

The Costs and Welfare Effects of ECB's Financial Repression Policy: Consequences for German Savers

Prof. Dr. *Gerhard Rösler* (Correspondence author)

Faculty of Business Administration, University of Applied Sciences – OTH Regensburg

Seybothstrasse 2, 93053 Regensburg, GERMANY

Tel: +49-941-943-1396 E-mail: gerhard.roesl@oth-regensburg.de

Homepage: www.oth-regensburg.de

Dr. *Karl-Heinz Tödter*

Bundesbankdirector (ret.), Deutsche Bundesbank

Wilhelm-Epstein-Strasse 14, 60431 Frankfurt am Main, GERMANY

E-mail: kh.toedter@t-online.de

Abstract: The losses in interest income of German savers as a result of ECB's monetary policy of extremely low interest rates are estimated at around €65bn pa. These losses exceed the financial costs of capital yields taxes and the inflation tax on consumer prices taken together. However, the calculations do not take into account that (especially public) debtors benefit from low interest rates. We develop new measurement concepts and apply an overlapping generation model in order to calculate stepwise the net welfare costs (excess burden) for the German economy. Capital yields taxes have an excess burden of €10bn per year. The excess burden from 1.5% inflation totals at €33bn pa. In comparison, the monetary policy of low interest rates that is conducted by the ECB since 2010 created an excess burden of €37bn or 1.4% of GDP pa. Hence, the cumulated net welfare losses resulting from the ECB policy of ultra-easy money already exceed the primary effects of the financial crisis.

Keywords: Financial repression, Interest rate policy, ECB, Savings losses, Welfare, OLG-model, Distortions, Deadweight loss, Retirement consumption

JEL Classifications: E58, E21, I31

1. Introduction

In the Maastricht treaty, the European Central Bank (ECB) was agreed as an independent monetary institution with the overriding goal to maintain low and stable inflation rates in the euro area. However, in the aftermath of the global financial and economic crisis, the ECB became deeply involved into activities aiming at stabilizing the financial system, over-leveraged banks, and over-indebted governments. By effectively imitating the monetary policy of “Quantitative Easing” of the US-Federal Reserve System (FED) the ECB also cut its key interest rate through a bundle of unconventional measures (fixed rate tender operations with full allotment, several asset buying programs, etc.). This article addresses the costs of these monetary policy measures which heavily exceed the typical distributional side effects of conventional monetary policy during a “normal” business and interest rate cycle. The empirical estimates presented refer to Germany, which is center stage in this new de facto European transfer system.

The remainder of this paper is organized as follows. Section 2 identifies the main factors determining real interest rates and discusses different channels through which economic policy makers (government, central bank and regulatory authorities) can influence its level. Section 3 discusses how the phenomenon of suppressed interest rates, also referred to as financial repression, affects the inflation rate of future consumption. In section 4, in contrast to current inflation, we introduce the new concept of “effective inflation”, which measures inflation from the perspective of savers and retirement consumers. Moreover, the losses of German savers are calculated stepwise in three scenarios: capital yields tax, inflation, and financial repression. Section 5 outlines an overlapping generation (OLG) model and section 6 applies that model to analyze the deadweight losses for Germany in the same three scenarios as mentioned above. An OLG model is utilized here for the first time to quantify the welfare effects of ECB’s low interest rate policy for Germany. Section 7 discusses consistency and sensitivity of the results. A brief summary in Section 8 concludes.

2. Real Interest Rates and Monetary Policy

A private household shall have financial assets worth of K_0 at the beginning of the year. The share β is invested in interest bearing bonds while the remainder is held for reasons of payment needs and portfolio diversification in the form of (non-interest bearing) money in terms of currency and sight deposits with banks. If i denotes the interest rate on bonds, π the inflation rate of consumer goods and services, and τ the tax rate on capital yields, then the real value of its financial wealth after one year is:

$$K_1 = K_0 \frac{\beta[1+i(1-\tau)]+(1-\beta)}{1+\pi} \quad (1)$$

We define the ex-post net (i.e. after tax) real interest rate as:¹

$$r \equiv \frac{K_1}{K_0} - 1 = \frac{i \beta(1-\tau) - \pi}{1+\pi} \quad (2)$$

The portfolio structure β shall be considered as being determined by the risk and liquidity preferences of the owners of the financial assets and is therefore not subject to a direct manipulation by policy makers. A politically desired reduction of the debt burden, especially of public debtors, and, at the same time, a decrease in the respective real net interest income for savers (creditors) can thus principally be achieved through three channels:

1. Increase in the tax rate of capital yields τ ,
2. increase in the inflation rate (inflation tax) π , and
3. decrease in the nominal interest rate on bonds (financial repression tax) i .

First, as a redistributive measure by the government, a change in the tax rate on capital yields could be considered. From the viewpoint of the citizens such a policy is transparent and legitimate if approved by the national parliament. However, such decisions are often unpopular and raise the apparent question of who wins and who loses. The central bank has powerful instruments to change the real rates of return in the economy, as well. In particular, a politically desired decrease of the real value of debt service costs, notably of public debtors, can be achieved by triggering surprise

¹ Cf. Rösl (2014). As this study focuses on the influence of nominal and real interest rates by economic policy makers, we do not consider investment in stocks.

inflation, a measure that also generates additional seigniorage revenues for the money producers.² However, an increase in prices of goods and services decreases the purchasing power of nominal incomes and non-inflation-indexed assets and thus comes with additional costs (inflation tax). Such a “*cold expropriation*” of income and financial assets was quite common in many countries in the past and has been analyzed extensively in the academic literature.³

Although being widely practiced in many countries after WWII, a less known channel for a central bank to cut real interest rates is by means of “financial repression“. It can be defined as manipulative reduction of nominal interest rates, typically on government bonds, through measures of the central bank with the specific aim of reallocating savings from creditors to public debtors. These measures include a wide variety of regulatory provisions such as preferred acceptance of government bonds/banks in the central bank’s refinancing operations as well as “flooding” the money market by buying government bonds directly or indirectly on secondary markets at large scale by the central bank (cf. monetary policy of the FED) or increasing the demand for government bonds by providing provision of excessive liquidity to commercial banks (cf. monetary policy of the ECB).⁴ From the viewpoint of the holders of sound government bonds such a bail-out strategy comes at severe costs.⁵ The losses of interest income or even the erosion of the substance of savings by artificially suppressed interest rates can be interpreted as a special form of tax on financial assets imposed by the central bank (“financial repression tax”). It should be noted that real interest rates need not be negative for such a tax to become effective. The savers have to bear the corresponding costs in terms of forgone interest income (as remuneration for taking market risks and as compensation for foregone present consumption) as soon as the central bank pushes nominal interests rate below market rates.

