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3 A Cost-Benefit Analysis of Going from Low Inflation to Price Stability in Spain

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One of the most significant general economic developments of recent years in the 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 that 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 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 percentage points higher than the average of the three lowest in the European Union. Furthermore, the statutes of the future European System of Central

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Banks establish price stability as the primary goal of European monetary policy.

At the end of 1996, when this paper was written, the annual inflation rate in the European Union stood at 2.5 percent, a significant improvement from the 6 to 7 percent registered in the previous decade. Nevertheless, since price stability is typically taken to mean an inflation rate of between 1 and 2 percent, and 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, it is expected that further disinflation will 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 of moving 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 that started in the second half of the seventies, the average annual inflation rate still stood around 3.5 percent at the end of 1996. If for the sake of simplicity we define price stability as the midpoint of the 1–2 percent inflation range (1.5 percent), then moving from low inflation to price stability implies further lowering inflation by about 2 percentage points.[1]

While we have followed the above route for the sake of comparability with the other country studies in this volume, there is admittedly 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 percent—rather than 1.5 percent—more adequately represents price stability, then going from low inflation to price stability would mean further lowering inflation by 1.5 rather than 2 percentage points. In this case, the cost and benefit estimates presented in the paper could easily be rescaled.

Because the channels though which inflation affects the economy are multiple and highly complex (see Fischer and Modigliani 1978; Fischer 1994), any empirical analysis of the gains and losses to be made when lowering inflation is bound to be partial and highly speculative. The route taken in this paper—within the framework of the NBER project on the costs and benefits of achieving price stability—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 (1997) 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

1. An inflation rate of 1.5 percent probably comes close to being the upper bound of what we guess could be the measurement bias in the Spanish consumer price index (CPI). Unfortunately, no specific estimates of this bias are reported for Spain.

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 further economic benefits. All in all, however, the assessment provided in this paper is a useful starting point for ascertaining whether policies geared toward achieving price stability in Spain are justified from the standpoint of the general interests of society.

The rest of the paper is structured as follows. Section 3.1 assesses the likely economic costs of reducing inflation by 2 percentage points in Spain by estimating a simple two-equation macromodel of inflation and unemployment. Section 3.2 calculates the size of the likely economic benefits of reducing inflation by 2 percentage points, 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.

3.1 Measuring the Costs of Disinflation

The purpose of this section is to estimate the "sacrifice ratio" for the Spanish economy, that is, how much output will be lost for 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 that 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, López-Salido, and Vega (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 3.1 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 3.1 reports means, standard deviations, and correlations for various subintervals in the 1964:1–95:4 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 1986–91 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 macromodel.

