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Anti-Money Laundering Regulation and Crime: A Two-Period Model of Money-in-the-Utility-Function

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This paper presents a two-period model of money-in-the-utility-function to investigate the impact of anti-money laundering policy on crime. Our two- period model reveals that an increase in labor wage in the legal sector unambiguously decrease labor hours allocated for illegal sector. However, the crime-reducing impact of anti-money laundry regulation and the probability of the agent to be caught require both parameters should be above some thresholds. These thresholds are a function of the marginal rate of substitution of 'dirty' money for consumption and the responsiveness (elasticity) of illegal income to the policy parameter. Higher threshold implies the need for stringent anti-money laundering policy. Therefore, the marginal rate of substitution between 'dirty' money and consumption, and the elasticity of illegal income to the policy parameter are the key in governing the formulation of the anti-money laundry policy.

1. Introduction

Anti-money laundering policy has become a major issue in most part of the world, particularly in developed countries and has become an important front in the fight against crime. According to Wasserman (2002), measures against money laundering can facilitate detection of financial trails that provide important source of evidence, potentially linking the members of a criminal organization. In this sense, anti-money laundering regime can be understood in terms of increased efficiency of the legal system for catching offenders who otherwise would escape. Moreover, finding and seizing money or assets that result from criminal activity can discourage crime. Moreira (2007) pointed out two ways of combating criminality: repressing organized crime by legal

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authorities and by acting preventively and repressively against money laundering process.

Lopez-de-Silanes and Chong (2007) describe money laundering as any process that tries to legitimize the proceeds of illegal activities, thereby maintaining the value of the acquired asset. In other words, it is carried out to disguise or conceal the nature or source of entitlement to money or property from criminal activities. This process, in fact, is critical to the effective execution of organized crime.

Although the relevance of the study of anti-money laundering policy and organized crime seems growing, there is relatively very limited theoretical and empirical work on the issue. Camera (2001) noted that, until now little has been done to construct a model capable of rationalizing such a policy. There is growing need for appropriate policy measures to establish both local and international institutes to effectively combat organize crime and money laundering.

There are some theoretical and empirical studies that have attempted to model and empirically test the link between anti-money laundry regulation and organized crime. Moreira (2007) presents a two-period model where an individual practice concomitantly legal and illegal activity in the first period and in the second period there is no profit of illegal behavior. The result of his model unveils that effectiveness of anti-money laundering policies negatively affect the amount of resources obtained from criminal activities. However, the mechanism through which anti-money laundering policies reduce criminal activities is not clear from the model. Moreover, the model does not explicitly specify the illegal and the legal sector to identify the possible incentive or disincentive to work in either sector. The model also implicitly assumes that income generated from illegal activity is readily available for consumption without being laundered.

Araujo and Moreira (2005) present a basic model by which a representative agent chooses to allocate his saving optimally between money of legal origin and dirty money. The authors analyze the welfare of such an economy as result of money laundering. The result of the model indicates that the effectiveness of anti-money laundering regulations positively affects the consumption. Intuitively, it means that as the effectiveness of anti-money laundering improves, the workers reduce their time in the illegal activities and, therefore, the consumption level increase. In other words, where criminal activity with money laundering is predominant, the welfare of the economy is smaller than the welfare of an economy with a low level of criminality.

Camera (2001) developed a simple general equilibrium model capable of characterizing the links between availability of currency and extent of illegal economic activities. The author attempts to rationalize the policy that promotes replacement of currency with the objective of discouraging illegal economic activities using search theories. His result indicates that stationary monetary equilibria with both legal and illegal production exist, in which case the over-provision of currency may increment the extent of illegal production.

In studying whether anti-money laundry policy reduces crime rate, Ferwerda (2008) employed the basic model of ‘economics of crime’, which explains criminal behavior on the assumption of rational choice, based on the expected utility framework and extends the model by including money laundry and models `the economics of crime and money laundry'. His theoretical model shows that anti-money laundering policy deters potential criminals to commit not only the illegal act of laundering money, but crime in general. The empirical evidence shows that the crime level in a country can be reduced by improving anti-money laundering policies, especially if it focuses on international cooperation. However, Lopez-de-Silanes and Chong (2007) found out that measures that criminalize feeding activities and improve confiscation tend to matter more than other features of legislation.