The economic literature didn’t pay much attention to financial repression until recent years, probably because there is typically a long-term relation between inflation rates and nominal interest rates. According to the Fisher-theorem the central bank can reduce real interest rates by (surprise) inflation only temporarily due to induced adjustments of the expected inflation rate. Anticipated changes in inflation rates lead to corresponding or even proportional changes (Fisher-effect) in nominal interest rates in future savings contracts. Given a certain economic situation and a massive usage of monetary policy instruments, however, evidently the Fisher-effect can be distorted, even for prolonged periods of time, as **Figure 1** illustrates.

For that to happen, the following preconditions seem to be necessary:

1. Excess supply in the money (interbank) market by excessive provision of base money by the central bank.
2. Undercapitalized banks that do not possess enough equity capital in order to meet standards set by (inter-) national regulators and therefore cannot use the ample provision of liquidity to provide additional credit to the private sector.
3. Subdued demand for credit of the private sector due to economic stagnation or recession and thus high risks of default.

² Cf. Bailey (1956), Friedman (1971), Fry (1981), Neumann (1992), Rösl (2002).

³ The inflation bias is discussed in the monetary policy literature intensively following the groundbreaking work of Kydland and Prescott (1977), Barro and Gordon (1983).

⁴ Cf. McKinnon (1973), Shaw (1973), Sbrancia (2011), Reinhart and Sbrancia (2011), Reinhart (2012), Hoffmann and Zemanek (2012), Holzhausen (2013), Rösl (2014).

⁵ Cf. Engelen (2014), p 73.

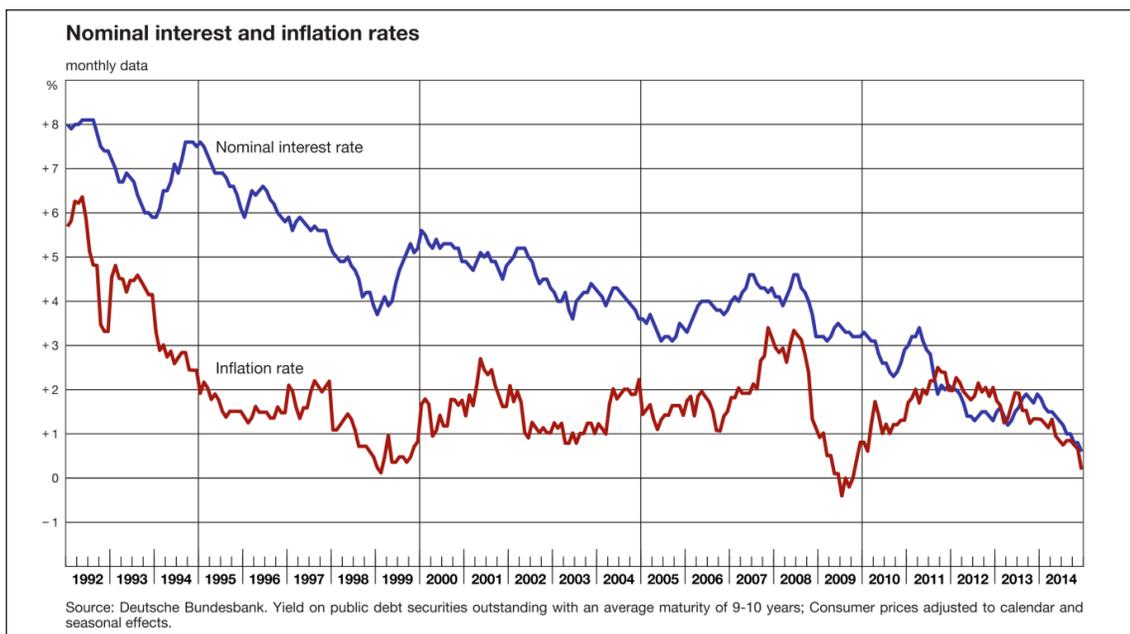


Figure 1 Nominal interest and inflation rates

Under these circumstances the main traditional channel of monetary policy is distorted. Although commercial banks are willing to absorb large quantities of base money (BM) provided by the central bank, no significant increase in credit granted to the non-bank sector is taking place and, as a consequence, there is no marked increase in (the growth rate of) money supply (m), i.e. no increase in non-bank liquidity, and no considerable increase in demand on the goods market, and neither inflation rates (π) nor nominal market interest rates (i) increase, as depicted in **Figure 2**.

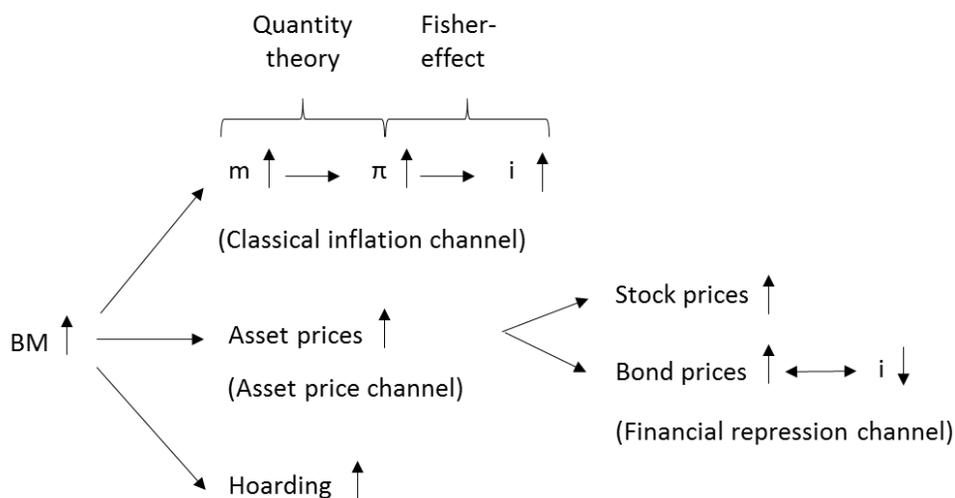


Figure 2 Transmission channels of base money

In fact, commercial banks use the additional liquidity in order to safeguard against possible payment shortfalls in the money market (hoarding) and/or buy securities for portfolio reasons which leads to increases in prices in the financial markets in general (asset price inflation). In the bonds market the increases in bond prices also correspond *uno actu* to decreases in the rate of return (bond yields).⁶ Consequently, in this case the expansionary monetary policy of the central bank does not lead to an excess supply of broad money (in the sense of non-bank liquidity) and to inflation on the goods market but the expansion of the monetary base leads to asset price inflation with distorted term structures of interest rates and financial market prices.

