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Insider Trading among Central Bankers – a Treatise on Temptation and Policy Choice

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University of Passau
February 06

Abstract

Corruption among central banks induces distorted policies by, first, increasing the inflation bias and, second, potentially inducing a pro-cyclical adjustment of employment. In response to a negative supply shock a corrupt central banker is tempted to decrease money supply. In this case, he pretends an ultra-conservative attitude while in reality he is driven by self interest. If societies with extreme tastes (relating only to inflation or employment) are not governed by central bankers with similar preferences, corruption might be tolerated as an instrument of bringing factual policies more in line with its public desire. This finding provides a warning signal against the choice of non-representative central bankers.

JEL classification: E5, K42
Keywords: Time-inconsistency, inflation bias, seignorage, stochastic supply side shocks, conservatives, populists.

1. Introduction

The central bank might fail in its actions, but one would not question its benevolence. Central bankers are perceived as honestly trying to optimize the well being of society. Meltzer [2002] refers to the Great Inflation in 1965-84 and states that it was not voluntarily created by malevolent central bankers. It merely emerged because the acting central bankers at that time were misinterpreting economic theories. Economic modeling has a similar viewpoint towards central bankers. For example, models of time inconsistency assume benevolence by letting the central banker share the same objectives as the society he is supposed to serve. It is just due to time inconsistency that such central bankers bring about adverse welfare consequences, [Kydland and Prescott 1977, Barro and Gordon 1983, Rogoff 1985, Persson and Tabellini 1990].

A self-seeking or even corrupt central banker is beyond the scope of current modeling. Being the governor of a central bank, however, opens ample opportunities for corrupt dealings. Following Klitgaard's [1988] classical analysis, corruption is assumed to flourish where there is a monopoly, discretionary freedom in the decisions and a lack of accountability. A closer look at central banks shows that their governor conducts his job under these circumstances that according to Klitgaard [1988] favor corruption. The central bank holds a monopoly related to the print and issuing of money. It has considerable discretion in how it goes about its task. This discretionary freedom encompasses the choice of the monetary strategy, which instruments to use in the conduct of monetary policy, which goals to follow, which targets to set and which banks to choose in their open market operations. All this is repeatedly done

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with a considerable level of secrecy. Greenspan [2002: 5] argues that "the undeniable, though regrettable, fact is that the most effective policymaking is done outside the immediate glare of the press. But that notion and others have been used too often in the past to justify a level of secrecy that turned out to be an unnecessary constraint on our obligation to be transparent in conducting the public's business." This secrecy, despite its capacity in enabling swift policy decisions, can also provide central bankers with the leeway necessary to conduct corrupt deals. This notion is further supported by the increasing number of instances and allegations of corrupt deals in the international media that involve the central banks.

There has been recent interest in the operation of central banks in a corrupt environment. But wherever corruption and central banks are analyzed in the same setting, the assumption of a benevolent central bank is generally upheld. Huang and Wei [2003] analyze the effects of corruption on monetary policy. They argue that a conservative central banker may fail to optimize seignorage in a corrupt environment, an argument, which might be particularly compelling in some less developed countries. However, it is not the central banker, who is corrupt in their model. Corruption affects the tax collectors and diminishes the tax revenue. This creates the need for revenues from an inflation tax to balance the state's budget. Al-Marhubi [2000] argues along similar lines. He states that societies with rampant corruption tend to have a larger shadow economy. Due to the illicit nature of the shadow economy the medium of transfer is preferably cash; the demand for the domestic currency is subsequently higher. At the same time, taxing this unofficial economy is near to impossible. This suggests that seignorage is a superior stream of public revenue. Al-Marhubi [2000] therefore argues that corruption is likely to go along with higher inflation and provides evidence on this link for a cross-section of countries.

Lambsdorff and Schinke [2002] provides a first investigation to the conduct of a self-seeking central banker. Given the possibility for corruption, it is shown that the public is likely to distrust a central banker's benevolence, not only his commitments. This distrust, measured by a high level of expected inflation, can have positive effects because it may force a conservative central banker to lower realized inflation rates. Empirical support is provided for a cross section of 23 countries from Eastern Europe and the former Soviet Union. One feature of the model is that the central banker can only obtain a corrupt income from increasing the economy's money supply. There are theoretic arguments suggesting that the corrupt central bankers might generally prefer to generate additional income by indulging in expansive monetary strategies. This assumption also holds for many of the case studies we collected. However, in some instances central bankers can also profit from decreasing the money supply. For example, they might engage in selling inside knowledge of a more restrictive stance of monetary policy. An illustrative example stems from the Bank of Japan (BoJ).

In the beginning of the year 1998 the Japanese society was shocked by a major corruption scandal that involved the BoJ and the Ministry of Finance (MOF). Although only marginally involved, it let to the suicide of the Bank of Japan`s chief director, Mr Takayuki Kamoshida (BBC: May 2, 1998). The scandal gathered momentum on the 13th of March 1998, when the Tokyo police arrested Mr Yasuyuki Yoshizawa. At the day of his arrest Mr Yoshizawa was head of the BoJ`s Capital Market Division. He was well connected to other important branches within the BoJ. As one of very few persons within the bank he was allowed to read the Bank of Japan's Tankan-Report several days before its official publication. This report contains important information on the development of the Japanese business cycle and the Japanese economy. It is a valuable source of information to analysts and brokers working in the Japanese stock markets because it contains details among others on the disposable income of the Japanese households, car sales and the development of the consumer price index.[2]

Mr Yoshizawa's position at the center of the BoJ`s money market actions and his good connections to other important BoJ departments ensured that he had even more valuable information for someone working in the Yen-business. He had inside knowledge on money market rates and tender volumes or planned exchange rate interventions by the BoJ. On the occasion of dinner invitations and golf outings – the expenses for these were covered by large Japanese investment and commercial banks – Mr Yoshizawa leaked these secrets to executives of the private banking sector and thus gave them advance knowledge of the BoJ`s actions. He was charged with accepting dinner and golf invitations from his sponsors worth about 51.600 € alone. However Mr Yoshizawa was not the only person from the BoJ with such intimate ties to the private banking sector. After the scandal broke, the Bank of Japan began to venture into the behavior of some 600 of its employees which were all from the management level, similar to Mr Yoshizawa's position. The majority of these employees were in charge of the allocation of funds to private banks. The chief director Kamoshida – also labeled Mr Clean – disciplined about 100 of these suspects for accepting entertainment and gifts from clients.[3]