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

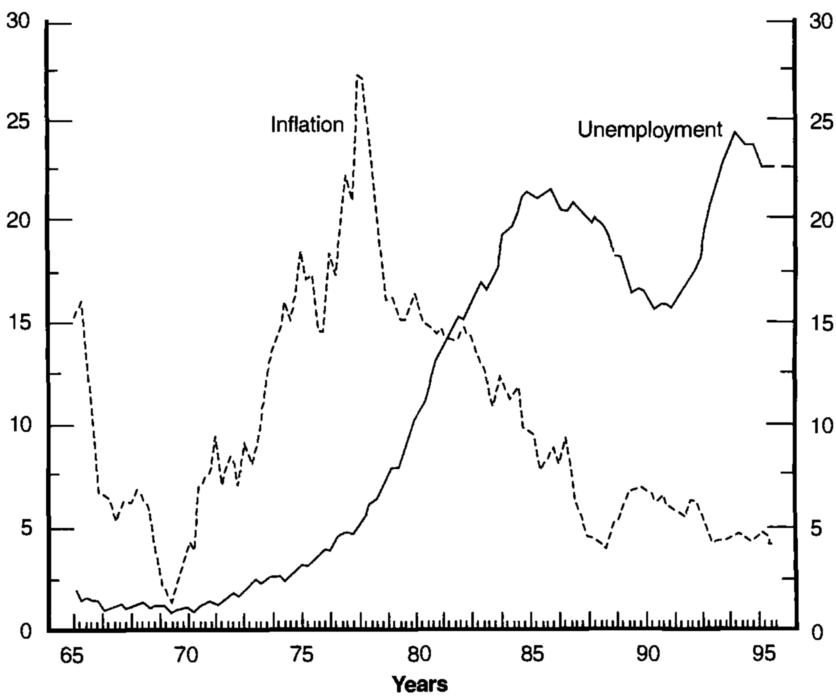

Fig. 3.1 Inflation and unemployment in Spain

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

$$(2) \qquad \Delta u_t = \lambda\Delta\pi_t + \sum_{j=1}^{p} \alpha_{u\pi,j}\Delta\pi_{t-j} + \sum_{j=1}^{p} \alpha_{uu,j}\Delta u_{t-j} + \varepsilon_{dt}.$$

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 error term ε_{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 error term ε_{dt} is the "demand" shock.

The variables in the equations are expressed in first-difference form since u_t and π_t show clear signs of unit-root behavior and are non-cointegrated over the sample period. Under the present specification, the "long-run" effects of disturbances ε_{dt} and ε_{st} can be estimated. In particular, the sacrifice ratio stemming from a disinflationary process can be computed as

$$\sum_{k=0}^{\infty}\left(\frac{\Delta u_{t+k}/\Delta\varepsilon_{dt}}{\Delta\pi_{t+k}/\Delta\varepsilon_{dt}}\right) \quad \text{when } \Delta\pi_{t+k} = -1 \quad \text{for } k \to \infty.$$

Table 3.1 **Summary Statistics**

Sample Period	Unemployment $\bar{u}$	Unemployment s_u	Inflation $\bar{\pi}$	Inflation s_π	Sample Correlation
1964:1–70:1	1.23	0.25	6.20	3.65	0.71
1970:2–73:3	1.77	0.53	7.95	1.88	0.71
1973:4–79:2	4.70	1.79	16.90	3.13	0.32
1979:3–86:1	16.25	4.10	12.07	2.27	−0.90
1986:2–91:4	8.33	1.94	6.08	9.15	−0.04
1992:1–94:1	21.01	2.70	5.08	0.76	−0.80
1992:1–95:4	22.05	2.36	4.85	0.65	−0.79

Note: $\bar{x}$ denotes the sample mean, and s_x the sample standard deviation ($x = u, \pi$). The sample correlations correspond to the HP filtered series.

Naturally, a preliminary step to be discussed is how the primitive shocks are estimated since the previous structural system is not identified without further restrictions. Thus, as is standard in the vector autoregression (VAR) literature, we estimate the reduced-form VAR model

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

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

(where $a(L)$, $b(L)$, $c(L)$, and $d(L)$ are polynomials in the lag operator L) and recover the structural shocks from the residuals in equations (3) and (4). To do so, we assume, as is customary, that the demand and supply shocks are orthogonal plus the following restriction: in the long run, inflation is purely a monetary phenomenon; that is, the long-run stochastic trend of inflation is governed only by demand shocks.[2] Nevertheless, it should be noted 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.[3]

The structural VAR model is estimated for Spain for the period 1964:1–95:4, yielding estimates regarding the unemployment costs of permanently bringing down inflation at different horizons.[4] In particular, after five years the long-run sacrifice ratio (in terms of higher unemployment per percentage point reduction in inflation) is estimated to be 1.3. Using Okun's law (around 2.0 for Spain)

2. While other identifying restrictions were considered that 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 et al. (1996) for a comparison of the three cases.

3. This is so because the long-run Phillips trade-off, i.e., lim $(\Delta\mu_{t+k}/\Delta\varepsilon_{dt})/(\Delta\pi_{t+k}/\Delta\varepsilon_{\pi t})$ 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 eqs. (3) and (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 $d = 0$.

4. The VAR is estimated using first differences of EU12 inflation and unemployment rates as exogenous conditioning variables.

