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

NEIFAR, MALIKI

IHEC SFAX

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

NEIFAR Malika¹

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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 macroeconomic 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 period 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).


¹ Professor, New Economic department, IHEC Sfax, Sfax University, Tunisia. Mail adress: mneifar68@gmail.com.
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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 Middle 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, \(\epsilon_i\), for each country \(i = 1, \ldots, N\). In a first investigation, these elasticities (dependent variable \(\epsilon_i\)) are grouped on Elasticities for Francophone countries and elasticities 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 Anglophone (A) and Francophone (F) countries.

An econometric model is then needed to address why group of countries with negative PG and less GDPG in average have more EMPG and less employment intensity in average? 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 $\varepsilon_i$) are grouped on Negative Elasticities and Positive Elasticities. These employment-output Elasticities $\varepsilon_i$, 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 needed 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 elasticities.

---

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 recommended 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 $\varepsilon_i$. Hence, for each country $i$, we regress the following equation

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

by OLS. Then,

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

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 Appendix). Period of study is from 2000 to 2017 (T = 18 < N = 44). The list of OLS point estimates of each employment to product elasticity, $\varepsilon_i$, is given in Table A 2 (see Appendix). Independent variables for cross section data are also built: the average of log of each considered time series. Overall, the point estimates for $\varepsilon_i$ 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.

![Elasticities](image)

**Figure 3. Distribution of Long-Run Employment Elasticities $\varepsilon_i$ (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. $\varepsilon_i$ for Anglophone countries are more volatile (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 elasticities. Elasticities are from -0.1658475 to 0.691423 with a positif average of 0.0476628. For negative elasticities, 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: $D = (Pop_{-U}, Pop_{-D}, Tx1524)'$, 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

<table>
<thead>
<tr>
<th>Variables</th>
<th>Abreviations</th>
<th>Sources</th>
<th>Expected signs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(D) : Demographic variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban population</td>
<td>Pop_U</td>
<td>WDI&lt;sup&gt;6&lt;/sup&gt;</td>
<td>+/-</td>
</tr>
<tr>
<td>Density of population</td>
<td>Pop_D</td>
<td>WDI</td>
<td>+/-</td>
</tr>
<tr>
<td>15-24 year_old participant in active population</td>
<td>Tx1524</td>
<td>WDI</td>
<td>+/-</td>
</tr>
<tr>
<td><strong>(S) : Structural and political variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Politic of work market</td>
<td>Pmp</td>
<td>EFW&lt;sup&gt;7&lt;/sup&gt;</td>
<td>+</td>
</tr>
<tr>
<td>Politic of product market</td>
<td>Lmp</td>
<td>EFW</td>
<td>+</td>
</tr>
<tr>
<td>Zise of gouvernement (% of PIB)</td>
<td>Size</td>
<td>WDI</td>
<td>+</td>
</tr>
<tr>
<td><strong>(M) : Macroeconomic variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Openess to trade</td>
<td>Trade</td>
<td>WDI&lt;sup&gt;8&lt;/sup&gt;</td>
<td>+</td>
</tr>
<tr>
<td>Inflation based on CPI&lt;sup&gt;9&lt;/sup&gt;</td>
<td>Inflation</td>
<td>WDI</td>
<td>-</td>
</tr>
<tr>
<td>Entries of Foreign Direct Investment (% du PIB)</td>
<td>FDI</td>
<td>WDI</td>
<td>+</td>
</tr>
<tr>
<td>Added values for service secteur</td>
<td>Va_s</td>
<td>WDI</td>
<td>+</td>
</tr>
<tr>
<td>GDP by capita</td>
<td>PIB_H</td>
<td>WDI</td>
<td>+</td>
</tr>
<tr>
<td>Volatility of GDPG</td>
<td>VOL_B</td>
<td>Author calculation</td>
<td>-</td>
</tr>
</tbody>
</table>