As shown by the need to discipline almost 100 staff members of the BoJ, the spreading of inside knowledge by the officials to the Japanese banking sector was systemic. The 146 largest banks of Japan had approximately 230 employees as "BoJ handlers" on their payroll. It was their job to maintain good relations with the Bank of Japan. This meant that on several occasions these persons had to meet with employees of BoJ and entertain them in order to obtain inside information. This advantage in knowledge often triggered large transactions by the private banks. Furthermore, failing to comply with the demands made by the BoJ-employees could result in severe punishment handed down on them by the Bank of Japan (LA Times, April 22, 1998). To punish "uppity" banks, the BoJ would withhold liquidity or actively withdraw liquidity so that the "culpable" bank ran into problems fulfilling its capital requirements. The bank's management would then have to kowtow to BoJ in order to receive additional liquidity and beg for a bailout. This treatment was called "grilled chicken" or, in Japanese, "yakitori". For example, in 1991, the Tokai Bank from Nagoya sacked its vice-president after a series of scandals. Unfortunately, the vice-president was a former employee of BoJ. In a move of alleged retaliation for firing the vice-president, BoJ, overnight, removed liquidity amounting to 100 billion Yen from the Tokai Bank, which was already struggling to meet its capital requirements.[4]

According to the present case of Mr Yoshizawa, employees in the mid and higher ranks of the central bank's hierarchy possess inside knowledge, valuable to persons in the private banking sector. With respect to the subsequent modeling we will deal with inside information on the strength of monetary policy. Monetary supply might increase or decrease and those who know the direction have some news to sell.

[2] See British Broadcasting Corporation (BBC), May 2, 1998: "Japanese Mr Clean Kills Himself". Japan Economic Institute (JEI), March 27, 1998: "JEI-Report: New BoJ Leadership Points to Continuity Change",No. 12B. Die Presse, Germany: March 12, 1998:"Japanische Notenbank in Skandal verwickelt".

[3] See British Broadcasting Corporation (BBC), April 7, 1998: "Scandal Grows at Japanese Central Bank". CNN Cable News Network (CNNfn), February 9, 1998: "Clouds Grip Bank of Japan".

[4] See Süddeutsche Zeitung, March 13, 1998: „So sorry, 'Tokio bei Nacht' ist einfach zu teuer". LA Times, April 22, 1998: „Slowly, Japan's Bank Reforms Gain Currency".

The sale of inside information was also the problem in Brazil in 1999. Francisco Lopes headed the Brazilian Central Bank as a governor for only three weeks. Upon his appointment he devalued the Brazilian currency, the Real, by eight percent. As alleged by the media, before the devaluation Lopes gave advance notice about the new exchange rate to several private Brazilian banks, enabling them to profit from the ”unexpected move”. Furthermore, a few days after the devaluation he sold dollars at favorable prices to the same banks. One year later in February 2000 Lopes was charged with fraud and the maintenance a foreign bank account that he neither declared to the tax office nor to the central bank.[5] Although the charges were dropped lately, the reports are illustrative to the potential insider dealings among central banks. Given that all banks might change their US dollars back into Real at the new, higher exchange rate, the money supply would increase. It appears equally reasonable for a central banker to sell inside information also on an appreciation, in which case the monetary supply would shrink.

This study investigates how central bank policies are distorted when central bankers can corruptly profit from changing the money supply. It is organized as follows. Section 2 develops a natural rate model and derives a measure for the additional income of the central banker. Section 3 introduces this feature into a standard model for central bank policy. Section 4 concludes.

2. Modeling Supplementary Income for Central Bankers

Our model consists of a demand function, a supply function, and the central banker’s cost function. The demand function assumes the validity of the classical quantity theory: $Y_t^r = 1/\gamma \cdot M_t / p_t$. Assuming that γ, the inverse of the income velocity, stays constant over time the change in the real national income between the periods *t*-1 and *t* is given by:

(1) $$\gamma \Delta Y_t^r = \frac{M_t}{p_t} - \frac{M_{t-1}}{p_{t-1}} = \frac{p_{t-1}\Delta M - M_{t-1}\Delta p}{p_t p_{t-1}}.$$

Using the definition of the inflation rate, $\pi = (p_t - p_{t-1})/p_{t-1} \Leftrightarrow p_t = p_{t-1}(1+\pi)$, to substitute for the price level p_t and setting $m = \Delta M / M_{t-1}$, equation (1) changes to:

(2) $$\gamma \Delta Y_t^r = m \frac{M_{t-1}}{p_{t-1}(1+\pi)} - \frac{M_{t-1}}{p_{t-1}} \frac{\pi}{(1+\pi)}.$$

Setting the income level in period *t*-1, Y_{t-1}^r, equal to one yields $M_{t-1}/p_{t-1} = \gamma$ and thus:

(3) $$Y_t^r = Y_{t-1}^r + \frac{m-\pi}{(1+\pi)}.$$

A rise in the nominal growth rate of the quantity of money, m_t, and a decrease of the inflation rate π_t raise the present level of income Y_t^r, as determined by the demand side. Assuming that the range for the inflation rate is such that $(1+\pi)$ is close to one, this implies

(4) $$Y_t^r = Y_{t-1}^r + m - \pi.$$[6]

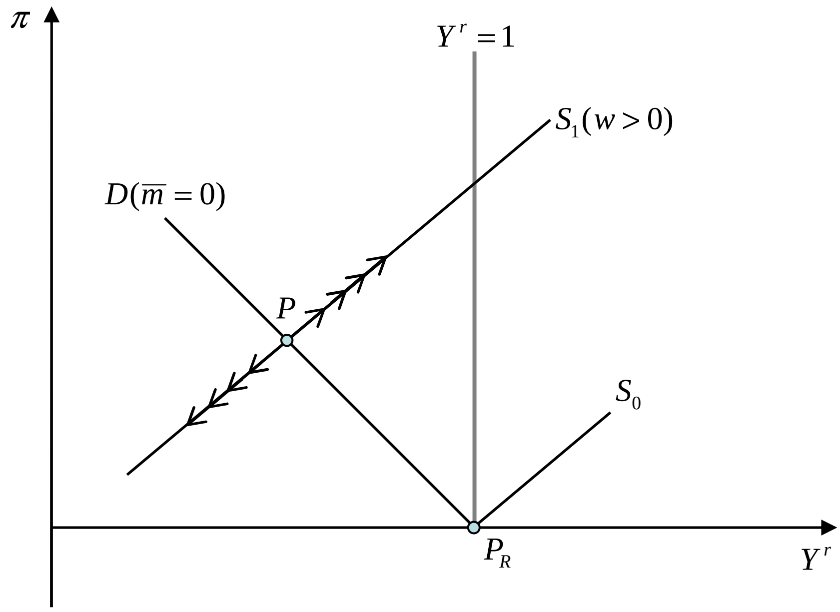
Likewise, the growth rate of the monetary stock *m* is:

(4’) $$m = Y_t^r - Y_{t-1}^r + \pi.$$

5 See British Broadcasting Corporation (BBC), February 2, 1999: “Brazil replaces Central Bank Governor for the 2nd time in a month”, April 14, 1999): “Brazilian Senate launches investigation against Central Bank“, April 26, 1999: “Ex-bank chief arrested,“ February 30, 2000: “Brazilian banker charged with fraud,“ and January 20, 2001: “Brazilian central banker charged.“

6 Apparently, the demand function derived here is similar to the usual logarithmic approach employed in other publications.

