticities.

With linear specifications, the majority of these results are not intuitive. We then give results of non linear models investigations.

[30] Macroeconomic, and demographic variables are used as a control and to test whether there is any statistically significant difference.

For **non linear** specification investigations, elasticities are grouped by **sign**. Then two groups having the same EMPG in average are considered : group of countries with **positive** elasticities (with less GDPG and null PG) and group of countries with **negative** elasticities. The main findings of **non linear models** can be summarized as follows:

- With **Quadratic** model, Lebor market policy (Lmp) has significant **increasing effect** on **elasticities** if it is **greater** than Lmp* = 7.5106193.
- For Cubic model, Product market policy (Pmp) has also an **increasing** effect on elasticities if Pmp is around Pmp*= $\mathbf{7.1823003}$.
- For Augmented **Cubic** model, results show that **GDP volatility** and foreign direct investment (**FDI)** are important factors in shaping the response of employment elasticities to structural variables. In particular, the results suggest that the **lower** the level of GDP **volatility** in the economy is, the **larger** the structural policies effects tend to have on employment elasticities. This implies that structural reforms have to be complemented by macroeconomic stability policies (less GDP volatility) to maximize the effect of structural policies on employment responsiveness. Since **FDI** has positive and significant effects, then, macroeconomic policies aimed at promoting FDI have a significant and positive impact on employment elasticities.

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Appendice

7. Data

Table A 1: List of countries.

Francophone countries	Anglophone countries	Francophone countries	Anglophone countries	Francophone countries	Anglophone countries
Algérie (AN)	Egypte	Congo, Rép. dém. (AC)du	Angola	Sénégal	Namibie
Maroc (AN)	Iran, République islamique	Côte d'Ivoire (AO)	Erythrée	Togo	Nigéria
Bénin	Iraq	Gabon (AC)	Gambie	Tchad	Ouganda
Burkina Faso (AO)	Jordanie	Guinée	Ghana	Tunisie	Rwanda
Burundi (AE)	Liban	Guinée-Bissau	Kenya		Sierra Leone
Cap-Vert (AO)	Libye	Madagascar	Lesotho		Tanzanie
Comores (AE)	Oman	Mauritanie	Malawi		Zambie
Congo (AC)	Yémen	Niger	Mozambique		Zimbabwe

Table A 2. Cross-section Data for Elasticities: point estimates from equation (1).

Country	Code	Elasticities	Country	Code	Elasticities	Country	Code	Elasticities
Algérie	0	0.3784868	Egypte	1	0.691423	Sierra Leone	1	0.002575
Maroc	0	0.0028011	Iran, République islamique	1	0.0255433	Tanzanie	1	0.0049916
Bénin	0	0.1870598	Iraq	1	0.0007784	Zambie	1	**-0.1541904**
Burkina Faso	0	**-0.1534659**	Jordanie	1	0.461259	Zimbabwe	1	**-0.002017**
Burundi	0	**-0.1452379**	Liban	1	0.1848282			
Cap-Vert	0	0.1110416	Libye	1	**-0.0146251**			
Comores	0	**-0.0174741**	Oman	1	**-0.070055**			
Congo	0	0.0862507	Yémen	1	**-0.0751716**			
Congo, Rép. dém. du	0	0.1332806	Angola	1	0.174284			
Côte d'Ivoire	0	0.2237389	Erythrée	1	0.0482562			
Gabon	0	0.0676433	Gambie	1	**-0.0146484**			
Guinée	0	**-0.0672511**	Ghana	1	**-0.0672511**			
Guinée-Bissau	0	**-0.017284**	Kenya	1	0.1639556			
Madagascar	0	0.0038587	Lesotho	1	**-0.0234364**			
Mauritanie	0	**-0.0018755**	Malawi	1	0.010658			
Niger	0	0.0076837	Mozambique	1	**-0.1658475**			
Sénégal	0	0.0108431	Namibie	1	0.0336307			
Togo	0	0.0597109	Nigéria	1	**-0.0070644**			
Tchad	0	**-0.0057461**	Ouganda	1	-0.0028587			
Tunisie	0	0.0255049	Rwanda	1	0.002575			

Note : For Francophone countries, code=0, and for Anglophone ones, code=1.

