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OPTIMAL FINANCIAL REPRESSION

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OPTIMAL FINANCIAL REPRESSION[3]

Modern financial repression in advanced economies does not rely on increasing seigniorage revenue, but mostly rests upon regulatory measures to enlarge the demand for public debt that delivers extremely low or negative real interest rate. In this paper we propose the extension of the overlapping generations model to question the optimality of financial repression in the form of non-market placement of the public debt in the captive pension fund. We show that financial repression and capital income taxation are not perfect substitutes. The optimal degree of financial repression depends on the growth rate of population. Moreover, the benevolent government makes a decision to confiscate some part of the pension wealth.

Keywords: financial repression; fully-funded pension system; public debt; overlapping generations.

JEL Classification: E62; G28; H21; H55; H63

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1. Introduction

In recent years, many developed economies run into the fiscal stress. Low growth rates and political indecision to implement fiscal austerity have forced governments to look for alternative means of supporting public debt on the sustainable path. Many countries turned to the measures, which can be perceived as a financial repression. The term financial repression was introduced by McKinnon (1973) and Shaw (1973) to characterize a hard regulation of financial markets in developing economies during 1970s, which was thought to slow down their economic growth. However, financial repression is not a specific phenomenon of developing economies. Some developed economies have used tight financial sector regulation for some decades after the World War II. Moreover, some elements of the macroprudential policy, which takes place after the global crisis of 2007-2009, can be also treated as financial repression measures.

To wide extent, financial repression is the regulation of financial system, which allows the government to substitute the market mechanism of interest rate determination (see, e.g., Reinhart, 2012). It also allows the government to attract additional finance and to reduce the debt service.[4] Financial repression can take the form of: (1) Direct low-interest lending to the government or a placement of the public debt in captive financial institutions, such as national banks, pension funds, etc.; (2) Setting the credit policy of the state-owned national banks or the pressure on the private commercial banks; (3) Tightening of the capital requirements with a preferential treatment of public debt (e.g., Basel 3); (4) Direct or indirect deposit interest rate ceilings; (5) Excessively high reserve requirement ratio; (6) Open market operations with the aim to keep interest rate on public debt low; (7) Taxation of financial transactions with the lower tax rate for public debt instruments; (8) Capital controls with the aim to preserve home bias in investment. Using these measures the government artificially supports the demand for public debt, which in turn lowers debt service, allows to impose an indirect tax on financial sector and to collect higher inflation tax.

The main research question of the paper: is there the case for optimal financial repression in the form of non-market debt placement? To address this issue we extent the Diamond-Samuelson overlapping generations model with fully-funded pension system and fiscal policy. The government finances its spending using capital taxation and public debt. Pension fund has to invest a fixed share of its resources in the public debt. The financial repression policy is captured

[4] Roubini and Sala-i-Martin (1995) note that some regulation of financial markets is needed to address market failures. And this should not be viewed as a financial repression aimed to attract additional finance to the government budget. However, in practice it is hardly possible to assess when a sound financial regulation turns into financial repression.

by the interest on public debt, which can be set lower than the market rate of return in production. Under the explicit assumption that households receive direct utility from government purchases of public goods, welfare maximizing fiscal policy does not reduce to *laissez-faire*. Treating financial repression as an indirect tax on the pension fund, we are dealing with the problem of optimal taxation. So the questions we address in the paper is whether financial repression is a part of optimal fiscal policy and are financial repression and direct capital income taxation perfect substitutes?

The growing literature on financial repression can be provisionally divided into four interrelated issues: (1) Description and the quantitative estimation of financial repression measures; (2) Political economy explanation of the financial repression bias; (3) An impact of financial repression on the economic growth; (4) Optimality of financial repression. Our paper deals with the last issue. As far as we know, this is the first attempt to explore the optimality of financial repression in the form of indirect taxation (or, in fact, expropriation) of the pension wealth, which is invested in the public debt with low interest rate.

The quantitative estimates of financial repression show its significance to public finance. Giovannini and de Melo (1993) estimate the revenue from financial repression as a product of interest rate differential (the difference between interest rate on government debt and the market interest rate) and the national debt, which is held by private investors. Considering the sample of 24 countries for the time period from 1972 to 1987 they find that 7 countries received the revenue from repression higher than 2 percent of GDP. Reinhart and Sbrancia (2011) show that even under moderately low inflation financial repression can produce negative real interest rates in the economy for a long time. It creates substantial "liquidation effect". For example, the estimation of this effect for the US in the period between 1945 and 1980 gives 3.6 percent of GDP or 26 percent of tax revenues per year.[5]

The financial repression measure that we have chosen – low interest public debt placement in the captive pension fund - is one of the most popular repression measures in the modern developed countries. Recent examples of pension funds reforms and their regulation can be found in van Reit (2014) and Reinhart (2012). Table 1 shows that investment of European pension funds in government bonds has risen substantially during the period from 2007 to 2011.

[5] The liquidation of the debt at the rate of 3-4 percent of GDP per year means the liquidation of the debt at the rate of 30-40 percent of GDP per decade. Hilscher, Raviv and Reis (2014) obtain similar estimates for the perspective of the liquidation of the US debt in the near future. It is hard to inflate the debt away when its maturity is short. But financial repression can extend the effective maturity of the public debt. In this case the liquidation effect becomes as much as 25 percent of GDP.