Figure 1: The Self-Serving Central Banker.



At the core of the macroeconomic supply side is the labor market behavior of private agents and firms. This is described by the expectations-augmented Phillips-curve, where a constant inverse ratio between unemployment and GDP is assumed. The supply side is further influenced by a stochastic supply side shock, *w*. If the value of *w* is positive, the economy is experiencing a contractive shock:

(5) $\pi_t = \pi_t^* + \theta\left(Y_t^r - \overline{Y}^r\right) + w, \qquad w \sim N\left(0; \sigma_w^2\right).$

Inflation depends positively on expected inflation, excess income, the level by which income exceeds its natural level ($\overline{Y}^r$ =1), and the shock variable *w*.

The central banker's cost function relates to public as well as private goals The central bank governor or an organized group of central bank employees sell inside information on future money tenders. In the following this group or the governor alone are referred to as the central banker. The bribe of the central banker is related to the development of the monetary stock, ΔM_t. If he keeps the money supply constant he has no news to sell to his corrupt partners in the private banking sector. In this case $m = Y_t^r - Y_{t-1}^r + \pi = 0 \Leftrightarrow Y_t^r - Y_{t-1}^r = -\pi$, which is a negatively sloped diagonal, as depicted in Figure 1. If a decision is made to lower the money supply, this information is equally valuable for the corrupt central banker as the sale of insider's knowledge on an increased money supply. Departing from the diagonal, the monetary stock is changed and the central bank has news to sell.

The supply curve according to (5) has a positive slope. A positive shock *w* shifts the curve to the left. Holding constant the money supply would bring about a solution at the intersection with the demand curve $D(\overline{m} = 0)$. But this solution would minimize the central banker's corrupt income. Any deviation from this policy will result in an increase of the corrupt revenue. Only lame ducks – in the sense of being rather passive and indecisive – would settle for this equilibrium. The increase in corrupt revenue will drive more industrious central bankers away from the solution in *P*, as indicated by the arrows. In the subsequent analysis the $D(\overline{m} = 0)$-line acts as a watershed: social optima that lie above this line are driven further up, signifying that corrupt income provides an incentive to further increase inflation. Social optima that lie below go along with a corrupt incentive to further decrease the inflation rate.

In order to make the model tractable we assume the central banker's costs to be negatively affected by the square of his supplementary income, B^r. This can be justified by the risks of corrupt transactions. Winston [1979: 840-1] argues that the risk associated with corruption increases with the number of transactions, the number of people involved, the duration of the transaction and the simplicity and standardization of the procedure. But the risk does not clearly increase with the value of a transaction. This suggests that large transactions are a superior base for demanding and arranging a bribe. We consider this argument by assuming that the benefit from corruption increases super proportionally with its base, the changing monetary stock. Graphically this implies that the further distant one is from the $D(\overline{m}=0)$-line the higher is the desire to further depart from this line. Disregarding money illusion, the supplementary income is expressed in real terms:

(6) $$\left(B^r\right)^2=\kappa\left(\frac{M_t-M_{t-1}}{p_t}\right)^2 .$$

We interpret the parameter κ as the extent of the central bankers' corruptibility. For κ approaching 1 the central banker will pocket the complete information rent. For κ approaching 0 the central banker is not able to take advantage of his insider's knowledge. Using the definition of the growth rate of the monetary stock $m=\frac{M_t-M_{t-1}}{M_{t-1}}$ equation (5) can be transformed to:

$$\left(B^r\right)^2=\kappa\left(m\frac{M_{t-1}}{p_t}\right)^2 .$$

From the definition of the inflation rate follows $p_t=(1+\pi)p_{t-1}$. Substituting for the price level p_t and using $M_{t-1}/p_{t-1}=\gamma$ we obtain:

$$\left(B^r\right)^2=\kappa\left(\frac{m}{1+\pi}\gamma\right)^2 .$$

Assuming that the inflation rate stays with in reasonable limits, $(1+\pi)$ is close to one:

(7) $$\left(B^r\right)^2=\kappa m^2\gamma^2 .$$

Substituting for the growth rate of the monetary stock $m=Y_t^r-Y_{t-1}^r+\pi$ in equation (7) yields:

(8) $$\left(B^r\right)^2=\kappa\gamma^2\left(Y_t^r-Y_{t-1}^r+\pi\right)^2 .$$

Substituting for the real national income in the period t according to equation (5) and remembering that the level of the real national income for the period $t-1$ is equal to its natural level, yields:

(9) $$\left(B^r\right)^2=\kappa\gamma^2\left(\frac{\pi-\pi^*-w}{\theta}+\pi\right)^2 .$$

In this model the central banker's behavior is influenced by three incentives. Like everybody in the economy the central banker dislikes inflation and output fluctuations. These incentives are captured by the social cost function *C*, which is implemented in the underlying models of time inconsistency:

(10) $$C=\pi^2+\lambda\left(Y^r-k\overline{Y}^r\right)^2, \qquad k>1.$$

The society's cost function measures the costs incurred from deviations of the real national income from its target value $k\overline{Y}^r$, which tends to be higher than that obtained in equilibrium level, and inflation rates that breach the aim of price stability. Walsh [1995] suggested adding government incentive payments to the central banker's cost function, thus mixing public and private goals. We follow his approach but augment the social cost function (10) by corrupt incentives. The additional income softens the impact of high unemployment and rampant inflation on the central banker's costs. When introducing the corrupt income into the cost function, the parameter κ obtains an additional interpretation: It signals a preference for private ends. Introducing the additional corrupt income target and substituting the real national income with the help of the supply function yields:

(11) $$K = C - \kappa\left(B^r\right)^2 = \pi^2 + \frac{\lambda}{\theta^2}\left[\pi - \pi^* - w - \theta(k-1)\right]^2 - \frac{\kappa\gamma^2}{\theta^2}\left[\pi(1+\theta) - \pi^* - w\right]^2.$$

This augmented cost function is labelled as a function $K(\pi,\pi^*)$ to better differentiate between the society's objectives C and the central banker's goals, which include also the income from corruption. For the sake of stability we introduce the assumption that κ stays within reasonable limits, that is $\kappa < \min\left(\left(\theta^2+\lambda\right)\Big/\left(\gamma^2(1+\theta)^2\right); \theta\Big/\left(\gamma^2(1+\theta)\right)\right)$. This becomes plausible as we proceed.