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

<sup>6</sup> World Bank World Development Indicators.
<sup>7</sup> Fraser Institute’s Economic Freedom of the World Database.
<sup>8</sup> World Bank World Development Indicators.
<sup>9</sup> CPI : consumer price index.
Francophone countries except 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.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Max</th>
<th>Country</th>
<th>Min</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIB_H</td>
<td>18078,2316</td>
<td>Oman (A)</td>
<td>227,855947</td>
<td>Burundi (F)</td>
</tr>
<tr>
<td>Inflation</td>
<td>60,6747081</td>
<td>Congo, Rép. dém. (F)</td>
<td>1,07323322</td>
<td>Zimbabwe (A)</td>
</tr>
<tr>
<td>Trade</td>
<td>144,511791</td>
<td>Lesotho (A)</td>
<td>38,6706056</td>
<td>Burundi (F)</td>
</tr>
<tr>
<td>FDI</td>
<td>15,0826601</td>
<td>Mozambique (A)</td>
<td>0,65452242</td>
<td>Burundi (F)</td>
</tr>
<tr>
<td>Pmp</td>
<td>8,69086909</td>
<td>Ouganda (A)</td>
<td>3,10636247</td>
<td>Mozambique (A)</td>
</tr>
<tr>
<td>Lmp</td>
<td>9,75022336</td>
<td>Lesotho (A)</td>
<td>4,98353703</td>
<td>Zimbabwe (A)</td>
</tr>
<tr>
<td>TX1524</td>
<td>83,1684994</td>
<td>Tanzanie (A)</td>
<td>15,2881668</td>
<td>Comores (F)</td>
</tr>
<tr>
<td>VA_s</td>
<td>9,58897848</td>
<td>Rwanda (A)</td>
<td>0,56325717</td>
<td>Angola (A)</td>
</tr>
<tr>
<td>Vol_e</td>
<td>27,0444913</td>
<td>Madagascar (F)</td>
<td>1,1849667</td>
<td>Algeria (F)</td>
</tr>
<tr>
<td>Size</td>
<td>8,29572653</td>
<td>Libanon (A)</td>
<td>3,99783593</td>
<td>Algeria (F)</td>
</tr>
</tbody>
</table>

1. Francophone vs Anglophone countries analysis

Table 3 present pairwise correlations between the estimated elasticities $\varepsilon_i$ 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 lower flexible labor and product market and lower government size. Now from Figure 4, there is linear relationship between elasticities $\varepsilon_i$ and the structural and Lebor market policy variables Lmp for both Francophone and Anglophone countries. While linear relation is less evident between $\varepsilon_i$ and Product market policy variable Pmp. These relations can be formally tested by econometrics methods.
Table 3: Correlation Between $\varepsilon_i$ and Structural Policy Variables and other control variables.

<table>
<thead>
<tr>
<th>Correlations/Countries</th>
<th>Francophone</th>
<th>Anglophone</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\rho$(Pmp, $\varepsilon_i$)</td>
<td>$-0.293894 (0.2085)$</td>
<td>$-0.048305 (0.8268)$</td>
</tr>
<tr>
<td>$\rho$(Lmp, $\varepsilon_i$)</td>
<td>$-0.274937 (0.2407)$</td>
<td>$-0.179925 (0.4114)$</td>
</tr>
<tr>
<td>$\rho$(Size, $\varepsilon_i$)</td>
<td>$0.124080 (0.6022)$</td>
<td>$-0.054810 (0.8038)$</td>
</tr>
<tr>
<td>$\rho$(Tx1524, $\varepsilon_i$)</td>
<td>$-0.340219 (0.1422)$</td>
<td>$-0.349185 (0.1024)$</td>
</tr>
<tr>
<td>$\rho$(POP_U, $\varepsilon_i$)</td>
<td>$0.073998 (0.7565)$</td>
<td>$0.057166 (0.7956)$</td>
</tr>
<tr>
<td>$\rho$(Inflation, $\varepsilon_i$)</td>
<td>$0.219841 (0.3807)$</td>
<td>$0.005625 (0.9792)$</td>
</tr>
<tr>
<td>$\rho$(Tradee, $\varepsilon_i$)</td>
<td>$0.038704 (0.8713)$</td>
<td>$-0.278379 (0.1984)$</td>
</tr>
</tbody>
</table>

Note: (.) are p-values.

Figure 4: Nonparametric fit of $\varepsilon_i$ on structural and policy variables.

2. Positive vs Negative elasticities analysis

Table 4 presents pairwise correlations between the estimated elasticities $\varepsilon_i$. 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 except for Size (at 10%) for countries with negative $\varepsilon_i$. Again, looking at Table 4, it is clear that countries with positive $\varepsilon_i$ are characterized by lower flexible labor and product market, and lower government size. Countries with negative elasticities are characterized by more volatil GDPG and less population density. While when elasticities are
positive, more elasticity is characterized by less 15 to 24 years old participant in active population (see Table 5). Again, from Figure 5, we conclude that linear relation betwen $\varepsilon_i$ and Lmp is evident. While no linear relation is more evident for Pmp and $\varepsilon_i$. More again, these relations can be formally tested by econometrics methods.

