THE INTERDEPENDENCE OF FISCAL AND MONETARY POLICY

THE CASE OF GUATEMALA

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INTRODUCTION

 Guerrilla’s prudent fiscal policy has led to one of the lowest fiscal deficit and public debt as percentage of GDP in the Latin American region during the last two decades. Also, the monetary policy framework has been strengthened by legal amendments (constitutional ban on finance the government spending by the Central Bank from 1994) and by the implementation of an inflation targeting regime.

 The literature has extensively explored the role of high and persistent fiscal deficit and/or public debt as driving factors of inflation but also the recognition of the lack of clarity of such relationship when inflation is low has been acknowledged. Therefore, empirical work on the relationship between monetary and fiscal policies in economies with different levels of inflation and institutional settings, as of de Rosende (2007) and empirical work on the long run relationship between inflation and fiscal deficit, as in Catao and Terrones (2003), intend to shed light when the relationship is not obvious.

 This document follows those empirical works to approach the monetary-fiscal policy relationship in Guatemala. Although the debt and deficit indicators in the country are in tolerable levels, the quantitative assessment becomes crucial for policy making.
BACKGROUND
PUBLIC DEBT, FISCAL DÉFICIT AND INFLATION
Percent of GDP

Barbados
Jamaica
St. Kitts and Nevis
Antigua and Barbuda
Grenada
Belize
St. Vincent and the Grenadines
Aruba
Dominica
Brazil
St. Lucia
El Salvador
Guyana
Uruguay
Argentina
Mexico
The Bahamas
Dominican Republic
Colombia
Bolivia
Suriname
Venezuela
Costa Rica
Panama
Honduras
Nicaragua
Trinidad and Tobago
Ecuador
Haiti
Guatemala
Peru
Paraguay
Chile

Gross debt of General Government. Average 2008 – 2018
Percent of GDP

St. Kitts and Nevis
Guyana
Jamaica
Antigua and Barbuda
Belize
Dominica
Nicaragua
Argentina
Grenada
Barbados
Brazil
Bolivia
St. Vincent and the Grenadines
Panama
Honduras
Uruguay
St. Lucia
Haiti
Aruba
Mexico
Peru
El Salvador
Ecuador
Colombia
Costa Rica
Paraguay
Trinidad and Tobago
Dominican Republic
Venezuela
Guyana
Trinidad and Tobago

Source: IMF, WEO Oct 2019
Percent of GDP

Fiscal déficit of General Government. Average 2008 – 2018
Percent of GDP

Source: IMF, WEO Oct 2019
Note: Positive (negative) represents deficit (surplus) fiscal

Note: Positive (negative) represents deficit (surplus) fiscal

-3.0 -2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0 6.0

Source: IMF, WEO Oct 2019
Note: Positive (negative) represents deficit (surplus) fiscal

Percent of GDP
Guatemala: Fiscal and quasi-fiscal déficits
1998 - 2019

Central Bank losses from open market operations and interest payments

Countercyclical fiscal policy in 2009-10 to support domestic demand given the impact of the global financial crisis

Political tensions from 2015, as a result of anti-corruption efforts, led to a paralysis in procurement and inadequate budgetary execution

Improved budgetary execution in 2018-19

Increased public expenditure (social and capital investment) as part of the 1996 Peace Accords

As a % of GDP

Source: Banco de Guatemala
**Guatemala: Inflation**

**1974 - 2019**

**Events in the 1980's:**

- Liberalization of the fixed exchange rate regime in the mid of 80's. External inflation due to pass through.
- Quasifiscal deficits due to exchange rate fluctuations at the end of the 80's.
- International reserves at low levels.
- Liberalization of the interest rates at the end of 80's.

