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# A COST-BENEFIT ANALYSIS OF GOING FROM LOW INFLATION TO PRICE STABILITY IN SPAIN <sup>(1)</sup>

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## **ABSTRACT**

One of the most significant economic developments of recent years in industrialized countries has been the increasing orientation of macroeconomic policies -and of monetary policies in particular- to achieving lower inflation rates. This has led to a move from low inflation to price stability in a number of countries and, in particular, in Spain. The purpose of this paper is to provide some empirical evidence on the net economic gains that have been obtained in the case of Spain from achieving inflation rates which are low enough to be considered consistent with a situation of price stability. We do this by making a compact and relatively homogeneous empirical comparison of the costs and benefits of achieving price stability, taking into account both macro and micro aspects. According to our estimates, going from low inflation to price stability in Spain seems to be a worthy enterprise, yielding a permanent net beneficial effect of 0.7 to 1.3% of GDP per year.



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## INTRODUCTION

One of the most significant general economic developments of recent years in industrialized countries has been the increasing orientation of macroeconomic policies -and of monetary policies in particular- to achieving lower inflation rates. In some countries, this trend has crystallized into legal reforms establishing price stability as the primary goal of monetary policy, while at the same time granting extensive independence to central banks for achieving that goal. In other countries, even if there have been no specific legal changes, monetary policy has been pursuing direct inflation targets in order to enhance the transparency of the authorities' commitment to price stability. Finally, even in many of the countries which have maintained their earlier legal norms and monetary policy arrangements, there has been a *de facto* strengthening of the anti-inflationary orientation of monetary policy.

The above developments have been of particular importance in recent years within the European Union (EU) in the context of the preparations to establish a fully fledged Economic and Monetary Union (EMU) in 1999. Accordingly, the convergence criteria laid out in the Treaty of Maastricht to select future EMU participants specify that national inflation rates cannot be more than 1.5 p.p. higher than the average of the three lowest in the EU. Furthermore, the Statutes of the future European System of Central Banks (ESCB) establish price stability as the primary goal of European monetary policy.

At present, the annual inflation rate in the EU stands at 2.0%, a significant improvement from the 6-7% registered ten years ago, and a rate which is in conformity with a situation of price stability. Since almost all EU national central banks either already have price stability as the primary goal of monetary policy -or will do under the Maastricht Treaty provisions sometime in 1998-, it is envisaged that price stability will continue to be a major policy goal in Europe. For this reason, it is of the foremost importance that an attempt be made to properly estimate the costs and benefits in moving -or, rather, having moved- from low inflation to price stability.

The purpose of this paper is to conduct such a cost-benefit analysis for the Spanish economy. In Spain, in spite of the long-lasting disinflationary process which started in the second half of the seventies, the average annual inflation rate still stood around 3.5% at the end of 1996, shortly before this paper was written. If -for the sake of simplicity- we define price stability as the mid-point of the 1 and 2% inflation



range (1.5%), then moving from low inflation to price stability implies a further lowering of inflation of about 2 p.p.<sup>(1)</sup> relative to the situation in 1996.

While we have followed the above route for the sake of comparability with the other country studies in the National Bureau of Economic Research project on the "Costs and Benefits of achieving Price Stability", admittedly there is some uncertainty about the inflation rate that exactly constitutes price stability in the case of Spain. If, for example, it were to be considered that an inflation rate of 2% -rather than 1.5%-more adequately represents price stability, then going from low inflation to price stability would mean -relative to the situation in 1996- a further lowering of inflation by 1.5 p.p. rather than 2 p.p. In such case, the costs and benefits estimates to be presented in the paper could be easily rescaled.

Because the channels through which inflation affects the economy are multiple and highly complex (see Fischer and Modigliani, 1978, and Fischer, 1994), any empirical analysis of the gains and losses to be made when lowering inflation is necessarily bound to be partial and highly speculative. The route taken in this paper -within the framework of the above mentioned NBER Project- consists of making a macroeconomic estimate of the costs, and a microeconomic estimate of the benefits, of moving from low inflation to price stability in Spain. Regarding the costs, we evaluate the output losses through estimates of the well-known sacrifice ratios. Regarding the benefits, we follow Feldstein's (1996) approach and focus on the distortions resulting from the interaction between inflation and the Spanish tax system.

The main virtue of the approach followed in the paper is to make a compact and relatively homogeneous comparison between the costs and benefits of achieving price stability. Its main pitfall is that by focusing on the interactions between inflation and the tax system it ignores some of the channels through which lowering inflation might convey economic benefits. All in all, however, the assessment provided in this paper is a useful starting point for ascertaining whether policies geared towards achieving price stability in Spain are justified from the standpoint of the general interests of society.

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<sup>(1)</sup> An inflation rate of 1.5% probably comes close to being the upper bound of what we guess could be the measurement bias in the Spanish CPI. Unfortunately, there are no specific estimates of this bias to be reported for Spain.

The rest of the paper is structured as follows. Section 1 assesses the likely economic costs of reducing inflation by 2 p.p. in Spain by estimating a simple two-equation macro-model of inflation and unemployment. Section 2 calculates the size of the likely economic benefits of reducing inflation by 2 p.p., taking into account the main sources of interaction between inflation and the Spanish tax system. The concluding section compares costs and benefits and makes an overall assessment of the magnitude of the net benefits to be gained in achieving price stability.

## **1. MEASURING THE COSTS OF DISINFLATION**

The purpose of this section is to estimate the 'sacrifice ratio' for the Spanish economy, ie. how much output will be lost by each percentage point of permanent reduction in inflation.

Because the relevant relationship that we seek to identify is what will be the real impact of a permanent reduction in inflation induced by a contraction in aggregate demand, it is important to have a model which can distinguish between supply and demand shocks. For this purpose, we adapt to the Spanish economy the general framework proposed by King and Watson (1994) with the modifications introduced by Dolado et al. (1996). While the model explores the dynamics of inflation and unemployment, its results regarding the sacrifice ratio can be easily translated into output losses through Okun's law.

As Figure 1 shows, the evolution of inflation and unemployment in Spain is rather different before and after 1979. Before 1979, there were periods when inflation and unemployment moved in the same direction as a result of supply shocks. Thereafter, inflation and unemployment generally show an inverse relationship. For the sake of precision, Table 1 reports means, standard deviations and correlations for various sub-intervals in the 1964:I-1995:IV period. The stagflationary episodes are clearly shown in the first three periods. In the rest, the correlations between inflation and unemployment are negative, with the exception of the 1986-1991 period where no correlation is present. However, because these simple correlations are dominated by both demand and supply shocks, they are not informative about the nature of the driving forces behind them. To disentangle the sources of these correlations and analyze the implicit Phillips curve trade-offs following a shock in aggregate demand we estimate a simple, but rather informative, empirical macro-model.

The basic model is that of King and Watson (1994), and consists of the following two structural relationships:

$$\Delta \pi_t = \delta \Delta u_t + \sum_{j=1}^P \alpha_{\pi\pi,j} \Delta \pi_{t-j} + \sum_{j=1}^P \alpha_{\pi u,j} \Delta u_{t-j} + \epsilon_{st} \quad (1)$$

$$\Delta u_t = \lambda \Delta \pi_t + \sum_{j=1}^P \alpha_{u\pi,j} \Delta \pi_{t-j} + \sum_{j=1}^P \alpha_{uu,j} \Delta u_{t-j} + \epsilon_{dt} \quad (2)$$

Equation (1) can be interpreted as an aggregate supply equation (Phillips curve) where inflation depends on unemployment -past and present- as well as lagged values of inflation. The term ' $\epsilon_{st}$ ' is the "supply" shock. Equation (2) can be interpreted as an aggregate demand equation where unemployment depends on -present and past- inflation and past unemployment. The term ' $\epsilon_{dt}$ ' is the "demand" shock.

The variables in the equations are expressed in first-difference form since  $u_t$  and  $\pi_t$  show clear signs of unit-root behaviour and are non-cointegrated over the sample period. Under the present specification, the "long-run" effects of disturbances ' $\epsilon_{dt}$ ' and ' $\epsilon_{st}$ ' are estimated, and the "sacrifice ratio" computed as:

$$\sum_{k=0}^{\infty} \left\{ \frac{\Delta u_{t+k} / \Delta \epsilon_{dt}}{\Delta \pi_{t+k} / \Delta \epsilon_{dt}} \right\} \quad \text{when } \Delta \pi_{t+k} = 1 \quad \text{for } k \rightarrow \infty$$

Naturally, a preliminary step to be discussed is how the primitive shocks are estimated since the previous structural system is not identified. Thus, as is standard in the VAR literature, we estimate the reduced form VAR model

$$\Delta \pi_t = a(L) \Delta u_{t-1} + b(L) \Delta \pi_{t-1} + e_{\pi t} \quad (3)$$

$$\Delta u_t = c(L) \Delta u_{t-1} + d(L) \Delta \pi_{t-1} + e_{ut} \quad (4)$$

and recover the structural shocks from the residual in (3)-(4). To do so, we assume as customary that the demand and supply-shocks are orthogonal plus the following restriction: in the long run, inflation is purely a monetary phenomenon, i.e. the long-

run stochastic trend of inflation is governed only by demand shocks<sup>(2)</sup>. Nevertheless, it should be noticed that the latter restriction does not necessarily impose a fully vertical Phillips curve in the long run. Whether this is the case or not in reality will be revealed by the empirical estimates<sup>(3)</sup>.

The model is estimated for Spain for the period 1964:I-1995:IV<sup>(4)</sup>, yielding concrete results regarding the unemployment costs of permanently bringing down inflation at different horizons. In particular, after five years the long-run 'sacrifice ratio' (in terms of higher unemployment per 1 p.p. reduction in inflation) is 1.3. Using Okun's law (around 2.0 for Spain) to express the 'sacrifice ratio' in terms of cumulative output losses (every five years) per 1 p.p. of inflation reduction, it becomes 2.6. This implies that cost of reducing inflation by 2 p.p. in Spain is about 1% of GDP per year, its permanence being due to the existence of full hysteresis<sup>(5)</sup>.

In order to assess how reasonable our estimates are, it is useful to look at the - unfortunately not very abundant- evidence obtained by other authors regarding the sacrifice ratio in Spain (see Table 2). In a recent paper, Andrés, Vallés and Mestre (1996) make use of a small quarterly macroeconometric model to compute the sacrifice ratio of permanently reducing inflation in Spain by 2 p.p. They conclude that these costs are about 0.9% of GDP per year on a permanent basis, which is very similar to the 1% of GDP we find in the monetarist case. Other authors, however, obtain once-and-for-all (rather than permanent) output costs. For example, according

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<sup>(2)</sup> While other identifying restrictions were considered which were closer in spirit to 'keynesian' or 'real business cycle' models, the 'monetarist' restrictions considered in the text seemed to be more reasonable. See Dolado, López-Salido and Vega (1996) for a comparison between the three cases.

<sup>(3)</sup> This is so since the long-run Phillips trade-off, i.e.  $\lim_{t \rightarrow \infty} (\Delta u_{t+k} / \Delta \epsilon_{dt}) / (\Delta \pi_{t+k} / \Delta \epsilon_{dt})$  when  $t \rightarrow \infty$ , is equal to  $[d + (1-b)\theta] / [(1-c) + a\theta]$  where  $a$ ,  $b$ ,  $c$  and  $d$  are the gains of the lag polynomials  $a(L)$ ,  $b(L)$ ,  $c(L)$  and  $d(L)$  in equations (3)-(4), and  $\theta = 1/\delta$ . It is easy to check that the monetarist case corresponds to  $\theta = 0$ . Thus, even if  $\theta = 0$ , the trade-off differs from zero unless  $d=0$ .

<sup>(4)</sup> The VAR is estimated using first differences of EU12 inflation and unemployment rates as conditioning variables.

<sup>(5)</sup> In the Spanish case, there is ample evidence of full hysteresis nowadays, with the proportion of workers unemployed for spells longer than a year (two years) close to 60% (40%).

to the international study conducted by Ball (1996), lowering inflation permanently by 2 p.p. would lead in Spain to a cumulative total output loss of slightly less than 2% of GDP. Nevertheless, as the author himself acknowledges, this estimate is based on the 'a priori' assumption of no hysteresis, which seems to be at odds with much of the empirical evidence for Spain. Indeed, in another paper, Ball (1996) himself presents cross-sectional empirical evidence which suggests that hysteretic effects have been common in OECD countries during recent disinflationary episodes. His results suggest that a permanent reduction in inflation of 2 p.p. comes with a permanent annual output loss of about 1.1% of GDP -a number remarkably close to the 1% estimated with our small macro-model.