Clearly, owners of stocks benefit from this monetary policy at least in the first round due to (heavy) capital gains⁷, but also owners of high-risk bonds will be on the winner's side. These speculators who previously bought high-risk (government) bonds can now avoid upcoming losses (up to total default) and can sometimes even reap capital gains due to the bail-out operations of the central bank. The bill resulting from the inflated monetary base, however, is to be paid by owners of relatively low-risk bonds and similar secure financial products such as bank deposits and savings accounts when reinvesting their funds. These costs occur in terms of foregone interest income they would have received alternatively if the central banks hadn't intervened in the money and capital markets (financial repression channel).

Under those circumstances, a decrease of market interest rate motivated by fiscal or bank stability considerations becomes a separate monetary policy variable by itself. Hence, if effects of monetary policy shall be analyzed properly with regard to its (re-) distribution of wealth and losses in welfare not only the inflation rate in the goods markets but also the financial repression tax on interest bearing financial assets have to be taken into account.

3. Effective Inflation Rate in Germany

For current consumption expenditures the actual inflation rate of consumer prices is the relevant measure. By contrast, for savers an intertemporal aspect is decisive: how much of consumption can be realized in the next period with funds saved and accumulated in the current period? The answer is just the 'other side of the coin' shown in eq. 2. The relevant inflation rate for today's savers (consumers in the future) mirrors the real interest rate; it depends on both, the current inflation rate and the current yield on interest bearing assets:

$$p = -\frac{r}{1+r} = \frac{\pi - i\beta(1-\tau)}{1+i\beta(1-\tau)} \quad (3)$$

We refer to this rate in the following as Effective Inflation Rate (EIR). Using $\theta \equiv \beta(1-\tau) < 1$ eq. (3) can be approximated by

$$p \approx \pi - \theta i \quad (3')$$

The EIR is a simple measure of inflation in future consumption, namely current inflation minus a "waiting premium" for deferred consumption.⁸ If nominal interest rates decrease, the

⁶ In addition, there will be also a decrease in interest rates of comparable financial products such as bank deposits and savings accounts due to arbitrage.

⁷ Similar considerations also apply for real estate owners if real estate prices increase due to fear of inflation in the goods markets or owing to decreased financing and opportunity costs.

⁸ For example, at $i=4\%$, $\pi = 1.5\%$, and $\theta=0.589$ (see Table 2), the EIR is $p = -0.9\%$. If the nominal interest rate drops to $i = 2\%$ with inflation unchanged, the EIR increases by approximately 1.2 percentage points to $+0.3\%$.

waiting premium declines and the EIR can increase without showing up in the current inflation rate.⁹ Although the financial repression tax applies to interest bearing assets only, it can have large effects on consumers' future standard of living. Suppressed nominal market interest rates are equivalent to an increase in prices for future consumption and, hence, lead to an immediate loss in savers' current wealth. This is the inflationary downside of a monetary policy aiming at low interest rates.

In order to assess the effects of such a policy we analyze three time periods:

Period A: 1992:1 to 1998:12 (Bundesbank regime)

Period B: 1999:1 to 2009:12 (ECB regime)

Period C: 2010:1 to 2014:12 (ECB low interest rate regime)

As the starting point of ECB's low interest rate regime we choose January 2010, when massive payments and credibility problems of Greece became apparent and led to a first so called "rescue package" in May 2010 in order to avoid official bankruptcy of the Greek government.¹⁰ **Table 1** shows average values of government bond yields and inflation rates in Germany for these periods.

Table 1 Government bond yields and inflation rates in Germany

	Period:	A	B	C
		1992-98	1999-09	2010-14
Bond yields *)	i	0.064	0.042	0.020
Inflation rate **)	π	0.026	0.015	0.015
Real interest rate	r	0.011	0.010	-0.004
Effective Inflation Rate	p	-0.011	-0.010	0.004

*) Yield on public debt securities outstanding with average maturity of 9-10 years: **) Consumer prices adjusted to calendar and seasonal effects.
Note: Calculations are based on more decimal places than shown in Tables.

In period A the EIR was on average at -1.1% pa. In period B long-term nominal interest rates decreased by 2 percentage points (pp). However, in comparison to period A the real interest rate and the EIR changed only a little because the decrease in nominal interest rates was accompanied by a corresponding decline in inflation rates. By contrast, in period C the financial repression effect is clearly visible as bond yields were heavily cut by more than 2 pp while the inflation rate remained virtually unchanged. As a consequence, and in stark contrast to current inflation, the EIR increased markedly by 1.4 pp.

In the following, period B (1992:1 – 2014:12) shall be our reference period. In this period the current inflation rate in Germany was at 1.5% pa and satisfied the definition of price stability of the ECB of "below, but close to 2 percent". Chart 3 shows the deviations of the inflation rate and the EIR from their respective averages (1.49, -0.97) shown in table 1 in the reference period B. In period A the EIR was permanently below the actual inflation rate and in reference period B no marked differences occurred. In the latter phase the ECB acted according to its primary objective of maintaining price stability. But this changed dramatically with the US-subprime crisis and insolvency of Lehman Brothers Inc. in September 2008. In the aftermath, the global recession

⁹ On the discussion of systematic measurement errors due to the non-consideration of future products in the consumer price index cf. Pollack (1975), Shibuya (1992), Bryan et al. (2002), Diewert (2002), and Reis (2005).

