Inflation and Inflation Tax in Developing Countries; A Panel Threshold Approach

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ABSTRACT Governments make revenue from issuing money. This revenue is called seigniorage and in general consists of two parts, namely the rising demand for money to keep up with the growth of economy and the “inflation” tax. This paper uses a panel threshold regression model to study whether a non-linear relationship between inflation Tax and inflation in 129 developing countries based on two regimes of inflation (low and high inflation regimes). Empirical results indicate the Laffer curve in inflation tax exists in 129 developing countries. The threshold inflation rate is 6.7%. Therefore, in low inflation regime (inflation rate is less than 6.7%), The inflation rate has a significantly positive impact on inflation tax. By contrast, when inflation rate is in high regime (inflation rate is larger than 6.7%), the inflation rate has a significantly negative impact on inflation tax.

KEY WORDS Seigniorage, Inflation tax, Panel Threshold Model, Laffer Curve, Developing Countries

JEL CODES E43, E52, E62

1. Introduction
The governments of developing countries usually spend more than they collect in revenues. The resulting deficits can be financed in three different ways: by borrowing from non-bank public,
by borrowing from the rest of the world, or by borrowing from the banking system, including the Central Bank. The first source is relatively limited in developing countries because their capital markets are poor or there is no such market at all, or because this method of financing is not being accepted by people in these countries who usually think that government borrowing means government bankruptcy.

By the 1980s many developing countries had come to rely on foreign borrowing to help finance their increasing public sector deficits. When external funding began to decrease as a result of debt crisis and so on, governments were forced to reduce their fiscal deficits or to finance them from the banking system. Some countries were able to reduce their fiscal deficits, but many were not. Cutting expenditures, especially those to which people had become accustomed was difficult from a social and political point of view, and raising additional revenues was not always feasible. Therefore, most governments shifted their financial requirements to the banking system.

The important point which this paper concentrates on is that government makes a profit from issuing money because the cost of producing modern money (largely bank notes) is less than the face value. This profit on new money is called seigniorage which is typically a source of government revenue in developing countries.

The remainder of this paper proceeds as follows: section 2 provides the meaning and the concepts of the government revenue from money creation. Model specification represented in section 3. The empirical analysis which is based on estimation of threshold value of inflation will be shown in section 4. The concluding section brings out the major implications of the paper.

2. Review of Literature

From a theoretical perspective, some distinctions would probably be necessary between seigniorage revenue collected from printing money and inflation tax. Seigniorage can be defined as the value of real resources acquired by the government through its ability to print money (Begg, Fischer and Dornbusch, 1994; Korap, 2006). Let SE represent the real seigniorage revenue, M nominal money balances or the non-interest bearing high powered money and P price level. So we can construct the real seigniorage relationship such as,

$$ SE = \frac{\Delta M}{P} = \frac{\Delta M}{M} \cdot \frac{M}{P} = \mu m $$

Where \( \mu \) is the change in nominal money balances, \( m \) the real money balances and \( \Delta \) the difference operator. Following Blanchard (1997), the larger the real money balances held in the economy, the larger the amount of seigniorage corresponding to a given rate of money growth. On the other side, the inflation tax refers to the increase in nominal money balances which individuals have to accumulate to keep their real balances constant in an inflationary framework. Let IT be the inflation tax,

$$ IT = \frac{\Delta P}{P} \cdot \frac{M}{P} = \pi m $$

Where \( \pi \) is the inflation rate. Equation 2 provides that government can reduce the real value of the non-interest-bearing part of the government debt by using inflation (Begg, Fischer and Dornbusch, 1994). In this sense, we can interpret \( \pi \) as the inflation tax rate and \( m \) as the tax base. When the inflation rate is zero, the government gets no revenue from inflation, while the amount of inflation tax received by the government would increase as the inflation rate rises.
But as the inflation rate rises, people would reduce their holdings of money base due to the fact that monetary base is now more costly to hold. Thus, individuals hold less currency, and banks hold as little excess reserves as possible, and eventually the real monetary base falls so much that the total amount of inflation tax revenue received by the government falls (Dornbusch and Fischer, 1994; Korap, 2006).