Source: Banco de Guatemala
OBJECTIVE

- Although Guatemala has proved to have a prudent fiscal policy in terms of debt and deficit, this research intends to quantify how fiscal policy is affecting monetary policy and whether the dynamics of debt and fiscal deficit contribute to determine the inflation rate in Guatemala.
First, the degree of fiscal dominance and central bank independence is analyzed following de Resende (2007) and his empirical work using an Dynamic Ordinary Least Squares (DOLS).

Once the big picture is drawn, the Autorregresive Distributed Lag (ARDL) technique is used to analyze the fiscal deficit and inflation relationship, following the work in Catao and Terrones (2003).
DEGREE OF FISCAL DOMINANCE AND CENTRAL BANK INDEPENDENCE
De Rosende (2007)'s work on the interdependence between fiscal and monetary policies:

- **Private sector.** In each period, consumers choose consumption ($c_t$), labor ($n_t$), and next-period holdings of capital ($k_t$), money ($m_t$) and nominal one-period government debt ($b_t$).

  $u(c_t, m_t/p_t, 1 - n_t)$

  s.t. $c_t + \frac{m_t}{p_t} + \frac{b_t}{p_t} + k_t = w_t n_t + r_t k_{t-1} + \frac{m_{t-1}}{p_t p_{t-1}} + i_{t-1} \frac{b_{t-1}}{p_t p_{t-1}} - \tau_t$

  Where $\tau_t$ is a lump-sum tax, $\pi_t = p_t/p_{t-1}$ is the gross inflation rate, $i_{t-1}$ is the gross nominal interest rate on government debt which is set in period $t-1$ and paid in period $t$, $w_t$ is the wage rate, and $r_t$ is the gross return on capital between periods $t-1$ and $t$.

- **Government.** In every period, the government spends an exogenous amount of resources $G_t$. Government expenditures may be financed by levying lump-sum taxes ($\tau_t$), by issuing money ($M_t$), and by increasing public debt ($B_t$).

  $G_t + (i_{t-1} - 1) \frac{B_{t-1}}{p_t} = \tau_t + \frac{(M_t - M_{t-1})}{p_t} + \frac{(B_t - B_{t-1})}{p_t}$
METHODOLOGY

- **Equilibrium.** After optimization, de Rosende (2007) obtains the equation that describes the aggregate price level as a function of consumption and of the stocks of money and debt:

\[
p_t = \frac{(1 - \beta)[M_t + (1 - \delta)B_t]}{\gamma c_t}
\]

- For the econometric strategy, de Rosende (2007) rewrites the previous equation to obtain estimates of \( \delta \), the parameter that measures the degree of interdependence between fiscal and monetary policies

\[
M_t = \frac{\gamma}{(1-\beta)} C_t - (1 - \delta)B_t \quad \text{where } C_t \equiv p_t c_t
\]

- Thus, for the empirical work:

\[
M_t = \alpha_0 + \alpha_1 C_t + \alpha_2 B_t + e_t
\]

- \( \delta \) would be identified from the coefficient on the stock of debt: \( \alpha_2 = -(1 - \delta) \)

- Two extreme cases: \( \delta = 1 \) it means no fiscal dominance (or equivalently, there is central bank independence); \( \delta = 0 \) it means there is fiscal dominance (or equivalently, no central bank independence).
The dynamic ordinary least squares (DOLS) method allows the estimation of the cointegrating vector \((M_t, B_t \text{ and } C_t)\).

\[
M_t = \alpha_0 + \alpha_1 C_t + \alpha_2 B_t + \sum_{s=-p}^{q} \varphi_{1,s}\Delta C_{t-s} + \sum_{s=-p}^{q} \varphi_{2,s}\Delta B_{t-s} + e_t
\]