3. The Corrupt Central Banker in a Stochastic World

The solving of this model follows the same rationale as the underlying basic model, [Persson and Tabellini 1990: 19]. In this game the private agents are first movers, [Alesina and Gatti 1995: 197]. They have to predict the future course of monetary policy and inflation under the presence of stochastic supply side shocks. Once they freeze their expectations by signing a wage contract with private companies the central banker will learn about the shock that will hit the model economy. Under these given circumstances he will determine his optimal response.

Proposition 1: The inflation bias, that is the inflation rate expected by private agents, increases with κ, the willingness of the central banker to follow his self-interest.

Proof: Rationally behaved private agents lack reliable information on the nature and the strength of the stochastic shock. But they know the underlying model, which determines the expected central bank's behavior. They thus know that the central banker's optimum requires the first derivative of equation (11) with respect to inflation to be zero:

$$\frac{dK}{d\pi} = 2\pi + \frac{2\lambda}{\theta^2}\left[\pi - \pi^* - w - \theta(k-1)\right] - \frac{2\kappa\gamma^2}{\theta^2}(1+\theta)\left[\pi(1+\theta) - \pi^* - w\right] = 0.$$

Taking expected values for all terms and implementing $E(\pi)=\pi^*$, we obtain:

$$\pi^* + \frac{\lambda}{\theta}\left[-(k-1)\right] - \frac{\kappa\gamma^2}{\theta}(1+\theta)\pi^* = 0 \Leftrightarrow$$

(12) $$\pi^* = \frac{\lambda(k-1)}{\theta - \kappa\gamma^2(1+\theta)}.$$

Equation (12) gives the private agents' inflation expectations. Given our restriction on the size of κ , the denominator is positive. As can be seen easily, an increase in κ increases the inflation bias. Already with $\kappa = 0$ we obtain the standard inflation bias, related to the fact that central banker's cannot commit to future policies. They will give in to the temptation of gaining short-term advantages from increasing the money supply, which is anticipated by private actors. But once selling news on this increase of the money supply, they can obtain a higher corrupt income by increasing the money supply even more. This multiplicatively adds to the standard inflation bias. Q.e.d.[7]

[7] Lambsdorff and Schinke [2002] argue that the corrupt income may also additively add to the inflation bias. The argument derived there relates to the idea that it might be easier for central bankers to obtain corrupt income from increasing the money supply.

Proposition 2: A highly corrupt central banker brings about hyperinflation or hyper deflation.

Proof: The central banker has information on the nature and the strength of the shock *w*. He chooses the inflation rate π that minimizes the augmented cost function (11), given the inflation expectation π^* and the shock *w*:

$$\frac{dK}{d\pi} = 2\pi + \frac{2\lambda}{\theta^2}\left[\pi - \pi^* - w - \theta(k-1)\right] - \frac{2\kappa\gamma^2}{\theta^2}(1+\theta)\left[\pi(1+\theta) - \pi^* - w\right] = 0$$

$$\Leftrightarrow \qquad \pi\left[\theta^2 + \lambda - \kappa\gamma^2(1+\theta)^2\right] = \lambda\left[\pi^* + w\right] + \lambda\theta(k-1) - \kappa\gamma^2(1+\theta)\left[\pi^* + w\right].$$

.

According to (12) $\lambda\theta(k-1) = \theta\pi^*\left(\theta - \kappa\gamma^2(1+\theta)\right)$. From this result follows:

$$\pi\left[\theta^2 + \lambda - \kappa\gamma^2(1+\theta)^2\right] = \lambda\left[\pi^* + w\right] + \theta\pi^*\left(\theta - \kappa\gamma^2(1+\theta)\right) - \kappa\gamma^2(1+\theta)\left[\pi^* + w\right]$$

$$\Leftrightarrow \qquad \pi\left[\theta^2 + \lambda - \kappa\gamma^2(1+\theta)^2\right] = \pi^*\left[\theta^2 + \lambda - \kappa\gamma^2(1+\theta)^2\right] + w\left[\lambda - \kappa\gamma^2(1+\theta)\right]$$

$$(13) \qquad \pi = \pi^* + \frac{\lambda - \kappa\gamma^2(1+\theta)}{\theta^2 + \lambda - \kappa\gamma^2(1+\theta)^2}w.$$

To ensure that this inflation rate is a minimum of the augmented cost function, a second derivative test is necessary, yielding:

$$(14) \qquad \frac{dK^2}{d^2\pi} = 2 + \frac{2\lambda}{\theta^2} - \frac{2\kappa\gamma^2}{\theta^2}(1+\theta)^2 > 0 \Leftrightarrow \frac{\theta^2 + \lambda}{\gamma^2(1+\theta)^2} > \kappa.$$

Given our restriction on the size of κ, equation (13) depicts a cost minimum and the denominator in (13) will be positive. A cost maximum is obtained if (14) is violated. This result marks a situation where the gains from increased corrupt income always surpass the disincentives from increased inflation. Rather than setting a fixed inflation rate according to (13) the central banker prefers to maximize his corrupt income by further increasing or decreasing the money supply. Q.e.d.