¹⁰ A comprehensive analysis of the financial crisis is provided by Sinn (2009).

pushed Greece, the weakest candidate among EMU-countries, close to bankruptcy in the spring of 2010. Since then, the ECB operates in full crisis mode, and stabilizing financial markets, over-leveraged banks and over-indebted governments play a pivotal role in its monetary policy stance. As shown in **Figure 3**, period C is characterized by a marked upward drift of the EIR from the actual inflation rate at the expense of German savers who continuously (re-) invested their funds in sound interest bearing assets such as German government bonds, pension funds and deposits with German banks.

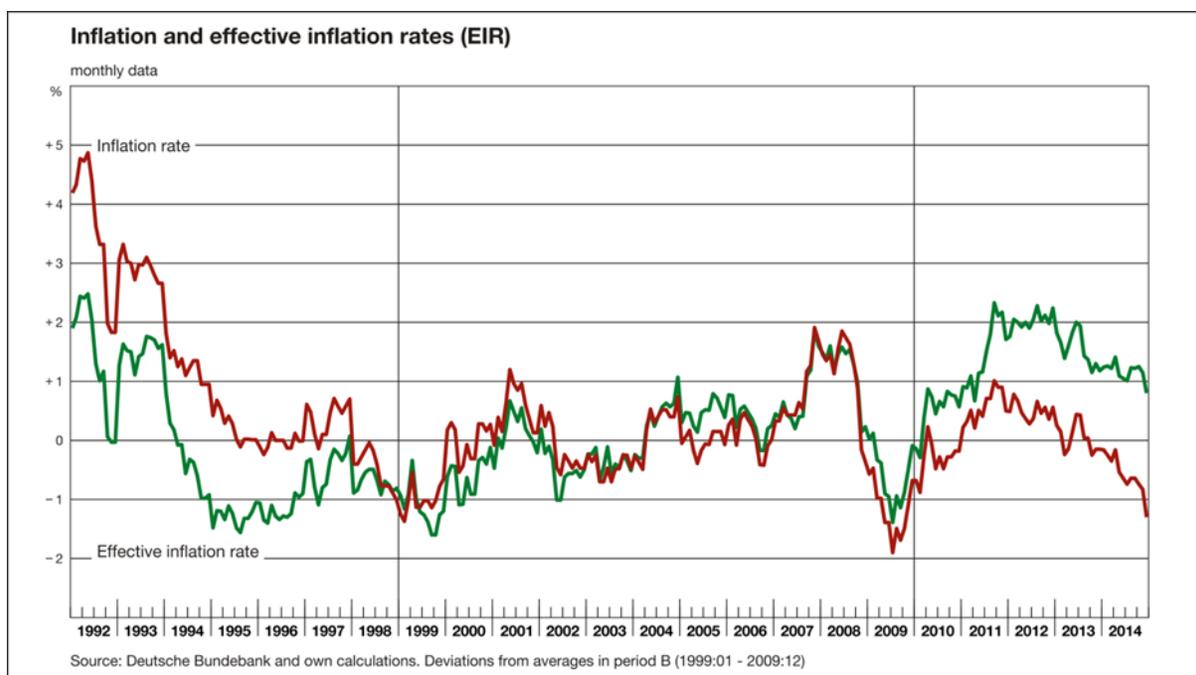


Figure 3 Inflation and effective inflation rates in Germany (deviations from averages in period B (1999:1 to 2009:12))

4. Losses of Interest Income by German Savers

To what extent do German savers have to carry losses of interest income due to ECB's monetary low interest rate policy since 2010? We discuss the effects of the ultra-low interest rate policy in perspective to two other relevant policy measures: capital yield taxes and inflation. In order to calculate these costs we apply a step by step approach. Explicitly referring to the determinants of the real interest rate discussed above, we at first assume a frictionless baseline scenario with no inflation, no capital yields tax, and no financial repression tax. According to the flow of funds statistics for Germany in 2013, the financial assets of German households add up to $K = €5,000\text{bn}$ and the share of interest bearing assets was $\beta = 0.8$.¹¹ In the baseline scenario we set the nominal interest rate to 2.7% pa.¹² In the next scenario, denoted CYT, we introduce a capital yields

¹¹ Currency in circulation and bank deposits as a percentage of total financial assets of the private household sector in Germany (average: 2008-2013); Cf. Deutsche Bundesbank (2014), p 46.

¹² As can be seen in table 1, this figure is the difference of the average nominal interest rate (4.2%) and the inflation rate (1.5%) in Germany in the reference period B, from 1999 to 2009.

tax of $\tau = 0.264$ on nominal interest income.¹³ In scenario INF, inflation is introduced at a rate of $\pi = 1.5\%$ pa and, in line with the Fisher-effect, the nominal interest rate is increased to $i = 4.2\%$ pa. Both rates now correspond to their respective averages in the reference period B. In the low interest rate scenario LIP, in line with the observed averages in period C, the nominal interest rate is suppressed by the central bank to $i = 2.0\%$ pa while the inflation rate remains at $\pi = 1.5\%$ pa.

Table 2 provides the relevant rates and the corresponding effects the scenarios have on the real interest rate and the EIR. Each of the three policy scenarios reduces the real interest rate and increases the EIR, from -2.1% in the baseline to $+0.3\%$ in the LIP regime. The final two rows show the associated losses of interest income measured in €bn.

Table 2 Interest income losses by German savers

		Base	CYT	INF	LIP
Capital yields tax rate	τ	0	0.264	0.264	0.264
Inflation rate	π	0	0	0.015	0.015
Nomnal interest rate	i	0.027	0.027	0.042	0.020
Real interest rate	r	0.022	0.016	0.010	-0.003
Effective inflation rate	p	-0.021	-0.016	-0.010	0.003
Loss of interest income	€bn	0	28	60	124
Added loss of interest income	€bn		28	32	64

$\beta=0.8; K = 5,000 \text{ €bn}$

Compared to baseline, the introduction of the capital yields tax (CYT) leads to a loss of interest income of €28bn, a value being roughly equivalent to the current revenues of the capital tax in Germany in 2013.¹⁴ Although in scenario INF the nominal interest rate increases by 1.5 pp to 4.2% pa in parallel to the introduction of 1.5% inflation pa (as observed in period B) the corresponding real interest rate drops by 0.6 pp. This alone causes a further loss of €32bn. In scenario LIP the nominal interest rate is suppressed to 2.0% pa while the inflation rate remains at 1.5% pa (as observed in period C). The consequences are significant: The annual interest income loss increases by €64bn, which exceeds the sum of the losses of both previous scenarios. This interest income foregone equates to 2.4% of German GDP or 3.8% of disposable income of private households in 2013. In per capita terms the loss is equivalent to an annual sacrifice of €800 per person. Adding up the costs of all three policy measures (capital yields tax, inflation tax and financial repression tax) the total sacrifice on interest income to be borne by German savers amounts to roughly €125bn per year, an estimate being in line with other calculations of interest income losses of German savers in the literature¹⁵.