Table 4: Pairwise correlation between $\varepsilon_i$ and Structural Policy Variables.

<table>
<thead>
<tr>
<th>Correlations/Elasticities</th>
<th>$\varepsilon_i &lt; 0$</th>
<th>$\varepsilon_i &gt; 0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\rho$(Pmp, $\varepsilon_i$)</td>
<td>0.128818 (0.6105)</td>
<td>-0.030709 (0.8816)</td>
</tr>
<tr>
<td>$\rho$(Lmp, $\varepsilon_i$)</td>
<td>0.091021 (0.7195)</td>
<td>-0.151772 (0.4592)</td>
</tr>
<tr>
<td>$\rho$(Size, $\varepsilon_i$)</td>
<td>0.407962 (0.0928)</td>
<td>-0.266282 (0.1885)</td>
</tr>
</tbody>
</table>

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

Table 5: Some significant pairwise correlations between $\varepsilon_i$ and some control variables.

<table>
<thead>
<tr>
<th>Correlations/Elasticities</th>
<th>$\varepsilon_i &lt; 0$</th>
<th>$\varepsilon_i &gt; 0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volatility</td>
<td>0.469655 (0.0492)</td>
<td>-0.478534 (0.0445)</td>
</tr>
<tr>
<td>POP_D</td>
<td></td>
<td>-0.383895 (0.0529)</td>
</tr>
<tr>
<td>TX1524</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: (.) are p-values.

10
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

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

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

\[ S = (Pmp, \text{Lmp, Size})' \]

The second group is the macroeconomic variables :

\[ M = (\text{Trade, Inflation, FDI, VA_s, PIB_H, VOL_B})' \]

And, the third group is the demographic one

\[ D = (\text{POP_U, POP_D, Tx1524})' \]

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 openess** 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

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

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

- $M3$: $\varepsilon_i = \alpha + \delta' \bar{S}_i + v_i$, (3)
- $M2$: $\varepsilon_i = \alpha + \theta' \bar{M}_i + v_i$,
- $M1$: $\varepsilon_i = \alpha + \mu' \bar{D}_i + v_i$,

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

$$
\bar{S} = (Lmp, Pmp, \text{Size})',
\bar{M} = (PIB_H, \text{Trade}, \text{Inflation}, \text{VOL}_B, \text{FDI}, \text{VA}_s)'\n$$

and

$$
\bar{D} = (\bar{\text{POP}}_{U}, \bar{\text{POP}}_D, \text{Tx1524})',
$$

denote empirical averages. Each parameter in vectors $\mu'$, $\theta'$, and $\delta'$ 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: $M1.2$: $\varepsilon_i = \alpha + \mu' \bar{D}_i + \theta' \bar{M}_i + v_i$, $M1.3$: $\varepsilon_i = \alpha + \mu' \bar{D}_i + \delta' \bar{S}_i + v_i$, $M2.3$: $\varepsilon_i = \alpha + \theta' \bar{M}_i + \delta' \bar{S}_i + v_i$, and $M1.2.3$: $\varepsilon_i = \alpha + \mu' \bar{D}_i + \theta' \bar{M}_i + \delta' \bar{S}_i + v_i$, $i=1, \ldots, N$.

In this section, $\varepsilon_i$ 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.
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 \textbf{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 \(\beta\) does not measure the change in \(\varepsilon_i\) with respect to \(X_i\). The slope of the relationship between \(X_i\) and \(\varepsilon_i\) depends on the value of \(X_i\). If the coefficient \(\beta\) is positive and the coefficient \(\gamma\) (on \(X_i^2\)) is negative, the quadratic has a parabolic shape. A U-shape arises in equation (4) when \(\beta\) is negative and \(\gamma\) is positive.

Estimated effect of \(X_i\) on elasticities can be biased because the functional relationship between \(X_i\) and \(\varepsilon_i\) in equation (4) is not entirely correct (may be rather cubic) or because we have controlled for no other factors (as macroeconomic factors \textbf{FDI} and Volatility of \textbf{GDP growth}, 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:

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

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 $\varepsilon_i$ depends on the value of $X_i$ and $X_i^2$.