Vaithilingam and Nair (2007) examined the factors that underpin the pervasiveness of money laundering, using a sample of 88 developed and developing countries, and found out that efficient legal framework with good corporate governance lower the pervasiveness of money laundering activities and a high-innovative capacity contribute negatively to the pervasiveness of money laundering activities. Masciandro (1999) also highlighted the inverse relationship between the degree of diffusion of money laundering activities and the effectiveness of anti-money laundering regulation in a given economy.

Following previous studies (see for example, Araujo and Moreira, 2005; Moreira, 2007), this paper presents a two period model in the classical framework of money- in- the- utility function to study the impact of anti-money laundry regulation on crime. It assumes a representative agent involving in both legal and illegal activities concomitantly to acquire goods and services. The agent uses the criminal sector to carry out criminal offenses and uses money laundry to hide the revenues of these activities in the formal economy. However, we also assume that the income generated from the illegal sector has no purchasing power[2] before it is laundered and used in the second period. Ferwerda (2008), for instance, noted that money laundering (at least to some extent) is needed in order to spend the money derived from illegal activities. Therefore, the agent involves in criminal activities only in the first period and the punishment[3] will occur in the second period. In contrast to Araujo and Moreira (2005) work[4], we do not make any specific assumption on the nature of the criminal activities. Such activities must meet the only requirement of producing 'dirty' money. Therefore, our specification allows for the wider application of the result of our model. We also assume that the same individual who involves in the criminal activity also involves in laundering the 'dirty' money. Moreover, we explicitly specify the illegal economy as a function of the probability of being caught and the effectiveness of anti-money laundering, both of which can be understood as an efficiency parameter in the production function.

2. The Model

We consider an agent that maximizes lifetime utility U which depends on period consumptions level and money holdings. The basic framework follows the classic work by Sidrauski (1967) on money- in- the- utility function. We assume that agents derive utility from money ('clean' and 'dirty') only in the first period.

$$U = u\left(c_{1,} m, \hat{m}\right) + \beta u(c_2) \qquad (4.1)$$

Where $c_{1,}$ and c_2 are consumption levels in two periods, and m and $\hat{m}$ are money of legal origin and 'dirty' money, respectively. Moreover,

[2] Araujo and Moreira (2005) also assume that income generated from the illegal sector has no purchasing power.
[3] Punishment is a part of enforcement pillar of the anti-money laundry regime. It mostly involves confiscation of the criminal proceeds.
[4] They assume a representative agent embezzles part of government transfer.

0<β<1 represents the subjective discount or time preference factor. The period utility function is strictly increasing and concave in consumption and money, $u_{c,}u_m, u_{\hat{m}} > 0$ and u_{cc} $, u_{mm}, u_{\hat{m}\hat{m}} < 0$. The agent allocates his one unit of time between legal and illegal activities. A fraction α[5] of his time is spent in the legal sector. The remaining fraction of his time (1- α) is spent in the illegal sector where he commits criminal offense to generate illegal income and involves in money-laundry activities[6].

Let z represent the illegal sector of the form:

$$z = [(1-p)(1-\varepsilon)]^{1-\emptyset}(1-\alpha)^{\emptyset} \tag{4.2}$$

Where 0 <$\emptyset$ <1, 0 < ε <1 and 0 < p <1. ε and p are parameters representing effectiveness of anti-money laundering regulation and the effort of the police force and legal system to caught and punish criminals (probability term) respectively. $\emptyset$ represents elasticity between illegal income and the time allocated for illegal activity and $(1-\emptyset)$ represents elasticity between illegal income and proxies to the ineffectiveness of the anti-money laundry regulation $(1-\varepsilon)$ and the subjective probability[7] that agent is not caught $(1-p)$. In other words, it indicates the responsiveness of the illegal income to policy parameters. In fact, both proxies as a product can be understood as efficiency parameter in the illegal sector. The rationale for including the ineffectiveness parameter and the probability of being not caught is to emphasis that generating illegal proceeds operates under the limits of such policy parameters. Since we assume an agent does both the predicate crime and laundering activity, we need both parameters in the function of the illegal sector. In the later section we will consider only the case where the probability of not being caught (1-p) will be considered in the illegal sector.