So far, we have relied on the sacrifice ratio computed from the estimated two-variable model for the Spanish economy which was presented in equations (1) to (4). Nevertheless, a controversial and somewhat discomforting implication of the model is that there seems to be a permanent Phillips curve trade-off even under the sensible assumption that inflation is purely a monetary phenomenon in the long-run. Therefore, it is important to explore whether this result is robust or not to changes in the specification of the model.

As pointed out by Evans (1994), it may be the case that what this sort of model identifies as demand shocks are not necessarily (nominal) monetary shocks but a mixture of the latter and (preference) consumption shocks or fiscal policy shocks. Since our framework so far consists of a two-variable system we are just able to identify pooled demand shocks. Thus, to disentangle a pure 'monetary' shock, one possibility is to add a third variable ( $x_t$ ) to the system which contains information about 'non-monetary' shocks so that  $\epsilon_{at}$  can be interpreted appropriately. Empirically this is done by adding lagged values of  $x_t$  to the system (1)-(2), allowing  $x_t$  to be influenced by contemporaneous values of  $u_t$  and  $\pi_t$  in its own equation (technically the original demand and supply shocks are treated as Wold causally prior to the third shock). We considered several candidates for  $x_t$  and found logged government current expenditure (in second differences) as a suitable one. In this case we found that the long-run trade-off was marginally insignificant, giving rise to a cumulative transitory loss of output of 10 percent of GDP per 2 p.p. of inflation reduction. These numbers are about twice those taken by Feldstein (1996) as representative of the total output cost for the US, which seems about right given the significantly larger increases in unemployment registered in the Spanish case during past disinflationary episodes.

As shown, new results arising from attempting to distinguish between monetary and non-monetary shocks yield very different implications regarding whether a long-run trade-off between inflation and unemployment exists (ie. whether the output costs are transitory or permanent). Nevertheless, it is interesting to note that for the purposes of the exercise we want to perform in this paper this very crucial conceptual difference can be easily taken into account from an empirical viewpoint. This can be seen once we express the total transitory output costs of moving to price stability (10% of GDP) in terms of an annual stream of costs with the same present value, which we can later compare to the annual stream of benefits to be estimated in Section 3. As in Feldstein, the discount rate that we use to perform the above calculation is the difference between the average after-tax real rate of return that an individual investor received from investing in the stock market (9.5% in the Madrid Stock Exchange in the 1985-95 period) and the average real growth rate of the economy (2.5% in Spain)<sup>(6)</sup>. This yields an equivalent permanent annual stream of costs of 0.6% of GDP, which is significantly below the permanent annual loss of 1% of GDP estimated with the original version of the model.

Thus, while there may be some controversy about whether the costs of moving from low inflation to price stability in Spain are transitory or permanent, and while recognizing that this as yet unsettled empirical issue has profoundly different conceptual implications for one's view of how the economy works, for our purposes it amounts to taking an annual cost estimate of 0.6% of GDP in the transitory case and 1% of GDP in the permanent case. Taking a conservative stance, in what follows we will consider that going from low inflation to price stability in Spain will be worthwhile insofar as the benefits involved in such a move are at least between 0.6-1% of GDP per year on a permanent basis (see Table 2).

It can be reasonably claimed that the estimates that we and other researchers obtain for the sacrifice ratio in Spain may underestimate the true output costs of going from low inflation to price stability since these costs are likely to increase as the inflation rate gets lower (ie. the Phillips curve gets flatter). On the other hand, there are also reasons to believe that historical estimates of the sacrifice ratio may overall significantly overestimate the actual costs of disinflation to be faced by the

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<sup>(6)</sup> See Section 3 for the derivation of the discount rate. While the cumulated output loss is 10% of GDP, its present value is 9.1% of GDP. Thus,  $(0.07)(9.1) = 0.64\%$  of GDP.

Spanish authorities nowadays. Firstly, our experience has been that with sufficiently low rates of inflation indexation mechanisms are deactivated, which enhances relative price and real wage flexibility. And secondly, the disinflationary experiences of the past -on which econometric estimates are based- took place in a context characterized by a high degree of regulation in goods and factor markets, a lack of central bank independence and an internally unbalanced macroeconomic policy mix. Very likely, this exacerbated the output costs of lowering inflation by reducing the credibility of the disinflationary strategies pursued and by increasing the degree of downward wage and price rigidity.

Nowadays the Spanish economy is considerably more open and flexible, mainly as a result of its integration into the European Union since 1986. In addition, the anti-inflationary reputation of the monetary authorities has been significantly enhanced, the Banco de España has been granted an independent status, and the macroeconomic policy mix has become much more balanced as a result of progress in fiscal consolidation. Other things being equal, this makes it reasonable to expect that the actual cost of moving from low inflation to price stability will now be significantly lower than in the past given the strengthened anti-inflationary credibility of macro policies and the greater flexibility of the overall economic structure.

That this may indeed be the case is reflected in the performance of the economy in the last few years, where progress on the inflationary front has been achieved with a much better overall economic performance than normally experienced in previous similar cyclical situations. For all the above reasons, our impression is that the cost estimate of 0.6 to 1% of GDP per year that we use as a benchmark for comparison with benefits very probably overestimates to some extent the true costs involved in moving towards price stability in Spain at present. If, as shown in the next section, the annual benefits do in fact exceed even this conservative cost estimate, it could be claimed with some confidence that going towards price stability in Spain is a worthy enterprise.

## **2. MEASURING THE BENEFITS OF GOING TO PRICE STABILITY**

According to the analysis presented above, in Spain the benefits of achieving price stability outweigh the costs if the annual benefit of lower inflation is at least worth 0.6 to 1% of GDP.

While an attempt to evaluate all the benefits associated with moving from low inflation to price stability would certainly be ideal (see Viñals, 1997), we follow the more modest -but more feasible- route of simply assessing the benefits stemming from the inter-relationship between inflation and the tax system<sup>(7)</sup>. In what follows, we apply Feldstein's (1997) framework to the Spanish economy, taking into account the peculiarities of the Spanish tax system. We consider those effects related to the lifetime allocation of consumption, to housing demand, to the demand for money and to the debt service. The total effects on each of these items will be decomposed into the direct effect of the reduced distortions and the associated welfare effects of the corresponding revenue changes.

## ***2.1. Inflation and the Intertemporal Allocation of Consumption***

A reduction in the rate of return that individuals earn on their saving, due to increases in effective tax rates at the corporate level and at the individual level, implies distortions in the allocation of consumption between the early years of working life and the age of retirement. Since the existence of tax laws creates such a distortion even in the presence of price stability, the extra distortion caused by inflation causes a first-order deadweight loss. In addition, there are associated effects on government revenue which need to be taken into account since a loss (gain) of revenue would have to be offset through increases (reductions) in other distortionary taxes. In what follows, we evaluate first the traditional welfare gain, and then turn to assess the additional welfare effect of changes in tax revenue.

### ***2.1.1. Welfare gain from reduced distortions in intertemporal consumption***

Following Feldstein (1996), the direct welfare gain from reducing inflation is computed making use of a simple two-period model of individual consumption. In such a model individuals earn income when young, and save a portion for retirement consumption by investing in a portfolio that earns a real net-of-tax return ( $r$ ). Considering that individuals retire on average after  $T$  years, then the price of retirement consumption ( $p$ ) which is purchased through saving is inversely related to the real rate of return. As the negatively sloping compensated demand curve in Figure

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<sup>(7)</sup> Notice that these benefits arise from lowering the rate of inflation even if it is perfectly anticipated.



2 shows, the amount of retirement consumption (C) purchased by individuals becomes lower when its price rises. Because inflation interacts with the tax system to increase the effective tax rate on capital income and thus to reduce the real net-of-tax return to individual savers, the higher the inflation rate, the higher the price of retirement consumption ( $p_2 > p_1$ ) and the lower the demand for retirement consumption ( $C_2 < C_1$ ) relative to the optimal situation of no inflation and no taxes ( $p_0, C_0$ )<sup>(8)</sup>.

As explained in Feldstein's analysis, the welfare gain from inflation reduction to an individual who saves while working and retires and consumes the return on his savings after retirement, can be expressed as the sum of triangle B and rectangle D under his compensated demand curve for retirement consumption in the Figure.

Using the standard Slutsky decomposition of the uncompensated change between compensated and income effects, the welfare gain (with taxes but no inflation) can be expressed as:

$$\text{Deadweight gain} = G_1 = \left[ \frac{p_1 - p_0}{p_2} + \frac{1}{2} \frac{p_2 - p_1}{p_2} \right] \left( \frac{p_2 - p_1}{p_2} \right) S_2 (1 - \eta_{sp} - \sigma) \quad (5)$$

where  $p_i$  is the price of retirement consumption:

$$p_i = (1 + r_i)^{-30} \quad (i = 0, 1, 2)$$

and the subscripts correspond to the following cases:

- (0) = no inflation and no taxes
- (1) = taxes and no inflation
- (2) = taxes and inflation

$S_2$  is savings during pre-retirement years at the existing inflation rate;  $\sigma = \partial S_2 / \partial y$  is the marginal propensity to save out of exogenous income, and  $\eta_{sp}$  is the uncompensated elasticity of savings with respect to the price of retirement consumption.

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<sup>(8)</sup> Throughout the text we refer to 'no inflation' or 'price stability' as a situation when the actual inflation rate is 1.5%, as stated in Section 1.

To evaluate the annual permanent welfare gain  $G_1$ , we must first measure the price of retirement consumption in the three situations described (0, 1 and 2).

· To calculate the price of retirement consumption in the absence of inflation and taxes ( $p_0$ ), we need an estimate of the real pre-tax return to capital. From 1985 to 1995, the median real return to capital in the Spanish manufacturing sector averaged 11.9%, according to company accounts of Central de Balances (Banco de España, 1996a)<sup>(9)</sup>. Thus,

$$p_0 = [1.119]^{30} = 0.0343$$

· To estimate the real net-of-tax return to savers in a world of taxes and inflation ( $p_2$ ), we need to take into account the effects of the existence of corporate and personal taxes. Between 1988 and 1995, taxes (net of deductions) paid by corporations averaged 23% of pre-tax returns (including interest payments). Corporate income taxation operates under an imputation system which mitigates the double taxation of dividends at the shareholder level. Dividends carry a tax credit of 40% of the amount received by the shareholder. The tax credit is included in the income tax base, and it is deductible from the computed individual income tax. In the computation of the effective tax rate on company profits, we have netted out these deduction payments. From 1985 to 1995, dividends averaged 18% of pretax profits (Banco de España, 1996a). Thus, the after-tax rate of return is  $11.9(1 - 0.23)(1 + 0.4 \times 0.18)$ , where the second term in brackets reflects the estimated amount of dividend tax credits that individuals can deduct against their tax liabilities. This leaves an after-corporate-tax return of 9.82%.

The after-tax rate of return to savers also depends on personal taxes. Spanish personal income taxation treats capital incomes differently, in a way that depends on how income is received. A taxpayer with average taxable income pays a statutory marginal tax rate of 30%, which is the rate falling on interest receipts. For dividends, we can use a marginal effective tax rate of  $1.4(30\%) = 42\%$ , since the imputation tax credit is liable to taxes. Finally, the effective tax rate on capital gains can be calculated as in King (1977) and Bakhshi et al. (1996). Real capital gains are taxed

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<sup>(9)</sup> We take the median since the average was severely distorted by huge outliers. This figure does not differ markedly from the real net return to business capital calculated by OECD for Spain: 14.1% on average over the 1985-1995 period.

at a fixed rate of 20% upon realization. The effective tax rate is  $20\%[\phi(1+i)/(\phi+i)]$ , where  $\phi$  is the fraction of accrued capital gains realised every period and  $i$  is the investor's discount rate, which is the after-tax rate of return to stocks. From company accounts of Central de Balances (Banco de España, 1996a), the dividends-net assets ratio between 1985 and 1995 averaged 2.1%. In the same years, stocks quoted on the Madrid Stock Exchange paid an average dividend of 5.8%. Here we use an intermediate figure: 4%. Over 1985-1995, the Madrid Stock Exchange Index rose by 12.2% on average in nominal terms, or 8.1%  $[12.2-(5.6-1.5)]$  in real terms. Thus:

$$i = (1-0.42) \times 4\% + [1-0.2 \times \phi(1+i)/(\phi+i)] \times 8.1\%$$

The solution for  $i$  is 9.5% for  $\phi=0.1$  or 9.2% for  $\phi=0.2$ . In the absence of information on the "true" value of  $\phi$ , we take  $\phi=0.1$ , which yields an estimate of the effective marginal tax rate on real capital gains of around 11%.