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

$$\varepsilon_i = \alpha + \beta X_i + \gamma X_i^2 + \delta X_i^3 + \theta D_i + \rho\text{Vol}_B + \pi\text{FDI}_i + u_i \quad (6)$$

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, $\varepsilon_i$ 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 present 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 summarises all significant 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). 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 policy 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. Trade openness in Francophone countries contribute then to explaining cross-country variations in employment elasticities.

(iii) For Anglophone countries (24), only \textbf{Tx1524} has a \textbf{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 \textbf{Francophone}, \textbf{Anglophone}, and all \textbf{44} countries.

<table>
<thead>
<tr>
<th>Countries</th>
<th>Model/variable s</th>
<th>Francophone countries</th>
<th>Anglophone</th>
<th>All countries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tx1524</td>
<td>Pop$_{u}$</td>
<td>Inflation</td>
<td>Trade</td>
</tr>
<tr>
<td>M1</td>
<td>$-0.00227$ (0.085)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M2</td>
<td></td>
<td></td>
<td>$0.00217$ (0.092)</td>
<td>$0.0032$ (0.088)</td>
</tr>
<tr>
<td>M1.2</td>
<td></td>
<td>$0.004$ (0.073)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M1.3</td>
<td>$-0.00263$ (0.024)</td>
<td>$-0.002$ (0.0471)</td>
<td></td>
<td>$-0.0397$ (0.023)</td>
</tr>
<tr>
<td>M2.3</td>
<td></td>
<td>$0.00224$ (0.035)</td>
<td>$-0.0466$ (0.072)</td>
<td></td>
</tr>
<tr>
<td>M1.2.3</td>
<td>$-0.004$ (0.077)</td>
<td></td>
<td></td>
<td>$-0.0035$ (0.072)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$-0.0028$ (0.009)</td>
</tr>
</tbody>
</table>

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.

For non-linear specification, two groups 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 choices 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) have been estimated using as explanatory variable the component of labor market policy 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

\[
\Delta \varepsilon_i = \beta + 2 \gamma Lmp_i.
\]

A U-shape arises in equation (4) since \(\beta\) is significant negative and \(\gamma\) is significant positive, 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 Appendix.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 column.

²¹ Results are presented in Table 7: for Cubic specification (equation (5) in column 2) and for the Augmented Cubic model (equation (6) in column 3).
Table 7: Marginal Effects of $Lmp$ in Quadratic model (4), Cubic model (5), and Augmented Cubic model (6).

<table>
<thead>
<tr>
<th>Variable and Coefficient</th>
<th>Quadratic (4)</th>
<th>Cubic (5)</th>
<th>Aumented Cubic (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Lmp$</td>
<td>$-0.21864209^*$</td>
<td>$-0.66825266$</td>
<td>$-0.62119743$</td>
</tr>
<tr>
<td>$Lmp^2$</td>
<td>$0.01455553^*$</td>
<td>$0.07739982$</td>
<td>$0.07035205$</td>
</tr>
<tr>
<td>$D$</td>
<td>$0.17311454^{***}$</td>
<td>$0.17152265^{***}$</td>
<td>$0.17269767^{***}$</td>
</tr>
<tr>
<td>$Lmp^3$</td>
<td>$-0.00286267$</td>
<td>$-0.00252184$</td>
<td>$-0.0029938^{**}$</td>
</tr>
<tr>
<td>Vol_B</td>
<td>$0.73886614$</td>
<td>$1.785074$</td>
<td>$1.6887987$</td>
</tr>
<tr>
<td>FDI</td>
<td>$\pi$</td>
<td>$0.33635961$</td>
<td>$0.33806998$</td>
</tr>
</tbody>
</table>

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
\[ \frac{\Delta \varepsilon_i}{\Delta P_{mp_i}} = \beta + 2 \gamma P_{mp}. \]

Since the coefficient on \( P_{mp} \) is \textbf{positive} and the coefficient on \( P_{mp}^2 \) is \textbf{negative} (see Table 8 first column), the quadratic has a \textbf{Parabolic shape} with \textbf{maximum} value correspond to a positive value of \( P_{mp}^* = 0.0386532 / (2*0.0033059) \) = \textbf{5.8460933}. Before this point, \( P_{mp} \) has a positive effect on elasticities, and after this point, \( P_{mp} \) has a negative effect on elasticities.

