Serving three masters: optimal monetary and regulatory policies when central bankers have career concerns

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Abstract

Central bankers (CB's) decide on policies that affect the interests of three social groups: government politicians, financial market institutions and citizens. While it is desired that the monetary authority focuses primarily on maximizing the well-being of the latter group, it might divert from doing so in order to please the interests of the other two. This happens because CB's will eventually leave office, and they are aware that holding a good reputation among the members of the government and/or the market may be providential to boost their future career path. We provide a model that analyzes the strategic interaction between the CB (she) and her "three masters". Our findings show that the CB always implements a less favorable regulatory policy to the market when the governmental career is chosen. Monetary policy decisions, however, depend on her "future employer's" preferences: if the government gives a sufficiently low weight to the output, the CB implements a higher interest rate when she works on the government; if the financial market cares enough about inflation fighting, the monetary policy is more conservative when she goes to the financial industry.

Keywords: Central Bank. Agency Theory. Regulation. Monetary Policy.
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Abstract

Os banqueiros centrais (BCs) definem políticas que afetam os interesses de três grupos sociais: políticos do governo, instituições do mercado financeiro e cidadãos. Embora se deseje que a autoridade monetária se concentre principalmente em maximizar o bem-estar desse último grupo, ela pode desviar-se dessa função para agradar os interesses dos outros dois. Isso ocorre porque os BCs sabem que deixarão o cargo em algum momento e que manter uma boa reputação entre os membros do governo e/ou do mercado pode ser essencial para impulsionar sua carreira no futuro. Dessa forma, este trabalho fornece um modelo que analisa a interação estratégica entre o BC e seus "três mestres". Nossas conclusões mostram que o BC sempre implementa uma política regulatória menos favorável ao mercado quando a carreira governamental é escolhida. As decisões de política monetária, no entanto, dependem das preferências de seu "futuro empregador": se o governo atribuir um peso suficientemente baixo ao produto, o BC implementará uma taxa de juros mais alta quando trabalhar no governo; se o mercado financeiro se importar bastante com o controle da inflação, a política monetária é mais conservadora quando o incumbente vai para o setor financeiro.

Palavras-chave: Banco Central. Teoria da Agência. Regulação. Política Monetária.

Área 4: Macroeconomia, Economia Monetária e Finanças.

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1 Introduction

Central banks stand out among government agencies for their profound capacity to affect the well-being of the population. The misconduct of monetary policy, the failure to preserve financial stability and the adoption of low-quality banking supervision and regulation policies are examples of how central banks can generate major losses for the society. Understanding how these institutions work, therefore, is a major concern in economic literature (Adolph, 2013; Blinder, 2010; Boot and Thakor, 1993).

Central banks around the world present a diversity of mandates and institutional forms, as they result from political arrangements that occur in each nation (Faria and Streit, 2016). In the United States, for example, the *Federal Reserve System (Fed)* is entrusted not only with maintaining price stability, but also with seeking the maximum sustainable employment and moderate long-term interest rates.[1] In Canada, the Central Bank (*Bank of Canada*) was given a more restricted role than usual: it responds for the country's monetary policy, but not for the regulation and the supervision of the financial system, as this competence was delegated to a separate government agency (the *Office of the Superintendent of Financial Institutions – Osfi*).[2] In the euro zone, the *European Central Bank (ECB)* is "formally independent" from the bloc's political authority, having the freedom to perceive a single "primary objective", namely, "maintaining price stability".[3] Last but not least, there is the case of the Swiss Central Bank (*Schweizerischen Nationalbank*), which is not even part of the country's governmental structure. Instead, it is a publicly listed company, with shares traded in the Zurich stock exchange (*SIX Swiss Exchange kotiert*).[4]

The examples above serve to show how different institutional rules that govern the monetary authority can be. Naturally, each institutional arrangement entails a different policy-making dynamic, since central bankers (CB's) do not define policies "in the vacuum". On the contrary, it is reasonable to assume that they grant an important weight to the specific reality that surrounds them (Ross, 1973).

Against this backdrop, in this article we develop a model to explain how a central banker (she) defines institutional policies in a context where she has career concerns. We unveil the incentive structure imposed on the CB by the environment, and we analyze how it affects policy choices. We assume that the CB is interested in pleasing three social groups while in office: (i) the citizens, both because of institutional mandate imposition (there are social goals among her official duties) and for ego-rent (helping society prosper may increase her welfare);[5] (ii) the government (e.g. the president and her political group) and (iii) the financial market (e.g. big banks and financial conglomerates), given that she might want to follow a career path in either of these areas after leaving office.

As we take into account central banker's career concerns in our analysis, our work considers the utility of the monetary authority incumbent (the central banker herself) instead of the Central Bank's (institution/citizens) in the maximization problem (Barro and Gordon, 1983; Rogoff, 1985). This division allows the incumbent policymaker to behave in an undesirable manner and to deliberately deviate from her institutional mission, as she may define policies with the purpose of serving her private interests instead of the society's. The government and the financial market also possess their own utility function, which differ from each other's, from the central banker's and from the citizens'.

We use an agency theory approach (Jensen and Meckling, 1979) to develop the model, in which the typical principal-agent problem occurs in the relationship between the central banker (agent) and the citizens (principal). The government politicians and the financial market industry enter this game as shadow principals[6] that do not participate directly in the contract, but are affected by it and have the power to exert

[1] Available here. Last access 01/27/2020.

[2] Available here and here. Last access 01/27/2019.

[3] Treaty on the Functioning of the European Union, art. 119, item 2, available here. Last access: 01/27/2020.

[4] Available here. Last access 01/27/2020.

[5] Preferences (or beliefs) about the "best form" to increase social welfare may differ from one incumbent to the other. Regarding this differences in central bank politics, it is worth exploring the "career socialization hypothesis" – which advocates that previous employment positions and educational backgrounds have a strong impact on such preferences. This topic is interestingly explored in Adolph (2013), Mishra and Reshef (2019) and Wirsching (2018).

[6] About the relationship between central bankers and shadow principals, see Adolph (2013).

some influence on the decisions that are adopted.

While we build on the standard agency theory framework (Laffont and Martimort, 2009), our model differs from it in a few aspects. We model the competition between the government and the financial market as a first-price sealed-bid auction, where both competitors present their salary offers at the same time (Krishna, 2009). In addition, the model does not foresee the existence of a participation constraint, meaning that the CB always chooses working either for the government or for the market after leaving office. The model also does not contemplate an incentive compatibility constraint, which would be important if we wanted to design a second-best type of contract. Finally, we run an extensive game with incomplete information where there is an informational asymmetry not only between the agent (central banker) and the principal (citizens) – as predicted by the theory –, but also in the relationship between the government and the financial market (shadow principals) (Adolph, 2013).

This article contributes to the literature by presenting a non-neutral central banker who has different interests from the government, the financial market and the citizens, and who actively pursues them through the adoption of a strategic behaviour. Our model predicts that the CB is always less condescending with the market regarding the regulatory policy when she follows a career in the government. Monetary policy decisions, however, depend on her "future employer's" preferences: if the government gives a sufficiently low weight to the output, the CB defines a higher interest rate when she works on the government; if the financial market cares enough about inflation fighting, the monetary policy is more conservative when she goes to work on the financial market.

As there are many different realities all over the world, whenever necessary, this article considers the Brazilian scenario as the reference environment to explain the behavior of the CB.

1.1 Outline

This article is organized as follows. After this introduction, section 2 presents the agency problem that exists in the relation between the (career concerned) central banker and her "three masters" and the consequences of this reality. We approach the question linking it to the related literature and to the Brazilian specific experience. In Section 3, we develop and run our baseline model, using a game theory approach to analyze how the strategic behaviour of the monetary authority incumbent affects monetary and regulatory policies outcomes. Section 4 concludes and suggests future research on the area.