In order to compute an aggregate marginal tax rate, we need weights for marginal tax rates falling on interest, dividends and capital gains. From Central de Balances, the average debt-capital ratio for companies between 1985 and 1995 was close to 50%, a split which we use also for individuals<sup>(10)</sup>. On the other hand, the above figures on average dividends and real capital gains imply a dividends/capital gains split of 33/67. Therefore, the aggregate personal tax rate on corporate after-tax profits is:

$$0.5 \times 30\% + 0.5[0.33 \times 42\% + 0.67 \times 11\%] = 25.6\%$$

This tax rate implies a net real return to savers of  $(1-0.256) \times 9.82\% = 7.31\%$ . Therefore, the associated price of retirement consumption is:

$$p_2 = [1.0731]^{-30} = 0.1204$$

According to our calculations, the joint presence of inflation and taxes leads to a significant wedge between the before- and after-tax real rate of return to

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<sup>(10)</sup> An issue which deserves closer attention is the role of tax-privileged savings vehicles. In 1995, direct holdings of firms' bonds, loans and stocks were less than 50% of total net financial assets held by households. On the other hand, the effective tax rate on other assets varies widely, a feature that is magnified when inflation increases (González-Páramo, 1991).

individual savers. In particular, this return drops from 11.9% to 7.3%, inducing an increase in the price of retirement consumption from 0.0343 to 0.1204.

We can now go on to calculate what the real rate of return would be in a world of taxes and no inflation ( $p_t$ ). For this we need to specify some additional tax information. Profit is taxed with a national tax rate of 35%. Interest payments are deductible. Capital gains are taxed at the corporation tax rate. Allowances for depreciation are available. Corporations may use the straight-line depreciation method (which is the only one available for buildings) and two variants of the declining balance method ("sum-of-the-years-digits" and "constant percentage"); switch-over is not allowed. From 1996 on, capital gains are partially indexed, and inventories can be valued using the LIFO method.

Consider a reduction in inflation of 2 p.p. For corporations, this has two opposing effects. First, since nominal debt interest payments are tax-deductible, a two-point decline in inflation raises the effective tax rate on profits. For a given real pre-tax cost of borrowing, and a debt-capital ratio of 50%<sup>(11)</sup>, the effective tax rate would increase by  $0.35(0.5)(0.02)=0.0035$ , or 0.35 p.p. On the other hand, since depreciation allowances are not indexed, a 2 p.p. reduction in inflation lowers taxable profits by increasing the real value of the tax-deductible depreciation. We do not have an independent estimate of this effect comparable to that provided by Auerbach (1978) for the US. However, available estimates of the overall effect of inflation upon the effective tax rate on company profits broadly coincide: a 2 p.p. reduction in the rate of inflation leads to a fall in the effective tax rate of about 0.1 p.p. In a comparative study of effective tax rates in developed countries, OECD (1991) finds that a 5 p.p. reduction in inflation is associated with a 0.5 p.p. fall in taxable profits in the case of Spain. In a more detailed analysis, Sanz (1994) evaluates effective tax rates in a sample of 883 private industrial companies<sup>(12)</sup>. He estimates that moving from 5% inflation to price stability causes the effective tax wedge to fall by approximately 1.1 p.p.. Given a fixed capital stock, this means that pre-tax profits fall by 0.22 p.p. per 1 p.p. decline in inflation. Thus, a 2 p.p. reduction in inflation raises

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<sup>(11)</sup> Data from Central de Balances 1995 (Banco de España, 1996a).

<sup>(12)</sup> Help by J.F. Sanz with these calculations is much appreciated.

the net-of-tax corporate return by  $0.35(0.22)(0.02)=0.0015$  or 0.15 p.p.<sup>(13)</sup>. That is, the net effect of achieving price stability is to raise the rate of return after corporate taxes from 9.82% to 9.97%.

To calculate a real net-of-tax return to savers, we must consider the combined effect of taxes at the personal level. Applying the weighted personal tax rate to the 9.97% return after corporate taxes implies a net return to savers of 7.42%. In addition, there is an independent effect of inflation channelled through the tax treatment of interest income<sup>(14)</sup>. Taking the share of debt in individuals' portfolios to be the same as the debt-capital ratio of companies, a 2 p.p. fall in inflation reduces the effective tax rate by  $0.3(0.5)(0.02)=0.003$  or 0.3%. Adding to the new after-tax rate of return (7.42%) the gain to savers in the taxation of interest income (0.3%), we arrive at a net-of-tax return to individuals of 7.72%, up 0.41 p.p. from the return when inflation is 2 p.p. higher. Thus, the associated price of retirement consumption is:

$$p_1 = (1.0772)^{-30} = 0.1074.$$

Substituting the values of  $p_0$ ,  $p_1$ ,  $p_2$  in the expression for the welfare gain (5), we have:

$$G_1 = 0.0714 S_2 (1 - \eta_{sp} - \sigma) \quad (6)$$

Now we need to measure savings during pre-retirement years, the marginal propensity to save out of exogenous income, and the uncompensated elasticity of saving with respect to the price of retirement consumption to evaluate the welfare gain in equation (5).

To provide an estimate of savings of the young at the existing rate of inflation,  $S_2$ , Feldstein exploits the relationship between  $S_2$  and net personal savings,  $S_N$ , in a steady-state growth path:

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<sup>(13)</sup> Note that this estimate implies that the effect of inflation through depreciation allowances is a 0.71% reduction in the taxable profits rate per additional 1% reduction in inflation.

<sup>(14)</sup> Since nominal capital gains are indexed, changes in the rate of inflation do not affect capital gains taxes.

$$S_2 = \frac{1}{1-(1+n+g)^{-T}} \frac{S_N}{GDP} \quad (7)$$

where  $n$  is population growth,  $g$  is the growth rate of real per capita wages, and  $T$  is the length of the working period in years. Over the 1985-1995 period, the growth of the wage bill in real terms was 2.8%, and the net personal savings rate averaged 5.0% of GDP (Banco de España, 1996b). Taking  $T=30$ , this implies that savings of the young is 9% of GDP. However, recent evidence from the expenditure survey *Encuesta de Presupuestos Familiares 1990-91* suggests that the foregoing figure is too low. Oliver, Raymond and Pujolar (1996) find that population cohorts spanning over the 35-65 year range save around 20% of their income. Since the personal income-GDP ratio has been quite stable around 0.7 over the 1985-1995 period, the implied saving ratio for the young is  $S_2=14\%$  of GDP. We use this estimate in our calculations<sup>(15)</sup>.

In order to compute the welfare gain according to equation (5), we need estimates for the savings function parameters. Assuming that  $\sigma$  equals the sensitivity of savings to wage income,  $\sigma=(S_2/GDP)/\alpha$ , where  $\alpha$  is the share of wages in GDP, which is around 0.66. Thus, for  $S_2/GDP=0.09$ ,  $\sigma$  is 0.135, and when  $S_2/GDP=0.14$ ,  $\sigma=0.21$ <sup>(16)</sup>, our chosen estimate. On the other hand, the elasticity of saving with respect to the price of retirement consumption can be calculated as in Feldstein (1995):  $\eta_{sp}=-(1+r) \eta_{sr}/rT$ , where  $\eta_{sr}$  is the uncompensated savings elasticity with respect to after-tax real rate of return.

Argimón, González-Páramo and Roldán (1993) estimate semi-elasticities of private consumption with respect to the real interest rate in the -0.2/0 range. For a given income, these elasticities are linked by the relationship:  $\eta_{sr}=-r(C/S) \eta_{cr}$ , where  $r$  is the real after-tax interest rate,  $C$  is personal consumption,  $S$  is private savings and  $\eta_{cr}$  is the semi-elasticity of consumption with respect to the real interest rate. Taking  $r=6\%$  and  $C/S=15.8$  from National Accounts data,  $\eta_{sr}$  ranges between 0 and 0.2. With

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<sup>(15)</sup> Gross household savings over 1985-1995 was 10.8%, 1.5% higher than the corresponding ratio in the UK. Since 11% is the lower bound of the savings ratio in the UK study, a 14% rate for Spain does not seem implausibly high.

<sup>(16)</sup> These figures are within the range of the available econometric estimates. According to Marchante (1993), with an income elasticity of 0.85-0.90 and an average propensity to consume of 0.95,  $\sigma$  estimates fall in the 0.14-0.19 interval.

$r=4\%$  and  $C/S=5$ , in line with expenditure surveys, the upper bound of these estimates would fall to 0.1. On the other hand, Estrada (1997) suggests even lower values for the savings elasticity (0.04). Thus we consider elasticities between 0 and 0.2 as reasonable estimates, and 0.4 for comparability with Feldstein's calculations.

Once we substitute the values for the different variables and parameters into equation (5), the associated welfare gains are:

$\eta_{sr}$	$\eta_{sp}$	$G_1$ (% of GDP)
0	0	0.79
0.2	-0.12	0.91
0.4	-0.24	1.03

In spite of the differences between the economic parameters and the tax systems of Spain and the US, the estimated permanent annual welfare gains from achieving price stability are remarkably similar.

### *2.1.2. Welfare Revenue Effects of Lower Inflation*

When inflation is lower, the tax revenue collected may be higher or lower than initially depending on the induced change in retirement consumption along the compensated demand curve. If we start from a situation such as that depicted by point 2 in Figure 2, with consumption  $C_2$  and price of retirement consumption  $p_2$ , a reduction in inflation lowers the effective tax rate on the return to savings, which implies a revenue loss corresponding to rectangle E. At the same time, a lower price of future consumption stimulates retirement consumption, which in turn generates additional revenues, reflected by rectangle D. Thus, the overall net effect on revenue can be either positive or negative (D-E). Using again the uncompensated savings elasticity, since the young generally ignore the need to pay for future lost revenue (the compensated case), the aggregate revenue effect can be expressed as:

$$dREV_1 = \frac{S_2}{GDP} \left[ \left( \frac{p_1 - p_0}{p_2} \right) \left( \frac{p_2 - p_1}{p_2} \right) [1 - \eta_{sp}] - \left( \frac{p_2 - p_1}{p_2} \right) \right] GDP \quad (8)$$

With the former parameter values computed in Section 2.1.1, the first effect dominates, generating the following revenue losses:

$\eta_{sr}$	$\eta_{sp}$	dREV <sub>1</sub> (% of GDP)
0	0	-0.59
0.2	-0.12	-0.48
0.4	-0.24	-0.37

These values are somewhat larger than those found for the US mainly as a result of differences in the savings ratio.

Now we can convert these revenue losses into welfare losses by scaling them using a deadweight loss coefficient  $\lambda$ . The value of  $\lambda$  measures the marginal deadweight loss per peseta of additional revenue, and it depends on the specific taxes used to make up for the revenue losses. Feldstein (1996) uses two benchmark values: 0.4 and 1.5. For the Spanish case, we can obtain estimates of  $\lambda$  from the computable general equilibrium model calibrated by Kehoe and others (1989). An across-the-board tax increase generating 100 pesetas of revenue produces a deadweight loss which is in the range of 29 to 47 pesetas<sup>(17)</sup>. These figures are very similar to those of Ballard, Shoven and Whalley (1985) used by Feldstein. We take as our central estimate  $\lambda=0.4$ . For the sake of comparability, we also use  $\lambda=1.5$ , an estimate which seems too high to us.

With the two chosen values for  $\lambda$ , the welfare revenue losses are:

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<sup>(17)</sup> We are grateful to Antonio Manresa and Ferrán Sancho for providing us calculations and guidance as to their interpretation.



$\eta_{sr}$	$\eta_{sp}$	dREV <sub>1</sub> (% of GDP)	
		$\lambda=0.4$	$\lambda=1.5$
0	0	-0.24	-0.88
0.2	-0.12	-0.19	-0.72
0.4	-0.24	-0.15	-0.56

As can be seen, the magnitude of the welfare revenue losses is quite sensitive to the assumed value of the marginal deadweight loss. All in all, however, in all cases but one the direct welfare gain is higher than the indirect welfare revenue loss.

The net welfare gain from reducing inflation by 2% is  $NG_1 = G_1 + \lambda dREV_1$ . This formula yields the following estimates (see first three rows of Table 3):

$\eta_{sr}$	$\eta_{sp}$	NG <sub>1</sub> (% of GDP)	
		$\lambda=0.4$	$\lambda=1.5$
0	0	0.55	-0.09
0.2	-0.12	0.72	0.19
0.4	-0.24	0.88	0.47

For  $\lambda=0.4$ , the range of estimates is around the size of US calculations.