Table 3.2 Output Costs of Moving to Price Stability

Authors	Country	Output Loss (% o GDP per year)
Dolado, López-Salido, and Vega[a] 1996	Spain	1.0
Andrés, Vallés, and Mestre 1996	Spain	0.9
Ball 1997	Cross section of OECD countries	1.1–1.7
This paper	Spain	0.6–1.0

[a]Monetarist case.

to express the sacrifice ratio in terms of cumulative output losses (every five years) per percentage point of inflation reduction, it becomes 2.6 percent of GDP. This implies that the cost of reducing inflation by 2 percentage points in Spain is about 1 percent of GDP per year, its permanence being due to the existence of full hysteresis.[5]

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 3.2). 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 percentage points. They conclude that these costs are about 0.9 percent of GDP per year on a permanent basis, which is very similar to the 1 percent of GDP we find under our identification restriction. Other authors, however, obtain once-and-for-all (rather than permanent) output costs. For example, according to Ball (1994), reducing inflation by 2 percentage points would lead in Spain to a cumulative total output loss of slightly less than 2 percent 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 (1997) himself presents cross-sectional empirical evidence that suggests that hysteretic effects have been common in OECD countries during recent disinflationary episodes. His results suggest that a permanent reduction in inflation by 2 percentage points comes with a permanent annual output loss of about 1.1 percent of GDP—a number remarkably close to the 1 percent estimated with our small macromodel.

So far, we have relied on the sacrifice ratio computed from the bivariate VAR model for the Spanish economy that was presented in equations (3) and (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 a purely monetary phenomenon in the

5. 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) percent.

long run. Therefore, it is important to explore whether this result is robust 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 these 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 that contains information about "nonmonetary" shocks so that ε_{dt} can be interpreted appropriately. Empirically, this is done by adding lagged values of x_t to the system of equations (3) and (4), allowing x_t to be influenced by contemporaneous values of u_t and π_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) to be suitable. 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 percentage points of inflation reduction. These numbers are about twice those taken by Feldstein (1997) as representative of the total output cost for the United States, which seems about right given the significantly larger increases in unemployment registered in Spain during past disinflationary episodes.

As shown, new results arising from attempting to distinguish between monetary and nonmonetary shocks yield very different implications regarding whether a long-run trade-off between inflation and unemployment exists (i.e., 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 easily be 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 percent 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 3.3. 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 percent in the Madrid Stock Exchange for the 1985–95 period) and the average real growth rate of the economy (2.5 percent in Spain).[6] This yields an equivalent permanent annual stream of costs of 0.6 percent of GDP, which is significantly below the permanent annual loss of 1 percent of GDP estimated with the original version of the model.

Thus, while there may be some controversy about whether the costs of mov-

6. See section 3.3 for the derivation of the discount rate. While the cumulated output loss is 10 percent of GDP, its present value is 9.1 percent of GDP. Thus (0.07)(9.1) = 0.64 percent of GDP.

ing from low inflation to price stability in Spain are transitory or permanent, and while recognizing that this as yet unsettled empirical issue has profound 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 percent of GDP in the transitory case and 1 percent 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 if the benefits from such a move are at least 0.6 to 1 percent of GDP per year on a permanent basis (see table 3.2).

It can be reasonably claimed that the estimates we and other researchers obtain for the sacrifice ratio in Spain may understate the true output costs of going from low inflation to price stability because these costs are likely to increase as the inflation rate gets lower (i.e., 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 overstate the actual costs of disinflation to be faced by the Spanish authorities nowadays. First, our experience has been that with sufficiently low rates of inflation, indexation mechanisms are deactivated, which enhances relative price and real wage flexibility. And second, 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 greatly enhanced, the Banco de España has been granted 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 far lower than in the past given the strengthened anti-inflationary credibility of macropolicies 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 past few years, when progress on the inflationary front has been achieved with 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 percent of GDP per year that we use as a benchmark for comparison with benefits probably overestimates to some extent the true costs involved in moving toward 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 toward price stability in Spain is a worthy enterprise.

3.2 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 0.6 to 1 percent 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, forthcoming), we follow the more modest—but more feasible—route of simply assessing the benefits stemming from the interrelationship between inflation and the tax system.[7] In what follows, we apply to the Spanish economy Feldstein's framework (chap. 1 in this volume), 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 demand for money and to 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.