The difference between seigniorage and inflation tax arises from the changes in real money demand, which in turn may be the consequence of financial liberalization or changes in the inflation rate, real income, and interest rates. This difference is sometimes referred to as the non-inflationary component of seigniorage, as it is the increase in money demand that is consistent with a zero inflation rate (Rodrik, 1990). Besides, as the economy grows the government can obtain some revenue from seigniorage even if there is no inflation. That is because when the demand for real monetary base is growing, the government can create some base without producing inflation (Dornbusch and Fischer, 1994).

If we consider a Laffer curve to represent the seigniorage revenue against inflationary framework,

**Fig 1: Seigniorage Laffer curve**

![Seigniorage Laffer curve](image)

Where S represents the seigniorage revenue as a proportion of the GDP and $\pi$ the domestic inflation rate. In Figure 1 above, we see that the seigniorage maximizing inflation rate is B with an inflation rate of $\pi_0$. Before this point the higher the inflation rate the larger the seigniorage revenue by means of an increase in the base money, and to the right of the point B, the higher the domestic inflation the lower the seigniorage revenue, since economic agents would try to avoid holding base money balances so that they can protect themselves from incurring inflation tax by reducing real monetary balances in their hands. We can also notice in Figure 1 that the same seigniorage revenue can be collected by imposing different inflation rates such as $\pi_2$ and $\pi_1$, where the tax rate is higher but the tax base is lower, that is the wrong side of the seigniorage maximizing Laffer curve in the latter case with respect to the former.

In this line, the former coincides with the correct or efficient side of the Laffer curve, in which there is still opportunity for a higher seigniorage at higher inflation rates (Kiguel and Neumeyer, 1995), and there is an implicit loss of seigniorage revenue if the economy moves to a lower level of inflation (Soydan, 2003; Korap, 2006).
Several studies have tried to consider seigniorage in recent years. Jafari Samimi (1994) examined the relationship between inflation and seigniorage in a sample of different developing countries via estimation of Laffer Curve for the period 1965-1990. He concluded that although the typically inverted U-shaped Laffer Curve is acceptable for developing countries, the government revenue from printing money arises from inflation tax only, which is a high costly method of financing government budget deficit. Tahsin (2003) have investigated the predictions of the theory of optimal seigniorage in developing countries over the period 1970-1999. He represented that the tax smoothing hypothesis, tested on forty selected developing countries, is rejected. However, the hypothesis that economies with high levels of expenditures and taxation also have high levels of inflation tax, tested on the forty selected developing countries and on a larger sample (up to 112 developing countries) could not be rejected. Korap (2006) have investigated the courses of inflation tax and seigniorage revenue for policy makers of the Turkish economy. For this purpose, he first constructed the ex-ante seigniorage revenue maximizing inflation model, and then calculated annual inflation tax and seigniorage revenues for the post-1980 period Turkish economy. Following these theoretical issues, his empirical model have constructed upon the Turkish economy, and his ex-post estimation results revealed that inside the period considered, the Turkish economy lies on the correct or efficient side of the seigniorage maximizing Laffer curve. Ehrhart et.al (2009) developed a growth model with public investment as the engine of perpetual growth, and look for the effect of deficit, tax and money financing on economic growth on a sample of developing countries. They studied in particular the way fiscal and monetary policies (through deficit and seigniorage respectively) deform the GLC (Growth Laffer Curve). They found that when accounting for public investment, there exists a GLC between taxes and economic growth. Second, this GLC depends on both fiscal deficits and seigniorage. On the one hand, a lower deficit-to-GDP-ratio or a higher money-growth rate reduces the GLC-maximizing tax rate. This may explain why Governments have difficulties in defining a fiscal policy that perfectly matches the optimal tax rate. On the other hand, a higher deficit ratio always moves the GLC downwards, while the effect of seigniorage is subject to nonlinearities.