### 2.1.3. Pensions and nonsavers

It must be noted that to the extent that individuals receive exogenous income during retirement (social security pensions), our annual estimates need to be adjusted downwards. With exogenous income B, retirement consumption is  $C = S/p + B$ , whereby  $\eta_{sp} = (1-k)(\eta_{sp} - 1)$ , where  $\eta_{sp}$  is the uncompensated elasticity of retirement consumption with respect to its own price and  $k = B/C$  is the benefit ratio for the relevant population (i.e. savers). This alters the welfare gain formula to  $G_1 = 0.0714S_2[(1-k)(1 - \eta_{sp}) - \sigma]$ .

In 1990<sup>(18)</sup>, the benefit ratio for households with heads aged 65 and older was around 30%. However, 42% of them received the minimum pension, due to insufficient contributions over their working years. Presumably, most of these retired individuals made no savings when young and depend solely on their pension. Excluding this group reduces the implied estimate to  $k=20\%$ , on the assumption that all of the remaining pensioners were young-age savers as well. To see how taking B into account would alter our estimate of  $G_1$ , the following table summarizes the results for  $k=0$  and  $k=20\%$ .

$\eta_{sr}$	$\eta_{sp}$	$G_1$ (% of GDP)		
		$k=0$	$k=0.2$	Change (%)
0	0	0.79	0.59	-25
0.2	-0.12	0.91	0.69	-24
0.4	-0.24	1.03	0.78	-24

While the existence of pensions reduces the welfare gains as indicated, the increase in the return to savings may cause some non-savers to save, a change that would increase both welfare and revenues. Though the magnitude of this "participation" decision is potentially important, reliable estimates are not readily available. Thus, we have no way to assess the net effect of these two adjustments and thus we stick to the estimates provided in the first three rows of Table 3.

## 2.2. Inflation and Demand for Housing

### 2.2.1. Welfare gain from reduced distortions in Housing Demand

Inflation distorts all forms of private housing demand through two main channels. First, it reduces the net return of alternative assets, an effect which

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<sup>(18)</sup> According to Oliver, Raymond and Pujolar (1996), average expenditure of the 4.2 million households with head aged 65 or older was slightly below 1.9 million pesetas. From official statistics, the average pension of the 3,241,908 old-age pensioners was 717,626 pesetas. A minimum pension of about 47,000 pesetas a month was received by 1,368,142 pensioners.

stimulates the demand for houses by all sectors or potential users: owner-occupiers, non-owner-occupiers (mainly, second residences) and landlords in the private rented sector. In addition, the tax advantages given to a large number of owner-occupiers and, to a lesser extent, to landlords, are magnified by inflation. In Spain, these tax privileges are quite generous by international standards, particularly in the case of owner-occupied housing, and the size of the housing stock is also relatively large. Therefore, a reduction in the rate of inflation is quite likely to produce sizable welfare gains, through both a reduction of the distortions caused by housing over-consumption and a reduction in tax revenue losses.

The welfare gains discussed above can be readily illustrated with the help of Figure 3, which shows the compensated demand curve relating the quantity of housing to its rental cost. In Spain, as in so many other countries, the effective subsidies to housing demand arising from the combination of inflation and the tax system reduce the implied rental cost of housing and thus lead to an over-consumption of housing ( $H_2$ ), compared to a situation of taxes but no inflation ( $H_1$ ) and of no taxes nor inflation ( $H_0$ ). Following Feldstein (1996), since the real pre-tax cost of providing housing capital is  $R_0$ , the existence of taxes with no inflation yields a welfare loss shown by triangle A. If on top of this there is also inflation, then the welfare loss increases by the areas C and D in the Figure. In what follows, we estimate the deadweight gains obtained by reducing inflation (from  $H_2$  to  $H_1$ ) for owner-occupied housing, non-owner occupied housing and rental housing.

In the absence of any taxes, the user cost of housing,  $R_0$ , net of maintenance costs ( $m$ ), and depreciation ( $\delta$ ), must equal the real return to capital in the non-housing sector ( $\rho$ ), ie.  $R_0 = m + \delta + \rho$ . With  $m=2\%$ ,  $\delta=2.2\%$ <sup>(19)</sup> and  $\rho=11.9\%$  (the real pre-tax return to capital in the manufacturing sector),  $R_0=16.1\%$ . Next we proceed to analyze the effect of taxes and inflation upon the real rental cost, housing demand and tax revenues.

One peseta of housing capital costs to a home-buyer  $(1-d)(1+\tau_i)$  pesetas, where  $\tau_i=7\%$  is the VAT tax rate on house purchases and  $d=15\%$  is a tax credit given to owner-occupiers on the value of the house including taxes. Tax payers may enjoy this advantage five years in advance of the purchase on the amounts invested in "housing

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<sup>(19)</sup> Fundación BBV (1996) assumes that  $\delta$  has increased from 1.5% in 1970 to 2% in 1990, which implies an estimate of  $\delta=2.2\%$  for 1995.

savings accounts", and after the purchase on mortgage repayments. In order to qualify for the tax credit, the house must be the main residence of the owner and cannot be sold in three years. Home-owners pay income tax on an "imputed rental":  $\beta\tau_h z$  per peseta of housing cost, where  $\beta=2\%$  is the imputation rate,  $\tau_h=42.5\%$  is the weighted marginal tax rate of home-owners<sup>(20)</sup> and  $z=33\%$  is the average ratio of the official tax value ("valor catastral") to the market value of the house (Gallego, 1995). Local property taxes (Impuesto sobre Bienes Inmuebles) are levied with an average rate  $\tau_p=1\%$  on the tax value of the house, and are deductible from the income tax base. Maintenance costs and depreciation are not deductible, and real capital gains are taxed unless the proceeds of the sale are reinvested in a new main residence. In addition, interest expenses are deductible in nominal terms at the marginal tax rate, with a ceiling of 1.6 million pesetas for a two-earner household. Given a mortgage-to-value ratio of  $\mu=50\%$ <sup>(21)</sup>, an average price of a new house of 17 million pesetas (Sociedad de Tasación, SA, January 1997) and the 1995 average mortgage interest  $i_m=10.8\%$ , the interest deduction ceiling is not likely to be binding in most cases. Finally, it is worth noting that a large fraction of old houses do not benefit from tax privileged treatment, either because they were bought before 1979 (when the tax credit was introduced) and/or because mortgages have been paid off.

With this description of the tax rules relevant to owner-occupiers with tax advantages, the user cost of housing can be expressed as:

$$RA_2 = (1-d)(1+\tau_i) [\mu i_m (1-\tau_h) + (1-\mu)(r_n + \pi) + \delta + m - (1-\tau_g)g - \pi] + (1+\tau_i) [(1-\tau_h)\tau_p z + \tau_h \beta z] \quad (9)$$

where  $r_n=7.31\%$  is the real after-tax rate of return on other investments,  $\tau_g=11\%$  is the effective tax rate on real capital gains,  $g=1.1\%$  is the average real capital gain on housing between 1988 and 1995 according to Sociedad de Tasación SA (5.4-4.3), and

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<sup>(20)</sup> Individual tax data suggest, according to Leal (1992), that 45% of the tax credit benefits taxpayers in the richest 10% of family income, 25% of the benefits are reaped by the following 20% and the rest goes to the remaining 70% of total taxpayers. Applying these weights to marginal tax rates of 56%, 40% and 24.5% gives an average of 42.5%.

<sup>(21)</sup> According to Banco de España's (1996b) data on financial liabilities of households, this ratio appears to be somewhat smaller. However, loans between individuals or between families and individual firms cancel each other out within the personal sector.

$\pi=3.2\%$  is the true rate of inflation in 1995. The computed rental is thus  $RA_2=8.21\%$ . In order to evaluate the real return associated with a 2 p.p. reduction in the rate of inflation,  $RA_1$ , we have that:

$$\frac{dRA}{d\pi} = (1-d)(1+\tau_i)[\mu(1-\tau_h)\frac{di_m}{d\pi} + (1-\mu)\frac{d(r_n+\pi)}{d\pi} - 1] = -0.29\%$$

where it is assumed that  $di_m/d\pi=1$  and  $dr_n/d\pi=-0.21$  stems from the fact that a 2 p.p. reduction in inflation raises the real after-tax return to savers from 7.31% to 7.72%. These calculations imply  $RA_1=8.79\%$ . In the case of owner-occupiers without tax advantages, expression (9) simplifies to:

$$RW_2 = (1+\tau_i)[r_n+\delta+m-(1-\tau_g)g+(1-\tau_h)\tau_p z + \tau_h \beta z] \quad (10)$$

The resulting cost is  $RW_2=11.77\%$ . On the other hand, since  $dRW/d\pi=(1+\tau_i)(dr_n/d\pi)=-0.23$ , a 2 p.p. reduction in inflation raises the user cost to  $RW_1=12.23\%$ .

Before evaluating the welfare effects, we need an estimate of the value of the housing stock and a value for the compensated elasticity of housing demand with respect to the rental price. Jaén and Molina (1994 a and b) provide econometric estimates which imply a compensated price elasticity of 0.9, with no significant differences between owner-occupied housing and rental housing. We assume that this elasticity applies to all forms of housing demand decisions. As to the value of the housing stock, Fundación BBV (1996) estimates a net stock of accumulated investment in housing of 117% of GDP. Given that land values represent on average 30% of total cost (Sociedad de Tasación SA, January 1977), the former estimate must be raised to 170% of GDP. An alternative calculation, based on data of average square meters per house and number of houses (INE, *Censo de Población y Viviendas*, various years), and average market prices per square meter (Ministerio de Obras Públicas y Urbanismo and Sociedad de Tasación SA), yields an estimate of 158.3 billion pesetas, i.e. 227% of 1995 GDP<sup>(22)</sup>.

In order to decompose this figure among house uses we can refer to the shares of owner-occupiers, non-owner-occupiers and rental houses: 76.55%, 10.45% and 13%, respectively. Assuming that non-owner-occupied houses (second residences and empty houses) have a price which is on average one half of the value of owner-

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<sup>(22)</sup> Assistance with these calculations was kindly provided by Ángel Estrada.

occupied and rental houses, the adjusted shares in the housing stock are: owner-occupied housing, 80.77%; non-owner-occupied housing, 5.51%; and rental housing, 13.72%. On the other hand, in 1994 there were 8.5 million taxpayers who declared housing income, of which 3.2 million -or 38%- claimed tax credits (Agencia Estatal de Administración Tributaria, 1996). Since houses without tax advantages are old houses, with lower selling prices, a further adjustment is needed in order to disaggregate the value of owner-occupied housing according to tax status. From professional reports based on market valuations (TINSA, february 1997), the average value of a house of 10 years or older is 30% below the value of equivalent houses built more recently. Thus, the value of the housing stock enjoying tax-privileged treatment can be scaled upwards to 46.7% of owner-occupied housing. Following these adjustments, stock values of owner-occupied houses with and without tax advantages are  $HA_2=85.6\%$  of 1995 GDP and  $HW_2=97.8\%$  of GDP, respectively. The remaining stock values are  $HN_2=12.5\%$  of GDP for non-owner-occupied housing and  $HR_2=31.1\%$  of GDP for rental housing.

Let us return to owner-occupiers enjoying tax advantages. The welfare gain from a 2 p.p. reduction in the rate of inflation corresponds to the sum of rectangle C and triangle D under the compensated housing demand curve in Figure 3, and can be expressed as:

$$GA = \epsilon_{HR} \left[ \frac{R_0 - RA_1}{RA_2} \cdot \frac{RA_1 - RA_2}{RA_2} + \frac{1}{2} \left( \frac{RA_1 - RA_2}{RA_2} \right)^2 \right] RA_2 \frac{HA_2}{GDP} \cdot GDP \quad (11)$$

where  $\epsilon_{HR}$  is the absolute value of the compensated elasticity of housing demand with respect to the rental cost, and  $HA_2$  is the 1995 market value of owner-occupied housing with tax advantages (59.7 billion pesetas). By substituting previous values and estimates in equation (11), we have:

$$GA = 0.41\% \text{ of GDP}$$

In the case of owner-occupied housing without tax advantages, we can use equation (11) with  $RW$  and  $HW$  instead of  $RA$  and  $HA$ , to get:

$$GW = 0.14\% \text{ of GDP}$$

Adding up these figures, the resulting total welfare gain from the reduced distortion of owner-occupied housing demand is 0.55% of GDP. This estimate is five times Feldstein's (1997) calculation for the US, a sizable difference that reflects both the much higher ratio of housing values to GDP and the enormous implicit subsidy that tax rules and inflation give to the purchase of owner-occupied houses in Spain. With actual taxes and inflation, the rental cost for owner-occupiers with tax advantages in 1995 was around 51% of the no-tax user cost (76% in the US and 71% in the UK), and a 2 p.p. reduction in inflation would increase the rental cost of owner-occupied housing by nearly 7% (4.8% in the US and 4.2% in the UK).