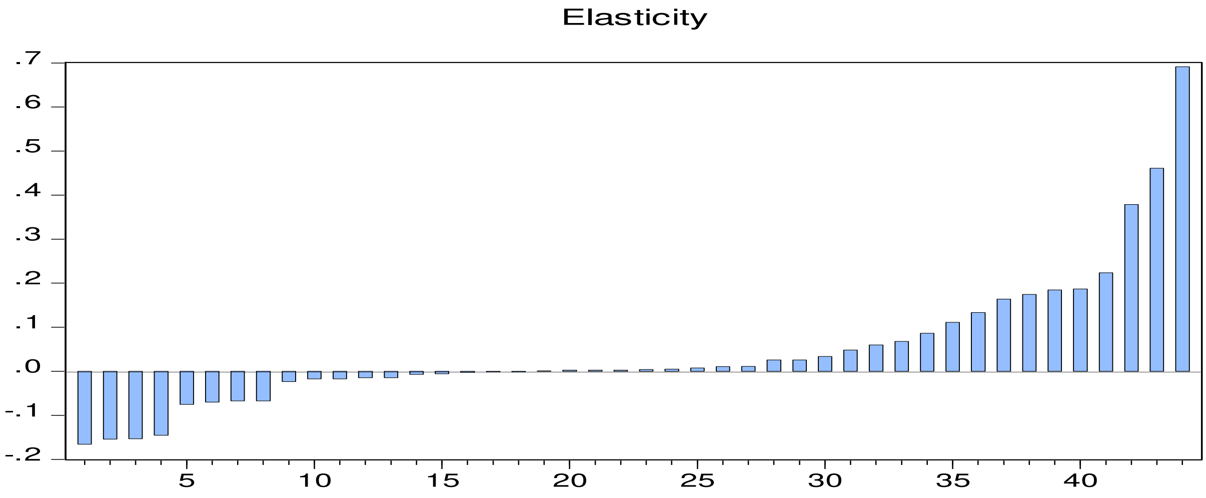


Figure B 1 : Distribution of positive and negatives elasticities.

8. Tables

Table A 3: Correlation Matrix for independent variables of all countries

	Pop_U	Tx1524	Pop_D	Size	Pmp	Lmp	VA_S	. Inflat~n	Trade	FDE	Vol_B
Pop_U	1.0000										
Tx1524	0.2172	1.0000									
Pop_D	0.3632*	-0.0588	1.*0000*								
Size	-0.1855	-0.1016	0.1370	1.0000							
Pmp	-0.0011	-0.1726	-0.0254	0.1138	1.0000						
Lmp	-0.0671	-0.0337	-0.1568	-0.0570	0.1041	1.0000					
VA_S	0.2536	0.0838	0.2173	-0.0177	0.3035*	0.0022	1.0000				
Inflation	-0.0121	0.0620	-0.1065	-0.0068	-0.1365	-0.1283	-0.1873	1.0000			
Trade	-0.3623*	-0.2382	-0.0910	-0.1378	-0.0459	0.2272	-0.2228	-0.0377	1.0000		
FDI	0.0366	0.0594	0.3750*	0.0875	-0.0838	-0.0576	0.1885	-0.0060	0.4503*	1.0000	
Vol_B	-0.1968	0.2559	-0.1953	0.2749	-0.1307	-0.0535	-0.2676	0.0127	0.0449	-0.0446	1.0000

Table A 4: descriptive statistics of Independent variables for Francophone coutries