3. Model Specification

We have used the following model:

\[ \text{InfTax}_{it} = \alpha + \beta \text{Inf}_{it} + I[\text{Inf}_{it} > \gamma](\delta \text{Inf}_{it}) + \varepsilon_{it} \quad (3) \]

\[ I[\text{Inf}_{it} > \gamma] = \begin{cases} 1 & \text{if } \text{Inf}_{it} > \gamma \\ 0 & \text{if } \text{Inf}_{it} \leq \gamma \end{cases} \quad (4) \]

Where “InfTax” is multiple Money in inflation as a proxy for inflation tax. “Inf” is inflation rate based on consumer price index. Subscribe i and t are cross section and time symbol. We have estimated this model for 129 developing countries at 2000-2008 periods.
The threshold value γ can be found by estimating the regression (3) through finding the minimum Error Sum of Squared. In this paper we set “Inflation Rate” as the threshold variable.

5. Empirical Results

This paper uses panel threshold regression model to study whether a non-linear relationship between inflation Tax and inflation based on two regimes of inflation (low and high inflation). The threshold value is 6.7% and this means that one threshold exists.

Table 1: Results of Estimation of Model

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C(1)</td>
<td>-6.97E+15</td>
<td>9.91E+14</td>
<td>-7.027283</td>
</tr>
<tr>
<td>C(2)</td>
<td>1.47E+15</td>
<td>3.49E+14</td>
<td>4.199056</td>
</tr>
<tr>
<td>C(3)</td>
<td>-8.31E+14</td>
<td>3.49E+14</td>
<td>2.379547</td>
</tr>
</tbody>
</table>

R-squared 0.997537
Adjusted R-squared 0.997514
S.E. of regression 2.49E+16
Sum squared resid 5.95E+35
Log likelihood -37914.55
S.E. of regression 2.49E+16
Akaike info criterion 78.35650
Schwarz criterion 78.40687
Hannan-Quinn criter. 78.37567
F-statistic 43107.65
Durbin-Watson stat 1.416872
Prob(F-statistic) 0.000000

As table 1 indicates, in the non-linear model, when “inflation rate” is the threshold variable, in low inflation regime (inflation rate is less than 6.7%), The inflation rate has a significantly positive impact on inflation tax. By contrast, when inflation rate is in high regime (inflation rate is larger than 6.7%), the inflation rate has a significantly negative impact on inflation tax. So the inflation rate has a threshold value in 129 developing countries that it has a different effect on inflation tax based on two regimes of inflation rate.

Table 2 represents 55 developing countries that have Inflation rate greater than 6.7% at 2008.

Table 2: developing countries that have Inflation rate greater than 6.7% (2008)

<table>
<thead>
<tr>
<th>Country</th>
<th>Inflation rate</th>
<th>Country</th>
<th>Inflation rate</th>
<th>Country</th>
<th>Inflation rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>8.831413</td>
<td>Jamaica</td>
<td>9.293255</td>
<td>Russian Fe.</td>
<td>9.007227</td>
</tr>
<tr>
<td>Azerbaijan</td>
<td>16.69284</td>
<td>Kazakhstan</td>
<td>10.76867</td>
<td>Rwanda</td>
<td>9.080722</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>9.106985</td>
<td>Kenya</td>
<td>9.75888</td>
<td>Sierra Leone</td>
<td>11.51117</td>
</tr>
<tr>
<td>Belarus</td>
<td>8.4215</td>
<td>Kyrgyz Re.</td>
<td>10.17524</td>
<td>Solomon Is</td>
<td>7.663484</td>
</tr>
<tr>
<td>Bolivia</td>
<td>8.706247</td>
<td>Latvia</td>
<td>10.10717</td>
<td>Sri Lanka</td>
<td>15.84211</td>
</tr>
<tr>
<td>Botswana</td>
<td>7.080998</td>
<td>Lesotho</td>
<td>8.03031</td>
<td>St. Vincent and the</td>
<td>8.337708</td>
</tr>
</tbody>
</table>
Table 2: Countries with Lowest and Highest Inflation Rates