Where \(M_t\)=Monetary base (M1) \(C_t\)=Household consumption expenditure; \(B_t\)=General government gross debt; \(\alpha_0\) = intercept; \(\alpha_j\) for \(j=1,2\) are constant coefficients; \(e_t\)=disturbance term; \(\varphi_{j,s}\) for \(j=1,2\) and \(s = -p, -p + 1, ..., q - 1, q\) are constant coefficients.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Sample</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monetary base</td>
<td>1980-2019</td>
<td>Annual, nominal in quetzales, per-capita data</td>
<td>Banco de Guatemala</td>
</tr>
<tr>
<td>General government gross debt (internal + external)</td>
<td>1980-2019</td>
<td>Annual, nominal in quetzales, per-capita data</td>
<td>Ministry of Finance and Banco de Guatemala</td>
</tr>
</tbody>
</table>
**RESULTS**

- **Stationarity.** $M_t$, $C_t$ and $B_t$ are non stationary variables, according to ADF unit root test (Ho: The variable has a unit root)

<table>
<thead>
<tr>
<th>Variable</th>
<th>lags</th>
<th>t-stat</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_t$</td>
<td>0</td>
<td>-2.58</td>
<td>0.2912</td>
</tr>
<tr>
<td>$M_t$</td>
<td>0</td>
<td>2.73</td>
<td>1.0000</td>
</tr>
<tr>
<td>$B_t$</td>
<td>0</td>
<td>0.17</td>
<td>0.9969</td>
</tr>
</tbody>
</table>

  *Notes:*
  1. ADF test equations include a constant and a linear trend
  2. Lag length based on AIC criterion

- **Cointegration.** $M_t$, $C_t$, and $B_t$ are cointegrated according to the Engle-Granger cointegrations test (Ho: Series are not cointegrated).

<table>
<thead>
<tr>
<th>Lag length selection criteria</th>
<th>lags</th>
<th>t-stat</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIC</td>
<td>5</td>
<td>-4.58</td>
<td>0.0144</td>
</tr>
<tr>
<td>SIC</td>
<td>5</td>
<td>-4.58</td>
<td>0.0144</td>
</tr>
<tr>
<td>MAIC</td>
<td>0</td>
<td>-1.17</td>
<td>0.9497</td>
</tr>
</tbody>
</table>
## DOLS Estimation of Structural Parameters

### Lag and lead method

<table>
<thead>
<tr>
<th>Lag and lead method</th>
<th>$\alpha_1$</th>
<th>$\alpha_2$</th>
<th>$\delta$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>point estimate</td>
<td>95% conf. Interval</td>
<td></td>
</tr>
<tr>
<td><strong>Fixed (lead=4 and lag=4)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>estimate</td>
<td>0.091</td>
<td>0.146</td>
<td>1.146</td>
</tr>
<tr>
<td>t-statistic</td>
<td>6.128</td>
<td>3.139</td>
<td></td>
</tr>
<tr>
<td>p-value</td>
<td>0.000</td>
<td>0.011</td>
<td></td>
</tr>
<tr>
<td><strong>AIC (lead=3 and lag=4)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>estimate</td>
<td>0.079</td>
<td>0.228</td>
<td>1.228</td>
</tr>
<tr>
<td>t-statistic</td>
<td>3.572</td>
<td>3.358</td>
<td></td>
</tr>
<tr>
<td>p-value</td>
<td>0.003</td>
<td>0.005</td>
<td></td>
</tr>
<tr>
<td><strong>SIC (lead=3 and lag=0)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>estimate</td>
<td>0.097</td>
<td>0.126</td>
<td>1.126</td>
</tr>
<tr>
<td>t-statistic</td>
<td>6.086</td>
<td>2.565</td>
<td></td>
</tr>
<tr>
<td>p-value</td>
<td>0.000</td>
<td>0.017</td>
<td></td>
</tr>
<tr>
<td><strong>HQC (lead=3 and lag=4)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>estimate</td>
<td>0.079</td>
<td>0.228</td>
<td>1.228</td>
</tr>
<tr>
<td>t-statistic</td>
<td>3.572</td>
<td>3.358</td>
<td></td>
</tr>
<tr>
<td>p-value</td>
<td>0.003</td>
<td>0.005</td>
<td></td>
</tr>
</tbody>
</table>
FISCAL DEFICIT AND INFLATION
Catao and Terrones (2003)’s work on the relationship between fiscal deficit and inflation:

**Household.** The representative household maximizes \( \sum_{t=0}^{\infty} \beta^t u(c_t, l_t) \) s.t. \( c_t + \frac{b^g_{t+1}}{R_t} + \frac{m_{t+1}}{p_t} = y_t - \tau_t + b^p_t + \frac{m_t}{p_t} \)

**Government.** The government budget constraint \( \frac{b^g_{t+1}}{R_t} = \tau_t + b^g_t - g_t + \frac{M_{t+1} - M_t}{p_t} \)

**Equilibrium.** After optimization, Catao and Terrones (2003) obtain the equation that describes the long run relationship between the rate of inflation as a proportion to the ratio of gross-of-interest government deficit to the average stock of narrow money during the period:

\[
\frac{\pi}{1 + \pi} = p\left[ g - \tau + b^g \frac{(R - 1)}{R} \right] \frac{M}{M}
\]

Thus, for the empirical work

\[
\pi = \psi \frac{(G - T)}{M}
\]

Where \( (G - T) \) is the nominal budget deficit and \( \psi \) is the semi-elasticity parameter to be estimated.
METHODOLOGY

- An auto-regressive distributed lag (ARDL) structure is used where dependent and independent variables enter the right-hand side with lags of order p and q, respectively:

\[ \pi_t = \mu_t + \sum_{j=1}^{p} \lambda_j \pi_{t-j} + \sum_{l=0}^{q} \delta'_{i,l}x_{i,t-l} + \varepsilon_{i,t} \]

Where \( \pi_t \) stands for the observed inflation; \( \mu_t \) represents fixed effects; and \( x_{i,t} \) is a \((k \times 1)\) vector of explanatory variables which includes \( \psi \), the coefficient on \( \frac{(G-T)}{M} \); \( \lambda_j \) are scalars and \( \delta_{i,l} \) are \((k \times 1)\) coefficient vectors.

- The previous equation can be re-parameterized and written in terms of a linear combination of variables in levels and first differences

\[ \Delta\pi_t = \mu_t + \phi_{t}[\pi_{t-1} - \theta'x_{i,t}] + \sum_{j=1}^{p-1} \lambda_j^* \Delta\pi_{t-j} + \sum_{l=0}^{q-1} \delta^*_{i,l} \Delta x_{i,t-l} + \varepsilon_t \]

Where \( \theta \) defines the long-run equilibrium relationship between the variables involved and \( \phi \) the speed with which inflation adjust toward its long-run equilibrium following a given change in \( x_{i,t} \).
<table>
<thead>
<tr>
<th>Variable</th>
<th>Sample</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic inflation</td>
<td>1990Q1 - 2020Q1</td>
<td>Quarterly, y-o-y variation of the CPI, the last month of the quarter</td>
<td>National Institute of Statistics (INE) and Banco de Guatemala</td>
</tr>
<tr>
<td>Government deficit</td>
<td>1990Q1 - 2020Q1</td>
<td>Quarterly, nominal in quetzales, sum of the three months of the quarter</td>
<td>Ministry of Finance and Banco de Guatemala</td>
</tr>
<tr>
<td>M1</td>
<td>1990Q1 - 2020Q1</td>
<td>Quarterly, nominal in quetzales, average of the three months of the quarter</td>
<td>Banco de Guatemala</td>
</tr>
<tr>
<td>Oil price</td>
<td>1990Q1 - 2020Q1</td>
<td>Quarterly, West Texas Intermediate, spot price FOB, dollars per barrel, average of the three months of the quarter</td>
<td>US Energy Information Administration</td>
</tr>
<tr>
<td>Foreign exchange rate</td>
<td>1991Q2 - 2020Q1</td>
<td>Quarterly, Quetzales per US Dollar, buy and sell weight rate average, average of the quarter</td>
<td>Banco de Guatemala</td>
</tr>
<tr>
<td>US inflation</td>
<td>1990Q1 - 2020Q1</td>
<td>Quarterly, y-o-y variation of the US CPI, the last month of the quarter</td>
<td>US Bureau of Labor Statistics</td>
</tr>
</tbody>
</table>
RESULTS