2 The strategic relation between the central banker and her three masters

2.1 The Central Banker and the information asymmetry environment

Since the seminal contributions of George Akerlof, Michael Spence and Joseph Stiglitz in the 1970s (which awarded them the 2001 Nobel Prize in Economic Sciences), the effects of information asymmetry on economic and social relations have been documented and studied in different contexts. This approach has been transforming the way in which economists analyze the functioning of markets, and it has helped us to understand phenomena that were not commonly addressed by economic theory before (Löfgren et al., 2002; Molho, 1997). By loosening the neoclassical assumption of perfect knowledge, the so-called "agency relations" emerged and, with them, the perception that there were market inefficiencies that classic models were unable to explain (Besley, 2006; Jensen and Meckling, 1979; Mirrlees, 1999).

In light of this literature, we discuss the agency problem that arises on the relationship between the central banker and her "three masters". We understand that there is a contract (albeit an implicit one) between the CB (agent) and the citizens of a given country (principal). This contract is offered to the agent when she is invited to assume the incumbency of the monetary authority, in a "take it or leave it" type

contract (Löfgren et al., 2002).[7] In brief, this contract states that, if the appointee accepts the job, she must aim all her efforts at maximizing the well-being of the citizens of that country, promoting optimal policies towards them and efficiently fulfilling the institutional mission of the organization.[8]

However, it is unlikely that the scenario proposed above will easily emerge in an information asymmetry environment. In this context, the "costs" from behaving opportunistically are relatively low (if not non-existent), which creates the possibility for the CB (if she wants to) not to keep her word and to deliberately choose policies that she does not consider to be the optimal ones for the citizens (Boot and Thakor, 1993; Walsh, 1995). Therefore, when we relax the perfect information hypothesis, it becomes reasonable to assume that the CB may (at least) consider the possibility of deviation from the contract in order to maximize her own well-being, even if the side effect of this strategy is to harm citizens' interests.

This is where the shadow principals – the government and the financial market – enter the analysis. Despite not participating directly in the contract, these groups' importance for the strategic interaction proposed here cannot be ignored, as they have the power to significantly affect CB's well-being (Adolph, 2013).[9] They influence her mainly because she is aware that she will not work on the monetary authority forever, and because she knows that the governmental sector or the financial industry may be the natural course for her career afterwards. Hence, holding a good reputation among the members of these groups ends-up being very important for her professional future (Boot and Thakor, 1993; Fratianni et al., 1997).

Against this scenario, the CB – as a rational economic agent – realizes that the remuneration that will be offered to her after leaving office will be positively related to how these "potential employers" perceive the quality of her job. Thus, the CB may be tempted to bend the institutional policies in accordance with these groups interests, so to improve her image among them, consequently boosting future salary offers.[10] It is in this context that Adolph (2003) points out that "career rewards may be among the most potent tools that shadow principals possess for manipulating bureaucrats" (p.7).

The deviation of institutional policies towards government interests may be used by the CB as a strategy to strength her influence inside the government's political group (Fratianni et al., 1997). By achieving a more prominent position on it, she may, for example, maintain her job in a context where she is being politically attacked; she may be elevated to a more expressive position within government when circumstances are favorable (e.g. a CBB Governor that becomes the next Minister of Finance); she may pave her way to be appointed to an important International Organization as high rank government official, with a high salary in a nice city of the world; or she may project herself inside the group as a political actor that possesses the necessary support to be appointed as a candidate in the next pools (e.g. running for President, State Governor, Senate, etc.).

The deviation towards the financial market (Grossman and Helpman, 1992; Stigler, 1971), in turn, may be used by the CB as way to promote her image as an "outstanding financial market executive" among the members of that industry (Dal Bó, 2006). This can happen specially because monetary authority incumbents are not (at least as a rule) "traditional politicians" that have to worry about what the electorate thinks of them.[11] Instead, they usually are seen as "technical bureaucrats" that come from an elite public service career, a renowned University or a big financial market institution (Adolph, 2013). This position facilitate the use of their performance in the public sector as a way to project their career in the market after leaving office (Shive and Forster, 2017).

[7] When someone is invited for such a position, all the rules that govern this contract are (usually) already defined by the country's legal order (salary, mandate, institutional powers, etc.), leaving little (or no) space for bargaining.

[8] In exchange, she receives a correspondent salary and other non-monetary rewards (which may be even more important than the salary itself): the image gains from the office exposition; and the ego-rent that comes from the social respectability of the job.

[9] Meanwhile, the shadow principals are also affected by the CB as she has the power to decide on policies that are sensitive to these groups preferences (for obvious reasons), such as inflation, output, interest rates and financial regulation and supervision policies.

[10] For the purposes of this article, we disregard the possibility of corruption schemes, which would be an obvious source of deviation. We do this in order to show that the risk of deviation persists even with a completely honest chairman.

[11] "Traditional politicians" develop their careers in the public sector and, therefore, act based on electoral incentives. CB's, in turn, do not necessarily have this characteristic, as they are not elected, but appointed.

This idea becomes clearer when we realize that the salaries paid by the government to Central Bank officials are not exactly attractive,[12] if compared to the salaries paid by the financial sector. From this perspective exclusively, becoming a CB can be seen more as a (temporary) "penalty" than a "prize" for someone who holds a high position in the market, making it reasonable to assume that the monetary reward is not the sole reason why these "technical bureaucrats" accept the job. Nevertheless, if we consider that these actors also value the ego-rent that comes from being in office and (specially) the future career benefits related to such an exposure, then this choice seems more "rational". The question about salaries and career concerns in central banks was interestingly explored by Adolph (2003) for specific case of the Fed, where he states that:

> In the US, several former FOMC [Federal Open Market Committee] members attributed quitting the Fed to the gap between public and private sector salaries. [...] This view has been made explicit by former Governors Robert C. Holland, who protested he could not pay his children's tuition bills on a Fed Governor's salary, and Jeffrey M. Bucher, who lamented the "financial penalty" he paid to leave the private sector for the Fed. (Katz, 1992) [...] The evidence for career-concerned central bankers grows when one notes from 1950 to 2000, the median Fed Governor chose to serve only 5.2 years of a guaranteed fourteen year term (Adolph, 2003, p.8).

In short, our model is developed in an environment with information asymmetry, where the monetary authority incumbent and the shadow principals have perfect information about Central Bank policy choices (and its probable consequences), while the citizens suffer from a certain degree of "myopia". As the latter do not realize if the central banker is (or is not) acting on their best interest, they are not able to punish her for acting opportunistically (e.g. terminating the contract). This reality allows her to deviate from the contract without the necessity to incur in costs that would exist under a perfect information scenario.

2.2 What kind of Central Bank are we talking about? The Brazilian case

To develop our model, we first need to understand the incentive structure faced by our representative CB. As we saw on the introduction of this article, Central Banks around the world have their own specific organizational structures and mandates, and the environment they operate diverge from country to country. So, for the sake of simplicity, we use the Brazilian specific scenario as a model whenever necessary.

The Central Bank of Brazil (CBB) was tasked with the mission to "ensure the stability of the currency's purchasing power and a solid and efficient financial system". Roughly, its mandate can be subdivided into two main areas: the first one related to monetary and inflation control policy; and the second one related to the regulation and supervision of the National Financial System (NFS) policy.

Regarding monetary and inflation control policy, the CBB exercises the traditional functions of a monetary authority. Accordingly, its mandate includes issuing the country's currency and acting as the Government's Banker and the Banker's bank. This competence comprises what we usually understand by a Central Bank's activity and why it is important for the society.

As for the regulation and supervision of the NFS, the CBB exhibits characteristics of a governmental regulatory agency. Under this mandate, the CBB has the responsibility to define the rules for financial institutions, to impose fines on them, to approve (or to remove) members from their board of directors and even to decide on extrajudicial liquidation of the regulated entities, among others. This function is not as usually addressed by the literature as the first one, but it is also very relevant for social welfare.

2.3 Policy deviations and related literature

Considering what was exposed in the subsection 2.2, we assume for the purpose of this article that the policy deviation can occur in two ways: the monetary policy deviation and the regulatory policy deviation.