[5] Assume crime and works are substitute activities.

[6] In many cases, it is not unusual to assume that the offender himself involves in money laundering (see Gilmore, 1999).

[7] The effort of the police force and legal system to caught and punish criminals is measured by the probability p.

We have the legal economy of the form:

$$Y = \alpha L, \text{ per capita form } y = \alpha \tag{4.3}$$

Where L is labor and $\alpha > 0$

Hence, in the first period we have

$$c_1 = \alpha w + z - m - \widehat{m} \tag{4.4}$$

A representative agent can hold its wealth in the form of m and $\widehat{m}$. And αw is the income from legal sector, where w represent wage rate in the legal sector. The agent saves part of the income in the form of money. There is no incentive for the representative agent to hold part of his income from legal origin in the form of 'dirty' money. With our assumption of no immediate purchasing power of illegal income in the first period, we have

$$\widehat{m} = z \tag{4.5}$$

Equation (4.5) states that a representative agent saves all its illegal income in the form of dirty money. In the second period, the individual can consume an amount equal to saving from legal (m) and the expected illegal income which is the fraction of illegal income expressed in terms of the ineffectiveness of the anti-money laundering regulation and the probability of not to be caught by the legal system minus the value of expected illegal income that can be apprehended by legal authorities in the second period (cost due to anti-money laundering regulation[8] and the probability of being caught). Measure against money laundering facilitates detection of financial trails through financial transaction record that allow hidden asset to be located and indentify the criminals. Here, the effectiveness of the anti-money laundering policy is measured by the proportion that the illegal income is apprehended,$\varepsilon\widehat{m}$, and the effort of the police and legal system to caught and punish criminals is

[8] The cost of money laundering will therefore depend on the effectiveness of anti-money laundry regulation.

measured by the probability p. The term $\varepsilon p\hat{m}$ reveals aspects of prevention and repression for combating illegal market.

What is important in here is the expected income of illegal origin and the expected loss, if caught, as described above. Our assumption of high positive correlation of the anti-money laundering policy and the probability of the agent be apprehended and punished makes our specification more tractable. This is because we may not consider the case where there is very effective (high value) anti-money laundering policy and the probability of being caught to be low. However, we can still make sense of our second period constraints for different values of the parameters.

Let us take numerical example. If both ε and p are close to zero, the agent would get all illegal income ($\hat{m}$). And if they are close to 1, then the agent would lose his legal income by the amount equals to the income generated by the criminal activities (punishment). For the case where the police force and the legal system is less effective to catch and punish criminal (assume *p=0*) and where we have very effective anti-money laundering regulation ($\varepsilon = 1$) , then the individual will lose all of his illegal proceed ($\hat{m}$). The converse is also true. Institutively it means that anti-money laundering help to confiscate ill-gotten money and increase the efficiency of the legal system to catch and punish criminals. This in, in fact, reduces the incentive to practice criminal activities. Therefore, we have

$$c_2 = (1-\varepsilon)(1-p)\hat{m}/(1+\pi) - \varepsilon p\hat{m}/(1+\pi) + m/(1+\pi) \qquad (4.6)$$

A representative agent solves the following Lagrangian maximization problem:

Max:

$$u(c_1, m, \hat{m}) + \beta u(c_2) + \lambda[\alpha w + (1-\varepsilon)(1-p)\hat{m}/(1+\pi) - \varepsilon p\hat{m}/(1+\pi) - m + m/(1+\pi)] \qquad (4.7)$$

FOC:

$$c_1 : u'_{c_1} = \lambda \tag{4.8}$$

$$c_2 : \beta u'_{c_2} = \lambda \Rightarrow \beta u'_{c_2} = u'_{c_1} \Rightarrow \frac{u'_{c_2}}{u'_{c_1}} = \frac{1}{\beta} \tag{4.9}$$