Inflation and taxes also distort the demand for non-owner occupied housing. In this case, the rental cost can be written as:

$$RN_2 = (1+\tau_i) [\mu i_m + (1-\mu)(r_n + \pi) + \delta + m + \beta \tau_h z + \tau_p z - g(1-\tau_g) - \pi] \quad (12)$$

where we assume a mortgage-to-value ratio of  $\mu=30\%$ . Note that here there are no tax credits nor interest deductions, and property taxes are not deductible. The resulting cost is  $RN_2=12.1\%$ . A 2 p.p. reduction in inflation raises the rental cost to  $RN_1=12.42\%$  through its effect on the return of alternative investments. Computing the analog of expression (11) we obtain a welfare gain of:

$$GN = 0.01\% \text{ of GDP}$$

Houses may be demanded as an investment: landlords buy residences and rent them out. When this is the case, interest, depreciation, property taxes and maintenance costs are deductible without limit. The user cost of rental sector houses is:

$$\begin{aligned} RR_2 = (1+\tau_i) [\mu i_m (1-\tau_h) + (1-\mu)(r_n + \pi) + \\ + (1-\tau_h)(\delta + m + \tau_p z) - g(1-\tau_g) - \pi] \end{aligned} \quad (13)$$

With an assumed mortgage-to-value ratio of  $\mu=20\%$ ,  $RR_2=8.64\%$ . A 2 p.p. reduction in inflation increases the rental cost to  $RR_1=9.18\%$ , which in turn implies a welfare gain of:

$$GR = 0.13\% \text{ of GDP}$$

All in all, the value of the aggregate welfare gain from reduced distortions on housing implied by a 2 p.p. reduction in the rate of inflation is:

$$G_2 = GA + GW + GN + GR = 0.69\% \text{ of GDP}$$

### 2.2.2. Welfare Revenue Effects from Lower Inflation

Given the importance of the tax-inflation distortions and the composition of the housing stock, the revenue effects implied by a 2 p.p. reduction in the inflation rate are expected to be sizable and concentrated in the owner-occupied sector. Consider the effect of the inflation reduction upon the stock of owner-occupied housing with tax advantages (from  $HA_2$  to  $HA_1$ ):

$$\frac{\Delta HA}{HA_2} = -\epsilon_{HR} \frac{RA_1 - RA_2}{RA_1} = -5.9\%$$

that is, a decline of 3.5 billion pesetas, from  $HA_2=59.7$  billion pesetas to  $HA_1=56.2$  billion pesetas.

On the assumption that housing capital shifts to the business sector, there are as many as six different channels through which the change in housing demand affects government revenues.

First, net property tax payments are reduced by:

$$\tau_p(1-\tau_h)z\Delta HA = -0.0066 \text{ billion pesetas}$$

Second, as both mortgage interest rates and the housing stock decline, the amount of deductible interest payments falls, thus increasing net revenues by:

$$\tau_h\mu[HA_2i_m - HA_1(i_m - 0.02)] = 0.3192 \text{ billion pesetas}$$

Third, the tax credit on housing purchases declines. If the shift of capital out of the housing sector were instantaneous, the net revenue increase would be  $d\Delta HA$ , or in annuity terms:



$$-id\Delta HA = 0.0499 \text{ billion pesetas}$$

where  $i$  is the investor's discount rate ( $i=9.5\%$ ). Fourth, taxes paid on imputed housing rentals fall by:

$$\tau_a \beta \Delta HA = -0.0098 \text{ billion pesetas}$$

Fifth, as housing capital shifts to the business sector, revenues from taxes on capital income increase by:

$$-(0.119-0.0772)\Delta HA = 0.1463 \text{ billion pesetas}$$

where the expression in brackets is the difference between the pre-tax return to business investment and the after-tax return to savings when the rate of inflation is 2 p.p. lower. Finally, it should be noted that additional revenues arising from business investment must include sales and VAT taxes, an effect which can be estimated as<sup>(23)</sup>:

$$-0.361\tau_s\Delta HA = 0.2022 \text{ billion pesetas}$$

where  $\tau_s=16\%$  is the standard VAT rate. The total revenue gain is thus:

$$dREV_A = 0.7012 \text{ billion pesetas} = 1.01\% \text{ of GDP}$$

In the case of owner-occupiers without tax advantages, the revenue gain is much smaller, given the absence of tax credits and mortgages outstanding. The reduction in the housing stock is 3.4% or  $\Delta HW=-2.3$  billion pesetas. Revenue losses from reduced imputation taxes and property taxes are 0.0064 and 0.0044 billion pesetas, respectively. Additional business taxes yield 0.0961 billion pesetas, and new VAT taxes can be estimated in 0.1328 billion pesetas. The ensuing net revenue effect is:

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<sup>(23)</sup> New business investment generates additional sales and value added, which in turn implies more revenues in an amount that could be non-negligible. Note that value added, VA, equals capital income,  $pK$ , plus wages,  $W$ . Given a fixed labour income share  $W=0.66VA$ ,  $VA/K=3.03\rho=36.1\%$  of the additional capital stock per year when  $\rho=11.9\%$ . New business capital of 3.5 billion pesetas arising from the owner-occupied sector would generate 1.2635 billion pesetas of value added per year. With a VAT tax rate of 16% this translates into 0.2022 billion pesetas per year of additional revenue, or 0.29% of GDP per year.

$$dREV_H = 0.2181 \text{ billion pesetas} = 0.31\% \text{ of GDP}$$

The overall size of the revenue gain from the interaction of lower inflation and the tax treatment of owner-occupied housing is quite large: almost three times Feldstein's estimate for the US and as much as five times the UK's figure<sup>(24)</sup>. However, there should be little surprise once we recall the size of the tax-inflation subsidy to owner-occupied housing and the popularity of home ownership in Spain: the net per capita stock in 1992 was \$26,600, 27% higher than Germany's stock, 31% larger than the US figure and 67% higher than the per capita stock in the UK (see Bakhshi and others, 1997, and Toedter and Ziebarth, 1997).

Turning to the non-owner-occupied sector (second residences and empty houses), the revenue effect is the result of two opposing changes: a transfer of capital to the business sector -which yields additional business taxes and VAT revenues- and a revenue loss from lower property taxes and imputation taxes. The reduction in the stock of houses is 2.3%, or  $\Delta HN = -0.20$  billion pesetas. The additional revenues arising from the business sector are calculated as  $-(0.119 - 0.0772) + 0.361\tau_s \Delta HN = 0.0199$  billion pesetas. The change in property taxes is  $\tau_p z \Delta HN = -0.0007$  billion pesetas and the loss of imputation taxes is  $\tau_h \beta z \Delta HN = -0.0006$ . The resulting net revenue gain is:

$$dREV_N = 0.0186 \text{ billion pesetas} = 0.03\% \text{ of GDP}$$

Consider lastly the rental sector. Given an increase in the user cost of 0.54 p.p., the implied decline in demand is -5.3% or  $\Delta HR = -1.15$  billion pesetas. The revenue impact is fivefold: 1) Increased revenue from business investment:  $-(0.119 - 0.0772)1.15 = 0.0481$  billion pesetas; 2) Additional revenue from VAT taxes:  $-0.361(0.16)(1.15) = 0.0664$  billion pesetas; 3) Loss of interest deductions:  $0.2(0.108 \times 21.7 - 0.088 \times 20.55) = 0.0455$  billion pesetas; 4) Loss of maintenance and depreciation deductions:  $-\tau_h(m + \delta) \Delta HR = 0.0215$  billion pesetas; 5) Loss of property taxes:  $z\tau_p(1 - \tau_h) \Delta HR = -0.0022$  billion pesetas. The revenue effect from all these sources is:

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<sup>(24)</sup>For homogeneity, this comparison does not include sales or VAT taxes.

$$dREV_R = 0.1793 \text{ billion pesetas} = 0.26\% \text{ of GDP}$$

The overall revenue change through all sorts of housing demand is the sum of the former effects:

$$\begin{aligned} dREV_2 &= dREV_A + dREV_W + dREV_N + dREV_R = \\ &= 1.1172 \text{ billion pesetas} = 1.60\% \text{ of GDP} \end{aligned}$$

It should be noted that 70% of this revenue gain comes from two sources: additional VAT taxes (0.59% of GDP) and loss of interest deductions (0.52% of GDP).

In order to calculate the welfare effects of the above revenue gain we have to multiply it by  $\lambda$ . For  $\lambda=0.4$ , it yields 0.64% of GDP, and for  $\lambda=1.5$ , 2.40% of GDP. As can be seen, the welfare revenue gains are quite significant by themselves. Relative to the direct welfare gains, they are roughly similar for low values of the marginal deadweight loss and more than three times as high for high values (see row 4 in Table 3).

Finally, the net welfare gain arising from the effects of a 2 p.p. reduction in inflation upon the housing market is the sum of the direct gain from the reduced distortion and the indirect welfare gain associated with the resulting revenue gains:

$$NG_2 = G_2 + \lambda dREV_2 = (0.69 + \lambda 1.60)\% \text{ of GDP}$$

The overall gain is 1.33% of GDP for  $\lambda=0.4$  and 3.09% of GDP for  $\lambda=1.5$  (see row 4 in Table 3). Not surprisingly, given our previous explanations of the magnitude of the subsidy to owner-occupied housing and of the size of the housing stock in Spain, the net welfare gain is quite large: around six times the figures of the US.

Needless to say, there are margins of uncertainty in our calculations. In this respect, two key parameter values are the housing demand elasticity and the mortgage-value ratio in the owner-occupied tax-advantaged sector. Suppose that the mortgage-value ratio were  $\mu=25\%$  instead of the maintained  $\mu=50\%$ . The resulting overall direct gain would fall by 0.1% of GDP to 0.59%, still a sizable improvement. Revenue gains would decline to 1.29% of GDP from 1.6%, which in turn implies a net welfare gain of 1.11% of GDP for  $\lambda=0.4$  and 2.52% of GDP for  $\lambda=1.5$ . Assume, in addition to  $\mu=25\%$ , that the true value of  $\epsilon_{HR}$  were 0.45 instead of 0.90. The net

gain in this case would be 0.84% of GDP for  $\lambda=0.4$  and 2.00% of GDP for  $\lambda=1.5$ . Therefore, although halving both  $\mu$  and  $\epsilon_{HR}$  reduces our reference estimates by about 35%, it still leaves welfare gains far larger than those found in the US.

### ***2.3. Inflation and the Demand for Money***

#### ***2.3.1. Welfare Effects of Distorting Money Demand***

Perhaps the best-known source of welfare losses resulting from inflation relates to the distortions on money demand. As established in the seminal work of Bailey (1956), an increase in inflation increases the opportunity cost of holding money by raising interest rates, and reduces the level of money holdings relative to the social optimum. This effect ("shoe leather costs") makes inflation socially costly because, as Friedman (1969) noted, money holdings are optimal only when the nominal interest rate is zero, thus equating the marginal utility and the (zero) social marginal cost of money. Consequently, any increase in an already positive nominal interest rates tends to lower the level of money holdings further below the optimum.

Assuming an initial situation characterized by inflation ( $\pi_2$ ) and a positive nominal interest rate ( $i_{n2} = r_{n2} + \pi_2$ ), reducing inflation entails a welfare gain. As shown in Figure 4, which plots the demand for money as a function of the nominal interest rate, a reduction in inflation (from  $\pi_2$  to  $\pi_1$ ) leads to an increase in money demand (from  $M_2$  to  $M_1$ ) and to a welfare gain represented by the area C plus D between the money demand curve and the zero opportunity cost line. As can be seen, the size of the gain crucially hinges on the interest elasticity of money demand.