[12] To have an idea, the Governor and the deputy-governors of the Central Bank of Brazil (CBB) – if they do not have another position in public service – are entitled to a monthly salary (before taxes) of 30,934.70 BRL (near 7,152 USD) and 17,327.65 BRL (near 4,006 USD), respectively. Available here. Last access: 02.17.2020.

2.3.1 The monetary policy deviation

The possibility of monetary policy deviation towards government interests has already been identified and debated by several studies in economic literature (Eggertsson and Le Borgne, 2010). Most of these studies start from the assumption that the monetary authority – when exposed to political influence – may present an "inflationary bias" (Barro and Gordon, 1983; Kyland and Prescott, 1977; Rogoff, 1985) due to the possibility of exploiting the short-term Phillips curve trade-off between unemployment and inflation.

The idea developed here is that the incumbent may deliberately choose to implement a more "loose" (*dovish*) monetary policy than (she considers) necessary, without the citizens immediately realizing that a *hidden action* was adopted. This creates the possibility to maintain an artificial level of (high) income and (low) unemployment rate in the short-term, which may help to sustain the popularity of the political group in power (Chortareas and Miller, 2008). The inflationary effects of such a policy are noticed only within a time lapse, which might be a cost that the government in power is willing to pay. The adoption of this kind of policy – although technically questionable – can be quite rational from a political perspective, specially in certain situations, such as when elections are approaching and when the government's political group perceives that the next pools are going to be heated (Alesina and Stella, 2010; Hayo and Hefeker, 2002).[13]

A whole literature dealing with Central Bank Independence (CBI) and the optimal level of conservatism of its representative bring an important contribution not only to understanding the subject, but also to help improving the institutional design of monetary authorities all over the world (Hayo and Hefeker, 2002; Walsh, 1995). These studies show that such a behaviour is harmful for the citizens welfare in the long run, mainly due to the loss of credibility of the monetary authority and to the increase in the future average inflation rate (Chortareas and Miller, 2008).

Despite being less examined by the literature, a pro-market monetary policy deviation is also a possibility that must be taken into account when we discuss the strategic behaviour of the central banker. Differently from the latter, a pro-market deviation analysis is less straightforward as the market can benefit both from an inflationary and from an non-inflationary environment.

From a micro perspective, financial institutions individually can profit in an inflationary economy by adjusting its portfolio structure (e.g. loans and bonds) and its operational costs (e.g. wages) to benefit from changes in the price level (Perry, 1992). Consider, for instance, a bank that operates in a high inflation economy: in this case, this institution – which is usually better informed than the rest of society – can protect (and even increase) its profits by adjusting contracts so that revenues raises faster than costs. This bank may use different market instruments – such as the overnight operations – in order to achieve its objective, generating a wealth transfer from the depositors to the itself (Vinhado and Divino, 2013). Naturally, the opposite may happen when inflation goes down.[14] The existence of a positive relationship between inflation and banking profitability has been demonstrated by a number of empirical studies. Alexiou and Sofoklis (2009) and Athanasoglou et al. (2008) found a positive relation between these two variables for the Greek banking sector. Kasman et al. (2010) found the same pattern in a study for all European Union (which includes new members and candidate countries). Moreover, the Brazilian banking sector presented similar results in studies conducted by Rover et al. (2011) and Vinhado and Divino (2013).

Yet, from a macro perspective, the financial industry as a whole is averse to the risk of a rising inflation because it gradually erodes the country's macroeconomic fundamentals. (Hayo and Hefeker, 2002). This reality may lead the country to economic stagnation and, therefore, lower profits. In this context – as monetary policy is not an exact science –, the CB may choose a really conservative approach in this area as a way to ensure the protection of financial industry interests (Adolph, 2013). This strategy may be specially useful considering that there are a diversity of inflationary shock risks to which monetary policy is subjected

[13] In these cases, the political group in power is more interested in do well in the forthcoming elections and deal with the economic problems generated by poor policy choices latter than to loose political space but knowing they "did the right thing".

[14] In Brazil, the end of the (hyper)inflation in 1994 (with the *Plano Real*) represented a major loss for several private and public financial institutions, which became insolvent after floating operation revenues diminished dramatically. The problem was so big that the federal government had to create national programs to restructure the sector (PROER, PROES and PROEF in their Portuguese acronyms).

to.

The incentive for the CB to behave this way is strengthened in institutional structures like the Brazilian one. In Brazil, there is an an inflation targeting system in which the National Monetary Council (CMN) defines the inflation target that must be pursued by the CBB. For example, in 2020 the goal was set at 4.00%, with a tolerance interval of 1.50 p.p.[15] This means that any level of inflation that falls outside the range [2.5%, 5.5%], *both for more or for less*,[16] is seen as a failure by the CBB to meet the target in 2020. If this happens, the Central Bank Governor receives an "image punishment": she is bound to write an open letter to the Minister of Finance, explaining the causes that led to the non-fulfillment of the goal and the measures adopted to ensure that the inflation will return to the established limits.[17] Therefore, as we can infer from this structure, the CB has no political or social responsibility for economic growth and for unemployment problems. In fact, issues on these areas usually fall into the account of other public actors, namely the Minister of Finance and the President. In this scenario (which includes also a country with a traumatic inflationary history), the CB may benefit from adopting a really conservative approach in the monetary policy, accepting even a greater risk than the socially optimum that inflation will be too low.[18]

Whilst not always underscored by the literature, an inflation below expected is also a source of financial and social losses for the citizens. It induces, for example, a payment of a higher (real) spread for financing public debt than necessary, a greater gap between income and potential income and an unemployment rate higher than the natural one (Adolph, 2013; Svensson, 2015). In this sense, Svensson (2015) presented an interesting study about inflation below a (credible) target and its effects on the Swedish economy. The author found out that, during the studied period (1997-2011), the country's inflation was, on average, 0.6 p.p. below the center of the target (of 2%), generating unnecessary unemployment costs for society. As the author concludes:

> Average inflation below target has been associated with average unemployment being about 0.8 percentage points higher over the 15 years of 1997-2011 than what would have been the case if average inflation had been equal to the target. This is a large unemployment cost of average inflation below a credible target (Svensson, 2015, p.26).

2.3.2 The regulatory policy deviation

In cases where the Central Bank aggregates the role of a regulatory and supervisory agency for the financial system (as it occurs in Brazil), the CB has more power on her hands and, therefore, more ways to affect regulated industry interests. Within this scope, the CB may, for example, stimulate or hinder competition on the market, may facilitate or prevent mergers and acquisitions of financial institutions, may increase or decrease the regulations to be complied with by the sector, among others. Accordingly, this competence introduces another source of deviation towards the financial market that do not exist in structures where the monetary authority holds no regulatory and supervisory competence (like the Canadian one).

There are two relevant areas of study on the related literature that must be considered when we talk about the regulatory and supervisory question. The first one addresses the (possibility of) "capture" of government

[15] Resolution 4,582/2017-CMN, available here. Last access: 03/04/2020.

[16] We highlight this part of the text, because – when we think about inflation – we tend to focus only on the problems that arise in a high inflation context, and we may disregard the problems that emerge when inflation is unduly low.

[17] Decree 3,088, issued in 6/21/1999. Avaiable here. Last access: 03/04/2020.