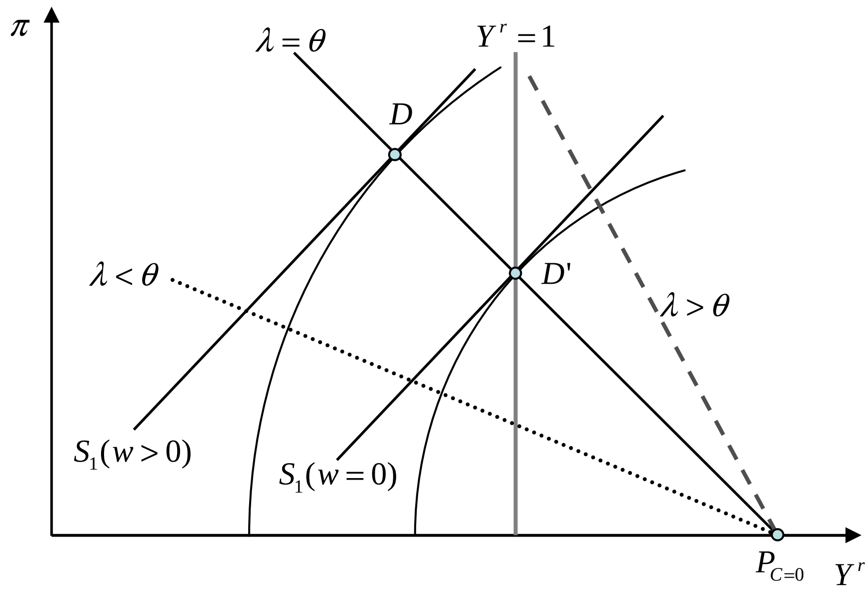
If the central banker's decision is undistorted by selfish interests (κ=0), he will stabilize the effects of the shock on the economy's output.[8] A contractive shock $(w > 0)$ induces the central banker to increase the growth rate of the monetary stock and to raise the inflation rate. This softens the impact of the shock on output and employment. The central banker will feel more compelled to do so the higher his preference for the employment target is, as expressed by the weight λ. This standard result is no longer warranted with κ>0. To understand how this comes about, we define a central banker to be conservative in the sense of Rogoff [1985] if $\lambda < \theta$. For a populist as described by Velasco and Guzzo [1999] or Lippi [2002] we require that $\lambda > \theta$.

Lemma 1: If $\lambda = \theta$ a non-corrupt central banker prefers the growth rate of the monetary stock to be invariant to supply shocks.

Proof: Inserting $\kappa = 0$ and $\lambda = \theta$ into (13) und using (12), yields the well known standard solution for the discretionary inflation rate:

[8] Note that by setting the corrupt preference weight κ equal to zero equation (13) simplifies to the time consistent solution of the standard model: $\pi = \lambda w/\left(\lambda + \theta^2\right) + \lambda(k-1)\bar{Y}^r/\theta$.

Figure 2: Conservative and Populist Central Bankers



$$\pi_D = \pi^*{}_D + w\frac{\lambda}{\theta^2+\lambda}.$$

Inserting this into (4) and rearranging shows how output fluctuations are dampened:

$$Y_D^r = 1 - w\frac{\theta}{\theta^2+\lambda}.$$

Inserting these two assessments into (4') reveals that due to $\lambda = \theta$ monetary growth is independent of the shock:

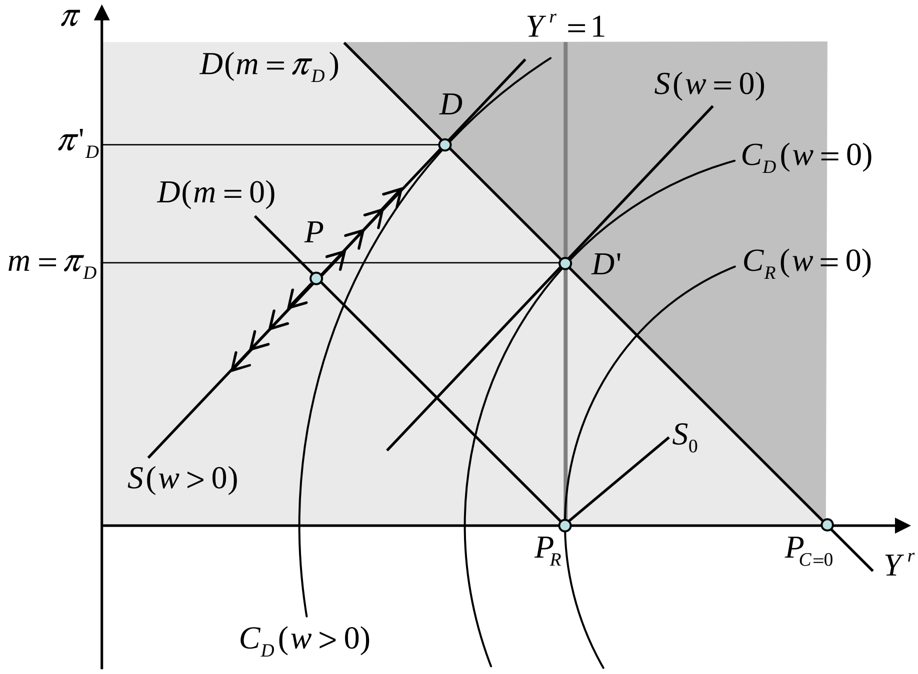
$$m_D = Y_D^r - 1 + \pi_D = -w\frac{\theta}{\lambda+\theta^2} + \pi_D^* + w\frac{\lambda}{\lambda+\theta^2} = \pi_D^*.$$ Q.e.d.

Figure 2 depicts the non-corrupt central banker's choice for the case of $\lambda = \theta$. Due to Lemma 1, the optimal response to supply shocks implies a constant monetary growth; the optima are located on a demand curve. Thus, the demand curve for $\lambda = \theta$ represents optimal responses and denotes those points where the supply curves (shifted by the shock) are tangential to the iso-cost-ellipses. This implies that the demand curve also intersects at the focal point of the cost ellipses, $P_{C=0}$.

The dividing line between conservatives and populists is presented in figure 2 by the path of optima – the $\lambda = \theta$-line. For a conservative central banker the path of optima lies below the $\lambda = \theta$ line. The ellipses of a conservative central banker are compressed. The tangential point of the conservative, incorruptible central banker's iso-cost-ellipses and the relevant supply curve is therefore reached at a lower inflation rate. The opposite holds true for an incorruptible, populist central banker. This case is presented by the $\lambda > \theta$ – line.

We note in passing that $\lambda = \theta$ seems to be a realistic assumption. After the oil price shocks of 1973/74 and 1979/80 the Bundesbank, ceteris paribus, tended to decrease the money supply while the FED reacted with an increase. Leaving the money supply unaffected therefore seems to be realistic assumption for a central bank that is neither populist nor conservative.

Figure 3: Shock Treatment by Corrupt Central Bankers.



Proposition 3: A procyclical behaviour with respect to output fluctuations can result if $\lambda < \theta$.

Proof: As depicted in Figure 3, a non-corrupt, conservative central banker will choose an equilibrium on the supply curve $S(w>0)$, which lies to the left of the $D(m=\pi_D)$-line. The area is marked by the light grey shade. An optimum of a non-corrupt populist central banker will be situated in the dark grey area on top of the demand function, $D(m=\pi_D)$. A corrupt incentive now pushes the equilibrium away from the social optimum according to the arrows on the $D(m=0)$-line. Socially optimal solutions to the right of the $D(m=0)$-line are pushed further to the right. Those on the left of the line are pushed further to the left. In the case of a populist central banker this incentive will induce the corrupt central banker to increase the inflation rate to even higher values. Thus, corruption causes a deviation from the path of social optima.