Equation (4.9) is a standard intertemporal Euler equation. The left hand side represents consumer's marginal rate of substitution of period one (present) for period two (future) consumption, while the right-hand side can be understood as the price of future consumption in terms of present consumption. High value of the discount factor implies the agent place more value to present consumption. Further, first order condition with respect to m yields

$$u'_m = \lambda \left[1 - \left(\frac{1}{1+\pi}\right)\right] \tag{4.10}$$

This implies

$$\frac{u'_m}{u'_{c_1}} = \left[1 - \left(\frac{1}{1+\pi}\right)\right], \tag{4.11}$$

The left hand side of equation (4.11) represents the marginal rate of substitution between money (clean) and consumption. u'_m and u'_{c_1}denotes the marginal benefit of holding additional money and the marginal benefit of an additional consumption in the first period respectively. The right hand side of equation (4.11) represents the relative price holding additional clean money or the opportunity cost of holding one additional unit of clean money.

Moreover, FOC with respect to $\widehat{m}$ gives:

$$u'_{\widehat{m}} = \lambda \left(\frac{(\varepsilon+p)-1}{(1+\pi)}\right) \quad 4.12)$$

this implies

$$\frac{u'_{\widehat{m}}}{u'_{c_1}} = \left(\frac{(\varepsilon+p)-1}{(1+\pi)}\right), \tag{4.13}$$

The left hand side of equation (13) represents the marginal rate of substitution[9] ($MRS_{\widehat{m}c_1}$) of dirty money for consumption. It is the ratio of marginal utility of holding one additional unit of dirty money to the marginal utility of consuming one more unit of good. The right hand side of equation (4.13) indicates the relative price of holding one additional unit of dirty money or an opportunity cost of holding one more unit of dirty money in terms of the forgone consumption in the first period. It is an increasing function of ε and p . It implies that strong anti-money laundering policy (high value of ε) and high probability of being caught (high value of p) make it costly for agent to engage in illegal activities. In other words, the relative price of holding additional dirty money is higher when we have effective anti-money laundering regulation, which in turn reduces criminality.

Finally, FOC with respect to α yields:

$$\lambda w + \lambda\left(\frac{(1-\varepsilon)(1-p)\emptyset(1-\alpha)^{\phi-1}[(1-\varepsilon)(1-p)]^{1-\phi}}{(1+\pi)}\right) - \lambda\left(\frac{\varepsilon p\emptyset(1-\alpha)^{\emptyset-1}[(1-\varepsilon)(1-p)]^{1-\emptyset}}{(1+\pi)}\right) = 00 \qquad (4.14)$$

From (4.14) we obtain the optimal fraction of time allocated to the legal activity

$$\alpha^* = 1-(1-\varepsilon)(1-p)\left[\frac{\emptyset[(\varepsilon+p)-1]}{(1+\pi)w}\right]^{\frac{1}{1-\emptyset}} \qquad (4.15)$$

Let $A = \frac{\emptyset[(\varepsilon+p)-1]}{(1+\pi)w} = \frac{\emptyset\, MRS_{\widehat{m}c_1}}{w}$, and rewrite equation (4.15) as:

$$\alpha^* = 1-(1-\varepsilon)(1-p)[A]^{\frac{1}{1-\emptyset}} \qquad (4.16)$$

The partial derivatives of α^* with respect to ε and w:

$$\frac{\partial\alpha^*}{\partial w} = \frac{[(1-\varepsilon)(1-p)]}{1-\emptyset}A^{\frac{\phi}{1-\emptyset}}\left[\frac{\emptyset[(\varepsilon+p)-1]}{(1+\pi)w^2}\right] > 0 \qquad (4.17)$$

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[9] Assuming a positive $MRS_{\widehat{m}c_1}$ implies $\frac{(\varepsilon+p)-1}{(1+\pi)} > 0$

Our comparative statics result (equation 4.17) shows that an increase in wage rate in the legal sector unambiguously reduces labor hours allocated for legal activity. Our result has an important implication that substitution effect dominates the income effect. That is, the agent supply more labor hours as wage rate increase. An increase in the wage rate can be understood as an increase in the opportunity cost for illegal activities.