[18] The case of Mr. Ilan Goldfajn (CBB governor from June 2016 to February 2019) serves to illustrate how a CB may boost his image in the market by adopting a conservative monetary policy approach. Having brought inflation down from 10.57% in 2015 to 3.75% in 2018, Mr. Goldfajn was elected the "Central Banker of the year" by the British publication "The Banker", from the Financial Times group. Interestingly enough, the CBB did not meet its 4.5% target not even once during Mr. Goldfajn's tenure. In 2017 (his first full year as the incumbent), inflation was so low (2.95%) that it did not even reached the 3% floor of the band. In 2018 (his second and last full year of incumbency), inflation rose to 3.75% (still below the 4.5% target), a result which was in part due to a truck driver's strike that "helped" to elevate general prices. While other CBB governors had been held accountable for inflation above the ceiling of the inflation target, he was the first one that had to explain inflation below the floor level. Yet, this performance yielded Mr. Goldfajn a great image among financial market members. He was appointed Chairman of the Advisory Board of Credit Suisse Brazil immediately after finishing his quarantine period in September 2019.

institutions by interest groups (Grossman and Helpman, 1992; Hardy, 2006; Stigler, 1971), while the second analyzes the movement of personnel between regulatory agency and regulated private companies, in what became known as the "revolving door problem" (Adolph, 2013; Gormley, 1979; Wirsching, 2018). Both of these literature are not specifically about Central Banks, but may be applied to it as well.

Regarding the first area of study, Stigler (1971) demonstrates in a seminal article that regulators are frequently subject to pressure from regulated companies, in order to change the rules of the game accordingly to their preferences. Naturally, if they succeed on this task, these changes may harm the citizens' interests and favour their own (Grossman and Helpman, 1992). This situation can be viewed as a government failure inherent to the relationship among regulatory and regulated entities, which demands a greater degree of accountability and transparency for its solution (Faria and Streit, 2016; Miller and Dinan, 2009).

Regarding the possibility of the specific risk of monetary authority capture, Hardy (2006) presents an interesting argument:

> There is no reason to suppose that financial sector regulation is immune from capture, and features of financial markets may make the sector especially prone to it. [...] The financial sector often contains a number of very large institutions, or is organized into powerful banking associations [...] Financial institutions tend also to be well connected to the political establishment and thus to have access to channels of influence. In the United States, for example, they are among the largest contributors to political campaigns. [...] Supervisory staff, including senior staff, are frequently attracted to work in the regulated institutions, which offer high salaries (Hardy, 2006, pp.5-6).

In the same direction (but from a different perspective), the "revolving door problem" literature presents the moral hazard risk that emerges from the circulation of officials between regulated industry and regulatory government agencies. The idea here is that the transit of former public officials to the private sector can entail a relevant source of conflict of interests (Dal Bó, 2006; Miller and Dinan, 2009). As these actor's have future career goals on the market, they may feel tempted to grant a "special treatment" for her "future employers" while in office, in a sort of an opportunistic behaviour (Shive and Forster, 2017; Wirsching, 2018). This dynamic may be helpful for them as a way to facilitate the transition to the private market afterwards, but it is obviously not beneficial for society.

As a way to (try to) offset these conflict of interests, in many countries there are laws preventing civil servants from working in regulated industry for a certain period of time after leaving office, in an institution known as the "quarantine". In Brazil, this institution exists since May 2013 (when the Federal Law No. 12,813/2013[19] was enacted) and works as fallows. State authorities who intend to exercise another activity with a potential conflict of interest after leaving the government must fill out a form addressed to the Public Ethics Committee (*Comissão de Ética da Presidência da República*) explaining the activity they intend to perform. The Committee analyzes it and rules whether there is (or there is not) a conflict of interest on the case. If the Committee rules for the existence of a conflict of interest, a six-month "quarantine" restriction is imposed, during which the authority is not allowed to exercise the requested activity. As compensation, the authority continues to receive her former governmental salary during the period of legal impediment.

Considering this reality, we requested to the Brazilian Government, through the Information Access Law,[20] data on the CBB's employees "quarantine requests". As a result, we obtained the information that – since May 2013 until January 2020 – fourteen out of sixteen central bankers[21] who left their positions on the CBB during this period consulted the necessity to comply (or not) with the "quarantine". In nine of these cases, the Ethics Committee ruled that there was a potential conflict of interest and imposed the "quarantine" restriction. In addition to that, we obtained the information that another 10 CBB civil servants with a lower

[19] Avaiable here. Last access: 03/06/2020.

[20] Federal Law No. 12,527/2011. Available here. Last access: 03/06/2020.

[21] For the purpose intended here, we consider central bankers the Governor (1), the Deputy Governors (8) and the Executive-Secretary (1), as these actors compose the CBB Board of Governors (the Executive-Secretary participates on the meetings without voting rights).

hierarchical level consulted the necessity to comply with the "quarantine", and that the Committee ruled that 5 of them had to.

These data suggest that the potential conflict of interest in the public service's relationship with the market should not be disregarded. This is especially true in the case we are dealing with here, since the monetary authority operates on an economic sector that pays high salaries (Adolph, 2013; Hardy, 2006). In fact, the Central Bank's case is so emblematic in Brazil that there is even a bill project in discussion in the Chamber of Deputies that intends to double the "quarantine" period only for the specific case of the CBB.[22]

Although the "capture" and "revolving door problem" literature do not specifically deal with central banks, there is no reason to suppose that they should not be applied in this case. Quite the contrary, since the financial industry is a sector that requires a high level of regulation for its proper functioning and is a sector that offers high remuneration to its executives, it seems reasonable to assume that these problems may arise in this context.

3 The Model

Our article contributes to the literature debate by approaching the relationship of the central banker with the government, the financial market and the citizens simultaneously. We provide a model to explain how a representative central banker behaves in office considering that she is a utility maximizer rational agent that intends to develop a career either in the government or in the financial market after leaving office. We assume that the incumbent has at her disposal two kind of policies: a monetary policy (i) and a regulatory policy (x), each affecting differently the utility functions of her "three masters".

3.1 Environment

Consider the problem of a central banker who must implement both monetary and regulatory policies. For the sake of simplicity, we assume that the former is equivalent to choose the level of the economy's basic (nominal) interest rate[23] $i \in \mathbb{R}_+$. The level of regulation in the banking sector – or financial market – is measured by $x \in \mathbb{R}_+$, a variable that may incorporate the degree of the concentration of the market, the number and strength of the barriers to entry into it and other factors that affect the competition in the industry. We assume that the higher x the more competitive the banking sector, as a consequence of a unfavorable (for those which are already established in the sector) regulation.

The CB stays in office for one term – where she implements a single pair of policies (i, x) – and than leaves. There are two alternatives of career paths to follow: in the banking sector (e.g. as a CEO or CFO of a big financial institution) or in the government (e.g. as a Minister of Finance or other political position). Her choice depends on the salaries – which include more than just the pecuniary compensation – offered by the two groups interested in her services. Let w^G and w^M denote the salary offered by the government and by the banking sector (market), respectively. We assume that the central banker sells her labor force through a sealed-bid first-price auction: as her services are very specialized, this market works as a monopoly with only two potential buyers.

Three important economic variables are directly affected by the policies implemented by the CB. First, the inflation rate $\pi(i)$ is a function of the nominal interest rate, such that $\pi(i)' < 0$ and $\pi(i)'' > 0$. In other words, inflation decreases as i increases but this effect is diminishing. Second, the retail lending rate $r(i, x)$ is increasing in i and decreasing in x. Formally, $\frac{\partial r(i,x)}{\partial i} > 0$ and $\frac{\partial r(i,x)}{\partial x} < 0$. These assumptions reflect the fact that there is a direct relationship between the two interest rates as well as that more competition implies in lower prices to consumers (retail lending rate). Finally, the domestic output $y(i)$ is also negatively affected

[22] Bill Project No 6,363/2016. Avaliable here. Last access: 03/04/2020.

[23] The basic interest rate of the Brazilian economy is the SELIC rate, which is calculated by the weighted average interest rate of the overnight interbank operations, collateralized by federal government securities. Its equivalent in the US system is the Federal Funds Rate.

by i: high interest rate implies in both high opportunity cost of investing and high cost of raising money for businesses, which decreases the economic growth. Thus, as usual, we assume that $y(i)' < 0$ and $y(i)'' > 0$.