3.2.1 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, associated effects on government revenue need to be taken into account since a loss (gain) of revenue would have to be offset by 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.

Welfare Gain from Reduced Distortions in Intertemporal Consumption

Following Feldstein (1997), 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, the price of retirement consumption (p) that is purchased through saving is inversely related to the real rate of return. As the negatively sloping compensated demand curve in figure 3.2 shows, the amount of retirement consumption (C)

7. Note that these benefits arise from lowering the rate of inflation even if it is perfectly anticipated.

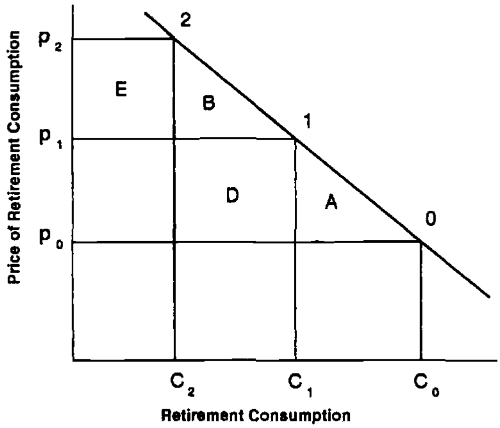

Fig. 3.2 Retirement consumption

purchased by individuals becomes lower when its price (p) 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).[8]

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, as depicted in figure 3.2.

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

$$(5)\quad \text{Deadweight gain} = G_1$$

$$= \left(\frac{p_1 - p_0}{p_2} + \frac{1}{2}\frac{p_2 - p_1}{p_2}\right)\left(\frac{p_2 - p_1}{p_2}\right) S_2(1 - \eta_{Sp} - \sigma),$$

where p_i is the price of retirement consumption: $p_i = (1 + r_i)^{-30}$ for $i = 0$ (no inflation, no taxes), 1 (taxes and no inflation), and 2 (taxes and inflation). S_2 is savings during preretirement years at the existing inflation rate; $\sigma = \partial S_2/\partial y$ is the marginal propensity to save out of exogenous income, and η_{Sp} is the uncompensated elasticity of saving with respect to the price of retirement consumption.

8. Throughout the text we refer to "no inflation" or "price stability" as a situation in which the actual inflation rate is 1.5 percent, as stated in section 3.1.

To evaluate the annual permanent welfare gain G_1 we must first measure the *price of retirement consumption* in the three situations described above (0, 1, and 2). First, to calculate the price of retirement consumption in the absence of inflation and taxes (p_0) we need an estimate of the real pretax return to capital. From 1985 to 1995, the median real return to capital in the Spanish manufacturing sector averaged 11.9 percent, according to company accounts of *Central de Balances* (Banco de España 1996a).[9] Thus $p_0 = (1.119)^{-30} = 0.0343$.

Second, 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 percent of pretax returns (including interest payments). Corporate income taxation operates under an imputation system that mitigates the double taxation of dividends at the shareholder level. Dividends carry a tax credit of 40 percent 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 percent 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 parentheses 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 percent.

The after-tax rate of return to savers also depends on personal taxes. Spanish personal income taxation treats capital income differently, depending on how income is received. A taxpayer with average taxable income pays a statutory marginal tax rate of 30 percent, which is the rate falling on interest receipts. For dividends, we can use a marginal effective tax rate of 1.4 times 30 percent, or 42 percent, because 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, Haldane, and Hatch (chap. 4 in this volume). Real capital gains are taxed at a fixed rate of 20 percent upon realization. The effective tax rate is 20 percent times $[\phi(1 + i)/(\phi + i)]$, where ϕ is the fraction of accrued capital gains realized 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* (see Banco de España 1996a), the ratio of dividends to net assets between 1985 and 1995 averaged 2.1 percent. During the same years, stocks quoted on the Madrid Stock Exchange paid an average dividend of 5.8 percent. Here we use an intermediate figure of 4 percent. Over 1985–95, the Madrid Stock Exchange Index rose by 12.2 percent on average in nominal terms, or 8.1 percent times (12.2 − (5.6 − 1.5)) in real terms. Thus

9. 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 the OECD for Spain: 14.1 percent on average over the 1985–95 period.