¹³ This rate results from the current German flat rate tax on capital income of 25% plus a 5.5% “solidarity surcharge” on capital yields.

¹⁴ Cf. Deutsche Bundesbank, Monthly Reports, Statistics, Table X.6.

¹⁵ See Holzhausen (2013), Rösl (2014), Sinn (2014).

5. Welfare Loss and Excess Burden in an OLG Model

As shown in the last section, the foregone interest income induced by the current monetary low interest rate strategy imposes large income losses for German savers. However, these calculations are not informative on the possible welfare losses for the German society as a whole since they do not take into account the reduction of interest expenses of debtors in the economy, particularly by the government sector. For the sake of simplicity we assume that the group of debtors only consists of the public sector.¹⁶ In principle, improved public household conditions could be used to finance welfare increasing expenditures or to reduce welfare reducing taxes. These welfare gains on balance dampen the primary welfare losses imposed on savers and pensioners. To analyze the net welfare consequences we use a simple overlapping generation model (OLG).¹⁷

A representative private household shall earn labor income during its active working period (youth) to the amount of Y . The household has an intertemporal utility function $U(C_y, C)$, consuming C_y while young and planning real consumption C after retirement. In order to finance retirement consumption the household saves part of his labor income during his working period: $S_y = Y - C_y$. The share β ($0 \leq \beta < 1$) is invested in interest bearing assets (bonds) at the nominal interest rate i (> 0) and the remainder is held in non-interest bearing assets (currency and sight deposits) with banks.¹⁸ Nominal interest income is subject to a capital yields tax at rate τ . Prices of consumer goods shall increase in line with the (expected) inflation rate π . Calculated over a generation of T years, interest rates, tax rates and inflation rates together determine the future purchasing power of the savings. Thus, the relative price level of retirement consumption is

$$P = (1 + p)^T = \left(\frac{1 + \pi}{1 + \theta i} \right)^T \quad (4)$$

with p being the EIR as defined in eq. (3).

We apply a logarithmic utility function, where α is the relative preference for retirement consumption, and which embodies an intertemporal elasticity of substitution (IES) of unity, implying that current consumption and savings (C_y, S_y) are held constant when the price level of retirement consumption changes:

$$U(C_y, C) = \ln(C_y) + \alpha \ln(C) \quad (5)$$

From eq. 5 and the intertemporal budget constraint $C_y + PC = Y$ the following optimal ratio of consumption in both periods of the household's life cycle is obtained

$$\frac{\partial U(C_y, C) / \partial C}{\partial U(C_y, C) / \partial C_y} = \alpha \frac{C_y}{C} = P \quad (6)$$

which yields the optimum consumption and savings plans:

$$C_y = \frac{1}{1 + \alpha} Y, \quad S_y = \frac{\alpha}{1 + \alpha} Y, \quad C = \frac{\alpha}{1 + \alpha P} Y \quad (7)$$

Any economic policy measure that changes the price level of retirement consumption (P) also affects the level of real retirement consumption (C) and the level of welfare the household can

¹⁶ This assumption does not change the results in principle; see Feldstein (1999), Tödter and Ziebarth (1999), Tödter and Mancke (2009), who used similar models to calculate the costs and benefits of disinflation.

¹⁷ Cf. Samuelson (1958), Blanchard and Fischer (1989, p 91-153).

¹⁸ We do not consider stocks as these investments accounted for only 5.8% of total financial assets of private households in Germany in 2013; cf. Deutsche Bundesbank (2014), p 75.

achieve in the future. More precisely, the elasticity of retirement consumption with respect to its price level is $\varepsilon_{CP} = -1$. If the price level increases from P_0 to P_X , retirement consumption decreases from $C(P_0)$ to $C(P_X)$. Computing the integral of the retirement consumption function $C(P)$ yields the corresponding loss in consumer surplus (CS):

$$CS_X = \int_{P_0}^{P_X} C(P)dP = S_y \ln(1 + \psi_X), \quad \text{with } \psi_X = \frac{P_X - P_0}{P_0} \quad (8)$$

The CS foregone is proportional to the level of savings while young, multiplied by the log-change of the price level of retirement consumption. Thus, savings of the young generation is the tax base, which is taxed at the rate ψ_X .

The OLG model sketched above is a partial equilibrium model. However, the IES of unity in eq. (5) implies that savings of the young generation (S_y) in eq. (7) are independent of the price level of retirement consumption (P). As a consequence, embedding our model into a general equilibrium setting would not change the results shown in eqs. (7) and (8). Changes of the real interest rate (and therefore of P) would have no effects on real savings and thus on real investment, the capital stock and output growth.

In welfare theory the loss in CS is not considered to be a reduction in overall welfare. Only the so called deadweight loss (DWL) or excess burden is to be counted.¹⁹ Owing to the above mentioned economic policy measures, the government obtains additional funds through increases in capital yields taxes and/or reduced expenditures for its debt service by the amount:

$$TX_X = (P_X - P_0) C(P_X) \quad (9)$$

In principle, the government could use this additional revenue to pay lump-sum transfers in order to compensate partially for the welfare loss in the society. As a consequence, the DWL is the loss in CS not compensated by the increase of government revenues:

$$DWL_X = CS_X - TX_X \quad (10)$$

Thus, eq. (10) strikes a balance between the loss of creditors and the gain of debtors. Using eq. (8), we rewrite eq. (10) as:

$$DWL_X = S_y \left[\ln(1 + \psi_X) - \frac{\psi_X}{1 + \psi_X} \right] \quad (10')$$

Mathematically, the DWL is a magnitude of second order. However, if on top of an already existing distortion (such as a capital yields tax) further distortions (inflation, financial repression) are imposed, the DWL becomes a first order effect. The ratio

$$\lambda_X = \frac{DWL_X}{TX_X} \quad (11)$$

measures the “harmfulness” or inefficiency of a policy change that results from an increase of government revenues by one euro.