Variable	Obs	Mean	Std. Dev.	Min	Max
ε_i	20	.0444785	.1224894	-.1534659	.3784868
Pop_U	20	54.04031	19.11945	15.36889	89.67533
Tx1524	20	48.02532	17.51192	15.28817	76.37211
Pop_D	20	78.73692	96.10831	2.630457	360.2086
Size	20	6.010401	.860818	3.997836	7.717513
Pmp	20	5.45262	1.326874	3.27528	7.811817
Lmp	20	7.463656	1.308839	5.017321	9.614015
VA_a	20	23.9643	13.5189	4.743264	47.02618
Inflation	20	7.012005	13.15115	1.579724	60.67471
Trade	20	74.85101	23.49342	38.67061	138.7351
FDI	20	4.13651	3.303858	.6545224	12.32006
Vol_B	20	4.065694	5.764456	1.184967	2

Table A 5: descriptive statistics of Independent variables for Anglophone countries

Variable	Obs	Mean	Std. Dev.	Min	Max
ε_i	24	.0503164	.1857005	-.1658475	.691423
Pop_U	23	50.19568	25.91689	1.758667	85.84922
Tx1524	23	48.98987	18.80505	26.13011	83.1685
Pop_D	23	123.5588	155.0856	3.388732	609.8672
Size	23	6.521603	.7529715	5.09534	8.295727
Pmp	23	6.50885	1.495016	3.106362	8.690869

Lmp	23	7.243802	1.491747	4.983537	9.750223
VA_a	23	16.62329	12.61347	1.647599	52.058
Inflation	23	10.43152	10.099	1.073233	51.75409
Trade	24	74.7246	27.07699	40.92907	144.5118
FDI	23	4.425131	3.27208	.7399844	15.08266
Vol_B	23	3.721307	2.899808	1.262685	13.64711

9. Other results for Lmp marginal effects

E. Cubic model for Lmp

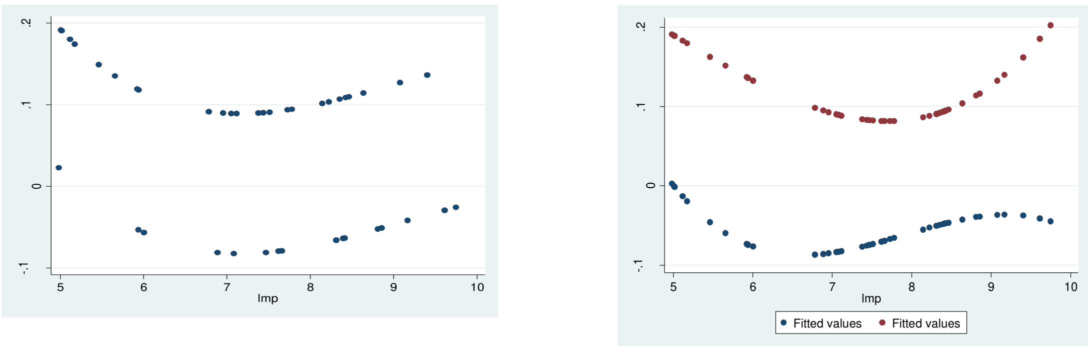
For Cubic model, there is two positive values of Lmp where the marginal effect of Lmp on elasticities is zero;

$$X = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \begin{cases} X_1^* = 7.1649322 \\ X_2^* = 10.860155, \end{cases}$$

where

$$\begin{cases} a = & 3\delta \\ b = & 2\gamma \\ c = & \beta. \end{cases}$$

Estimated equation implies that Lmp has **increasing** effect if Lmp is around $X_1^* = \mathbf{7.1649322}$ [and a **decreasing** effect on elasticities if Lmp is around $X_2^* = 10.860155$ (wich is out of available values for Lmp)]. This cubic relation is illustrated in Figure 8 (b) for the two groups (group of countries with $\varepsilon_i > 0$ and group with $\varepsilon_i < 0$).