And

$$\frac{\partial \alpha^*}{\partial \varepsilon} = (1-p)\left[A^{\frac{1}{1-\emptyset}} - \frac{\emptyset(1-\varepsilon)}{(1+\pi)(1-\emptyset)w} A^{\frac{\phi}{1-\emptyset}}\right] > 0 \qquad (4.18)$$

The condition[10] gives

$$\varepsilon > 1 - \left[(1-\emptyset)(1+\pi)MRS_{\widehat{m}c_1}\right] \qquad (4.19)$$

The right-hand side of equation (4.19) represents the critical or threshold value ε_c.The comparative statics (4.18) implies that an increase in effectiveness of anti-money laundry policy will increase the time allocated for the legal activity, only if the effectiveness of anti-money laundry regulation satisfies equation (4.19). Equation (4.19) indicates that ε must be above this threshold to have a positive impact (i.e. $\varepsilon > \varepsilon_c$). Higher marginal rate of substitution ($MRS_{\widehat{m}c_1}$) and higher elasticity term $(1-\emptyset)$ implies lower threshold (ε_c^l). Institutively, this also mean that when the agent is highly responsive to policy parameter and if the cost of illegal activity is high (in terms of current consumption), anti-money laundry can be effective at the lower threshold[11].

Further, FOC with respect to p gives:

$$\frac{\partial \alpha^*}{\partial p} = (1-\varepsilon)\left[A^{\frac{1}{1-\emptyset}} - \frac{\emptyset(1-p)}{(1+\pi)(1-\emptyset)w} A^{\frac{\phi}{1-\emptyset}}\right] > 0 \qquad (4.20)$$

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[10] Assume $\pi = 0$ gives the reduced form, $\varepsilon > 1 - \left[(1-\emptyset)MRS_{\widehat{m}c_1}\right]$

[11] The converse is also true.

The condition gives

$$p > 1 - \left[(1-\emptyset)(1+\pi)MRS_{\widehat{m}c_1}\right] \quad (4.21)$$

The right-hand side of equation (21) represents the critical or threshold valuep_c. Higher marginal rate of substitution ($MRS_{\widehat{m}c_1}$) and elasticity term $(1-\emptyset)$ implies lower threshold (p_c^l). Institutively, this also means that when the agent is highly responsive to policy parameter and if the cost of illegal activity is high, the subjective probability of being caught discourages the agent to engage in criminal activities at lower threshold.

Taking equation (4.2) and (4.5) and substituting α^* (equation 4.16) implies:

$$\widehat{m}^* = [(1-\varepsilon)(1-p)]^{(1-\emptyset)}(1-\alpha^*)^{\phi} = [(1-\varepsilon)(1-p)]A^{\frac{\phi}{1-\emptyset}} \quad (4.22)$$

Equation (4.22) indicates the optimal stock of ‘dirty’ money. In other words, the optimal labor hour determine the amount of income generated in the illegal sector which is equal to the amount of dirty money in the first period. The proportion of income that goes to the consumption of the second period depends on the effectiveness of anti-money laundering regulation.

Where

$$\frac{\partial \widehat{m}^*}{\partial w} = -\frac{[(1-\varepsilon)(1-p)]}{(1-\emptyset)}\frac{\emptyset^2[(\varepsilon+p)-1]}{(1+\pi)w}A^{\frac{2\phi-1}{1-\emptyset}} < 0 \quad (4.23)$$

Equation (4.23) shows that an increase in wage in the legal sector reduces the stock of ‘dirty’ money by increasing the opportunity cost of illegal activity. In other words, the economic agent supply more labor hour in the legal sector as wage rate increases which in turn reduces the optimal stock of dirty money.

$$\frac{\partial \widehat{m}^*}{\partial \varepsilon} = (1-p)\left[\frac{\emptyset^2(1-\varepsilon)}{(1+\pi)(1-\emptyset)w}A^{\frac{2\phi-1}{1-\emptyset}} - A^{\frac{\phi}{1-\emptyset}}\right] < 0 \quad (4.24)$$

The condition gives

$$\varepsilon > 1 - \left[\frac{(1-\emptyset)(1+\pi)MRS_{\widehat{m}c_1}}{\phi}\right] = \varepsilon_c' \tag{4.25}$$