- **Model selection method.** Starting with a max number of lags of the dependent variable (p) and the independent variable (q) = 8. AIC, SIC, HQ, ARS criteria used in the selection. It was chosen AIC with p=3 and q=0 (given the bounds test and error correction term that will be explained below).

\[
\text{infl} = c + \text{infl}_{-1} + \text{infl}_{-2} + \text{infl}_{-3} + \frac{\text{def}}{\text{m1}} + \text{oil} + \text{fx} + \text{infl}^{us}
\]

where

- \( \text{infl} = \) inflation
- \( \frac{\text{def}}{\text{m1}} = \) fiscal deficit as a ratio of M1
- \( \text{oil} = \) oil price
- \( \text{fx} = \) foreign exchange rate
- \( \text{infl}^{us} = \) US inflation
RESULTS

- **Checking long-run relationship.** Using the F-bounds test. If F-stat < I(0) cannot reject the Ho; if F-stat > I(1) reject the Ho; if I(0)<F-stat<I(1) indetermined.

**F-Bounds test**
Ho: No long-run relationship

<table>
<thead>
<tr>
<th>F-Statistic</th>
<th>Significance</th>
<th>I(0)</th>
<th>I(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.001253</td>
<td>10%</td>
<td>2.2</td>
<td>3.09</td>
</tr>
<tr>
<td></td>
<td>5%</td>
<td>2.56</td>
<td>3.49</td>
</tr>
<tr>
<td></td>
<td>1%</td>
<td>3.29</td>
<td>4.37</td>
</tr>
</tbody>
</table>

There is a long-run (cointegrating) relationship between the variables.

- **Estimation of the coefficients of the long-run equilibrium and the error correction form.**

\[ d(inf_l) = d(inf_{l-1}) + d(inf_{l-2}) + ect_{-1} \]

Where ect = error correction term
• The long-run coefficient of def/M1 (12.6) is higher than the found by Catao and Terrones (2003) for the average of developing countries (1.40). However, the def/M1 coefficient is not statistically significant.

• The long-run coefficient of the US inflation is statistically significant and with the expected sign. However, the long run coefficient of oil and fx is not statistically significant or does not have the expected sign.

• The error correction term (ect) is statistically significant and has the correct sign: it means that a deviation from the long-run equilibrium in inflaton is corrected by 35%. This is below the 53% average for developing countries found by Catao and Terrones (2003).

<table>
<thead>
<tr>
<th>Variable</th>
<th>ARDL (3,0,0,0,0)</th>
<th>Long-run coefficients</th>
<th>Error Correction Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>infl_1</td>
<td>0.590558***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.091773]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>infl_2</td>
<td>0.219403**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.106956]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>infl_3</td>
<td>-0.161128*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.084244]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>def/m1</td>
<td>4.424252</td>
<td>12.59871</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[4.715252]</td>
<td>[13.52716]</td>
<td></td>
</tr>
<tr>
<td>oil</td>
<td>-0.004948</td>
<td>-0.014091</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.005607]</td>
<td>[0.015755]</td>
<td></td>
</tr>
<tr>
<td>fx</td>
<td>-0.453001*</td>
<td>-1.289987**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.258484]</td>
<td>[0.639234]</td>
<td></td>
</tr>
<tr>
<td>infl_us</td>
<td>0.773281***</td>
<td>2.202032***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.131661]</td>
<td>[0.462329]</td>
<td></td>
</tr>
<tr>
<td>constant</td>
<td>4.213713**</td>
<td>11.99917**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[2.100438]</td>
<td>[4.783204]</td>
<td></td>
</tr>
<tr>
<td>d(infl_1)</td>
<td></td>
<td>-0.058275</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.078045]</td>
<td></td>
</tr>
<tr>
<td>d(infl_2)</td>
<td></td>
<td>0.161128**</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.077472]</td>
<td></td>
</tr>
<tr>
<td>ect</td>
<td>-0.351167***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.046633]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The variable “influs” was consistently significant with the expected sign in different samples and frequencies.