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

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

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 percent, a split we use also for individuals.[10] 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 $(1 - 0.256) \times 9.82$ percent, or 7.31 percent. 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 rates of return to individual savers. In particular, this return drops from 11.9 to 7.3 percent, inducing an increase in the price of retirement consumption from 0.0343 to 0.1204.

Finally, we can now go on to calculate what the real rate of return would be in a world of taxes and no inflation (p_1). For this we need to specify some additional tax information (see Albi and Ariznavarreta 1995). Profit is taxed at a national tax rate of 35 percent. 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 thus a reduction in inflation of 2 percentage points. For corporations, this has two opposing effects. First, since nominal debt interest payments are tax deductible, a 2 percentage point decline in inflation raises the effective tax rate on profits. For a given real pretax cost of borrowing and a debt-capital ratio of 50 percent,[11] the effective tax rate would increase by $0.35(0.5)(0.02) = 0.0035$, or 0.35 percentage points. On the other hand, since depreciation allow-

10. An issue that 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 percent 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 (see González-Páramo 1991).

11. Data from *Central de Balances 1995* (Banco de España 1996a).

ances are not indexed, a 2 percentage point 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 United States. However, available estimates of the overall effect of inflation on the effective tax rate on company profits broadly coincide: a 2 percentage point reduction in the rate of inflation leads to a fall in the effective tax rate of about 0.1 percentage points. In a comparative study of effective tax rates in developed countries, the Organization for Economic Cooperation and Development (OECD 1991) finds that a 5 percentage point reduction in inflation is associated with a 0.5 percentage point fall in taxable profits in the case of Spain. In a more detailed analysis, Sanz (1994), by evaluating effective tax rates in a sample of 883 private industrial companies,[12] finds that moving from 5 percent inflation to price stability causes the effective tax wedge to fall by approximately 1.1 percentage points. Given a fixed capital stock, this means that pretax profits fall by 0.22 percentage points for each percentage point decline in inflation. Thus a 2 percentage point reduction in inflation raises the net-of-tax corporate return by 0.35(0.22)(0.02) = 0.0015, or 0.15 percentage points.[13] 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 percent.

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 percent return after corporate taxes implies a net return to savers of 7.42 percent. In addition, there is an independent effect of inflation channeled through the tax treatment of interest income.[14] Taking the share of debt in individuals' portfolios to be the same as the debt-capital ratio of companies, a 2 percentage point fall in inflation reduces the effective tax rate by 0.3(0.5)(0.02) = 0.003, or 0.3 percent. Adding to the new after-tax rate of return (7.42 percent) the gain to savers in the taxation of interest income (0.3 percent), we arrive at a net-of-tax return to individuals of 7.72 percent, up 0.41 percentage points from the return when inflation is 2 percentage points higher. Thus the associated price of retirement consumption is $p_1 = (1.0772)^{-30} = 0.1074$.

Substituting the values of p_0, p_1, and p_2 into the expression for the welfare gain (5), we have

$$G_1 = 0.0714 S_2 (1 - \eta_{S_p} - \sigma). \tag{6}$$

Next we need to measure *savings* during preretirement 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).

12. Help from J. F. Sanz with these calculations is acknowledged.

13. Note that this estimate implies that the effect of inflation through depreciation allowances is a 0.71 percent reduction in the taxable profit rate per additional 1 percent reduction in inflation.