Let the right-hand side of equation (4.25) represented by ε_c' showing the critical value. Anti-money laundering policy reduces the optimal stock of dirty money only if it is above the critical value. As in the previous case (ε_c), this is also the function of the marginal rate of substitution between dirty money and consumption (i.e. the rate at which an individual is ready to give up consumption to hold one additional unit of dirty money), the responsiveness of illegal income to the policy parameter.

$$\frac{\partial \widehat{m}^*}{\partial p} = (1-\varepsilon)\left[\frac{\emptyset^2(1-p)}{(1+\pi)(1-\emptyset)w} A^{\frac{2\phi-1}{1-\emptyset}} - A^{\frac{\phi}{1-\emptyset}}\right] < 0 \tag{4.26}$$

The condition gives

$$p > 1 - \left[\frac{(1-\emptyset)(1+\pi)MRS_{\widehat{m}c_1}}{\phi}\right] \tag{4.27}$$

p_c' represents the threshold value which is the right-hand side of equation (4.27). The comparative statics from (4.23) indicates that an increase in wage reduces the optimal stock of dirty money by increasing the opportunity cost of illegal activities. However, anti-money laundry regulation discourages illegal activities, only if the anti-money laundry regulation satisfies equation (4.25). As usual, equation (4.25) indicates that ε must be above this threshold to reduce the amount of dirty money[12].

We also re-examine our optimal labor allocation our and the associated comparative statics for different specification of illegal sector:

$$z = (1-p)^{1-\emptyset}(1-\alpha)^{\emptyset} \tag{4.28}$$

[12] The same line of argument applies to the subjective probability term *p*

The rationale for the above specification is that we should only allow the probability of being not caught to enter into the illegal sector and consider the anti-money laundering policy in the money laundering process. Using our equation (4.28), our optimal labor supply is given by:

$$\alpha^* = 1 - (1-p)[A]^{\frac{1}{1-\emptyset}} \qquad (4.29)$$

Our comparative statics with respect to wage w gives the same qualitative result as before. However, we have ambiguous result with respect to ε.

2.1 A Specific Case

Our model in the previous section makes a distinction between efforts of the legal system to prosecute and punish criminals (p) and anti-money laundering policy (ε) to prevent criminals from laundering their ill-gotten proceeds. However, as pointed out by Reuter and Truman (2004), Anti-money laundering (AML) regime as it has evolved over some thirty years has two basic pillars: prevention and enforcement[13]. The prevention pillar of the AML regime is designed to deter criminals from using private individuals and institution to launder the proceeds of their crime. Enforcement is designed to punish criminals when, despite prevention effort, they have facilitated the successful laundering of those proceeds. As criminals gather the proceeds of their predicate crimes, the investigation, prosecution and punishment, and confiscation elements of the enforcement pillar are employed to combat the underlying crime as well as to tighten the screws on the money laundering process (see Truman & Reuter, 2004).

Lopez-de-Silanes and Chong (2007)[14] empirically studied which aspect of the anti-money laundry regulation matters the most and found out the enforcement pillar[15] is found out to be the most important one.

[13] Lopez-de-Silanes and Chong (2007) noted that the two are not mutually exclusive.
[14] They admit the limitation of their data to capture different aspects of prevention and enforcement
[15] Particularly criminalizing the feeding activities and improved confiscation

Therefore, we assume that p and ε are strongly correlated and can be understood as the two pillar of the anti-money laundry policy. As in the case of Moreira (2007), without the loss of generality, we admit that

$$p= \varepsilon \qquad 4.28)$$

Given equation (4.28), we rearrange and resolve the previous maximization model and the results are presented below.

Our illegal sector will take the following form:

$$z = [(1-\varepsilon)^2]^{1-\emptyset}(1-\alpha)^{\emptyset} \qquad (4.29)$$

Consumption in the first period (Equation 4.4) remains the same and consumption in the second period is given by:

$$c_2 = (1-\varepsilon)^2\widehat{m}/(1+\pi) - \varepsilon^2\widehat{m}/(1+\pi) + m/(1+\pi) \qquad 4.30)$$

Based on our optimization result, the first-order condition with respect to c_1 , c_2 and m and remain the same as given by equation (4.8), (4.9) and (4.10).