The variable “deficit/M1” was statistically significant in few samples only although with a high coefficient.

The rest of variables were not always consistently significant neither did they have the expected sign.

<table>
<thead>
<tr>
<th>Model:</th>
<th>AIC(3,0,0,0,0)</th>
<th>SIC (4,0,3,0)</th>
<th>ARS (5,3,4)</th>
<th>SIC (1,0,0)</th>
<th>AIC (3,0,0,0)</th>
<th>AIC (4,2,0,1,1)</th>
<th>SIC (1,0,0,0,0)</th>
<th>SIC (1,0,1,0,4)</th>
<th>AIC (1,0,1,0,4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a def/m1</td>
<td>12.59871</td>
<td>0.419573</td>
<td>0.660795</td>
<td>21.65629</td>
<td>23.52916</td>
<td>86.12897***</td>
<td>44.04442***</td>
<td>9.297641*</td>
<td>10.11303</td>
</tr>
<tr>
<td>b oil</td>
<td>-0.014091</td>
<td>-0.025522</td>
<td>-0.049478**</td>
<td>-0.035689**</td>
<td>0.002207</td>
<td>5.553974**</td>
<td>-0.023229*</td>
<td>-0.534138</td>
<td></td>
</tr>
<tr>
<td>c fx</td>
<td>-1.289987**</td>
<td>-1.69356**</td>
<td>-1.69356**</td>
<td>-1.69356**</td>
<td>-1.69356**</td>
<td>-1.69356**</td>
<td>-1.69356**</td>
<td>-1.69356**</td>
<td>-1.69356**</td>
</tr>
<tr>
<td>e oilv</td>
<td>-0.011623</td>
<td>0.18046*</td>
<td>0.18046*</td>
<td>0.18046*</td>
<td>0.18046*</td>
<td>0.18046*</td>
<td>0.18046*</td>
<td>0.18046*</td>
<td>0.18046*</td>
</tr>
<tr>
<td>f fxv</td>
<td>0.18046*</td>
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Note: The numbers in parenthesis for the models mean (p, q, a, q, b, q, c, d, q, e, q, f): p number of lags of dependent variable, q number of lags of independent variable a, b, c, d, e or f. 

oilv = y-o-y variation of oil price; fxv = y-o-y variation of foreign exchange rate.
Given that $\delta > 1$, the econometric technique suggests that there is no fiscal dominance (or equivalently, there is monetary independency) in Guatemala. This means, that the fiscal authority backs fully all outstanding debt. Since increases in current or future taxes are limited, the more feasible way is the reduction in current or future expenditures.

The punctual value of $\delta$ goes from 1.16 to 1.23 (depending on the lag and lead selection criteria), similar to those of some advanced economies found by de Rosende (2007). The 95% confidence interval confirm that the lower bound is not less than 1.

The ARDL econometric technique does not provide strong evidence of a long-run relationship between inflation and the fiscal deficit. Similarly, the oil price and exchange rate relationship changes depending on the sample. Conversely, the US inflation was statistically significant and with the expected sign throughout all the samples and model specifications.

The lack of a statistical significance in the long-run relationship between the fiscal deficit and inflation can be explained by the central bank independence in the sense that the debt plays only a minor role in the determination of the price level.
REFERENCES


THANKS FOR YOUR ATTENTION!