Table 1. Modern financial repression: pension funds investment in public debt, OECD

Selected OECD countries	2007	2011
Austria	29.44	1.50
Belgium	4.16	7.42
Bulgaria	24.99	32.48
Hungary	60.65	59.20
Germany	1.52	2.34
Greece	37.20	43.44
Denmark	24.08	47.42
Israel	63.81	65.70
Iceland	24.26	45.12
Spain	25.81	34.68
Italy	30.36	35.78
Netherlands	14.88	16.45
Norway	11.70	20.80
Poland	59.29	59.09
Portugal	17.06	24.58
Romania	21.08	67.40
Slovak Republic	18.62	41.49
Slovenia	28.94	23.63
USA	9.48	12.50
Czech Republic	61.96	70.64

Note: Bills and bonds issued by public sector as a share of total investment of the pension fund, percent. OECD Pension Statistics, authors' calculations.

Financial repression bias is often explained as a political phenomenon. Indeed, financial repression is an indirect tax and, so, it is less visible form of taxation (see, e.g., Reinhart, 2012). Thus, it is relatively harmless way for the government to improve the fiscal stance in times when it is hard to implement unpopular measures: increase direct taxes or cut spending.[6] Moreover, financial repression produces distortions in the financial market. Particularly, artificially low interest rates encourage investment, but discourage savings, which in turn can lead to the shortage of credit. In this case some supplementary regulation is needed: the government can implement selective credit policy, supporting some industries (as, e.g., in Japan in 1970s) or big business, which electoral support is important for the government (Buck and Maier, 2014).[7] Our research does not deal with these problems. On the contrary, we analyze the choice of benevolent

[6] Moreover, while captive home investors often follow "buy and hold" strategy, financial repression abates not only the debt service cost, but its volatility as well. Under the self-fulfilling debt crises this mechanism of shock absorption improves social welfare. See Missale (2012) and van Reit (2014).

[7] In some cases, selective credit policy was the primary goal, rather than a part of the efforts to attract additional finance to the budget. See, e.g., Haggard, Lee and Maxfield (1993), Lukauskas (1994) and Denizer, Dezai and Gueorguiev (1998).

government, which maximizes the welfare of the current and future generations. We show that the financial repression bias can be explained without appealing to the new political economy.

The discussion of the consequences of financial regulation for economic growth dates back to the late 1960s.[8] Until recently the liberal doctrine was dominated in the economic literature. Almost all theoretical and empirical papers on financial repression showed its negative influence on economic development (see, e.g., Fry, 1988; King and Levine, 1993; Haslag and Koo, 1999; and the extensive review in Roubini and Sala-i-Martin, 1992, 1995). The main channels of the negative impact of repression on growth are the following: fall in capital productivity, decrease in the investment level and the fall in the effectiveness of transformation of savings into investment. However, there are some recent papers (see, e.g., Bumann, Hermes and Lensink, 2013) that challenge this view. In fact, the most of developed economies in the 1950-1970s imposed tight financial sector regulation. Negative real interest rates allowed to stabilize government debt and were used as a part of industrial policy. However, these economies demonstrated quite high growth rates (Aloy, Dufrenot and Pegui-Fiessolle, 2014). Proponents of tight financial regulation also stress that financial liberalization in developing countries resulted in the financial instability, which is detrimental for economic growth (see, e.g., Stiglitz, 2000). However, this question is not in the focus of our research. We employ the model of exogenous economic growth. Financial repression and capital taxation both result in a decrease in the steady-state level of capital-to-labor ratio and output per capita, but do not influence their growth rates. In other words, we model only the effect of reduction in investment in productive capital.[9]

The small existing literature on optimal financial repression considers two different frameworks: optimal seigniorage and optimal tax structure under collection costs and tax evasion. Roubini and Sala-i-Martin (1992, 1995) consider the endogenous growth model, where the degree of financial development determines efficiency of productive capital (or transformation of savings into the investment) and also the willingness of the population to hold real money balances (financial repression corresponds to the high level of real money balances and so to the high inflation tax base). Authors show that the optimal policy is consistent with low degree of financial development (high degree of financial repression): in terms of the loss function of the government, slower economic growth is compensated by higher seigniorage and the possibility to impose low income tax rates. Bencivenga and Smith (1992) also characterize

[8] In 1970-1980s the discussion was between liberals and new structuralists. See, e.g., Buffie (1984).

[9] The assumption that financial repression provides supplementary finance for consumable public goods is also important. Alternatively, one can assume the case of productive government spending. Then, within the endogenous growth model, financial repression should influence not only the level, but the growth rate of output as well.

financial repression in the form of high required reserves ratio as an optimal decision of the government facing the need to monetize the budget deficit. They corroborate the original point of McKinnon (1980): stabilization of the public finance should lead the successful financial liberalization. In our paper we also assume, that the problem of the market placement of the debt compels the government to adopt financial repression.

Gupta (2008) and Gupta and Ziramba (2008, 2010) pursue the second framework to address the problem of optimal financial repression. They investigate financial repression in the overlapping generations model with money and fiscal policy. Costs of tax collection (costs of tax evasion alternatively) also make the high reserve ratio the optimal choice. Bai et al (2001) suggest an alternative argument. The inability of the government to verify taxable incomes makes the effective tax rate unevenly distributed. In this case optimal financial repression is an analog to the evenly distributed tax on savings.