14. Since nominal capital gains are indexed, changes in the rate of inflation do not affect capital gains taxes.

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:

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

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 1985–95 period, the growth of the wage bill in real terms was 2.8 percent, and the net personal saving rate averaged 5.0 percent of GDP (Banco de España 1996b). Taking $T = 30$, this implies that the saving of the young is 9 percent 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 the 35–65-year age range save around 20 percent of their income. Since the ratio of personal income to GDP has been quite stable around 0.7 over the 1985–95 period, the implied saving ratio for the young is $S_2 = 14$ percent of GDP, a figure that we will use in our calculations.[15]

In order to compute the welfare gain according to equation (5), we need estimates for the saving function parameters. Assuming that σ equals the sensitivity of saving to wage income, $\sigma = (S_2/\text{GDP})/\alpha$, where α is the share of wages in GDP, which is around 0.66. Thus, for $S_2/\text{GDP} = 0.09$, σ is 0.135, and when $S_2/\text{GDP} = 0.14$, σ is 0.21,[16] 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 (1997): $\eta_{Sp} = -(1 + r)\eta_{Sr}/rT$, where η_{Sr} is the uncompensated saving elasticity with respect to after-tax real rate of return.

Argimón, González-Páramo, and Roldán (1993) estimate semielasticities of private consumption with respect to the real interest rate in the -0.2 to 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 saving, and η_{Cr} is the semielasticity of consumption with respect to the real interest rate. Taking $r = 6$ percent and $C/S = 15.8$ from national accounts data, η_{Sr} ranges between 0 and 0.2. With $r = 4$ percent 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 (forthcoming) suggests an even lower value for the saving elasticity (0.04). Thus we consider elasticities between 0 and 0.2 as reasonable estimates, and 0.4 for comparability with Feldstein's calculations.

15. Gross household saving over 1985–95 was 10.8 percent, 1.5 percent higher than the corresponding ratio in the United Kingdom. Since 11 percent is the lower bound of the saving ratio in the U.K. study, a 14 percent rate for Spain does not seem implausibly high.

16. 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, σ estimates fall in the 0.14–0.19 interval.

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

η_{Sr}	η_{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 tax systems of Spain and the United States, the estimated permanent annual welfare gains from achieving price stability are remarkably similar.

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 3.2, 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 increases 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 saving 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

$$(8) \qquad d\text{REV}_1 = \frac{S_2}{\text{GDP}}\left[\left(\frac{p_1 - p_0}{p_2}\right)\left(\frac{p_2 - p_1}{p_2}\right)(1 - \eta_{Sp}) - \left(\frac{p_2 - p_1}{p_2}\right)\right]\text{GDP}.$$

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

η_{Sr}	η_{Sp}	$d\text{REV}_1$ (% 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 United States, mainly reflecting differences in the saving ratio.

Now we can convert these revenue losses into welfare losses by scaling them using a deadweight loss coefficient λ. The value of λ 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 (1997) uses two benchmark values: 0.4 and 1.5. For the Spanish case, we can obtain estimates of λ from the computable general equilibrium model calibrated by Kehoe et al. (1989). An across-the-board tax increase generating 100 pesetas of revenue produces a deadweight loss that is in the range of 29 to 47 pesetas.[17] 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, however, we also use $\lambda = 1.5$, an estimate that seems too high to us.

With the two chosen values for λ, the welfare revenue losses are

		$d\text{REV}_1$ (% of GDP)	
η_{Sr}	η_{Sp}	$\lambda = 0.4$	$\lambda = 1.5$
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 loss 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 percent is $NG_1 = G_1 + \lambda\, d\text{REV}_1$. This formula yields the following estimates (see first three rows of table 3.3 below):

		NG_1 (% of GDP)	
η_{Sr}	η_{Sp}	$\lambda = 0.4$	$\lambda = 1.5$
0	0	0.55	−0.09
0.2	−0.12	0.72	0.19
0.4	−0.24	0.88	0.47

It should be noted that for $\lambda = 0.4$, the range of estimates is around the size of U.S. calculations.

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 downward. With exogenous income B, retirement consumption is $C = S/p + B$, whereby $\eta_{Cp} = (1 - k)(\eta_{Sp} - 1)$, where η_{Cp} 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 changes the welfare gain formula to $G_1 = 0.0714S_2\,[(1 - k)(1 - \eta_{Sp}) - \sigma]$.