3.2 Timing of the game

The sequential game played between the central banker, the government and the banking sector consists of the following steps:

1. The CB chooses the pair of monetary and regulatory policies (i, x) to implement;
2. Both the government and the financial market observe it and then try to hire the central banker for an office or a position in the sector by offering w^G and w^M, respectively, in a competition that can be seen as a sealed-bid first-price auction.
3. The CB compares the offers and then chooses the career path that maximize her own utility function, that is, the one whose salary is the highest. A backward induction approach is used to solve the game.

3.3 The central banker

The central banker's payoff takes into account the two periods of the game, namely the one in which she is in office and the one in which she will work either for the government or for the financial market. Formally, her utility is given by

$$U^{CB}(i, x) = u(\pi(i), y(i), r(i, x)) + \beta \max\left\{w^G, w^M\right\}, \tag{3.1}$$

where $\beta \in (0, 1)$ is the intertemporal discount factor, and the function $u(\cdot)$ satisfies the following properties: $\frac{\partial u}{\partial y} > 0$, $\frac{\partial u}{\partial r} < 0$ and $\frac{\partial u}{\partial \pi} > 0$ if $\pi < \pi^*$ and $\frac{\partial u}{\partial \pi} < 0$ if $\pi > \pi^*$, where π^* is the inflation target. Observe that there are monotone effects of both the output and the retail lending rate on the central banker's welfare in the first period: while the former increases u, the latter decreases it. The impact of inflation, however, depends on its target level, such that if it is higher (lower) than π^*, then the central banker's utility is decreasing (increasing, respectively). For simplicity reasons, we assume that $u(\cdot)$ is equal to society's preferences: it depends on $\pi(i)$ and $r(i, x)$, because of institutional mandate imposition, and on $y(i)$, because of ego-rent.[24] We also assume that U^{CB} is concave in both arguments for all $(i, x) \in \mathbb{R}^2_+$.

3.4 The government

The government's payoff also takes into account the two periods of the game. In the first, the government is directly impacted by the policies implemented by the CB, such that its utility is $u^G(i, x)$. In the second, in case it wins the competition for the central banker's services, it must pay w^G to her but also has the benefit from having her as a member of its cabinet, for example. We assume that such a benefit is proportional to the utility obtained due to central banker's policies. For the sake of simplicity, it is also $u^G(i, x)$.[25] Let $Pr(w^M > w^G)$ denote the probability of the financial market hiring the central banker after she leaves office. Then, government's payoff is given by

$$U^G(i, x) = u^G(i, x) + \left[1 - Pr\left(w^M > w^G\right)\right]\left(u^G(i, x) - w^G\right), \tag{3.2}$$

where we assume that, whenever the government loses the competition for central banker's services, its utility in the second period is zero. Observe that we assume that the intertemporal discount factor of the government is equal to one. Such an assumption does not affect our results.

[24] The idea here is that the central banker is not only interested in fulfilling her duties, but also in helping society prosper. So her utility increases with high levels of output, low levels of retail lending rates and inflation close to its target.

[25] Let τ be the benefit from having the central banker among its members. Then, any function $\tau\left(u^G\right)$ satisfying $u' > 0$ would yield similar results.

The way (i, x) affects the government's welfare is described by the function

$$u^G(i,x) = \phi y(i) - \frac{(\pi(i) - \pi^*)^2}{2} - i, \tag{3.3}$$

where $\phi \in [0,1]$ is its private information. This implies that the financial market does not observe it; instead it only knows its probability distribution, which we assumed to be an uniform one. Observe that $\phi \sim U[0,1]$ implies that the utility is also uniformly distributed, formally $u^G(i,x) \sim U\left[-\frac{(\pi(i)-\pi^*)^2}{2} - i, y(i) - \frac{(\pi(i)-\pi^*)^2}{2} - i\right]$. We can also notice that $u^G(\cdot)$ is increasing in y, such that the government likes high output. In addition, the closer inflation is to its target the higher u^G. Finally, while the partial effect of i on the utility is negative ($\frac{\partial u^g}{\partial i} = -1$), the total one is ambiguous ($\frac{du^G}{di} = \phi y'(i) - (\pi(i) - \pi^*)\pi'(i) - 1$). For the case in which the inflation is lower than (or equal to) its target, $\frac{du^G}{di} < 0$. Instead, if $\pi(i) > \pi^*$, then the total effect may be either positive or negative, depending on the functional forms and parameters' values.

3.5 The financial market

Similar to the government's payoff, the financial market's can be expressed by

$$U^M(i,x) = u^M(i,x) + Prob\left(w^M > w^G\right)\left(u^M(i,x) - w^M\right), \tag{3.4}$$

where

$$u^M(i,x) = r(i,x) - \xi\frac{(\pi(i) - \pi^*)^2}{2} - i, \tag{3.5}$$

where $\xi \in [0,1]$ is its private information. Similar to the previous case, the government does not observe its true value but knows its probability distribution. For the sake of simplicity, we assumed to be a uniform one as well. Formally, $\xi \sim U[0,1]$, which implies that $u^M(i,x) \sim U\left[r(i,x) - \frac{(\pi(i)-\pi^*)^2}{2} - i, r(i,x) - i\right]$. One can see that u^M increases as the retail lending rate increases and that the partial effect of i on it is negative. The total effect of the basic interest rate, however, is ambiguous as an increase in it also increases $r(i,x)$. Finally, the financial market also cares about inflation, namely the closer to its target the higher the welfare.

An important remark about u^G and u^M is that they are quite similar when $\phi = 0$ and $\xi = 1$, that is, when the government does not care about output and the financial market cares about inflation as much as the government. One can observe that $\phi = 0$ and $\xi = 1$ implies the following relation between the preferences $u^M(i,x) = u^G(i,x) + r(i,x)$. This is the case in which the players' preferences are aligned the most. Clearly, as the literature and evidence discussed in the previous sections show, such a circumstance is not likely to be observed in practice.

3.6 Equilibrium

We solve the game by backward induction. Thus, we must first solve the subgame played by the government and the financial market, in which both compete for the services of the central banker after she leaves office. Once we have found their optimal salary offers we can analyze the central banker's problem, that is, the optimal monetary and regulatory policies to be implemented.

3.6.1 The auction between the government and the financial market

The government and the financial market make their offers to the central banker after observing the implemented policies (i, x). In particular, they both can evaluate how valuable her services are through their first-period utility. We model this competition through a sealed-bid first-price auction: each player makes its offer without knowing the opponent's "bid" – or simultaneously – and the highest salary is the one chosen by the CB.

Let us start by solving the government's problem. We follow the standard approach developed in seminal texts such as Gibbons (1992) and Krishna (2009). Given that the financial market's offer is unknown by the government, we may conjecture that it is a linear function of its "valuation", that is, how much it values the central banker's services. Formally, the conjecture is $w^M = A + Bu^M(i,x)$, where A and B are constants to be determined in equilibrium and $B > 0$ as we assume that the higher the utility from the policies implemented by the CB the higher the wage offered – because she is seen as valuable for both the financial market and the government. As the probability distribution of $u^M(i,x)$ is known, it is possible to calculate

$$\begin{aligned} Pr\left(w^M > w^G\right) &= Pr\left(A + Bu^M(i,x) > w^G\right) \\ &= Pr\left(u^M(i,x) > \frac{w^G - A}{B}\right) \\ &= \frac{2}{(\pi(i) - \pi^*)^2}\left[r(i,x) - i - \left(\frac{w^G - A}{B}\right)\right]. \end{aligned} \tag{3.6}$$

Thus, the government must solve

$$\max_{w^G} u^G(i,x) + \left\{1 - \frac{2}{(\pi(i) - \pi^*)^2}\left[r(i,x) - i - \left(\frac{w^G - A}{B}\right)\right]\right\}\left(u^G(i,x) - w^G\right), \tag{3.7}$$

whose solution is given by

$$w^G = \frac{1}{2}\left\{u^G(i,x) + B\left[r - i - \frac{(\pi(i) - \pi^*)^2}{2}\right] + A\right\}. \tag{3.8}$$

One can see that, regardless of the values of A and B, the offer that the government makes to the CB is increasing in its own utility. In fact, $\frac{\partial w^G}{\partial u^G} = 1/2$, which implies that the marginal impact is constant and half of the increase in its utility.