Corruption provides an ambiguous incentive to the conservative central banker. In case of a moderate supply shock, the social optimum is above the $D(m=0)$-line (this can be seen by plotting the $\lambda < \theta -$line into figure 3 and shifting the supply curve only marginally to the left). As implied by the arrows, corruption then operates counter-cyclically, pushing the equilibrium further upwards and further to the right; the central banker will increase inflation and stabilize output. But as soon as the shock is large enough, the social optimum is below the $D(m=0)$-line. The corrupt incentive now pushes the equilibrium further downward and further to the left; the central banker will lower inflation and decrease output. The $D(m=0)$-line operates like a watershed: Once beyond this line, the central banker obtains an adverse incentive. This results because a large negative supply shock decreases the monetary supply. Making profit out of selling news is then only achieved by further decreasing the monetary supply. The additional corrupt income makes the conservative central banker even more hawkish on aspects of price stability. Setting a negative growth rate of the monetary stock increases the corrupt revenue gained by the conservative central banker. This compensates the increased costs from lowered employment that results from this policy. Thus, the reaction of conservative central bankers is ambiguous and largely depends on the scale of the shock.

This pro-cyclical incentive is revealed in (13). If $\lambda - \kappa\gamma^2(1+\theta) < 0$, the impact of w on π is negative. In this case the central banker amplifies the shock and makes it more onerous to society. His willingness to soften the impact of shocks on production is outbalanced by the pro-cyclical impact of his supplementary income. He reacts to a negative shock by adjusting the inflation rate downward relative to the inflation bias, thus increasing the shock's negative impact on production. Two conditions must be met for this result. The value of κ must be sufficiently large to induce the central banker to pro-cyclicity, $\lambda - \kappa\gamma^2(1+\theta) < 0$. But it must not exceed the threshold value that guarantees a cost minimum, according to (14). Jointly, we obtain:

(15) $$\frac{\lambda}{\gamma^2(1+\theta)} < \kappa < \frac{\theta^2 + \lambda}{\gamma^2(1+\theta)^2} \Leftrightarrow \lambda < \theta .$$[9]

A central banker who places more relative importance on the employment target is a populist central banker denoted by $\lambda > \theta$. Such a central banker is not in danger of acting pro-cyclically. If the central banker is sufficiently uninterested in the employment target a pro-cyclical reaction can arise, because in this case $\lambda < \theta$. As soon as κ is sufficiently large the impact of large shocks on production will no longer be dampened but are instead aggravated. Q.e.d.

Our corrupt, conservative central banker acts as an ultra-conservative. His actions may appear extremely principle-guided, and he may defend them in this fashion – quite to the contrary of his true intentions. Someone who was formerly a populist would claim that he converted to regarding price-stability as the more important goal. Such conversions may take place, but our model shows that they might also be the reaction of a corrupt central banker to a large supply shock. Given our model, it is straightforward to derive two conclusions:

Proposition 4: In a world where central bankers seek compromises between a moderate level of preference for employment $\lambda = \theta$ and more extreme preferences by society λ_S, such that $\lambda_S < \lambda < \theta$ or $\lambda < \lambda_S < \theta$, society might be tempted to allow a non-zero level of corruption of the central bank, that is $\kappa > 0$..

From scrutinizing figure 3 it can be observed that this logic becomes relevant if society suffers from a positive shock (a shift of the supply function to the left). A conservative central banker would exacerbate output fluctuations. Given a large shock, corruption induces the central banker to decrease the money supply, acting more in line with society's ultraconservative desires. We must investigate whether such a result would also be obtained if the shock w is unknown.

[9] Observe that the same condition results from considering the alternative restriction $\kappa < \theta / \left(\gamma^2(1+\theta)\right)$.

Proof: Society seeks to minimize the expected costs according to function (10), which in (11) was expressed as $C=\pi^2+\frac{\lambda_S}{\theta^2}\left[\pi-\pi^*-w-\theta(k-1)\right]^2$. This time we allow for society's preference for employment, λ_S, to differ from that of the central bank.

Inserting $\pi=\pi^*+\frac{\lambda-\kappa\gamma^2(1+\theta)}{\theta^2+\lambda-\kappa\gamma^2(1+\theta)^2}w$ and $\pi^*=\frac{\lambda(k-1)}{\theta-\kappa\gamma^2(1+\theta)}$, we obtain:

$$C=\left[\frac{\lambda(k-1)}{\theta-\kappa\gamma^2(1+\theta)}+\frac{\lambda-\kappa\gamma^2(1+\theta)}{\theta^2+\lambda-\kappa\gamma^2(1+\theta)^2}w\right]^2+\frac{\lambda_S}{\theta^2}\left[\frac{\lambda-\kappa\gamma^2(1+\theta)}{\theta^2+\lambda-\kappa\gamma^2(1+\theta)^2}w-w-\theta(k-1)\right]^2$$

Rearranging and determining the expected value yields:

$$E(C)=\left[\frac{\lambda(k-1)}{\theta-\kappa\gamma^2(1+\theta)}\right]^2+\left[\frac{\lambda-\kappa\gamma^2(1+\theta)}{\theta^2+\lambda-\kappa\gamma^2(1+\theta)^2}\right]^2\sigma_w^2+\frac{\lambda_S}{\theta^2}\left[\frac{\kappa\gamma^2(1+\theta)\theta-\theta^2}{\theta^2+\lambda-\kappa\gamma^2(1+\theta)^2}\right]^2\sigma_w^2+\frac{\lambda}{\theta^2}\left[\theta(k-1)\right]^2$$

$$E(C)=\left[\frac{\lambda(k-1)}{\theta-\kappa\gamma^2(1+\theta)}\right]^2+\frac{\left(\lambda-\kappa\gamma^2(1+\theta)\right)^2+\lambda_S\left(\kappa\gamma^2(1+\theta)-\theta\right)^2}{\left(\theta^2+\lambda-\kappa\gamma^2(1+\theta)^2\right)^2}\sigma_w^2+\frac{\lambda}{\theta^2}\left[\theta(k-1)\right]^2.$$

The impact on social costs of a marginal increase in κ can be obtained from the first derivative.