The literature on optimal financial repression has some peculiarities. Firstly, it has the focus on issues of the developing economies with low level of financial development, high level of tax evasion and the need to monetize the budget deficit. Secondly, financial repression is captured by the increase in the inflation tax base. Our research is novel in the following way: we analyze financial repression in the context of the real economy. In the previous literature financial repression is linked to the inflation tax or a fall in the financial system effectiveness. Instead, we consider debt finance and assume that the government places its debt in the captive institution – the pension fund. Redistribution of resources between public and private sectors does not lead to a fall in the efficiency of financial intermediaries. So we pursue to assess the optimality of the specific form of financial repression in the developed countries under the fiscal stress.

The paper has the following structure. In Section 2 we propose the extension of the OLG model with financial repression and fiscal policy. Section 3 contains the analysis of the steady state. In Section 4 we study the optimal choice of the benevolent government. The final section concludes.

2. The model

The following model is the extension of the Samuelson-Diamond overlapping generations model (Samuelson, 1958; Diamond, 1965) with fully-funded pension system and fiscal policy. There are two assets in the economy – productive capital and government bonds. To simplify the

exposition we assume that there is no market for the government debt. The only holder of the government bonds is the captive pension fund. The government exercise financial repression by setting the interest rate on public debt lower than the rate of return in production.

2.1. Households

A representative household lives for two periods t and $t+1$. Generations are overlapping. In the period t there are N_t young and N_{t-1} old households. The growth rate of generations is n, so that $N_t = N_0(1+n)^t, n > -1$. Households do not have any initial wealth and do not have any bequest motive.[10]

In the first period a household is employed in the production and receives wage w_t. Labor supply is absolutely inelastic and equal to one. The share γ of the labor income is to be paid to the fully-funded pension fund. On the one hand, this is perceived as mandatory saving. On the other hand, as will be articulated later, this is the part of financial repression. Households divide first period disposable income $(1-\gamma)w_t$ between their first period consumption $c_{1,t}$ and voluntary saving s_t. The gross capital income $(1+r_{t+1})s_t$ is imposed to the tax at rate τ_k. The second period consumption $c_{2,t+1}$ is determined by the sum of the after-tax gross capital income, $(1-\tau_k)(1+r_{t+1})s_t$, and the pension benefit h_{t+1} (to be defined later).

To make the motivation for financial repression sound, we explicitly assume that households receive direct utility from both private spending $c_{1,t}$ and $c_{2,t+1}$ and government purchases of public goods g_t and g_{t+1} (per capita). Using logarithmic instantaneous utility function we introduce the additively-separable life-time utility of the representative household:

$$u(c_{1,t}, c_{2,t+1}, g_t, g_{t+1}) = \ln c_{1,t} + \varphi \ln g_t + \frac{1}{1+\theta}\left(\ln c_{2,t+1} + \varphi \ln g_{t+1}\right), \quad (1)$$

where θ is the subjective discount rate and φ is the elasticity of substitution between private and public goods.

The household maximizes life-time utility (1) with respect to private consumption in both periods subject to budget constraints (2) and (3):

[10] One can expect that the existence of the effective bequest motive could be important for the optimality of financial repression, which, as we show, implies some intergenerational redistribution. But we leave it for future research.

$$c_{1,t} + s_t = w_t(1-\gamma), \tag{2}$$

$$c_{2,t+1} = (1+r_{t+1})(1-\tau_k)s_t + h_{t+1}. \tag{3}$$

Solving the problem (1)-(3), we receive optimal private consumption and saving:

$$c_{1,t} = (1-\gamma)\frac{1+\theta}{2+\theta}w_t + \frac{1+\theta}{2+\theta}\frac{h_{t+1}}{(1+r_{t+1})(1-\tau_k)}, \tag{4}$$

$$c_{2,t+1} = \frac{w_t}{2+\theta}(1-\gamma)(1+r_{t+1})(1-\tau_k) + \frac{h_{t+1}}{2+\theta}. \tag{5}$$

$$s_t = \frac{(1-\gamma)w_t}{2+\theta} - \frac{1+\theta}{2+\theta}\left(\frac{h_{t+1}}{(1+r_{t+1})(1-\tau_k)}\right). \tag{6}$$

2.2. Firms

Perfectly competitive firms produce output using labor and capital inputs. There is no technological progress. To simplify analysis we assume Cobb-Douglas production function:

$$Y_t = K_t^{\alpha} N_t^{1-\alpha}. \tag{7}$$

We also assume full capital depreciation during one period that is empirically plausible if one period corresponds to 30 years. Thus, the problem of the representative firm is to maximize the profit:

$$K_t^{\alpha} N_t^{1-\alpha} - r_t K_t - K_t - w_t N_t \to \max_{K_t, N_t}. \tag{8}$$

Corresponding first order conditions are:

$$1 + r_t = \alpha k_t^{\alpha-1}, \tag{9}$$

$$w_t = (1-\alpha)k_t^{\alpha}, \tag{10}$$

where $k_t = K_t / N_t$ is the capital-to-labor ratio.