<table>
<thead>
<tr>
<th>Country</th>
<th>Inflation Rate</th>
<th>Country</th>
<th>Inflation Rate</th>
<th>Country</th>
<th>Inflation Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>8.402475</td>
<td>Madagascar</td>
<td>10.30072</td>
<td>Sudan</td>
<td>7.976023</td>
</tr>
<tr>
<td>Burundi</td>
<td>8.342032</td>
<td>Malawi</td>
<td>7.95221</td>
<td>Swaziland</td>
<td>9.458525</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>9.357331</td>
<td>Maldives</td>
<td>7.375163</td>
<td>Tajikistan</td>
<td>13.14912</td>
</tr>
<tr>
<td>Egypt</td>
<td>9.318969</td>
<td>Mauritania</td>
<td>7.254108</td>
<td>Tanzania</td>
<td>7.025514</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>17.238</td>
<td>Mauritius</td>
<td>8.802725</td>
<td>Trinidad and Tobago</td>
<td>7.889358</td>
</tr>
<tr>
<td>Georgia</td>
<td>9.244919</td>
<td>Moldova</td>
<td>12.36687</td>
<td>Turkey</td>
<td>8.756181</td>
</tr>
<tr>
<td>Ghana</td>
<td>10.73273</td>
<td>Mongolia</td>
<td>9.045246</td>
<td>Ukraine</td>
<td>12.8402</td>
</tr>
<tr>
<td>Grenada</td>
<td>7.400659</td>
<td>Mozambique</td>
<td>8.162567</td>
<td>Uruguay</td>
<td>8.114214</td>
</tr>
<tr>
<td>Guyana</td>
<td>12.30443</td>
<td>Namibia</td>
<td>6.727789</td>
<td>Venezuela, RB</td>
<td>18.69865</td>
</tr>
<tr>
<td>Honduras</td>
<td>6.936215</td>
<td>Nicaragua</td>
<td>11.12693</td>
<td>Vietnam</td>
<td>8.303789</td>
</tr>
<tr>
<td>Hungary</td>
<td>7.934519</td>
<td>Pakistan</td>
<td>7.598684</td>
<td>Zambia</td>
<td>10.65735</td>
</tr>
<tr>
<td>Argentina</td>
<td>8.831413</td>
<td>Paraguay</td>
<td>8.128776</td>
<td>Zimbabwe</td>
<td>24411.03</td>
</tr>
<tr>
<td>Iran</td>
<td>17.21305</td>
<td>Qatar</td>
<td>13.75816</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on table 2, these countries should be decline inflation to raise government revenue from issuing money.

6. Conclusion

In recent years, most governments in developing countries shifted their financial requirements to the banking system. As a result, governments make revenue from issuing money. This revenue is called seigniorage and in general consists of two parts, namely the rising demand for money to keep up with the growth of economy and the “inflation” tax. This paper uses panel threshold regression model to study whether a non-linear relationship between inflation Tax and inflation in 129 developing countries based on two regimes of inflation (low and high inflation regimes). Empirical results indicate the Laffer curve in inflation tax exists in 129 developing countries. The threshold inflation rate is 6.7%. Therefore, in low inflation regime (inflation rate is less than 6.7%), the inflation rate has a significantly positive impact on inflation tax. By contrast, when inflation rate is in high regime (inflation rate is larger than 6.7%), the inflation rate has a significantly negative impact on inflation tax.
References

Korap, L. (2006). Seigniorage revenue and Turkish economy, MPRA Paper No. 20106