To compute the welfare gain it is necessary to estimate the change induced by the reduction in inflation on nominal interest rates, and the induced increase in money demand ( $M_1-M_2$ ). At a "true" initial inflation rate ( $\pi_2$ ) of 2% (3.5-15), the net-of-tax return on the debt-equity portfolio in Spain ( $r_{n2}$ ) is 7.31%, thus leading to a nominal interest rate ( $i_{n2}$ ) of 9.31% (7.31+2). When the "true" inflation rate ( $\pi_1$ ) is zero (1.5-1.5), then the real and nominal net-of-tax return ( $r_{n1} = i_{n1}$ ) becomes 7.72% since  $dr_n/d\pi = -0.21$ . Thus the welfare gain corresponding to the area C+D in the Figure is:

$$\begin{aligned}
G_3 &= i_{n1} (M_1 - M_2) + \frac{1}{2} (i_{n2} - i_{n1}) (M_1 - M_2) \\
&= 0.0772 [1 + 0.5 (0.0931 - 0.0772)] (M_1 - M_2) \\
&= -0.08515 \epsilon_M M \frac{1}{r_n + \pi} (0.0159) \text{GDP} \\
&= -0.00135 \epsilon_M \frac{M}{\text{GDP}} (r_n + \pi)^{-1} \text{GDP}
\end{aligned} \tag{14}$$

In Spain, the long-run interest-rate elasticity of money demand ( $\epsilon_M$ ) is estimated to be roughly 0.2, and in 1995 non-interest-bearing money balances amounted to 8,930 billion pts, or 12.8% of GDP (M). Substituting these values into equation (13) yields a total welfare gain of

$$G_3 = 0.04\% \text{ of GDP}$$

As can be seen, the size of the welfare gain associated with the changes in money demand (Bailey effect) is rather small, although almost twice that in the US. This is mainly due to the money-to-income ratio being twice as large in Spain.

### 2.3.2. *Welfare Revenue Effects of Changes in Money Demand*

Following Feldstein (1996), the reduction in inflation leads to changes in government revenue through several channels: the loss of seigniorage associated with the lower 'tax' on money holdings (the Phelps effect); the loss due to the portfolio shift from other productive assets to money balances; and the gain related to the one-time replacement of interest-bearing government debt by higher money balances. These sources of revenue changes are examined in what follows.

The marginal change in seigniorage induced by a unit reduction in inflation is shown in Feldstein (1996) to equal:

$$\begin{aligned}
d\text{Seign}/d\pi &= M + \pi (dM/d\pi) = M/\text{GDP} [1 - \epsilon_M d(r_n + \pi)/d\pi (\pi/r_n + \pi)] \text{GDP} = \\
&= 0.1236 \text{ GDP}
\end{aligned}$$

Thus, the loss of seigniorage will be  $(0.02)(0.1236)\text{GDP} = 0.25\%$  of GDP. As in the US, the Phelps revenue effect is higher than the Bailey money demand effect.

As concerns the revenue loss from shifting capital (taxed) to money balances (non-taxed), since the reduction in productive capital is equal to the increase in money balances, we have that

$$M_1 - M_2 = \varepsilon_M M \frac{i_{n2} - i_{nl}}{i_{n2}} = 0.0044 \text{ GDP}$$

When these assets are invested in productive capital they earn a real pre-tax return of 11.9% but a net-of-tax return of only 7.72%. The difference between them is the combined effective tax rate at the corporate and personal levels. Applying this difference to the reduction in productive capital gives a revenue loss of  $(0.119 - 0.0772)0.0044$  of GDP = 0.02% of GDP.

Concerning the substitution of increased money balances for government debt, this implies a one-time reduction of the stock of government debt and thus a permanent reduction in debt service. Taking a value for the nominal interest on government debt ( $r_{ng}$ ) of 8.5% in 1995, a value for the personal tax rate ( $\theta_m$ ) of 0.3, and a true inflation rate in 1995 of 2.8%, the real net-of-tax interest rate on government debt would be  $(1 - 0.3)8.5\% - 2.8\% = 3.2\%$ , and the reduced debt service in perpetuity  $r_{ng}(M_1 - M_2) = 0.01\%$  of GDP.

Combining the three revenue effects above yields a total revenue loss

$$dREV_3 = -0.25 - 0.02 + 0.01 = -0.26\% \text{ of GDP}$$

In welfare terms, the revenue loss depends on the assumed value of the marginal deadweight loss, amounting to 0.10% of GDP for  $\lambda=0.4$ , and 0.39% of GDP for  $\lambda=1.5$ .

On the basis of the above calculations, the total welfare gain (direct welfare plus indirect welfare revenue effects) can be estimated as:

$$NG_3 = G_3 + \lambda dREV_3 = 0.00037 \text{ GDP} - \lambda 0.0026 \text{ GDP}$$

For  $\lambda=0.4$ , this yields -0.07% of GDP, and for  $\lambda=1.5$ , -0.35% of GDP.

As can be seen, reducing inflation implies overall a welfare loss through the money demand channel. The reason is that the welfare losses arising from the lost revenue more than outweigh the welfare gains resulting from the reduced distortion of money holdings: ie., the Phelps effect dominates the Bailey effect (see row 5 of Table 3).

Finally, it is important to point out that all of the above estimates critically hinge on the value taken for the interest-elasticity of money demand. According to Lucas (1994), the money demand curve becomes infinitely elastic for sufficiently low nominal interest rates. Thus we would be seriously underestimating the direct welfare gain from reducing the distortion on money demand. On the contrary, according to Mulligan and Sala-i-Martin (1996), we would be seriously overestimating the direct welfare gain if it is the case -as the authors claim- that money demand becomes completely interest-rate-inelastic for sufficiently low nominal interest rates. Unfortunately, the empirical work on money demand functions in Spain is based on linearity assumptions and it is not yet possible to know whether we are under- or overestimating the direct welfare gain on money holdings.

#### ***2.4. Debt Service and the Government Budget Constraint***

This final item relates to the higher cost of servicing the national debt that results from a reduction in inflation of 2 p.p. This happens because inflation does not alter the real pre-tax interest rate on government debt while the inflation premium is taxed at the personal level. If the debt-to-income ratio is to be kept constant, then an increase in taxes is required. This, in turn, implies welfare costs insofar as taxes are distortionary.

As shown in Feldstein (1996), in equilibrium the revenue loss resulting from lower inflation can be approximated as the product of the change in inflation ( $d\pi$ ), the effective tax rate ( $\theta_m$ ) and the debt-to-income ratio ( $b$ ):

$$dREV_4 = d\pi \cdot \theta_m \cdot b$$

Considering that in Spain  $\theta_m$  is 30%, and that the relevant<sup>(25)</sup> debt-to-GDP ratio is 40% (once we exclude debt in the hands of both foreign investors and tax-favoured institutional investors), the revenue change is:

$$dREV_4 = -(0.02)(0.3)(0.4) = -0.24\% \text{ of GDP}$$

In turn, the net welfare revenue is:

$$NG_4 = -0.24\lambda$$

which yields -0.10% of GDP for  $\lambda = 0.4$ , and -0.36% of GDP for  $\lambda = 1.5$  (see row 6 of Table 3). These figures are in line with those obtained for the US.

## 2.5. *Total benefits*

Table 3 summarizes our estimates of the permanent annual benefits that can be obtained when moving from low inflation to price stability in Spain. As can be seen from the last three rows of the table, the total welfare effect is in all cases positive and sizable, ranging from 1.71% to 2.87% of GDP<sup>(26)</sup>.

While the values presented in the table correspond to different assumptions regarding the marginal deadweight loss per peseta of additional revenue ( $\lambda$ ) and the interest elasticity of saving ( $\eta$ ), some of these assumptions are more plausible than others. In particular, the empirical evidence available for Spain suggests that  $\lambda$  is very close to 0.4, and that  $\eta$  is somewhere between 0-0.2. Under this more realistic scenario, the annual welfare benefits are estimated to be still quite significant, ranging from 1.71 to 1.88% of GDP.

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<sup>(25)</sup> If debt holders are tax-exempt to begin with, then there are no revenue losses.

<sup>(26)</sup> It could be claimed that we are not taking into account the welfare losses resulting from the need to raise distortionary taxation to finance the revenue shortfall and higher unemployment compensation payments stemming from the lower output -transitorily or permanently- induced by the disinflation process and discussed in Section 1 of the paper. In the case of Spain, our calculations show that this would amount, on welfare terms, to less than 0.1% of GDP in the more realistic scenario of  $\lambda=0.4$ , and to 0.3% of GDP when  $\lambda=1.5$ . These calculations are available upon request.



As can be seen, the four types of effects considered in the table contribute quite differently towards the total net welfare effect. While the changes induced by lower inflation on retirement consumption and housing demand contribute favourably to the total welfare effect, the induced changes in money demand and in the cost of servicing the public debt make a negative contribution. Under the most realistic scenario, the first two factors amount to 1.88-2.05% of GDP, and the other two to -0.17% of GDP.

Another interesting feature is that both the direct welfare effect and the indirect welfare revenue effect are positive when we aggregate over the four economic categories in the table. Nevertheless, it should be observed that the traditional direct welfare effect is significantly higher than the indirect effect. For instance, under the more realistic scenario, the direct effect ranges from 1.52 to 1.64% of GDP, while the indirect effect ranges from 0.20 to 0.25% of GDP. So, while the conceptual framework employed in the paper has clearly gained from the inclusion of the indirect revenue effects together with the traditional direct welfare effects, under our more realistic scenario this does not seem empirically to make a big difference.

Finally, it is worth mentioning that the net welfare gains of achieving price stability increase with the marginal deadweight loss and with the interest elasticity of saving. One reason is that since a reduction of inflation increases total revenue, it allows other distortionary taxes to be reduced. Thus the larger the marginal deadweight loss per peseta of additional revenue, the higher the welfare revenue gain. The other reason is that the more interest-elastic saving is, the larger the favourable effect of a reduction in inflation on the amount of retirement consumption purchased by individuals and the lower the revenue loss.

Table 4 presents the values of the underlying variables and parameters used in evaluating the benefits of going to price stability in Spain (and in the US), and Table 5 presents a comparison of our results with those obtained by Feldstein (1997) for the US within the same conceptual framework. For the sake of comparability, we take  $\lambda=0.4$  and  $\eta=0$ , which correspond to our more realistic scenario. As can be seen by looking at the last row, the total net welfare gain is almost three times larger in Spain (1.71% of GDP) relative to the US (0.65% of GDP). This is mostly due to the very different net gains associated with the effect of a reduction in inflation on the demand for housing (1.33% of GDP in Spain for 0.22% in the US). For the other

three economic categories, the gains are remarkably similar, as can be seen in the last column of the table. According to our analysis, the much larger effects of reduced inflation on housing demand in the case of Spain mainly reflect the much higher ratio of housing values to GDP in our case and the enormous implicit subsidy that tax rules and inflation give to the purchase of owner-occupied houses. Of course, both factors are deeply interrelated from a general equilibrium viewpoint.

### 3. COSTS AND BENEFITS COMPARED

#### *3.1. Benefits minus costs*

The most important difficulty with which economists are faced when examining the costs and benefits of moving from low inflation to price stability is the absence of a fully satisfactory general equilibrium theory of money. In this paper, we have followed the more pragmatic route of combining a macroeconomic estimate of the costs and a microeconomic estimate of the benefits of achieving price stability in Spain within an admittedly partial equilibrium framework. Rather than trying to identify and quantify all of the various channels through which the inflationary process entails costs and benefits, we have focused only on those channels that we think are most important.

Table 6 summarizes our estimates of both the costs and the benefits of achieving price stability in Spain. As regards the costs, we have relied on estimates of the sacrifice ratio to arrive at a rough figure for how costly it is to move to price stability in terms of lost output. We have concluded that in Spain such costs are equivalent to 0.6 to 1% of GDP per year on a permanent basis. As regards the benefits, we have adopted Feldstein's (1996) approach and focused on the interactions between inflation and capital income taxation. Since inflation leads to increases in the effective rate of capital income taxation in non-fully indexed tax systems, it distorts consumption-saving decisions and asset allocation decisions, resulting in welfare losses. Our empirical estimates of the welfare gains to be obtained from achieving price stability in Spain -shown in Table 3- are quite sizeable by international standards, ranging from 1.7 to 2.9% of GDP per year on a permanent basis, depending on the assumptions made about the marginal deadweight loss of raising revenue and the interest elasticity of saving. In what we consider to be the more realistic scenario, the benefits are estimated to be 1.7 to 1.9% of GDP per year on a

permanent basis. Consequently, the net benefit (benefit minus costs) of going from low inflation to price stability in Spain is estimated to be -in the more realistic scenario- 0.7 to 1.3% of GDP per year on a permanent basis. Thus, according to our preliminary results, achieving price stability seems to be a worthwhile enterprise.

Given that our paper applies Feldstein's (1996) methodology to Spain, it is useful to compare our results to those obtained by this author for the US. If we take Feldstein's more realistic scenario, then the estimated output costs of achieving price stability in the US are equivalent to 0.16% of GDP per year on a permanent basis<sup>(27)</sup>, while the estimated benefits are 0.6-1% of GDP per year on a permanent basis. This yields an annual net benefit of 0.5-0.8% of GDP, which is similar although somewhat smaller than the 0.7-1.3% of GDP that we find for Spain. Excluding the revenue effects from VAT taxes, which do not exist in the US, the annual net benefit for Spain would fall to 0.5-1.0% of GDP, which is almost identical to the US range of estimates.