2.3. The pension fund

To introduce financial repression we assume a fully-funded pension system. Captive pension fund in period t receives contribution γw_t from each young household. The share β of the fund has to be put in government bonds and the share $(1-\beta)$ can be invested in the productive capital. The gross interest income from investment in capital is subject to taxation. We assume that the pension fund is the only agent in the economy who buys government debt. The interest rate on public debt, r^b, is set by the government. Thus, within the fully-funded system, in period $t+1$ the old household receives the pension benefit $h_{t+1} = \gamma w_t \left(\beta\left(1+r^b\right)+\left(1-\beta\right)\left(1-\tau_k\right)\left(1+r_{t+1}\right)\right)$.

2.4. Financial repression and the capital accumulation.

The government can pursue financial repression by setting $r^b < r_{t+1}$. In this case the weighted average rate of return of the pension fund portfolio is below market. So financial repression acts as an indirect tax on the pension fund or, ultimately, on old households. Thus, both parameters β and γ become the instruments of financial repression that are chosen by the government. For the sake of generality we do not restrict r^b to be positive allowing $r^b \geq -1$. Small negative values of r^b correspond to the realistic liquidation effect: for example, if one period is 30 years, then $r^b = -0.5$ corresponds to the annual interest rate of -2.28 percent, which is historically plausible. The very special case is $r^b = -1$, which is the confiscation of some part of the pension fund or the use of the fund to finance the budget deficit (see some historical examples in Reinhart, 2012).

In the standard overlapping generations model without fiscal policy the fully-funded pension system does not affect the dynamics of capital accumulation (see, e.g., Blanchard and Fischer, 1989). Here this is not the case. First, there is a drain from capital accumulation as the share of contribution to the pension fund, which is effectively a mandatory household saving, is put in government bonds. Second, under financial repression the choice of γ, β and $r^b < r_{t+1}$ affects both voluntary saving s_t and mandatory saving γw_t, and thus capital accumulation.[11] Third, there is the general equilibrium effect: the wage and the interest rate, which determine the level of saving, both depend on capital-to-labor ratio and thus on the policy of the government.

[11] If the government does not pursue financial repression and set $r^b = r_{t+1}$, then instruments β and γ do not affect household's decision about total savings $s_t + \gamma w_t$: voluntary and mandatory saving earn the same interest.

2.5. The government

Let us consider the government finance in period t. The government collects capital taxes that are imposed on old households and the pension fund, $T_t = N_{t-1}\tau_k(1+r_t)s_{t-1} + N_{t-1}\tau_k\gamma(1-\beta)w_{t-1}(1+r_t)$, provides young and old households with public goods, $G_t = (N_t + N_{t-1})g_t$, borrows from the pension fund the amount $b_{t+1}/(1+r^b) = N_t\beta\gamma w_t$ and repays the previous period debt $b_t = (1+r^b)N_{t-1}\beta\gamma w_{t-1}$.

The dynamic government budget constraint is the following:

$$G_t - T_t = \frac{b_{t+1}}{1+r^b} - b_t, \tag{11}$$

or

$$(N_t + N_{t-1})g_t - N_{t-1}\tau_k(1+r_t)(s_{t-1} + \gamma(1-\beta)w_{t-1}) = N_t\beta\gamma w_t - (1+r^b)N_{t-1}\beta\gamma w_{t-1}. \tag{12}$$

We have to provide some elucidation for the way of modeling government finance and financial repression. We assume that the pension fund is the only agent who invests in the government debt. As we discussed in the Introduction, captive pension funds indeed hold (or, effectively, are forced to hold) a substantial part of the government debt with the below-market rate of return. It can be viewed as a financial repression. This policy allows the government to reduce the debt service cost and, thus, increase spending or cut traditional taxes. Moreover, this is one of the few possibilities to borrow in the situation when the access to the market is limited or the debt market is thin.

We do not consider the market placement of the public debt (i.e., we do not consider the purchases of government bonds by young households) for several reasons. Firstly, within the deterministic model No-Arbitrage condition would impose the equality of the interest on public debt and the rate of return in production. Thus, there is no case for financial repression with $r^b < r_{t+1}$.[12] Secondly, the assumption that all debt is held by the pension fund allows us to omit No-Ponzi-Game condition: public debt is sustainable by construction. It makes modelling the financial repression more tractable. But it does not mean that fiscal policy faces no constraint. Traditional No-Ponzi-Game condition is a constraint on future fiscal policy: the discounted sum

[12] The rationale for different discounts for the public debt that is bought by the pension fund and other private investors is hardly possible. In the practice of financial repression, aside from the riskiness, flight to quality and liquidity, lower interest rate on public debt results from the artificially increased demand on the side of pension funds and other captive investors. While interesting and potentially important, these arguments do not easily embed into the overlapping generation model.

of future budget surpluses should be a sufficient backing for the public debt. It allows multiple trajectories of future budget surpluses within the feasibility constraint. The budget surplus in any period is constrained from above: spending cannot be negative and tax income is constrained by the Laffer curve. In this model the budget constraint (12) is the constraint on the surplus (or deficit) in any period: its level is restricted by the pension fund capacity, which in turn increases as the population grows.[13] Such 'fiscal rule' makes the public debt sustainable by construction. Moreover, by setting $-1 < r^b < n$, the government can pursue budget deficit in the steady-state.