FOC with respect to and $\widehat{m}$ yield:

$$u'_{\widehat{m}} = \lambda\left(\frac{2\varepsilon-1}{(1+\pi)}\right) \qquad (4.31)$$

this implies

$$\frac{u'_{\widehat{m}}}{u'_{c_1}} = \left(\frac{2\varepsilon-1}{(1+\pi)}\right) \qquad (4.32)$$

The left hand side of equation (4.30) represents the marginal rate of substitution[16] ($MRS_{\widehat{m}c_1}$) of dirty money for consumption, while the right

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[16] Assuming a positive $MRS_{\widehat{m}c_1}$implies $\frac{(2\varepsilon-1)}{(1+\pi)} > 0$

hand side is the price of present dirty money in terms of current consumption or it represents the relative price of holding one additional unit of dirty money. We note that the higher the effectiveness of the anti-money laundering policy, the higher the price of dirty money with respect to the current consumption.

First-order condition with respect to α yields the following optimal (equilibrium) value of labor allocation in the legal sector:

$$\alpha^{*} = 1 - (1-\varepsilon)^{2}\left[\frac{\emptyset[2\varepsilon-1]}{(1+\pi)w}\right]^{\frac{1}{1-\emptyset}} \qquad (4.34)$$

Let B = $\frac{\emptyset[2\varepsilon-1]}{(1+\pi)w} = \frac{\emptyset\, MRS_{\widehat{m}c_{1}}}{w}$, and rewrite equation (31) as

$$\alpha^{*} = 1 - (1-\varepsilon)^{2}[B]^{\frac{1}{1-\emptyset}} \qquad 4.35)$$

The partial derivatives of α^{*} with respect to ε and *w* give the same result as given above (equation 4.17 and 4.18).

Taking equation (4.2), (4.5) and (4.31) implies:

$$\widehat{m}^{*} = [(1-\varepsilon)^{2}]^{(1-\emptyset)}(1-\alpha^{*})^{\phi} = (1-\varepsilon)^{2}B^{\frac{\phi}{1-\emptyset}} \qquad (4.36)$$

The partial derivatives of m^{*} with respect to ε and *w* give same result as given above (equation 4.23 and 4.24).

In general, our assumption of high correlation between anti-money laundering policy and legal system to prosecute and punish criminals gives the same result without lose of generality. Therefore, we can argue that our special case captures the two aspects of the anti-money laundering regime (prevention and enforcement) allow us to specifically study the impact of AMR to combat crime.

3. Conclusion

This paper presents a two-period model based on the classic framework of money- in- the- utility function, whereby, an individual is assumed to engage concomitantly in both legal and illegal activities. Our model reveals that an increase in labor wage in the legal sector unambiguously decrease the labor hours allocated for illegal sector by increasing the opportunity cost for illegal activities. However, the crime-reducing impact of anti-money laundry regulation and probability of the agent to be caught and punished require that both parameters should be above some critical or threshold values. These thresholds are a function of the marginal rate of substitution[17] ($MRS_{\hat{m}c_1}$) of 'dirty' money for consumption and the elasticity (responsiveness) parameter in the illegal sector.

Higher marginal rate of substitution implies that a representative agent places a higher value on holding one extra unit of 'dirty' money (higher opportunity cost). In other words, agent with a characteristic of higher marginal rate of substitution (holding dirty money is costly) may easily be discouraged from committing a crime as compared to a person with lower marginal rate of substitution for a given level of anti-money laundering regime. Higher effectiveness of anti-money laundering policy and a well organized effort by the police force and legal system to catch criminals drive the value (price) of dirty money (in terms of current consumption) up. In other words, higher values of both parameters make criminal activities costly.

Higher value of the elasticity term $(1 - \emptyset)$ implies more inelastic or less responsive of the illegal income to the policy parameters. In this case, we expect that criminals are more likely to engage in criminal activities due to less responsiveness of such activities to policy parameters.

[17] Higher marginal rate of substitution ($MRS_{\hat{m}c_1}$) of dirty money for consumption implies that the individual is willing to give up more of consumption to have an additional unit of dirty money.