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 \( P_{mp} \) has a \textbf{diminishing} effect on elasticities if \( P_{mp} \) is around \( P_{mp}^* = 5.8460933 \). It is possible that the effect of \( P_{mp} \) really becomes negative at some point, but it is hard to believe that this happens at 5.8460933 of \( P_{mp} \) (\( \beta \) and \( \gamma \) are not significant). A more likely possibility is that the estimated effect of \( P_{mp} \) on elasticities is biased because we have controlled for no other factors, or because the functional relationship between \( P_{mp} \) and \( \varepsilon_i \) in equation (4) is not entirely correct.

(c) for \( \varepsilon_i = F(P_{mp}) \)

Figure 7: Quadratic Models

---

\footnote{Both are not significant.}

\footnote{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),\(^\text{25}\) now there is two positive values of Pmp where the marginal effect of Pmp on elasticities is nul;

\[
\begin{align*}
\{Pmp_1^* &= 4.6977913 \\
\{Pmp_2^* &= 7.1823003
\end{align*}
\]

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

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

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

Figure 8: Cubic model

Politics depend then on the starting value for Pmp. It means that if any country starts from Pmp less than 4.6977913, it has to achieve this value to gain maximum of elasticities. If it starts from 7.1823003, it can improve its elasticity 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) elasticities. So governments have to be vigilant.\(^\text{27}\) 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), \textit{Results reported in Table 8 column 3}),\(^\text{28}\) now there is two other positive values for Pmp where the marginal effect of Pmp on elasticities is null;

\[\text{Fitted values are from -0.1653368 to 0.1694609.} \]

\[\text{Fitted values are from 2.959229 to 3.343042. All coefficients are significant.}\]

\(^{25}\) 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 \(\varepsilon_i < 0\), \(\{Pmp_1^* = 4.6495109, Pmp_2^* = 7.3787904\). While if \(\varepsilon_i > 0\), \(\{Pmp_1^* = 4.6994641, Pmp_2^* = 6.916789\) \(\text{see Figure 8 (a').}\)

\(^{28}\) Fitted values are from 2.959229 to 3.343042. All coefficients are significant.
(Pmp\_1 = 4.7186128 > 4.6977913; Pmp\_2 = 7.2479261 > 7.1823003)

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 ε\_i = F(Pmp, FDI, Vol\_B)

Figure 9: Augmented Cubic models.

Table 8: Marginal Effects of Pmp in model (4), (5) and (6)\(^{29}\)

<table>
<thead>
<tr>
<th>Variable and Coefficient</th>
<th>Quadratic (4)</th>
<th>Cubic (5)</th>
<th>Aumented Cubic (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pmp (\beta)</td>
<td>0.03865325</td>
<td>1.3874443**</td>
<td>1.73019**</td>
</tr>
<tr>
<td>Pmp(^2) (\gamma)</td>
<td>−0.00330591</td>
<td>−0.24425759**</td>
<td>−0.30269431**</td>
</tr>
<tr>
<td>D (\delta)</td>
<td>0.17406153***</td>
<td>0.15069993***</td>
<td>0.14725153***</td>
</tr>
<tr>
<td>Pmp(^3) (\theta)</td>
<td>0.01370683**</td>
<td>0.01686337**</td>
<td>0.00433102***</td>
</tr>
<tr>
<td>Vol_B (\rho)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FDI (\pi)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: * p<.1; ** p<.05; *** p<.01. \(D_i = \begin{cases} 1 & \text{if } \varepsilon_i > 0 \\ 0 & \text{if } \varepsilon_i \leq 0. \end{cases} \)
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. 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 promote 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 countries, 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 countries, only 15-24 years old participant in active population (Tx1524) have negative and significant effect on elasticities.

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

\[
\begin{array}{|c|c|c|c|}
\hline
\text{cons} & \alpha & N & R^2 \\
\hline
-1.6097736 & -2.5291408** & 44 & 0.3048658 \\
-3.1416902** & & 44 & 0.37734602 \\
& & 44 & 0.43753772 \\
\hline
\end{array}
\]

---

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 \( Pmp^* = 7.1823003 \).
- 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.

Bibliographie


### Appendix

#### 7. Data

Table A 1: List of countries.