The suggested way of modeling public finance helps us to focus the analysis on financial repression. For equilibrium wage and saving the budget constraint (12) describes the trade-off problem between the fiscal policy instruments. On the one hand, the choice of the capital tax rate τ_k and three parameters of financial repression β, γ and r^b uniquely determines the government purchases g_t. So the government faces the choice: the taxation of capital income allows financing more public goods, from which households receive direct utility. However it reduces the resources available for private consumption. On the other hand, the particular level of g_t could be achieved for different sets of τ_k, β, γ and r^b. So the government can choose the optimal mix of capital income taxation and financial repression. We solve this problem in Section 4.

3. Equilibrium

The allocation $\{c_{1,t}, c_{2,t}, s_t, k_t, b_t, r_t, w_t, g_t, \quad t = 0...\infty\}$ is an equilibrium path if the following conditions are held:

1. The set $\{c_{1t}, c_{2,t+1}, s_t\}$ is the solution of the household problem (1)-(3) given equilibrium paths of r_t and w_t.
2. Factor prices r_t and w_t are determined by conditions (9) and (10) conditions given the equilibrium path of k_t.
3. The equilibrium path of k_t satisfices the capital market balance:

$$N_t\left(s_t + \gamma(1-\beta)w_t\right) = N_{t+1}k_{t+1}. \qquad (13)$$

[13] An alternative interpretation is possible. If one treats the payment of interest and principal of the public debt as a transfer to the pension fund, while the fund's investment in government bonds as an indirect taxation (financial repression), then the government budget is always balanced. The balanced budget rule is rather typical assumption in overlapping generations modelling.

4. Given fiscal policy instruments τ_k, β, γ and r^b, the budget constraint (12) determines government purchases g_t.
5. Goods market is in equilibrium:

$$N_t c_{1t} + N_{t-1} c_{2t} + N_{t+1} k_{t+1} + (N_{t-1} + N_t) g_t = N_t f(k_t). \tag{14}$$

By substituting equations (6), (9) and (10) and the definition of h_t into the condition (13) we arrive at the dynamic equation for the capital-to-labor ratio:

$$(1+n)(2+\theta)k_{t+1} = \\ = (1-\alpha)k_t^{\alpha}\left[(1-\gamma)+\gamma(1-\beta)(2+\theta)-\gamma(1+\theta)\frac{\beta(1+r^b)+(1-\beta)(1-\tau_k)\alpha k_{t+1}^{\alpha-1}}{(1-\tau_k)\alpha k_{t+1}^{\alpha-1}}\right]. \tag{15}$$

Unfortunately, equation (15) does not allow us to derive dk_{t+1}/dk_t and d^2k_{t+1}/dk_t^2 analytically. Fig. 1 illustrates the existence and uniqueness of the steady state for the following reasonable set of parameters and fiscal instruments (assuming that one period lasts for 30 years): $\alpha = 0.33$, $n = 0.348$, $\theta = 1.098$, $\gamma = 0.2$, $\beta = 0.145$, $\tau_k = 0.28$, $r^b = -1$. This set corresponds to the optimal fiscal policy of the benevolent government that is derived in Section 4. Numerical exercises for other reasonable sets show the robustness of this result.

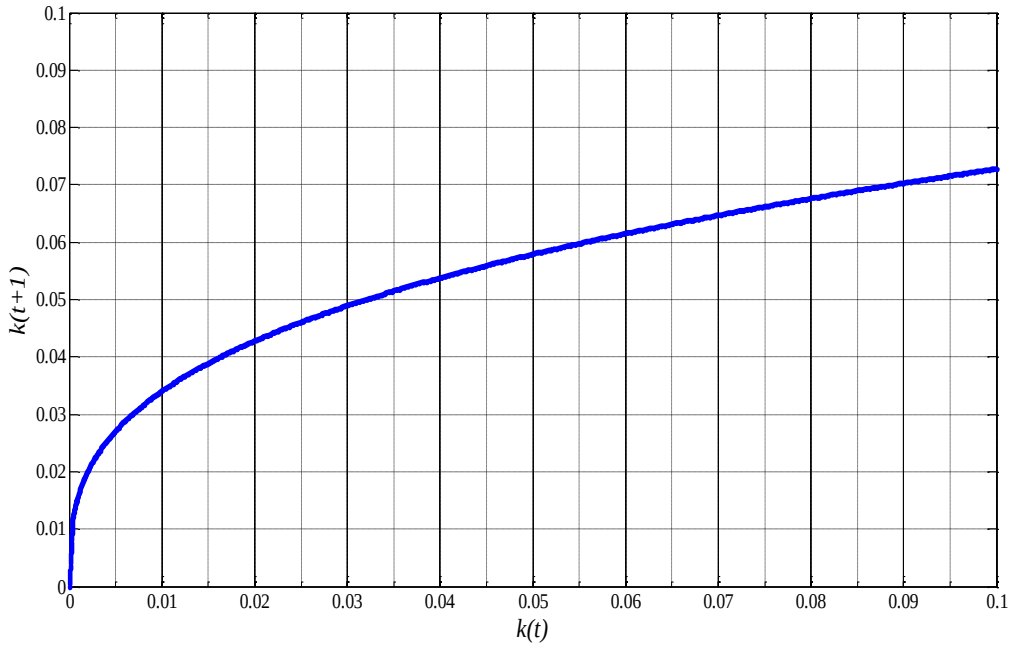

Figure 1. Capital-to-labor ratio dynamics.