The similarity between the estimated net benefits of achieving price stability in Spain and the US is rather striking considering the very significant differences in their respective economic structures and tax systems. Still, it happens to be the case that while the costs of achieving price stability are significantly higher in Spain so are the benefits, thus leading to net benefits of the same order of magnitude in both cases.

### ***3.2. Some Caveats***

As emphasized earlier, our calculations of the net benefits of going from low inflation to price stability are based on a relatively simple partial equilibrium framework. Still, even if we keep to the methodology that we have followed there are a number of factors that should be mentioned to get some idea of the margin of uncertainty of our cost and benefit estimates.

Regarding the costs, since our simple macromodel is linear it does not take into account the possibility -often mentioned- that the Phillips curve becomes flatter

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<sup>(27)</sup> While Feldstein finds the output costs of disinflation to be transitory in the US, the figure mentioned in the text corresponds to an annuity which has the same present value as the cumulative transitory output costs.

as the inflation rate gets lower, thus making it costlier to achieve a given reduction in inflation<sup>(28)</sup>. While there is no empirical evidence on this issue in the Spanish case, if the above criticism were valid we would be underestimating the true output costs of further reducing inflation. This is, nevertheless, not the only -nor possible the most important- source of bias in our estimate of the costs of reducing inflation. Indeed, it could seriously be claimed that we have overestimated the output costs of achieving further disinflation in Spain since anti-inflationary policies are now more credible and the degree of downward wage and price flexibility higher than in the past. While it is hard to assess which of the two biases is likely to be larger, the recent performance of the Spanish economy indicates that the disinflation process has tended to become easier in recent years, even as the inflation rate has been progressively lowered. This would suggest that, if anything, we may have empirically overestimated -rather than underestimated- on balance the true output costs of achieving price stability in Spain today.

As regards the benefits, by focusing on the interaction between inflation and capital income taxation, we have omitted other interactions with the tax system that could lower our estimated welfare gains from reducing inflation. In particular, as noted by Persson, Persson and Svensson (1996), shifting to a lower rate of inflation has a permanent negative effect on tax revenues due to incomplete or delayed indexation of the transfer payment system, and partial indexation of personal income tax brackets in progressive tax systems. Against this, it can be argued that with a lower inflation rate there is also a permanent increase in the real value of the tax revenues collected, insofar as tax collection lags behind the actual generation of income. While we have not attempted to make such estimates for Spain, the evidence presented by Persson, Persson and Svensson for Sweden suggests that, overall, our benefits could be overestimated.

On the other hand, there are also a number of benefits associated with lowering inflation that have nothing to do with the tax system and which have not

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<sup>(28)</sup> As recently suggested by Akerlof, Dickens and Perry (1996), reaching an inflation rate which is low enough to be consistent with price stability may deprive policymakers of the possibility of achieving the real wage cuts that are needed for the economy to perform adequately. Yet, it is unclear to us why those real wage cuts may not also be obtained through nominal wage cuts in an environment where price stability prevails. Furthermore, it could be argued that in countries with wage indexation mechanisms -like Spain-, going to a low enough rate of inflation leads to a deactivation of such mechanisms, thus improving real wage flexibility.

been considered in our analysis, like the saving from not having constantly to revise prices (menu cost), the more efficient allocation of resources which comes with lower -and thus generally more stable- inflation rates, and the redistribution of income and wealth in favour of those with fewer resources to protect themselves against inflation. While these benefits are quite hard to quantify reliably, they may nevertheless be significant.

It is evident from the above that it is rather difficult at this stage to ascertain the net effect of the various factors mentioned regarding the net benefits of going from low inflation to price stability. Nevertheless, it is comforting to know that the sources of bias might, to some extent, cancel each other out.

Another word of caution concerns the considerations relating to the time profile of costs and benefits in our calculations. Regarding the costs, timing consideration have been taken fully into account when computing in Section 2 the 'cost annuity' which is equivalent in present value to the transitory output losses resulting from disinflation. Nevertheless, regarding the benefits we have followed Feldstein (1996) in assuming that all the adjustments to the new equilibrium with price stability take place instantaneously, and thus that the 'steady state' benefits are obtained from year 1. Thus, if it turned out to be the case that these adjustments take several years to be completed, this would reduce the estimated 'benefit annuity'. This effect might be particularly relevant in the case of the demand for housing given the structural characteristics of the housing market. Since the reduced housing distortion accounts for three-quarters of the estimated total welfare gain of 1.7-1.9% of GDP per year in our more realistic scenario (see Table 3), this downward revision might be non-negligible.

In order to assess how important these time profile considerations are, we have considered how our net benefit calculations would be affected if, for example, the benefits stemming from housing demand were to occur, say, only after 5 or 10 years rather than instantly. If we take, for simplicity, the more realistic scenario of  $\lambda=0.4$  and  $\eta=0.0, 0.2$ , our findings are that the benefits are always higher than the costs in the five year case, while in the ten year case annual benefits range from 1-1.1% of

GDP relative to costs of 0.6-1% of GDP<sup>(29)</sup>. Consequently, it would seem that our conclusions would continue to hold even when considering significant delays in the benefits accruing from housing.

To check how robust our results are, we have carried out sensitivity analysis by allowing some of the parameters to take a range of values containing those reference estimates considered in the main text<sup>(30)</sup>. In particular, we have specified the following ranges for the key parameters  $\eta$ ,  $\epsilon_{HR}$ ,  $\lambda$  and  $\mu$ :  $\eta=0.0, 0.1, \dots, 0.4$ ;  $\epsilon_{HR}=0.5, 0.6, \dots, 0.9$ ;  $\lambda=0.4, 0.5, \dots, 1.5$ ; and  $\mu=0.25$  and  $0.50$ . These ranges give rise to 600 possible calculations of net benefits (benefits minus costs) which have been tabulated in Table 7 for three alternative values of  $T$  (the number of years after which the housing benefits accrue). As can be seen from the table, insofar as the housing benefits start accruing within the first five years, it is very likely that the benefits of going to price stability will continue to exceed the costs.

A criticism that can be made regarding our conclusions is that since the welfare benefits from lower inflation could be obtained alternatively through first-best tax-reform at an unchanged rate of inflation, it is fiscal policy rather than monetary policy that should be adjusted to reap the ensuing welfare gains. The problem is, however, that in practice it is very difficult to foresee such a radical tax reform as a result of well-known political economy problems.

In the same vein, it could be argued that once disinflationary demand policies have been undertaken -and the output costs being born-, if there were a future tax-reform of the sort described above, there would be then no more benefits to reap from having achieved price stability after such reform is in place, thus leading to an unfavourable 'ex post' relationship between benefits and costs. A reply to this would be that, insofar as a fully comprehensive tax reform doesn't come very early in time, it will still be worthwhile to undertake demand policies oriented towards price

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<sup>(29)</sup> In particular, the benefits (B) will be larger than the costs (C) in annuity terms if  $B = x_R + x_H e^{-\rho T} > C$ , where  $x_R$  are the annual benefits other than housing and  $x_H$  are the annual housing benefits starting to accrue after  $T$  years ( $T=5,10$ ).

<sup>(30)</sup> While, for the sake of comparability with the other country studies contained in this volume, we have omitted in our benefits calculations summarized in Table 3 the impact of the net revenue losses arising from the output costs due to disinflation (ie. payments for unemployment compensation), these nevertheless were taken into account when elaborating Table 7.

stability. In fact, for Spain we have calculated that, in the case of temporary output costs -which are born mainly during the first five years-, going to price stability would be justified on benefit-cost grounds insofar as the tax reform does not happen during the first six years. For the case where the output costs are permanent, going to price stability would be justified insofar as the tax reform does not take place during the first eleven years.

To conclude, it is evident from the above paragraphs that our cost-benefit analysis of achieving price stability in Spain is merely a very rough and preliminary attempt to study a very complex phenomenon. Still, since it captures some of what are generally considered to be the most important costs and benefits it is a useful starting point. According to our empirical results, going from low inflation to price stability in Spain seems to be a worthy enterprise, yielding a net beneficial effect of 0.7 to 1.3% of GDP per year in the more reasonable scenarios.

**Table 1**  
**Summary Statistics**

Sample period	Unemployment		Inflation		Sample correlation
	$\bar{u}$	$s_u$	$\bar{\pi}$	$s_{\pi}$	
1964:1 - 1970:1	1,23	0,25	6,20	3,65	0,71
1970:2 - 1973:3	1,77	0,53	7,95	1,88	0,71
1973:4 - 1979:2	4,70	1,79	16,90	3,13	0,32
1979:3 - 1986:1	16,25	4,10	12,07	2,27	-0,90
1986:2 - 1991:4	18,33	1,94	6,08	9,15	-0,04
1992:1 - 1994:1	21,01	2,70	5,08	0,76	-0,80
1992:1 - 1995:4	22,05	2,36	4,85	0,65	-0,79

Note:  $\bar{x}$  denotes the sample mean and  $s_x$  the sample standard deviation ( $x = u, \pi$ ).



**Table 2**  
**The output costs of moving to price stability**  
**(in % of GDP per year)**

Dolado, López-Salido and Vega <sup>(1)</sup> (1996)-Spain	1.0
Andrés, Vallés and Mestre (1996)-Spain	0.9
Ball (1996) - cross section of OECD countries	1.1-1.7
This paper-Spain	0.6-1.0

Note: <sup>(1)</sup> Monetarist case.

**Table 3**  
**The Net Welfare Effect of Achieving Price Stability**  
(evaluated as a percent of GDP for an inflation reduction of 2 p.p.)

Source of change		Direct Effect of Reduced Distortion	Welfare Effect of Revenue Change		Total Effect	
			$\lambda=0.4$	$\lambda=1.5$	$\lambda=0.4$	$\lambda=1.5$
Consumption timing	$\eta=0$	0.79	-0.24	-0.88	0.55	-0.09
	$\eta=0.2$	0.91	-0.19	-0.72	0.72	0.19
	$\eta=0.4$	1.03	-0.15	-0.56	0.88	0.47
Housing Demand		0.69	0.64	2.40	1.33	3.09
Money Demand		0.04	-0.10	-0.39	-0.07	-0.35
Debt Service			-0.10	-0.36	-0.10	-0.36
Totals	$\eta=0$	1.52	0.20	0.77	1.71	2.29
	$\eta=0.2$	1.64	0.25	0.93	1.88	2.57
	$\eta=0.4$	1.76	0.29	1.09	2.04	2.87

**Notes:**

$\eta$ : uncompensated interest rate elasticity of savings.

$\lambda$ : marginal deadweight loss per peseta of additional revenue.

The shaded areas show what we consider to be the more realistic figures for Spain given the available evidence on  $\lambda$  and  $\eta$ .

**Table 4**  
**Underlying Variables and Parameters in the Evaluation of the**  
**Benefits of Going to Price Stability (Spain vs. US)**

VARIABLE/PARAMETER	Spain	US
<u>Fiscal</u>		
Average tax on corporations	23%	41%
Marginal corporate income tax	35%	35%
Marginal capital income tax on individuals	26%	25%
Effective marginal tax on capital gains	11%	10%
Rate of property tax	1%	2.5%
Tax credit on value of the house	15%	-
Marginal deadweight loss	0.4, 1.5	0.4, 1.5
<u>Financial</u>		
Pretax real return to capital in corporate sector	11.9%	9.2%
Debt/capital in corporations	50%	40%
Share of equity in individuals' portfolio	66%	60%
Interest paid on mortgage	10.8%	7.2%
Value of owner occupied housing as a proportion of GDP	184%	105%
Currency plus bank reserves as a proportion of GDP	12.8%	6.1%
Relevant Govt. debt as a proportion of GDP	40%	50%
Mortgage as a proportion of the value of owner-occupied house	50%	20-50%
Maintenance cost	2%	2%
Rate of depreciation	2.2%	2%
<u>Macroeconomic</u>		
Rate of growth of the wage bill	2.8%	2.6%
Inflation average	5.6%(1985-95)	4.7%(1960-94)
Current inflation	3.5% (1996)	2.9%
Inflation bias	1.5%	2.0%
GDP growth	2.5%(1964-95)	2.5%(1970-94)
Share of wages in GDP	66%	75%
Saving of the young in percent of GDP	14%	9%
<u>Behavioural</u>		
Elasticity of saving wrt real net of return	0, 0.2, 0.4	0, 0.4, 1.0
Compensated elasticity of housing demand wrt rental pricing	0.9	0.8
Elasticity of demand for money wrt interest rate	0.2	0.2
Propensity to save	0.21	0.12

Source: Feldstein (1996) and own elaboration.