The financial market solves a similar problem. First, we must calculate its probability of winning the auction. Given that the distribution of $u^G(i,x)$ is common knowledge, it can obtain the following:

$$\begin{aligned} Pr\left(w^M > w^G\right) &= Pr\left(w^M > C + Du^G(i,x)\right) \\ &= Pr\left(\frac{w^M - C}{D} > u^G(i,x)\right) \\ &= \frac{1}{y(i)}\left[\frac{w^M - C}{D} + \frac{(\pi(i) - \pi^*)^2}{2} + i\right], \end{aligned} \tag{3.9}$$

where we use the conjecture $w^G = C + Du^G(i,x)$ for the government's offer. Once again, C and D are constants to be determined in equilibrium and $D > 0$.

The financial market solves the following optimization problem:

$$\max_{w^M} u^M(i,x) + \frac{1}{y(i)}\left[\frac{w^M - C}{D} + \frac{(\pi(i) - \pi^*)^2}{2} + i\right]\left(u^M(i,x) - w^M\right). \tag{3.10}$$

The optimal offer is, therefore,

$$w^M = \frac{1}{2}\left\{u^M(i,x) - D\left[\frac{(\pi(i) - \pi^*)^2}{2} + i\right] + C\right\}. \tag{3.11}$$

Observe that, similar to the government's offer, w^M increases as the policies implemented by the CB improve its utility u^M. This effect continues to be constant and equal to $1/2$ as well as it is independent on the

values of C and D.

The equilibrium is obtained by solving a system with four equations: $w^M = A + Bu^M(i,x)$, $w^G = C + Du^G(i,x)$ and (3.8) and (3.11). It is straightforward to check that $B = D = 1/2$ – recall the above remarks about the marginal effect of u^j on w^j for $j = G, M$. This allows us to find:

$$A = \frac{1}{6}\left[r(i,x) - 3i - \frac{3}{2}\left(\pi(i) - \pi^*\right)^2\right] \tag{3.12}$$

$$C = \frac{1}{6}\left[2r(i,x) - 3i - \frac{3}{2}\left(\pi(i) - \pi^*\right)^2\right]. \tag{3.13}$$

Thus, we have that $C = A + r(i,x)/6$, which implies that $C > A$. This allows us to conclude that, although the offers of the government and the financial market respond in the same magnitude to changes in their utilities, the "independent part" (the one that is not affected by the utility) of the government is larger than financial market's. In fact, if the chosen policy is such that $u^G = u^M$, than government's offer is higher.

We are now able to state the optimal salary offers made by both players to the central banker:

$$w^G = \frac{r(i,x)}{3} - i - \frac{\left(\pi(i) - \pi^*\right)^2}{2} + \frac{\phi}{2}y(i) \tag{3.14}$$

$$w^M = \frac{2}{3}r(i,x) - i - \frac{\left(\pi(i) - \pi^*\right)^2}{4}(1+\xi). \tag{3.15}$$

Observe that both offers are linear functions of r, $\left(\pi - \pi^*\right)^2$ and y. In fact, except by the presence of r in u^M, they differ from each other only by their parameters' values. As one could expect, when preferences are aligned the most ($\phi = 0$ and $\xi = 1$), we have that offers are very similar function, namely $w^M = \frac{r(\cdot)}{3} + w^G$. Although both players face the same incentives concerning inflation and output, there is still a substantial difference between them, namely the presence of the retail lending rate in the financial market's utility. This explains why they are at the same time similar as functions, but not identical. Conversely, when the utilities of the government and the financial sector are very different, their offers will reflect such a divergence.

As we have not defined the functional forms of $r(\cdot)$, $\pi(\cdot)$ and $y(\cdot)$, it may be the case that $w^G < w^M$ for all $(i,x) \in \mathbb{R}^2_+$ and $\phi, \xi \in [0,1]$. As we have seen, when $\phi = 0$ and $\xi = 1$ we have $w^M = \frac{r(\cdot)}{3} + w^G$ regardless of the implemented monetary and regulatory policies. This is not a case of interest as the central banker's policies do not affect her choice between working in the government or in the market afterwards – she always chooses the latter. To ensure that all cases are possible, we make the following assumption.

Assumption 3.1 *Functions $r(i,x)$ and $y(i)$ are such that $y(i) > \frac{2}{3}r(i,x)$ for all $(i,x) \in \mathbb{R}^2_+$.*

The above condition requires that the output be sufficiently high, such that monetary policy can have a strong impact on the government's utility.

3.6.2 The optimal monetary and regulatory policies

As we have seen, the central banker chooses (i,x) to maximize (3.1). However, given that this utility involves the maximum function, its optimization is not straightforward. In this article, we analyze separately the cases in which the government and the financial market wins the auction. In order to do so, we assume that the functional forms of $r(\cdot)$, $\pi(\cdot)$ and $y(\cdot)$, and the parameter π^*, are such that either $w^G > w^M$ or $w^G < w^M$ for all $(i,x) \in \mathbb{R}^2_+$.

Let us start by assuming that the financial market's offer is the highest one ($w^G < w^M$). In this case, the first-order condition is

$$\frac{\partial r}{\partial x}\left(\frac{\partial u}{\partial r} + \frac{2}{3}\beta\right) = 0 \tag{3.16}$$

$$\pi'(i)\left[\frac{\partial u}{\partial \pi} - \beta\frac{(1+\xi)(\pi(i)-\pi^*)}{2}\right] + \frac{\partial u}{\partial y}y'(i) + \frac{\partial r}{\partial i}\left(\frac{\partial u}{\partial r} + \frac{2}{3}\beta\right) = \beta \tag{3.17}$$

For future use, we use the above system rewritten in the following form:

$$\frac{\partial u}{\partial r} = -\frac{2}{3}\beta \tag{3.18}$$

$$\pi'(i)\left[\frac{\partial u}{\partial \pi} - \beta\frac{(1+\xi)(\pi(i)-\pi^*)}{2}\right] + \frac{\partial u}{\partial y}y'(i) = \beta \tag{3.19}$$

We must now analyze the case in which the government is the winner in the auction. One can show that when $w^G > w^M$, the central banker's optimal choice satisfies

$$\frac{\partial r}{\partial x}\left(\frac{\partial u}{\partial r} + \frac{1}{3}\beta\right) = 0 \tag{3.20}$$

$$\pi'(i)\left[\frac{\partial u}{\partial \pi} - \beta\left(\pi(i) - \pi^*\right)\right] + y'(i)\left[\frac{\partial u}{\partial y} + \beta\frac{\phi}{2}\right] + \frac{\partial r}{\partial i}\left(\frac{\partial u}{\partial r} + \frac{1}{3}\beta\right) = \beta, \tag{3.21}$$

which can also be rewritten as

$$\frac{\partial u}{\partial r} = -\frac{1}{3}\beta \tag{3.22}$$

$$\pi'(i)\left[\frac{\partial u}{\partial \pi} - \beta\left(\pi(i) - \pi^*\right)\right] + y'(i)\left[\frac{\partial u}{\partial y} + \beta\frac{\phi}{2}\right] = \beta. \tag{3.23}$$

As usual, the first-order conditions make marginal benefit equal to marginal cost. However, as some of the effects are not monotone, the analysis is not straightforward. For example, an increase in the interest rate may improve the welfare by making the inflation approach its target, but may change the retail lending rate and the output, decreasing the utility. In addition, the effects on the salary are different depending on which one is the highest. When $\phi = 0$ and $\xi = 1$, one can observe that the optimal conditions for x (equations (3.18) and (3.22)) are never equal – but they are similar functions – whereas the conditions for i (equations (3.19) and (3.23)) are identical. We explore the consequences of this similarity below.

We analyze each component of the optimal policy separately.