Lower $MRS_{\hat{m}c_1}$ (marginal rate of substitution) and, less responsive illegal income to anti-money laundry policy and the probability to be caught, imply that anti-money laundering regulation only reduce the incentive for illegal activity if the policy parameter (ε) is above some critical or threshold value ε_c^h (higher threshold). In other words, we need a stringent anti-money laundering regulation and effective legal system to deter criminals with high tendency of engaging in criminal activities (money laundering and organized crimes).

Higher marginal rate of substitution (high opportunity cost of holding dirty money) and, more responsive illegal income to anti-money laundry regulation and the probability of being caught, imply that anti-money laundering policy only discourage illegal activities if the policy parameter (ε) is above some critical or threshold value ε_c^l (lower threshold). And, we have already established that $\varepsilon_c^h > \varepsilon_c^l$, which implies the need for tough anti-money laundry regulation for the case with high tendency of criminal activities.

In sum, the marginal rate of substitution between 'dirty' money and consumption and the responsiveness of illegal income to the policy parameter are the key in governing the formulation of the anti-money laundry policy. However, it is very difficult to observe and measure both factors to formulate policy prescriptions based on the attributes of criminals. The severity and frequency of the problem among different groups of people, sectors and countries should be carefully identified before allocating resources to combat money laundering and organize crime. More specifically, countries may formulate different punishment mechanisms to discourage such criminal behavior. For instance, formulating severe punishment for repeated offenders (high tendency criminals, ε_c^h) rather than having the same punishment for first time offender. Moreover, due to the nature of the crime, countries may also need to seek international cooperation to effectively fight money laundering and the predicate crimes.

Finally, the assumption of strong correlation between anti-money laundry policy effectiveness and the probability of being caught for the predicate crime doesn't considerably change our result and conclusion. However, it captures, in a better sense, the two aspect of anti-money laundering regulation: prevention and enforcement. Some policy makers may argue that countries with effective legal system may effectively fight criminal activities without having anti-money laundering regulations. However, our results imply that anti-money laundering regulations help combating criminality by increasing the cost of engaging in criminal activities and help to prevent and repress illegal activities which justify resource allocation for anti-money laundering regime.

Future research may focus on introducing other forms of punishment mechanisms in addition to confiscation of the proceeds from illegal activities.

References

Araujo, R.A. and Moreira, S.T. (2005), An Inter-Temporal Model of Dirty Money, *Journal of Money Laundry Control*, Vol.8, Issue 8, 260-262.

Camera, G. (2001), Dirty money, *Journal of Monetary Economics* 47, 377-415.

Ferwerda, J. (2008), The Economics of Crime and Money Laundering: Does Anti-Money Laundering Policy Reduce Crime? Tjalling C. *Koopmans Research Institute*, Discussion Paper Series 08-35.

Gilmore, W. (1999), Dirty Money: The Evolution of Money Laundering Countermeasures. Strasbourg, France: Council of Europe Publishing.

Lopez-de-Silanes, F. and Chung, A. (2007), Money laundering and Its Regulation, Inter-*American Development Bank*, Research department, working paper # 590.

Masciandaro, D. (1999), Money Laundering: the Economics of Regulation, *European Journal Of Law and Economics*.

Masciandaro, D. (1999), Illegal Sector, Money Laundering and Legal Economy: A Macroeconomic Analysis, *Journal of Financial Crime* 2: 103-112.

Moreira, S. T. (2007), A Two-Period Model of Money Laundering and Organized Crime, *Economics Bulletin*, Vol. 11, No. 3, 1-5.

Reuter, P. and Truman, E.M. (2004), *Chasing dirty money: The fight against money laundering*. Washington D.C.: Institute for International Economics.

Sidrausky, M. (1967), Rational Choice and Pattern of Growth in Monetary Economics, *American Economic Review*, Vol.57, No.2, 534-544.

Vaithilingam, S. and Nair, M. (2007), Factors affecting money laundering: lesson for developing countries, *Journal of Money Laundering Control*, Vol. 10, No. 3.

Wasserman, W. (2002), Dirty Money, Regional Review Q1.