**Table 5**  
**Comparison of Net Welfare Effects: Spain vs. US**  
(evaluated as a percent of GDP for an inflation  
reduction of 2 p.p. where  $\eta=0$  and  $\lambda=0.4$ )

	Direct		Revenue		Total		Difference
	<u>SPAIN</u>	<u>US</u>	<u>SPAIN</u>	<u>US</u>	<u>SPAIN</u>	<u>US</u>	
Consumption timing	0.79	0.73	-0.24	-0.17	0.55	0.56	-0.01
Housing Demand	0.69	0.1	0.64	0.12	1.33	0.22	+1.11
Money Demand	0.04	0.02	-0.10	-0.05	-0.07	-0.03	-0.04
Debt Service	-	-	-0.10	-0.10	-0.10	-0.10	0
Totals	1.52	0.85	0.20	-0.21	1.71	0.65	+1.06

**Note:** US figures taken from Feldstein (1997).

**Table 6**  
**Summary of Benefits and Costs of**  
**Achieving Price Stability in Spain**

Permanent annual benefits and costs of going from low inflation to price stability  
(evaluated as a percent of GDP for an inflation reduction of 2 p.p.)

		$\lambda = 0.4$	$\lambda = 1.5$
<b>BENEFITS</b>			
	$\eta=0$	1.71	2.29
	$\eta=0.2$	1.88	2.57
	$\eta=0.4$	2.04	2.87
<b>COSTS</b>		0.60-1.00	0.60-1.00
<b>BENEFITS minus COSTS</b>			
	$\eta=0$	0.71-1.11	1.29-1.69
	$\eta=0.2$	0.88-1.28	1.57-1.97
	$\eta=0.4$	1.04-1.44	1.87-2.27

The shaded areas correspond to the scenario which seems to be more plausible for Spain on the basis of the available empirical evidence on  $\lambda$  and  $\eta$ .

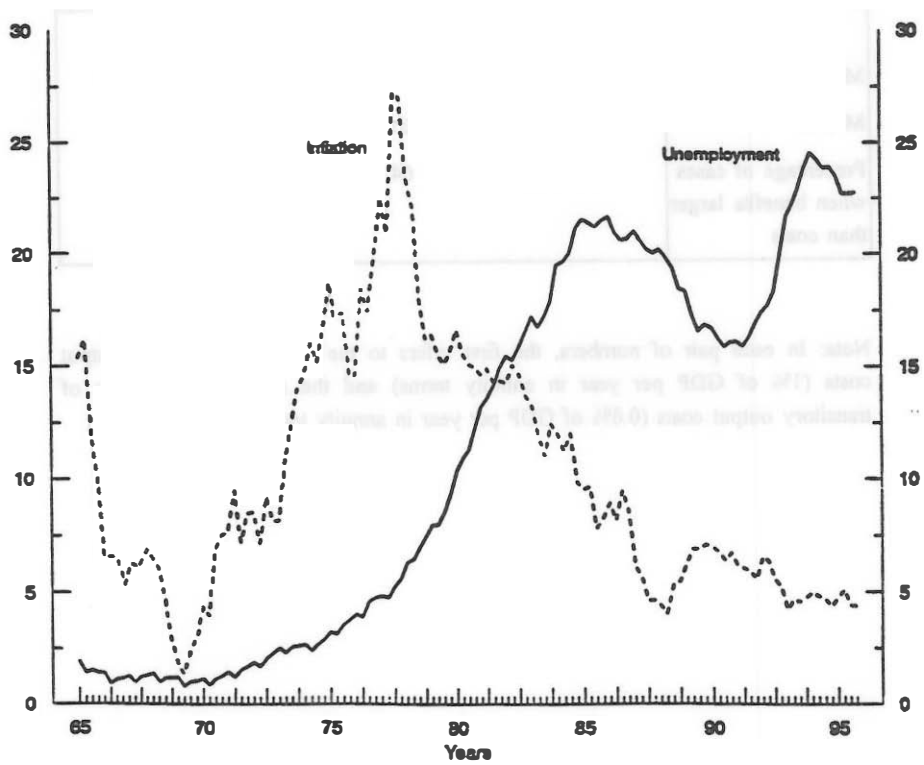
**Table 7**  
**Sensitivity analysis**  
(benefits minus costs, in % of GDP)

	T=0	T=5	T=10
Mean value	0.62 , 1.09	0.12 , 0.53	-0.29 , 0.14
Median	0.60 , 1.14	0.09 , 0.59	-0.22 , 0.21
Percentage of cases when benefits larger than costs	94.1 , 100	64.7 , 92.8	37.7 , 53.6

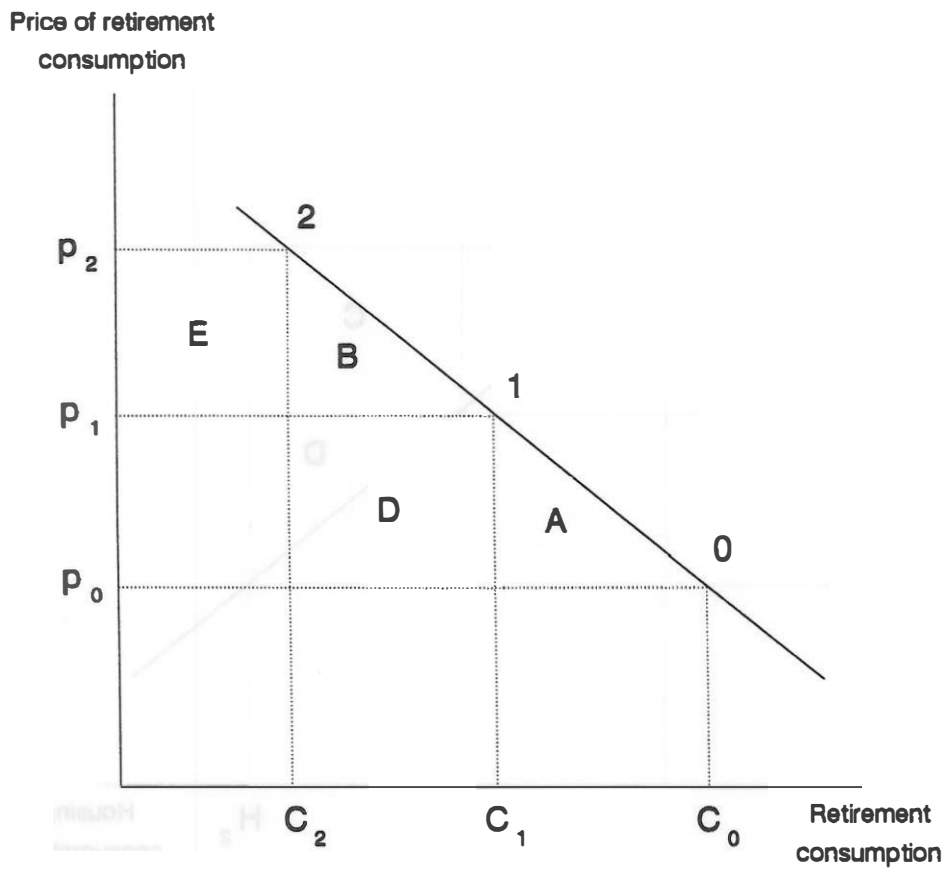
Note: In each pair of numbers, the first refers to the case of permanent output costs (1% of GDP per year in annuity terms) and the second to the case of transitory output costs (0.6% of GDP per year in annuity terms)

FIGURE 1

### INFLATION AND UNEMPLOYMENT IN SPAIN



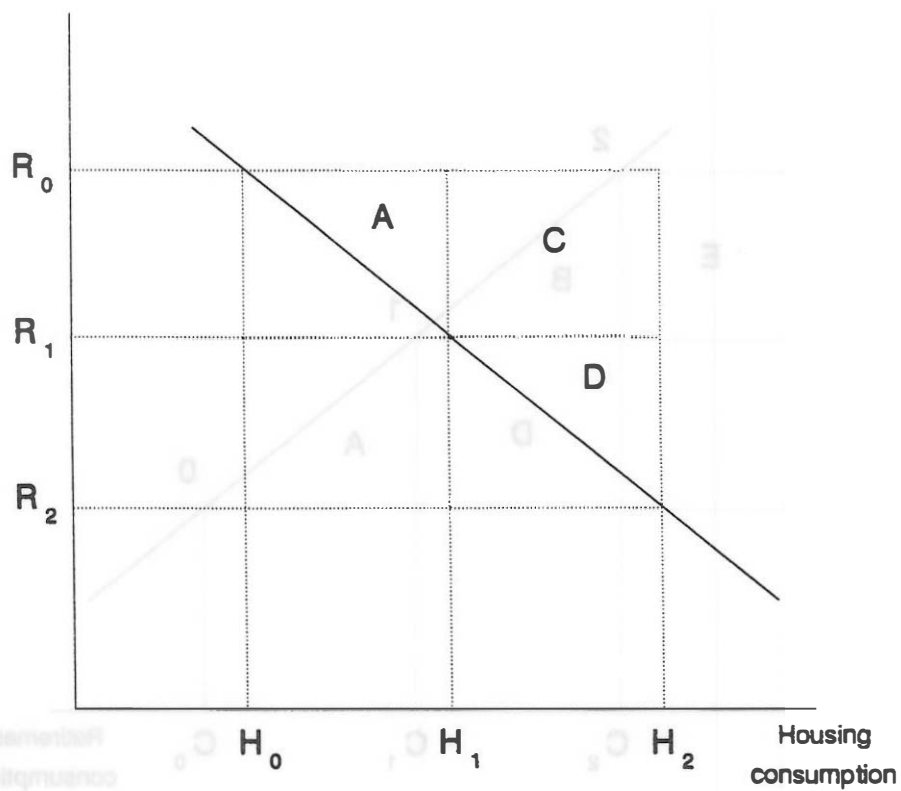
**Figure 2: Retirement consumption**



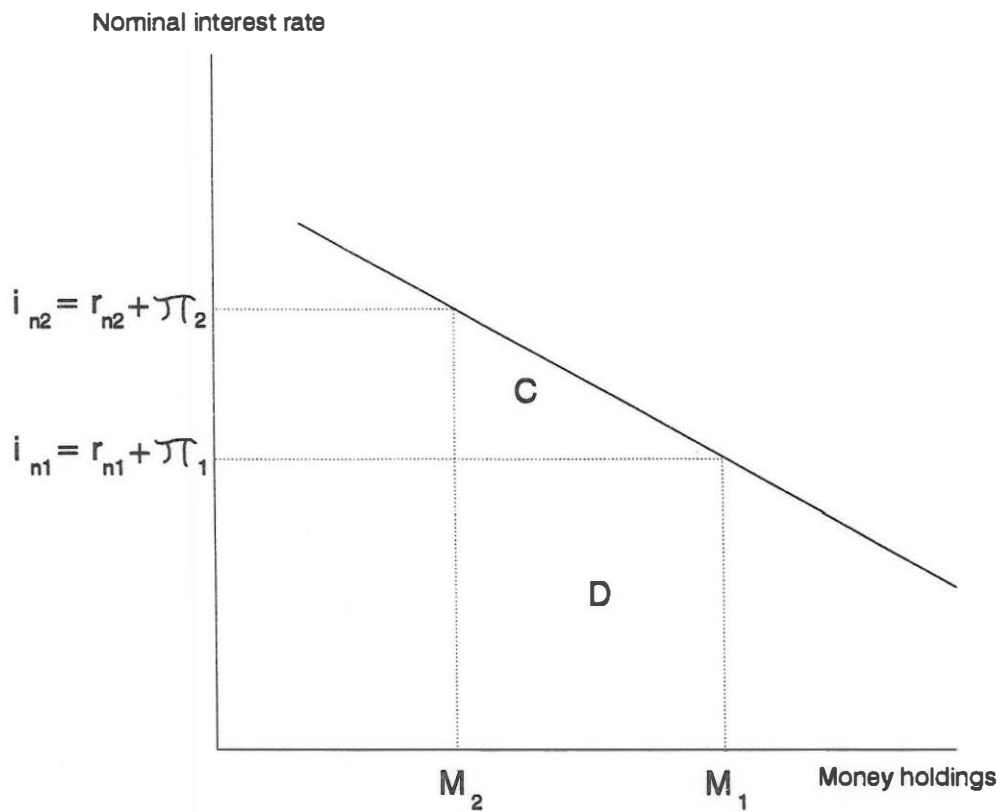


**Figure 3: Housing**

Rental equivalent per  
peseta of house



**Figure 4: Money demand and seigniorage**





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