Proposition 3.2 *Suppose that all the assumptions presented above hold. Then for the any basic interest rate i fixed, the optimal regulatory policy is such that the banking sector is more competitive when the central banker works in the government after leaving office rather than in the financial market (i.e. $x^G > x^M$).*

This first result states that there is a correlation between the level of regulation of the banking sector and the career path chosen by the CB. The choice for the financial market is associated with a more favorable regulation to the sector (e.g. by implementing measures that limit competition and that keep the market share of the current banks unchanged) in comparison with the choice for a career path in the government. Another interesting fact is that the regulatory policy is independent on the preference parameters ϕ and ξ (see (3.18) and (3.22)). This happens due to the fact that none of these parameters is related to x: while the former is the weight that the government assigns to the output, the latter is the weight the financial market assigns to inflation fighting.

More important, we propose in this article that there is a causal relationship between the optimal policy choice x and the career path chosen by the CB. As she knows in advance – through backward induction – that a softer regulation has a positive impact on her future market salary offer, her policy while in office reflects that. Considering this reality, Wirsching (2018) conducted empirical tests using data from more than 400 ministers of finance and central bankers of 32 OECD countries. The author found out that ministers of finance are more likely to be hired by financial entities if they implement deregulatory policies during their tenure, and that CB's with past experience in the financial sector – who are more likely to go back – tend to deregulate significantly more than the ones without this background.

When it comes to the optimal level of i, we have to analyze two cases separately, namely when the current inflation is higher and when is lower or equal to the target. While the assumptions that we have made so far are sufficient for the analysis of the later, we have to make further requirements for ensuring that there is solution in the former.

Assumption 3.3 *Regarding the marginal effect of the interest rate on inflation and output, we assume that* $\lim_{i\to 0}\frac{|\pi'(i)|}{|y'(i)|} = +\infty$ *and* $\lim_{i\to +\infty}\frac{|\pi'(i)|}{|y'(i)|} = 0$.

The intuition behind the above assumption is that for very low interest rates (close to zero), the magnitude of the marginal impact on inflation is sufficiently higher than the one on output. The opposite happens when the interest rate is very high (as it approaches to infinity): the magnitude of the marginal impact on inflation is sufficiently lower than the one on output. In other words, inflation is substantially more (less) sensitive to the interest rate than the output when i is very low (high, respectively). This seems to be compatible with the empirical evidence that the interest rate has a "higher power" in affect inflation when its value is low and that the effect on the output is decreasing.

The next proposition analyzes the optimal level of i for the two cases mentioned above.

Proposition 3.4 *Suppose that all the assumptions presented above hold. Then regarding the optimal monetary policy we have the following:*

(i) if the current inflation is lower or equal to its target, then for the any level of regulation x fixed, both (3.19) and (3.23) has corner solutions, that is the optimal basic interest rate is the lowest, $i = 0$;

(ii) if the current inflation is higher than its target, then for the any level of regulation x fixed, there exists $\bar{\phi}(\xi) \in (0,1)$ such that if $\phi < \bar{\phi}(\xi)$, then the optimal basic interest rate is lower when the central banker works in the financial market after leaving office than when she works in the government (i.e. $i^M < i^G$). Moreover, there exists $\bar{\xi}(\phi) \in (0,1)$ such that if $\xi > \bar{\xi}(\phi)$, then the optimal basic interest rate is higher when the central banker follows a career path in the financial market rather than in the government (i.e. $i^M > i^G$).

Let us start by analyzing item (i) of the above proposition. Recall that $\pi'(i) < 0$, such that an increase in the interest rate makes the inflation gap increase when $\pi \leq \pi^*$. In this case, the government's marginal utility of i is negative (see eq. (3.3)). The same happens with $u(\cdot)$, the first term of the central banker's utility (eq. (3.1)). The effect on the financial market's welfare, instead, can have either sign, depending on the magnitude of $\frac{\partial r}{\partial i}$ (eq. (3.4)). Although both $\frac{\partial w^G}{\partial i}$ and $\frac{\partial w^M}{\partial i}$ can have either sign, the competition between the services of the CB after she leaves office decreases the marginal impact of i on the optimal offers. Thus, when the inflation is lower than its target, if the CB chooses to raise i, the only positive impact on her utility, if any, is due to the increase in her future salary, but this potential benefit is always lower than the cost of a larger inflation gap and a higher retail lending rate. As a scenario with low inflation does not represent the most common reality in developing countries (e.g. Brazil), we do not explore in detail this case.

Item (ii) of proposition 3.4 shows that the optimal monetary policy is conditional on the preferences of both the financial market and the government. For instance, when the government assigns a small weight to output (ϕ is low), a high interest rate does not affect substantially its utility through $y(i)$. This means that the government in power tolerates a higher interest rate. Thus, if the parameter that measures the government's preference for output is small enough (lower than the threshold $\bar{\phi}(\xi)$), the optimal interest rate is lower when the CB chooses to work in the financial market than when she chooses the governmental career ($i^M < i^G$). In this context, it is also important to stress that the more the financial market cares about inflation fighting (ξ is high), the closer to zero the threshold $\bar{\phi}(\xi)$ should be for the result to hold, given that $\bar{\phi}'(\xi) < 0$ (see appendix A.2, equation (A.9) in particular).

When ϕ is not so low and the financial market worries about inflation (ξ is higher than the threshold $\bar{\xi}(\phi)$), the above proposition states a correlation similar to the one of our first result: the basic interest rate is higher when the central bankers chooses to work in the financial market rather than joining the government. In this case the output has a significant impact on government's utility and the preferences in terms of inflation fighting are relatively close between the two players. Therefore, as the government does not want the output to be impacted and the financial market wants a higher retail lending rate, the optimal monetary policy is the one with $i^M > i^G$. Similarly to our previous result, we have that $\bar{\xi}'(\phi) < 0$, which means that

the more the government cares about economic growth (ϕ is high), the closer to zero should the threshold $\bar{\xi}(\phi)$ be for this result to hold.

Notice that, once again, our model establishes a causal effect: once the CB is aware of the effects of her monetary policy choice on her future salary, the optimal interest rate is such that it considers her future employer's satisfaction. Thus, as the marginal impact of the interest rate on the utility is higher for the financial market for all $\phi, \xi \in [0, 1]$, the central banker tries to please this sector in order to increase her salary in the future. Similarly, when she knows that her future job is in the government, the monetary policy may be softer (depending on the parameters' values) because the government's welfare takes into account the negative effect of the interest rate on output.

The parameters ϕ and ξ have an important role in driving the magnitude of the difference between i^M and i^G. In fact, given that they can be seen as a measure of the difference between the preferences of the financial market and the government, the larger such a difference the higher $|i^M - i^G|$. As we have known, by comparing u^M and u^G, it is possible to note that the preferences are quite similar when $\xi = 1$ and $\phi = 0$ – recall that, although they are never equal, in this case we would have $u^M = u^G + r$. The next proposition formalizes such an argument.

Proposition 3.5 *The higher $\phi \in [0, 1]$ the higher the difference $|i^G - i^M|$. The lower $\xi \in [0, 1]$ the higher the difference $|i^G - i^M|$.*

The intuition behind the above result is straightforward: the lower ϕ and the higher ξ the closest the preferences of the two players. In the limit, when $\xi = 1$ and $\phi = 0$, $|i^M - i^G|$ achieves its minimum. Observe that in this case $i^M = i^G$ as the preferences over output and inflation are identical (see the first order conditions in the proof of proposition 3.4). Contrary to the case of the regulatory policy, because the financial market and the government assign the same weight to the inflation and to the output in the limit case, the monetary policy is the same. This happens because the retail lending rate does not impact the first order conditions of the monetary policy problem.

4 Concluding remarks

This article contributes to the general comprehension of how Central Banks define policies in the real world. It contradicts the idea that central bankers always aim at maximizing social welfare and proposes, instead, that they define institutional policies according to their private interests. Our model explains central bankers' policy options by their career aspirations rather than by their personal preferences (e.g. more/less conservative, more/less interventionist), which may be an important insight to the field.