$$\frac{dE(C)}{d\kappa}=\frac{\lambda^2(k-1)^2\,2\left(\theta-\kappa\gamma^2(1+\theta)\right)\gamma^2(1+\theta)}{\left(\theta-\kappa\gamma^2(1+\theta)\right)^4}$$

$$+\frac{1}{\left(\theta^2+\lambda-\kappa\gamma^2(1+\theta)^2\right)^4}\Bigg[\left(\theta^2+\lambda-\kappa\gamma^2(1+\theta)^2\right)^2\left[2\left(\lambda-\kappa\gamma^2(1+\theta)\right)\left(-\gamma^2(1+\theta)\right)+2\lambda_S\left(\kappa\gamma^2(1+\theta)-\theta\right)\gamma^2(1+\theta)\right]$$

$$-\left[\left(\lambda-\kappa\gamma^2(1+\theta)\right)^2+\lambda_S\left(\kappa\gamma^2(1+\theta)-\theta\right)^2\right]2\left(\theta^2+\lambda-\kappa\gamma^2(1+\theta)^2\right)\left(-\gamma^2(1+\theta)^2\right)\Bigg]\sigma_w^2$$

Since the first term is positive, we devote more effort to investigating the second term. Corruption, certainly, would have the dismal effect of increasing the inflation bias. However, if equilibrium employment equals the level desired by society, $k=1$, or if the variance of shocks is so high that the resulting disutilities dominate our calculus, the focus on this second term is justified. This term will be positive, that is corruption would increase social costs, if and only if

$$\underbrace{(\lambda-\theta)^2\kappa\gamma^2(1+\theta)}_{>0}+(\lambda-\theta)(\lambda-\lambda_S)\underbrace{\left(\theta-\kappa\gamma^2(1+\theta)\right)}_{>0}>0$$

See the appendix for a derivation of this finding. Given that the first term is positive, this disequation may be violated if the second term is negative and sufficiently large in magnitude. This term would be negative if either $\lambda_S<\lambda<\theta$ or $\lambda_S>\lambda>\theta$, Q.e.d.

Simulations reveal the relevance of our findings. Given $\lambda_S=0$, $\lambda=1$, $\theta=2$, $\gamma=1$, $k=1$, $\sigma_w^2=1$ and $\kappa=0$ we obtain expected social costs $E(C)=0.04$. But with increased corruption, $\kappa=0.2$ social costs are reduced to $E(C)=0.016$. Likewise, if $\lambda_S=2$, $\lambda=1.2$, $\theta=1$, $\gamma=1$, $k=1$, $\sigma_w^2=1$ and $\kappa=0$ we obtain expected social costs $E(C)=0.71$. But with increased corruption, $\kappa=0.2$ social costs are reduced to $E(C)=0.69$.

Proposition 4 should not be interpreted as a case of beneficial corruption. The theoretical and empirical evidence against corruption is sufficiently strong so that this old debate does not deserve revision. Rather, the proposition points to policies that might foster tolerance towards corruption. It may arise that societies with extreme tastes (λ_S differing considerably from θ) are not governed by central bankers with similar preferences, $\lambda_S = \lambda$. In such an environment society may tolerate bribes to central bankers as an instrument of bringing factual policies more in line with its desires.

This finding provides a refinement with respect to the recommendation of having central bankers be more conservative than society itself. In populist societies, $\lambda_S > \lambda > \theta$, this choice may increase tolerance towards corruption if the central banker is slightly more conservative than the populist society.[10] .

4. Conclusion

Looking at central banks one cannot other but notice that there are commonly all the necessary conditions for arranging corrupt deals. They have the necessary discretionary freedom, the monopoly position and the needed level of secrecy. This is also acknowledged by the International Monetary Fund. In a Code of Good Practices on Transparency in Monetary and Financial Policy the IMF [2000] states: "*Without trust in the financial probity and freedom from conflict of interest of the officials and staff of the central bank, the authority and ability of a central bank to perform its functions would be severely hindered. It would affect its effectiveness to interact with the financial institutions under its jurisdiction, and the general public would not trust the impartiality of its operations.*" This notion is supported by the argument of our paper. Corruption and therefore distrust in the benevolence of the central bank amplifies the inflation bias. This bias is the first of two policy distortions we were able to address in the model.

The second policy distortion relates to a pro-cyclical impact of corruption on a conservative central bank policy, where employment fluctuations are exacerbated rather than dampened. We showed that this pro-cyclical incentive can dominate central bank policy in case of a negative supply shock, which induces central banks to decrease the money supply and thus amplifying the drop in output. Such a central banker acts as an ultra-conservative. His actions may appear extremely principle-guided. He might claim to have converted to providing a higher weight to price stability, while in reality his self interest and a negative supply shock are at play.

Central bankers who differ in their taste from society might induce tolerance towards corruption. This arises in particular in societies with extreme tastes, for example where either inflation or employment are disregarded from its cost function. Central bankers who only mildly adjust to these preferences open the door to tolerance towards corruption. We thus recommend that central bankers taste should be similar to those of society. This finding provides a warning signal against the choice of non-representative (for example mildly conservative) central bankers.

Corruption among central bankers, admittedly, is only the tip of the iceberg. Although we collected a variety of cases, corruption among central banks is still likely to be a rather rare incident. But below this tip of the iceberg are much more common variants of simple self

[10] In order to avoid tolerance towards corruption, a truly conservative choice according to $\lambda \le \theta$ would also be a choice. But society's overall tolerance towards corruption is likely to increase even more if the policy distortion induced by bribery is in line with its own preferences. These consideration, however, are beyond the scope of the current model.

seeking. By focusing on the extreme case of corruption we sharpen our understanding also of these more moderate types of individual maximizing behavior. Central bankers may not necessarily sell inside information, but they may feel badly about being disregarded and considered irrelevant. They may strive to maximize public attention. Interestingly, this produces results that are parallel to the ones derived here. Such central bankers feel little incentive to stick to simple monetary rules, providing them with little public tribute. Their active contribution to the economy might be felt stronger if they constantly interfere in the money market. They might prefer to be recognized as populists or conservatives rather than inactive lame ducks, someone who will be forgotten by history. Thus, beyond corruption there might be payoffs from changing the money supply – suggesting that our model is valid also to more subtle forms of behavior.