<table>
<thead>
<tr>
<th>Francophone countries</th>
<th>Anglophone countries</th>
<th>Francophone countries</th>
<th>Anglophone countries</th>
<th>Francophone countries</th>
<th>Anglophone countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algérie (AN)</td>
<td>Egypte</td>
<td>Congo, Rép. dém. (AC)du</td>
<td>Angola</td>
<td>Namibie</td>
<td></td>
</tr>
<tr>
<td>Maroc (AN)</td>
<td>Iran, République islamique</td>
<td>Gabon (AC)</td>
<td>Erythrée</td>
<td>Nigéria</td>
<td></td>
</tr>
<tr>
<td>Bénin</td>
<td>Iraq</td>
<td>Guinée</td>
<td>Gambie</td>
<td>Ouganda</td>
<td></td>
</tr>
<tr>
<td>Burkina Faso (AO)</td>
<td>Jordanie</td>
<td>Guinée-Bissau</td>
<td>Ghana</td>
<td>Rwanda</td>
<td></td>
</tr>
<tr>
<td>Burundi (AE)</td>
<td>Liban</td>
<td></td>
<td>Kenya</td>
<td>Sierra Leone</td>
<td></td>
</tr>
<tr>
<td>Cap-Vert (AO)</td>
<td>Libye</td>
<td></td>
<td>Lesotho</td>
<td>Tanzanie</td>
<td></td>
</tr>
<tr>
<td>Comores (AE)</td>
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<td>Malawi</td>
<td>Zambie</td>
<td></td>
</tr>
<tr>
<td>Congo (AC)</td>
<td>Yémen</td>
<td></td>
<td>Mozambique</td>
<td>Zimbabwe</td>
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</tr>
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</table>

23
Table A 2. Cross-section Data for Elasticities: point estimates from equation (1).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Algérie</td>
<td>0</td>
<td>0.3784868</td>
<td>Egypte</td>
<td>1</td>
<td>0.691423</td>
<td>Sierra Leone</td>
<td>1</td>
<td>0.002575</td>
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<td>Maroc</td>
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<td>0.0028011</td>
<td>Iran, République islamique</td>
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<td>0.0255433</td>
<td>Tanzanie</td>
<td>1</td>
<td>0.0049916</td>
</tr>
<tr>
<td>Bénin</td>
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<td>0.1870598</td>
<td>Iraq</td>
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<td>0.0007784</td>
<td>Zambie</td>
<td>1</td>
<td>-0.1541904</td>
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<tr>
<td>Burkina Faso</td>
<td>0</td>
<td>-0.1534659</td>
<td>Jordanie</td>
<td>1</td>
<td>0.461259</td>
<td>Zimbabwe</td>
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<td>-0.002017</td>
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<td>Burundi</td>
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<td>Liban</td>
<td>1</td>
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Note: For Francophone countries, code=0, and for Anglophone ones, code=1.

Figure B 1 : Distribution of positive and negatives elasticities.
### Table A 3: Correlation Matrix for independent variables of all countries

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<tr>
<th></th>
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<th>Lmp</th>
<th>VA_S</th>
<th>Inflat</th>
<th>Trade</th>
<th>FDE</th>
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### Table A 4: descriptive statistics of Independent variables for Francophone countries

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<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
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### Table A 5: descriptive statistics of Independent variables for Anglophone countries

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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 \( X_1^* = 7.1649322 \) [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 \( \varepsilon_i < 0 \), \( X = \{ X_1^* = 6.6315186, X_2^* = 9.195051 \} \), while for group of countries with \( \varepsilon_i > 0 \),

\[
X = \{ X_1^* = 2.4691716, X_2^* = 7.6972322 \}
\]

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;\(^{32}\)

\[
X = \{ X_1^* = 7.2102434, X_2^* = 11.387829 \};
\]

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 \( \varepsilon_i < 0 \), \( X = \{ X_1^* = 0.2899442, X_2^* = 8.3604367 \} \),

While if \( \varepsilon_i > 0 \), \( X = \{ X_1^* = 2.5757045, X_2^* = 7.7163307 \} \),

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 \(-0.0861583\) to \(0.1990592\).

\(^{33}\) \(11.387829\) is out of available values for Lmp.
(b) for $\varepsilon_i = F(\text{Imp}, \text{FDI}, \text{Volatility}_{PIB})$

(C) for $\varepsilon_i = F(\text{Imp}, \text{FDI}, \text{Volatility}_{PIB})$

Figure 9 (suite): Augmented Cubic models