¹⁹ In the case of a financial repression tax which lacks democratic legitimacy, it is however questionable whether such an argument in welfare theory really is sound.

6. Quantifying the Welfare Losses

We refer here to the same policy measures described by the scenarios introduced in section IV [Base, CYT, INF, LIP] and analyze the respective effects on the price level for retirement consumption and the welfare implications that are caused by these distortions of the intertemporal allocation of consumption and savings.

With just two parameters, the OLG model is calibrated very parsimoniously: Generation length is set at $T = 30$ years and the relative preference for retirement consumption at $\alpha = 0.4$, implying a discount rate of future consumption of $\delta = 1 - \alpha^{1/T} = 3\%$ pa. The labor income of the working generation is normalized to $Y = 100$.

The average values of the variables shown table 2 remain unchanged. However, here we do not reduce the nominal interest rate in scenario LIP by 2.2 pp as was the case in section IV. This would be reasonable if the low interest rate policy lasted for a whole generation. The LIP regime was already in effect for five years (2010-14). In January 2015 the ECB announced a massive program of Quantitative Easing to buy government bonds and other assets of euro zone countries of at least €1,140bn within the next two years²⁰. Therefore, we assume that the LIP regime will continue at least for 11 years, from 2010 to 2020, until monetary policy returns to a normal stance. In the OLG model, an interest rate decrease by 2.2 pp over 11 years is equivalent to a decline of 0.8 pp (from 4.2% to 3.4% pa) over a full generation.

Table 3 shows how the policy measures of the three scenarios affect the prices of retirement consumption (P), the average EIR (p), and the level of retirement consumption (C). Owing to the introduction of a capital yields tax in scenario CYT, the price level increases from 0.53 in the baseline to 0.62. An inflation rate of 1.5% pa in scenario INF pushes the price level up to 0.75, and reduced interest rates in scenario LIP increases it further to 0.86. Each scenario increases the implied average EIR, from -2.1% in the baseline to -0.5% in the LIP regime.

Table 3 Prices, effective inflation and retirement consumption in different model scenarios

		Base	CYT	INF	LIP
Capital yields tax	τ	0	0.264	0.264	0.264
Inflation rate	π	0	0	0.015	0.015
Nominal interest rate	i	0.027	0.027	0.042	0.034
Price level of ret. consumption	P	0.527	0.623	0.751	0.862
Effective Inflation rate	p	-0.021	-0.016	-0.010	-0.005
Retirement consumption	C	54.2	45.9	38.0	33.1

$\beta = 0.8; T = 30; \alpha = 0.4; Y = 100$

The level of consumption that can be realized after retirement (C) decreases from 54% of labor income in the baseline to 46% in scenario CYT, falls to 38% in scenario INF, and further drops to 33% in scenario LIP. The last step alone reduces the standard of living in old age by 13%.

Table 4 summarizes the corresponding welfare consequences. Accordingly, the capital yields tax creates a loss in CS of 4.8% of labor income. Adding inflation increases the loss in CS to 10.1%. Financial repression in scenario LIP increases the loss in CS to 14.1%.

²⁰ Cf. European Central Bank (2015).

Table 4 Deadweight losses

		Base	CYT	INF	LIP
Loss in consumer surplus	CS		4.79	10.13	14.08
Government revenue	TX		4.41	8.53	11.12
Deadweight loss (%)	DWL		0.38	1.60	2.96
Deadweight loss (GDP)	€bn	0	10	43	80
Added deadweight loss (GDP)	€bn		10	33	37
Average tax inefficiency	λ		0.09	0.19	0.27
Marginal tax inefficiency	$\Delta\lambda$			0.30	0.53
$\Delta\lambda = \Delta DWL / \Delta TX$					

Government revenues from capital yield taxes amount to 4.4% of labor income, adding inflation raises revenues to 8.5%, and lowering interest rates increases them 11.1%. As a net effect, the DWL of taxing capital yields amounts to a moderate 0.4% of labor income. Inflation raises the DWL to 1.6%. Finally, financial repression increases the excess burden to sizable 3% of labor income.

Relating these figures to German GDP data (roughly at €2,700bn in 2013); the corresponding DWL is equivalent to €10bn in scenario CYT. Inflation in scenario INF creates an excess burden of €33bn. Scenario LIP generates an additional excess burden of €37bn, which is 1.4% of GDP. This is equivalent to a net annual welfare loss of €450 per capita.

The capital yields tax was modelled here as a linear flat tax which is a relatively efficient form of tax collection. As table 4 shows, if the tax rises by one euro, an excess burden of 9 cents is created. By contrast, government revenue raised by the inflation tax is comparatively more expensive: every euro of revenues creates an excess burden of 30 cents. By far the most inefficient way of raise government revenues is by suppressing interest rates. Every euro that reduces the interest bill of the government loads consumers with an excess burden of 53 cents.

It is instructive to perform the following counter-factual exercise. Assume that the low interest policy hits the economy without any existing distortions due to inflation (that is, at $\pi = 0$), by reducing the level of nominal interest rates by 0.8 pp (from 2.7 to 1.9% pa) over a whole generation. In this case, the excess burden of scenario LIP would amount to €23bn. If, in addition, capital yields taxes were removed as well (that is, at $\pi, \tau = 0$), the excess burden the LIP regime would drop to merely €13bn, rather than €37bn as shown in table 4. Here, the working of an effect emphasized by Martin Feldstein shows up most clearly: a distortion of the intertemporal allocation of consumption and savings (interest rate repression) which comes on top of already existing distortions (capital yields tax, inflation tax) creates a welfare loss which is no longer a magnitude of second order, but becomes a first order effect. In other words, the small Harberger triangle of welfare economics turns into a large trapezoid.²¹

7. On Consistency and Sensitivity of the Results

In the OLG model savings of the active (young) generation goes along with dis-savings of the currently old generation whose retirement consumption expenditure is financed on the basis of savings (S_o) accumulated during their work life. Given an average real growth rate of the economy