(b): For $\varepsilon_i = F(Lmp)$

(c): for each group of $\varepsilon_i = F(Lmp)$; blue line for $\varepsilon_i < 0$ and red line for $\varepsilon_i > 0$

Figure 8 (suite): Cubic model

If we take each group a part, there is two other positive values of lmp where the marginal effect of lmp on elasticities is zero; If $\varepsilon_i < 0$, $X = \begin{cases} X_1^* = 6.6315186 \\ X_2^* = 9.195051 \end{cases}$, while for group of countries with $\varepsilon_i > 0$,

$$X = \begin{cases} X_1^* = 2.4691716 \\ X_2^* = 7.6972322 \end{cases};$$

See Figure 8 (c) .[31] Estimated equation implies that Lmp has **increasing** effect if Lmp is around $X_2^* = 7.6972322$ if $\varepsilon_i > 0$ and a **decreasing** effect if Lmp is around $X_2^* = 9.195051$ If $\varepsilon_i < 0$.

F. Augmented cubic for Lmp

For augmented cubic model now, there is two positive values of Lmp where the marginal effect of **Lmp** on elasticities is zero;[32]

$$X = \begin{cases} X_1^* = 7.2102434 \\ X_2^* = 11.387829; \end{cases}$$

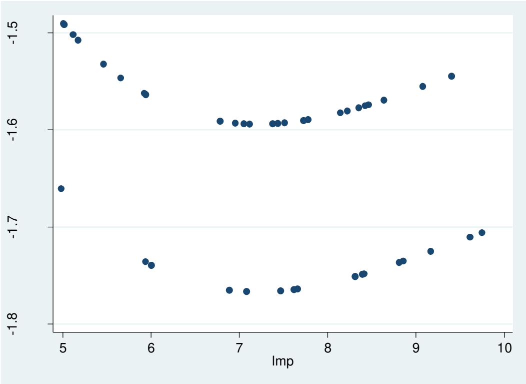
see *Figure 9* (b).[33] Estimated equation implies that Lmp has **increasing** effect if Lmp is around $X_1^* = 7.2102434$.

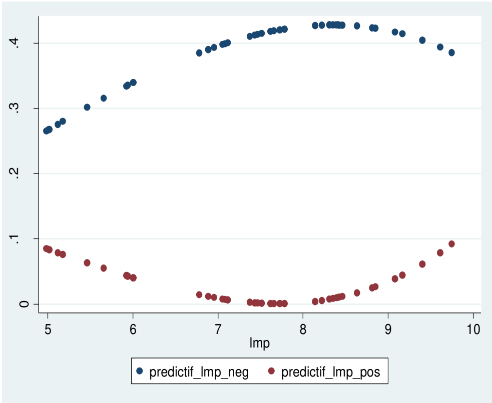
If we take each group a part, there is two other positive values of Lmp where the marginal effect of Lmp on elasticities is zero ; If $\varepsilon_i < 0$, $X = \begin{cases} X_1^* = .2899442 \\ X_2^* = 8.3604367 \end{cases}$,

While if $\varepsilon_i > 0$, $X = \begin{cases} X_1^* = 2.5757045 \\ X_2^* = 7.7163307 \end{cases}$;

see Figure 9 (c). Estimated equation implies that Lmp has **increasing** effect if Lmp is around $X_2^* = 8.3604367$ if $\varepsilon_i < 0$. While Lmp has **decreasing** effect if Lmp is around $X_2^* = 7.7163307$ when $\varepsilon_i > 0$.

[31] $X_1^* = 2.4691716$ is out of the available values of Lmp.
[32] Fitted values are from -.0861583 to .1990592.
[33] 11.387829 is out of available values for Lmp.





(b) : for $\varepsilon_i = F(lmp, FDI,\ Volatility\_PIB)$ (C) : for $\varepsilon_i = F(lmp, FDI,\ Volatility\_PIB)$

Figure 9 (suite): Augmented Cubic models