In the steady state $k_t = k_{t+1} = k^*$. Fortunately, we can easily derive k^* from equation (15):

$$k^* = \left[\frac{\alpha(1-\alpha)(1-\gamma\beta)(1-\tau_k)}{\alpha(1+n)(2+\theta)(1-\tau_k) + \gamma\beta(1-\alpha)(1+\theta)(1+r^b)} \right]^{\frac{1}{1-\alpha}}. \tag{16}$$

Corresponding steady-state levels of private consumption in both periods and government purchases per capita are:

$$c_1^* = (1-\alpha)(1-\gamma\beta)k^{*\alpha} - (1+n)k^*, \tag{17}$$

$$c_2^* = \left[\alpha(1+n)(1-\tau_k) + \gamma\beta(1-\alpha)(1+r^b)\right]k^{*\alpha}, \tag{18}$$

$$g^* = \left[\frac{\gamma\beta(1-\alpha)(n-r^b) + \alpha(1+n)\tau_k}{2+n} \right] k^{*\alpha}. \tag{19}$$

Table 2 provides steady-state levels of key variables, including "per young capita" investment into the productive capital, $I^* = s^* + w^*\gamma(1-\beta) = (1+n)k^*$, aggregate consumption, $c^* = c_1^* + c_2^*/(1+n)$, and government purchases, $\tilde{g}^* = g^*(2+n)/(1+n)$. Several observations are interesting to discuss. Firstly, while fiscal instruments γ and β singly determine the transitory dynamics of capital accumulation in equation (15), the steady-state levels of capital-to-labor ratio, private consumption and government purchases depend on the composite policy instrument $\chi = \gamma\beta$. In other words, in the steady state an important characteristic is the share of contribution to the pension fund that is put in government bonds, rather than shares of contribution to the fund out of wage and the share of fund's portfolio put in government bonds separately. Thus the number of relevant instruments to find optimal fiscal policy in the steady state is reduced to three: τ_k, χ and r^b. Secondly, while k^* and c_1^*, and thus y^* and I^* depend only on the ratio $\eta = (1+r^b)/(1-\tau_k)$, which can be interpreted as the perfect substitutability of direct and indirect taxation with respect to these two variables, c_2^* and g^* depend on r^b and τ_k separately. It means that for the whole determination of the steady state financial repression cannot be substituted by appropriate capital income taxation.

This result has an implication for the redistribution effect of taxation and financial repression. The spending decomposition of output in per young capita terms is

$$y^* = c^* + I^* + \tilde{g}^* = \\ = c_1^* + I^* + \frac{c_2^*}{1+n} + \tilde{g}^*. \quad (20)$$

The first and the second term in the right hand side of equation (20) – the spending of young households – depend on η, but not on τ_k and r^b separately. The third and the fourth term – the spending of old households and the government – depend on τ_k and r^b separately, but their sum is the function of η. It thus follows that the benevolent government that maximizes the welfare function of c_1^*, c_2^* and g^* does not face perfect substitutability of capital income taxation and financial repression.

Table 2. Key variables in the steady state

	k^*	y^*	w^*	r^*	c_1^*	c_2^*	c^*	I^*	$\tilde{g}^*$
Steady state	0.062	0.399	0.268	1.118	0.176	0.128	0.271	0.084	0.026
Share in y^* (percent)							67.9	21.0	11.1

Note. Parameters and fiscal policy instruments are: $\alpha = 0.33$, $n = 0.348$, $\theta = 1.098$, $\gamma = 0.2$, $\beta = 0.145$, $\tau_k = 0.28$, $r^b = -1$.

As in the baseline Samuelson-Diamond model the growth rate of output, capital and consumption on the balanced growth path is equal to the growth rate of population. Both taxation of capital income and financial repression affect only levels of output, capital and consumption, but not theirs growth rates.

Now let us discuss the results of the comparative statics, which are summarized in Table 3. It follows from equation (16) that the capital-to-labor ratio is a decreasing function of all three policy instruments τ_K, χ, and r^b. The negative impact of capital income taxation on capital accumulation is rather standard. It is interesting to note, that while tighter financial repression in the form of higher χ (higher share of private saving put in the public debt) restrains capital accumulation, tighter repression in the form of lower interest on public debt r^b stimulates higher capital-to-labor ratio. As far as funds directed to the government budget is a deduction

from investment, higher χ (more severe financial repression) leads to low capital-to-labor ration in the steady state. On the other hand, a lower r^b, which also means more severe repression, decreases the pension benefit for the old generation, and thus induces households to save more when they are young, which in turn increases investment and steady-state capital.

Table 3. The impact of fiscal policy on the key variables in the model

	k^*	y^*	w^*	r^*	c_1^*	c_2^*	I^*	g^*
τ_K	Negative	Negative	Negative	Positive	Ambiguous	Negative	Negative	Ambiguous
χ	Negative	Negative	Negative	Positive	Ambiguous	Ambiguous	Negative	Ambiguous
r^b	Negative	Negative	Negative	Positive	Ambiguous	Positive	Negative	Negative

First period consumption is an increasing function of the capital-to-labor ratio if the following condition holds:

$$\theta > \frac{1}{\alpha}\left(1 - \frac{\chi(1-\alpha)}{1+n}\frac{1+r^b}{1-\tau_K}\right) - 2, \tag{21}$$

that is, when households are relatively impatient. In this case, c_1^* is a decreasing function of τ_K, χ, and r^b. This condition is met for $\alpha = 0.33$ and $\theta = 1.098$.