²¹ Cf. Harberger (1964), Feldstein (1999), p. 14, Rösl (2006), pp. 18.

of $\omega (>0)$ the savings of the old generation in the model are smaller than the savings of the currently young generation by the factor of $Q = (1+\omega)^{-1} (<1)$. Therefore, the old generation is only able to consume $C_o = (Q/P)S_y$ and it dis-saves $S_o = -QS_y$ in order to pay for its costs of living. National savings in the economy (S_n) is the balance of savings by the active generation and dis-savings by the currently retired generation:

$$S_n = S_y + S_o = (1 - Q)S_y \quad (12)$$

Assuming a long-term growth rate of real GDP of $\omega = 1.3\%$ pa, we get $Q = 0.68$.²² Therefore, this model implies a savings ratio related to labor income (Y) of $S_n/Y = 9.2\%$. If we set the net labor income of the currently active generation to €1,400bn, roughly equivalent to the actual national accounts data of Germany in 2013, then the model predicts national savings of $S_n = €128$ bn, which roughly matches the current savings of private households in the national accounts of €158bn.²³

In section VI the loss of consumer surplus (CS) was calculated by integrating the retirement consumption function (eq. 8). How sensitive are the results with regard to other methods suggested in the literature? The classical approach by Harberger (1964) linearizes the retirement consumption function and estimates the loss of CS approximately by the so called Harberger-triangle

$$CS_X^{Harb} = (P_X - P_0)(C_0 + C_X)/2 \quad (13)$$

with $C_0 = C(P_0)$ and $C_X = C(P_X)$. Subtracting eq. 9 yields the following approximation of the excess burden:

$$DWL_X^{Harb} = \frac{(P_X - P_0)(C_0 - C_X)}{2} = \left(\frac{\frac{P_X + P_0}{P_0 P_X} - 1}{2} \right) S_y \quad (13')$$

The method of Lucas (2000) determines the income (Z_X) a household must receive in order to compensate for losses in CS resulting from a certain economic policy measure. Equating utility of both incomes (Y and Z_X , eq. 5),

$$\ln\left(\frac{Y}{1+\alpha}\right) + \alpha \ln\left(\frac{\alpha}{1+\alpha P_0} Y\right) = \ln\left(\frac{Z_X}{1+\alpha}\right) + \alpha \ln\left(\frac{\alpha}{1+\alpha P_X} Z_X\right) \quad (14)$$

yields the compensatory income Z_X and the loss in CS:

$$CS_X^{Lucas} = Z_X - Y = Y \left[\left(\frac{P_X}{P_0} \right)^{\frac{\alpha}{1+\alpha}} - 1 \right] \quad (15)$$

Table 5 shows that both alternative approaches generate results very close to those obtained by integration.

Table 5 Results from alternative approaches to consumer surplus

		Base	CYT	INF	LIP
Integration (eq. 8)	CS		4.79	10.13	14.08
Harberger approach (eq. 13')	CS		4.82	10.19	14.15
Lucas approach (eq. 15)	CS		4.91	10.39	14.42

²² Average annual growth (1992-2013) of real GDP in Germany.

²³ Cf. Deutsche Bundesbank, Monthly Report, November 2014, Table XI.8, p. 71*.

In the following, we check the sensitivity of our results with regard to the assumption of a logarithmic utility function with an intertemporal elasticity of substitution (IES) of unity (eq. 5). Here, we apply a more general utility function with constant relative risk aversion (CRRA) and a constant IES of $1/\rho$:

$$U(C_y, C) = (C_y^{1-\rho} + \alpha C^{1-\rho}) / (1 - \rho) \quad (16)$$

For $\rho=1$ logarithmic utility is included as a special case. The optimum consumption and savings plans remain as shown in eq. 7, provided the preference parameter α is replaced by $a(P)$, a term depending on the price level of retirement consumption:

$$CS_X = \frac{\rho}{\rho-1} Y \ln \left(\frac{1+a(P_X)}{1+a(P_0)} \right), \text{ with } a(P) = \alpha^{1/\rho} P^{1-1/\rho} \quad (17)$$

Empirical estimates of the substitution parameter ρ for Germany vary widely.²⁴ **Table 6** shows the DWL (net loss in consumer surplus) for three different values of ρ . It turns out that the results are quite robust against variations of the IES in the utility function. For $\rho = 2$ the DWL in the scenario LIP declines from €37bn to €32bn per year whereas it increases to €39bn per year for $\rho = 0.5$.

With the IES different from unity, the welfare effects of changes in the price level of retirement consumption are no longer isolated from general equilibrium repercussions from the production sector. However, since an IES around unity is broadly consistent with empirical facts, indirect effects through the production sector are likely to be small. Moreover, our model does not include the effects of low interest rates on exchange rates and foreign trade. Again, foreign trade effects are unlikely to override the primary effect. Firstly, around 40 percent of German foreign trade is isolated from exchange rate effects since it takes place within the euro-zone, and secondly, interest rates were reduced by most central banks after the Lehman bankruptcy in 2008.²⁵

Table 6 Robustness of OLG-model

			CYT	INF	LIP
		2.0	0.29	1.28	2.46
Deadweight loss (%)	ρ	1.0	0.38	1.60	2.96
		0.5	0.51	1.97	3.41
		2.0	8	27	32
Deadweight loss (€bn)	ρ	1.0	10	33	37
		0.5	14	39	39
		25	7	23	26
Deadweight loss (€bn)	T	30	10	33	37
		35	14	44	48
		0.3	8	27	30
Deadweight loss (€bn)	α	0.4	10	33	37
		0.5	12	38	43

²⁴ A comprehensive overview is provided by Havranek et al. (2013).

²⁵ Although desirable in principle, a global general equilibrium OLG model is beyond the scope of this paper.

The lower part of table 6 shows how sensitive the results are against changes of T and α . If generation length is reduced (increased) to $T=25$ (35), the DWL of LIP decreases (increases) to €26 (48) bn. If the preference parameter is reduced to $\alpha = 0.3$ ($\delta = 0.039$), the DWL of LIP falls to €30bn. Setting $\alpha = 0.5$ ($\delta = 0.023$) lifts the DWL to €43bn.