The results show that a central banker who wants to work on the financial market adopts a more lenient regulation (lower x) than if she were interested in a governmental career ($x^G > x^M$). The monetary policy results are not straightforward, depending on the shadow principal's preferences. If the government gives a sufficiently low weight to the output, the CB chooses a higher interest rate when she wants a governmental career ($i^M < i^G$); if the financial market cares enough about inflation fighting, she chooses a higher interest rate when she wants to work in the financial market ($i^M > i^G$).

Our findings suggest that a deeper debate regarding incentive structures and institutional designs of the monetary authority is the order of the day. Questions such as the development of accountability rules and transparency mechanisms appears to be specially relevant in this context (e.g. dispersing decision-making power, such that each member of the board is independent from the Governor; creating mechanisms to decrease the influence of well-connected individuals to the policy-makers; strengthening parliamentary oversight over the monetary authority; enacting stricter standards of conduct for government employees, including "quarantine" periods, etc.).

Future endeavors in this area may include developing indicators to measure the variables proposed here and empirical tests. Building a general model and adaptations to other monetary authorities may also improve the literature on central bank governance.

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A Omitted proofs

A.1 Proposition 3.2

Let $i = \bar{i}$ be any fixed value and compare (3.18) with (3.22):

$$\frac{\partial u(\bar{i},x^G)}{\partial r} = -\frac{2}{3}\beta \tag{A.1}$$

$$\frac{\partial u(\bar{i},x^M)}{\partial r} = -\frac{1}{3}\beta. \tag{A.2}$$

Observe that $\frac{\partial u(\bar{i},x^G)}{\partial r} < \frac{\partial u(\bar{i},x^M)}{\partial r}$, such that it suffices to show that $\frac{\partial u(\bar{i},x^G)}{\partial r} = -\frac{2}{3}\beta$ is decreasing in x to prove the proposition. For, notice that

$$\frac{d}{dx}\left(\frac{\partial u\left(i,x\right)}{\partial r}\right) = \frac{\partial^2 u\left(i,x\right)}{\partial r^2}\frac{\partial r}{\partial x} < 0, \tag{A.3}$$

where we use the facts that $\frac{\partial^2 u(i,x)}{\partial r^2} > 0$ and $\frac{\partial r}{\partial x} < 0$. This implies that $x^G > x^M$.

A.2 Proposition 3.4

Let $x = \bar{x}$ be any fixed value and compare (3.19) with (3.23):

$$\pi'(i^G)\left[\frac{\partial u}{\partial \pi}\left(i^G,\bar{x}\right) - \beta\frac{(1+\xi)(\pi(i^G)-\pi^*)}{2}\right] + \frac{\partial u}{\partial y}\left(i^G,\bar{x}\right)y'(i^G) = \beta \tag{A.4}$$

$$\pi'(i^M)\left[\frac{\partial u}{\partial \pi}\left(i^M,\bar{x}\right) - \beta\left(\pi(i^M)-\pi^*\right)\right] + y'(i^M)\left[\frac{\partial u}{\partial y}\left(i^M,\bar{x}\right) + \beta\frac{\phi}{2}\right] = \beta. \tag{A.5}$$

We must first prove that whenever $\pi(i) \leq \pi^*$ we have a corner solution with $i^M = i^G = 0$. Recall that if the inflation is lower than its target then $\frac{\partial u}{\partial \pi} > 0$. Given that $\pi'(\cdot) < 0$, this implies that the first term of the sum in the left-hand side of both equations is negative. Because the second term is always negative and $\beta > 0$, there is no interior solution. The same happens when $\pi(i) = \pi^*$: the fist term of the left-hand sides of both equations is null, such that the second one makes them negative. Given that U^{CB} is concave in i, we have that both left-hand sides are decreasing in i, which implies that the optimal interest rate is the lowest possible, namely $i = 0$.

Suppose now that $\pi(i) > \pi^*$, such that the first term of left-hand side of both equations is positive. As $\lim_{i\to 0}\frac{|\pi'(i)|}{|y'(i)|} = +\infty$, $\lim_{i\to+\infty}\frac{|\pi'(i)|}{|y'(i)|} = 0$ and U^{CB} is concave in i, there exists unique $i^G > 0$ and $i^M > 0$ that solve (A.4) and (A.5), respectively. Finally, we must show that $i^M > i^G$. For, observe that both equations can be written as

$$\pi'(i)A^j + y'(i)B^j = \beta, \tag{A.6}$$

for $j = G, M$. It is straightforward to see that

$$B^G = \frac{\partial u}{\partial y}\left(i,\bar{x}\right) + \beta\frac{\phi}{2} \geq \frac{\partial u}{\partial y}\left(i,\bar{x}\right) = B^M > 0, \tag{A.7}$$

given that $\frac{\partial u}{\partial y}\left(i,\bar{x}\right) > 0$. The equality in the above expression occurs only when $\phi = 0$. Moreover, one can notice that

$$|A^M| = \left|\frac{\partial u}{\partial \pi}\left(i,\bar{x}\right) - \beta\frac{(1+\xi)\left(\pi(i)-\pi^*\right)}{2}\right| \leq \left|\frac{\partial u}{\partial \pi}\left(i,\bar{x}\right) - \beta\left(\pi(i)-\pi^*\right)\right| = |A^G|, \tag{A.8}$$

when the equality holds only when $\xi = 1$. This implies that is not clear if (A.6) is higher or lower for $j = M$

or $j = G$. Observe that $\pi'(i)A^G + y'(i)B^G > \pi'(i)A^M + y'(i)B^M$ happens when

$$\begin{aligned}
\pi'(i)\left\{\tfrac{\partial u}{\partial \pi}(i,\bar{x}) - \beta(\pi(i)-\pi^*) - \left[\tfrac{\partial u}{\partial \pi}(i,\bar{x}) - \beta\tfrac{(1+\xi)}{2}(\pi(i)-\pi^*)\right]\right\} \\
+y'(i)\left(\tfrac{\partial u}{\partial y}(i,\bar{x}) + \beta\tfrac{\phi}{2} - \tfrac{\partial u}{\partial y}(i,\bar{x})\right) > 0 \\
\tfrac{\beta}{2}\left[\pi'(i)(\pi(i)-\pi^*)(\xi-1) + y'(i)\phi\right] > 0. \qquad \text{(A.9)}
\end{aligned}$$

While the first term inside the brackets is non-negative, the second is non-positive. Thus, a sufficient condition for (A.9) to hold is the later be close to zero, which happens whenever ϕ is sufficiently low. In fact, given the continuity of (A.9), there exists $\bar{\phi}(\xi) \in (0,1)$ such that is $\phi < \bar{\phi}(\xi)$ then (A.9) holds. As U^{CB} is concave in i, to guarantee that $\pi'(i^G)A^G + y'(i^G)B^G = \pi'(i^M)A^M + y'(i^M)B^M = \beta$ we must have $i^G > i^M$.

Finally, observe that the left-hand side of (A.9) is negative whenever $\pi'(i)A^G + y'(i)B^G < \pi'(i)A^M + y'(i)B^M$, which happens whenever the first term inside the brackets is close to zero (ξ is close to one). Thus, there exists a $\bar{\xi}(\phi) \in (0,1)$ such that if $\xi > \bar{\xi}(\phi)$, then $\pi'(i^G)A^G + y'(i^G)B^G = \pi'(i^M)A^M + y'(i^M)B^M = \beta$ is satisfied if and only if $i^G < i^M$.

A.3 Proposition 3.5

The difference between i^M and i^G is driven by the magnitudes of A^j and B^j. Thus, factors that increase $|A^G| - |A^M|$ and $B^G - B^M$ also increase $|i^G - i^M|$. It is straightforward to see in (A.9) that the higher ξ and the lower ϕ the higher the difference $|i^G - i^M|$.