Appendix

The derivative of expected social costs, $E(C)$, is determined with respect to changes in κ:

$$\frac{dE(C)}{d\kappa}=\frac{\lambda^2(k-1)^2\,2\left(\theta-\kappa\gamma^2(1+\theta)\right)\gamma^2(1+\theta)}{\left(\theta-\kappa\gamma^2(1+\theta)\right)^4}$$

$$+\frac{1}{\left(\theta^2+\lambda-\kappa\gamma^2(1+\theta)^2\right)^4}\Big[\left(\theta^2+\lambda-\kappa\gamma^2(1+\theta)^2\right)^2\left[2\left(\lambda-\kappa\gamma^2(1+\theta)\right)\left(-\gamma^2(1+\theta)\right)+2\lambda_S\left(\kappa\gamma^2(1+\theta)-\theta\right)\gamma^2(1+\theta)\right]$$

$$-\left[\left(\lambda-\kappa\gamma^2(1+\theta)\right)^2+\lambda_S\left(\kappa\gamma^2(1+\theta)-\theta\right)^2\right]2\left(\theta^2+\lambda-\kappa\gamma^2(1+\theta)^2\right)\left(-\gamma^2(1+\theta)^2\right)\Big]\sigma_w^2$$

Since the first term is positive, we devote more effort to investigating the second term. This will be positive, that is corruption would increase social costs, if and only if

$$\left(\theta^2+\lambda-\kappa\gamma^2(1+\theta)^2\right)\left[2\left(\lambda-\kappa\gamma^2(1+\theta)\right)\left(-\gamma^2\right)(1+\theta)+2\lambda_S\left(\kappa\gamma^2(1+\theta)-\theta\right)\gamma^2(1+\theta)\right]$$

$$+\left[\left(\lambda-\kappa\gamma^2(1+\theta)\right)^2+\lambda_S\left(\kappa\gamma^2(1+\theta)-\theta\right)^2\right]2\gamma^2(1+\theta)^2>0$$

Division by the term $2\gamma^2(1+\theta)>0$ yields:

$$\left(\theta^2+\lambda-\kappa\gamma^2(1+\theta)^2\right)\left[\lambda_S\left(\kappa\gamma^2(1+\theta)-\theta\right)-\left(\lambda-\kappa\gamma^2(1+\theta)\right)\right]+\left[\left(\lambda-\kappa\gamma^2(1+\theta)\right)^2+\lambda_S\left(\kappa\gamma^2(1+\theta)-\theta\right)^2\right](1+\theta)>0$$

We denote the term in angular brackets by $\psi=\lambda_S\left(\kappa\gamma^2(1+\theta)-\theta\right)-\left(\lambda-\theta+\theta-\kappa\gamma^2(1+\theta)\right)$ and expand the disequation by adding $-\theta+\theta$ where appropriate:

$$\left(\theta^2+\lambda-\theta+\theta-\kappa\gamma^2(1+\theta)^2\right)\psi+\left[\left(\lambda-\theta+\theta-\kappa\gamma^2(1+\theta)\right)^2+\lambda_S\left(\kappa\gamma^2(1+\theta)-\theta\right)^2\right](1+\theta)>0$$

Division by $1+\theta$ yields:

$$\left(\theta-\kappa\gamma^2(1+\theta)\right)\psi+\frac{\lambda-\theta}{1+\theta}\psi+\left(\lambda-\theta+\theta-\kappa\gamma^2(1+\theta)\right)^2+\lambda_S\left(\kappa\gamma^2(1+\theta)-\theta\right)^2>0.$$

ψ can be rearranged to $\psi=(1+\lambda_S)\left(\kappa\gamma^2(1+\theta)-\theta\right)+\theta-\lambda$ or $\psi=(1+\lambda_S)\kappa\gamma^2(1+\theta)-\lambda_S\theta-\lambda$. Inserting this, we obtain:

$$\left(\theta-\kappa\gamma^2(1+\theta)\right)\left((1+\lambda_S)\left(\kappa\gamma^2(1+\theta)-\theta\right)+\theta-\lambda\right)+(\lambda-\theta)\left((1+\lambda_S)\kappa\gamma^2-\frac{\lambda_S\theta+\lambda}{1+\theta}\right)$$

$$+(\lambda-\theta)^2+2(\lambda-\theta)\left(\theta-\kappa\gamma^2(1+\theta)\right)+(1+\lambda_S)\left(\kappa\gamma^2(1+\theta)-\theta\right)^2>0$$

Simplifying this expression, we obtain:

$$\left(\theta-\kappa\gamma^2(1+\theta)\right)(\theta-\lambda)+(\lambda-\theta)\left((1+\lambda_S)\kappa\gamma^2-\frac{\lambda_S\theta+\lambda}{1+\theta}\right)+(\lambda-\theta)^2+2(\lambda-\theta)\left(\theta-\kappa\gamma^2(1+\theta)\right)>0$$

$$\Leftrightarrow(\lambda-\theta)\left((1+\lambda_S)\kappa\gamma^2-\frac{\lambda_S\theta+\lambda}{1+\theta}+\theta-\kappa\gamma^2(1+\theta)\right)+(\lambda-\theta)^2>0$$

Multiplication by $(1+\theta)$ brings about:

$$(1+\theta)(\lambda-\theta)^2+(\lambda-\theta)\Big((1+\lambda_S)\kappa\gamma^2(1+\theta)-\lambda_S\theta-\lambda+(1+\theta)\theta-\kappa\gamma^2(1+\theta)^2\Big)>0$$

Adding $\lambda\big(\kappa\gamma^2(1+\theta)-\theta\big)-\lambda\big(\kappa\gamma^2(1+\theta)-\theta\big)$ yields:

$$(1+\theta)(\lambda-\theta)^2+(\lambda-\theta)\Big(\kappa\gamma^2(1+\theta)+\lambda_S\big(\kappa\gamma^2(1+\theta)-\theta\big)+\lambda\big(\kappa\gamma^2(1+\theta)-\theta\big)$$

$$-\lambda\big(\kappa\gamma^2(1+\theta)-\theta\big)-\lambda+(1+\theta)\theta-\kappa\gamma^2(1+\theta)^2\Big)>0$$

$$\Leftrightarrow(1+\theta)(\lambda-\theta)^2+(\lambda-\theta)\Big(\lambda\big(\kappa\gamma^2(1+\theta)-\theta\big)+\lambda+(1+\theta)\theta-\kappa\gamma^2\theta(1+\theta)\Big)+(\lambda-\theta)(\lambda-\lambda_S)\big(\theta-\kappa\gamma^2(1+\theta)\big)>0$$

$$\Leftrightarrow(1+\theta)(\lambda-\theta)^2+(\lambda-\theta)\Big(\big(\kappa\gamma^2(1+\theta)-1-\theta\big)(\lambda-\theta)\Big)+(\lambda-\theta)(\lambda-\lambda_S)\big(\theta-\kappa\gamma^2(1+\theta)\big)>0$$

$$\Leftrightarrow(\lambda-\theta)^2\kappa\gamma^2(1+\theta)+(\lambda-\theta)(\lambda-\lambda_S)\big(\theta-\kappa\gamma^2(1+\theta)\big)>0$$

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