In scenario INF of table 4 the excess burden of introducing 1.5% inflation pa in addition to already existing capital yields taxes was given as €33bn or 1.2% of GDP. Applying a substantially more elaborated version of the OLG model, Tödter and Ziebarth (1999, p 73) came up with an excess burden of 1.4% pa entailed by an inflation rate of 2% pa. Nonetheless, inserting into our model inflation of 2% pa (rather than 1.5%) and a correspondingly higher nominal interest rate of 4.7% pa produces a DWL of 1.8%, which is a comparable result.

The OLG model used here assumes a capital funded pension scheme. In Germany the pension scheme is predominately based on a “pay-as-you-go” principle. Tödter and Ziebarth (1999, p 88) also included such a scheme in their model and found that the welfare costs of inflation remained almost unchanged. The precise design of the pension scheme does not seem to matter much with regard to the magnitude of the DWL analyzed here.

In scenario LIP we assumed that the low interest rate regime lasts for 11 years and accordingly reduced the nominal interest rate from 4.2% to 3.4% pa. **Figure 4** shows the corresponding DWLs if the nominal interest rate declines from its average in period B (4.2%) towards its average in period C (2.0%) by steps of 10 basis points. The DWL reaches €37bn at $i = 3.4\%$ (as in scenario C, [the final dark bar]) and tops at €123bn if the LIP regime would be enforced for a full generation.

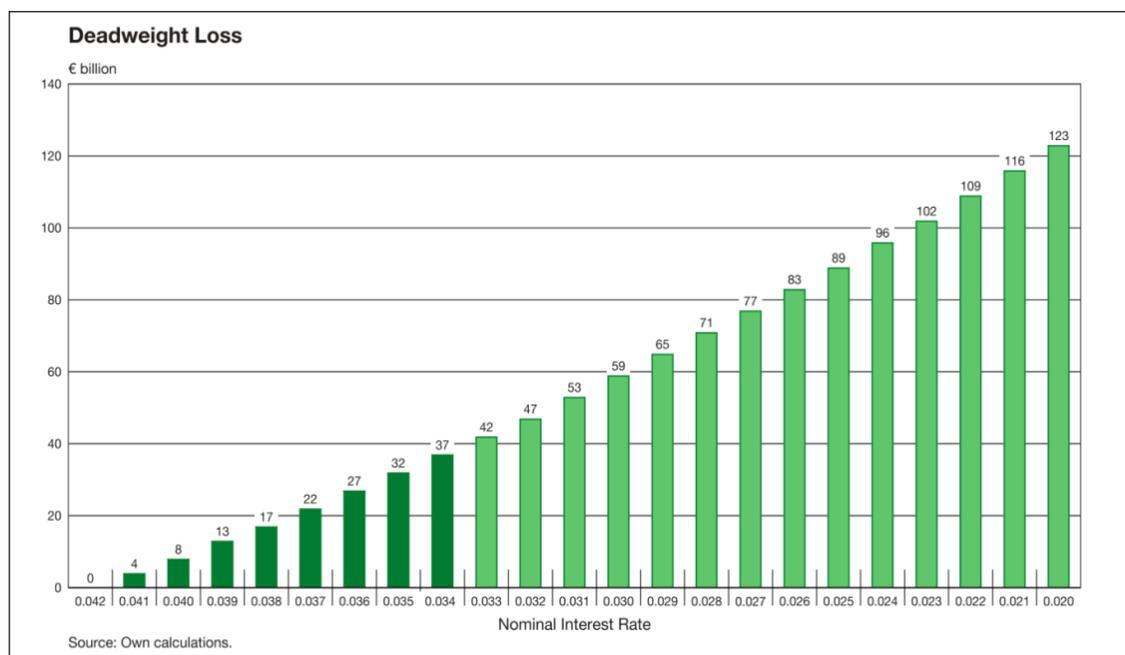


Figure 4 Deadweight losses affected by changes in nominal interest rates

Needless to say, such massive and lasting interventions in the savings and investment plans of millions of private households would massively distort the intertemporal allocation of consumption and savings and undermine the economic basis for private financial retirement precautions.

8. Summary: Substantial Costs and Welfare Losses of Low Interest Rate Policy

Not later than spring 2010, when the imminent bankruptcy of Greece was (temporarily) avoided by the governments of the EMU, the ECB began to flood the money market with liquidity and suppressed the interest rates on the capital market to historically low levels. As a consequence, the gap widened significantly between current inflation as showing up in official statistics of consumer prices and the Effective Inflation Rate which tracks prices for future consumption.

Through the low interest rate policy in the euro area since 2010 German savers lost an estimated interest income of around €65bn per year or 2.4% of GDP. This drain has to be borne by savers in addition to the financial load imposed by the distortions due to capital yields taxes and the costs of inflation. However, this figure overstates the true burden as this calculation does not take into account the relief cashed in by (mainly public) debtors due to cheaper net borrowing and lower costs of refinancing maturing debt. Both aspects are an integral part of our analysis using an overlapping generation model. In this framework, we derived net welfare costs, the co-called deadweight loss or excess burden, for the whole society. To put the costs into perspective, we again proceeded stepwise, starting from a baseline scenario, and calculated the excess burden by successively introducing capital yield taxes, inflation, and financial repression. Despite the simple model structure, the results are in line with empirical facts, robust with regard to various changes of model assumptions, and consistent with other estimates in the literature.²⁶

According to our calculations an introduction of a capital yields tax of 26.4% creates an excess burden and reduces the overall welfare in the economy equivalent to €10bn per year. The excess burden resulting from an average inflation rate of 1.5% pa totals at €33bn per annum. In comparison, the monetary policy of ultra-low interest rates that is conducted by the ECB since 2010 imposes an additional excess burden of €37bn or 1.4% of GDP per year. In the wake of the global financial and economic crisis German GDP declined by around 5% in 2009. Thus, the cumulated net welfare losses imposed on savers in Germany by the ECB's attempts to stabilize the financial system, fragile banks and over-indebted member countries already exceed the primary effects of the financial crisis. However, in view of the recently introduced massive ECB program of Quantitative Easing, and no EXIT strategy soon to come, it is likely that the process of "cold expropriation" of savers in Germany and elsewhere in the EMU will continue.

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²⁶ Cf. Sinn (2014).

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