Second period consumption, c_2^*, decreases with an increase in τ_K. If we combine (16) and (18) to obtain

$$c_2^* = \alpha(1-\alpha)(1-\chi)(1-\tau_k)k^{*2\alpha-1} - \alpha(1+n)(1+\theta)(1-\tau_k)k^{*\alpha},$$

then we see, that c_2^* is an increasing function of r^b, given a realistic assumption that $\alpha < 1/2$. Intuition is straightforward: higher r^b directly leads to higher pension benefit and induces higher return to capital r^*, and thus results in higher second-period consumption via the income effect. The effect of an increase in χ on c_2^* is ambiguous. On the one hand, the higher the share of the labor income that is remitted to the pension fund (and put into government bonds), the higher

pension benefit and second period consumption. On the other hand, higher χ leads to lower capital and income in the steady state.

Finally, let us consider characteristics of government purchases. First of all, we have to impose the constraint to ensure non-negativity of g^*:

$$r^b < n + \frac{\alpha(1+n)\tau_k}{\chi(1-\alpha)}. \tag{22}$$

Without capital income taxation ($\tau_k = 0$), the exploitation of the pension fund to finance government purchases is only possible if the base for repression grows faster than the debt service rate. Additional source of finance ($\tau_k > 0$) loosens the constraint on r^b, but the principle remains the same: the growth of population the growth of the base for financial repression.

Given condition (21), g^* increases with a decrease in r^b: the lower debt service expenses, the higher government purchases of public goods. The relation between g^* and τ_K, as well as between g^* and χ is ambiguous. In both cases there is a Laffer-curve effect: an increase in the tax rate τ_K and in the share χ leads to a decrease in the corresponding tax base (gross capital income and wage, respectively).

Summarizing these findings: aside the ambiguity of the impact of fiscal policy on consumption and government purchases on the balanced growth path, the provision of public goods that is financed by capital income taxation and financial repression generates non-trivial intergenerational redistribution of wealth. This poses the problem of optimal fiscal policy.

4. Benevolent government

Consider the benevolent government, which chooses policy instruments τ_K, χ, and r^b to maximize the welfare of the existing and all future generations on the balanced growth path. Households take the capital income tax rate and financial repression as given. Government purchases of public goods that provide direct utility are determined endogenously. So the problem of the benevolent government does not reduce to the *laissez-faire.*

We assume that the government discounts the welfare of future generations at the rate θ, which households themselves attach to the next period utility. Thus the welfare function in period t is

$$V(c_1, c_2, g) = N_{t-1}\left(\ln c_{2,t} + \varphi \ln g_t\right) + N_t(\ln c_{1,t} + \varphi \ln g_t) +$$
$$+ \frac{1}{1+\theta}\left[N_t \ln\left(c_{2,t+1} + \varphi \ln g_{t+1}\right) + N_{t+1}\left(\ln c_{1,t+1} + \varphi \ln g_{t+1}\right)\right] +$$
$$+ \frac{1}{(1+\theta)^2}\left[N_{t+1}\left(\ln c_{2,t+2} + \varphi \ln g_{t+2}\right) + N_{t+2}\left(\ln c_{1,t+2} + \varphi \ln g_{t+2}\right)\right] + \ldots$$

To assure the convergence of the sum in the steady state we have to assume that $n < \theta$. The welfare function in this case is

$$V(c_1^*, c_2^*, g^*) = \frac{1+2\theta-n}{(\theta-n)(1+n)}\left[(1+n)\ln c_1^* + \ln c_2^* + \varphi(2+n)\ln g^*\right] \to \max_{\tau_k, \chi, r^b}. \quad (23)$$

By substituting steady state consumption, government purchases and capital-to-labor ratio from (16)-(19) we arrive at the indirect welfare function of τ_K, χ, and r^b. Table 4 provides the results for maximizing (23) by numerical methods for different values of the elasticity of substitution between consumption of private and public goods.

Table 4. Optimal fiscal policy instruments and the key variables for different values of the elasticity of substitution between consumption of private and public goods

φ	0.01	0.2	0.5	0.75	1	2
τ_K	0.023	0.279	0.424	0.506	0.568	0.712
χ	0	0.029	0.125	0.179	0.220	0.316
r^b		-1	-1	-1	-1	-1
k^*	0.065	0.062	0.053	0.049	0.045	0.037
y^*	0.406	0.399	0.380	0.368	0.359	0.337
w^*	0.272	0.268	0.255	0.247	0.241	0.226
r^*	1.059 (2.41)[a]	1.118 (2.51)[a]	1.350 (2.86)[a]	1.506 (3.08)[a]	1.638 (3.25)[a]	2.006 (3.70)[a]
c_1^*	0.184	0.176	0.151	0.137	0.127	0.105
c_2^*	0.177	0.128	0.098	0.081	0.069	0.043
c^*	0.315 (75.2)[b]	0.271 (67.9)[b]	0.223 (58.7)[b]	0.197 (53.5)[b]	0.178 (49.6)[b]	0.137 (40.7)[b]
I^*	0.088 (23.8)[b]	0.084 (21.1)[b]	0.072 (18.9)[b]	0.065 (17.7)[b]	0.061 (17.0)[b]	0.050 (14.8)[b]
$\tilde{g}^*$	0.003 (1.0)[b]	0.045 (11.0)[b]	0.085 (22.4)[b]	0.106 (28.8)[b]	0.120 (33.4)[b]	0.150 (44.5)[b]

Notes: [a] In brackets: annual interest rate, percent.
[b] In brackets: share in output, percent.

There are several observations to be discussed. First observation is rather trivial: the higher households value public goods (i.e., the higher φ and $\tilde{g}^*$), the higher optimal capital income tax rate and more severe financial repression (higher χ). The corresponding increase in government purchases crowds out private consumption and investment. It is also associated with lower output. Second. When φ is relatively low (e.g. $\varphi = 0.01$), the benevolent government does not levy the financial repression (optimal χ is zero, the choice of r^b is irrelevant) and finance small amount of public goods solely by capital income taxation. Third. Whenever the government implements financial repression (optimal χ is positive), it is optimal to choose $r^b = -1$. This corner solutions means confiscation of the funds that are put in government bonds.

Table 5 provides comparative statics for different values of the growth rate of population. The higher the growth rate of population, the higher optimal capital income tax rate and less severe financial repression (i.e. the smaller χ). Optimal interest rate on government bonds is equal to minus one as in the benchmark case. Moreover, for the case of rapidly declining population ($n = -0.365$ or -1.5 percent annually in our example) it is optimal to finance government purchases solely by means of financial repression and set capital income tax rate at zero. On the other extreme, it is optimal to use only capital taxation when the growth rate of population is high ($n = 0.811$ or 2 percent annually) and refrain from repressing financial system.

The intuition behind these results is following. Given the need to finance government purchases of public goods (i.e. given the elasticity of substitution φ), capital income taxation and financial repression are imperfect substitutes.[14] Thus, one can expect that the government will choose different policy mix in different economic environment. A high growth rate of population results in a high growth rate of the pension fund that is subject to repression. It follows from equation (12) that in this case (high ratio N_t / N_{t-1} and given the optimality of total confiscation, $r^b = -1$) there is no need to set χ at a high rate to receive an appropriate finance $N_t \chi w_t$, while there is a need to set τ_K high enough to collect appropriately high $N_{t-1}\tau_k (1+r_t)(s_{t-1} + \gamma(1-\beta)w_{t-1})$.

[14] The issue of *strategic* substitutability between normal taxation and financial repression from the perspective of the new political economy is beyond the scope of the analysis of the benevolent government choice.

Table 5. Optimal fiscal policy instruments and the key variables for different rates of the growth of population

n	-0.365 (-1.5)[a]	-0.140 (-0.5)[a]	0.161 (0.5)[a]	0.348 (1.0)[a]	0.563 (1.5)[a]	0.811 (2.0)[a]
τ_K	0	0.09	0.217	0.79	0.338	0.358
χ	0.170	0.122	0.060	0.029	0	0
r^b	-1	-1	-1	-1	-1	
k^*	0.152	0.105	0.074	0.062	0.052	0.042
y^*	0.537	0.479	0.424	0.399	0.377	0.351
w^*	0.360	0.318	0.284	0.268	0.253	0.235
r^*	0.167 (0.52)[a]	0.495 (1.34)[a]	0.884 (2.11)[a]	1.118 (2.51)[a]	1.387 (2.91)[a]	1.765 (3.41)[a]
c_1^*	0.202	0.189	0.181	0.176	0.171	0.159
c_2^*	0.112	0.123	0.127	0.128	0.129	0.134
c^*	0.379 (70.6)[b]	0.332 (69.3)[b]	0.290 (68.4)[b]	0.271 (67.9)[b]	0.254 (67.4)[b]	0.233 (66.4)[b]
I^*	0.096 (17.9)[b]	0.090 (18.8)[b]	0.086 (20.3)[b]	0.084 (21.1)[b]	0.082 (21.8)[b]	0.076 (21.7)[b]
$\tilde{g}^*$	0.061 (11.5)[b]	0.057 (11.9)[b]	0.048 (11.3)[b]	0.044 (11.0)[b]	0.041 (10.8)[b]	0.042 (11.9)[b]

Notes: [a] In brackets: annual rate, percent.
[b] In brackets: share in output, percent.

5. Conclusion

Given the broad definition of financial repression, it is no longer the brand of developing economies. Modern advanced economies facing the fiscal stress have to find some alternative budget deficit finance as well as to bring the cost of debt service down. The principal feature of modern financial repression is that it does not rely on increasing seigniorage revenue, but rely on regulatory measures to enlarge the demand for public debt that delivers extremely low or negative real interest rate. While this financial repression bias has some explanation in line with the new political economy, we point that there is an alternative justification in terms of optimal fiscal policy of the benevolent government.

In this paper we built an overlapping generations model without money, but with fiscal policy that represses the captive fully-funded pension system. The main findings are following. First. In general case, financial repression in the form of setting the share of pension saving that are put in government bonds together with setting below market interest rate is a part of optimal fiscal policy. Moreover, whenever financial repression is implemented, it is optimal to set the

interest rate on public debt at minus one, that is, to confiscate a share of pension saving. Second. Financial repression is an imperfect substitute for capital income taxation. The lesser growth rate of population, the more benevolent government should rely on financial repression rather than on capital income taxation. The last result has a practical implication. The considered form of financial repression can be an optimal choice for some modern advanced economies with stagnating population, rather than for developing countries with a high growth rate of population.

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