In 1990, the benefit ratio for households with heads aged 65 or older was

17. We are grateful to Antonio Manresa and Ferrán Sancho for providing us with calculations and guidance as to their interpretation.

around 30 percent.[18] However, 42 percent of them received the minimum pension because their contributions over their working years had been insufficient. Presumably, most of these retired individuals made no savings when young and depend solely on their pensions. Excluding this group reduces the implied estimate to $k = 20$ percent, 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 summarizes the results for $k = 0$ and 20 percent:

		G_1 (% of GDP)		
η_{S_r}	η_{S_p}	$k = 0$	$k = 0.2$	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

Thus, while the existence of pensions reduces the welfare gains, the increase in the return to savings may cause some nonsavers to save, increasing both welfare and revenues. Nevertheless, 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 we stick to the estimates provided in table 3.3, below.

3.2.2 Inflation and Demand for Housing

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 that increases the demand for houses by potential users: owner-occupiers, non-owner-occupiers (mainly for 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 overconsumption and a reduction in tax revenue losses.

The welfare gains discussed above can be readily illustrated with the help of figure 3.3, which shows the compensated demand curve relating the quantity

18. According to Oliver et al. (1996), average expenditure of the 4.2 million households with heads 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 (Albi et al. 1994).

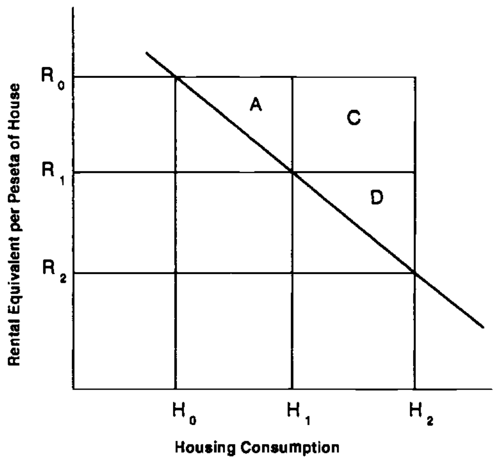

Fig. 3.3 Housing

of housing to its rental cost. In Spain, as in 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 overconsumption of housing (H_2) compared to a situation of taxes but no inflation (H_1) and of no taxes or inflation (H_0). Following Feldstein (1997), since the real pretax cost of providing housing capital is R_0, the existence of taxes with no inflation yields a welfare loss equivalent to triangle A. If, on top of taxes, there is also inflation, the welfare loss increases by the areas C and D in figure 3.3. 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 taxes, the user cost of housing, R_0, net of maintenance costs (m) and depreciation (δ), must equal the real return to capital in the nonhousing sector (ρ); that is, $R_0 = m + \delta + \rho$. With $m = 2$ percent, $\delta = 2.2$ percent, and $\rho = 11.9$ percent (the real pretax return to capital in the manufacturing sector), we get $R_0 = 16.1$ percent.[19] Next we proceed to analyze the effect of taxes and inflation on the real rental cost, housing demand, and tax revenues.

One peseta of housing capital costs a home buyer $(1 - d)(1 + \tau_1)$ pesetas, where $\tau_1 = 7$ percent is the value-added tax (VAT) rate on house purchases and $d = 15$ percent is a tax credit given to owner-occupiers on the value of the house including taxes. Taxpayers may enjoy this advantage five years in advance of the purchase on the amounts invested in "housing savings accounts" and after the purchase on mortgage repayments. In order to qualify for the tax

19. Fundación BBV (1996) calculates that δ increased from 1.5 percent in 1970 to 2 percent in 1990, which implies an estimate of $\delta = 2.2$ percent for 1995.

credit, the house must be the main residence of the owner and cannot be sold in three years. Homeowners pay income tax on an "imputed rental": $\beta\tau_h z$ per peseta of housing cost, where $\beta = 2$ percent is the imputation rate, $\tau_h = 42.5$ percent is the weighted marginal tax rate of homeowners,[20] and $z = 33$ percent is the average ratio of the official tax value (*valor catastral*) to the market value of the house (see Gallego 1995). Local property taxes (*impuesto sobre bienes inmuebles*) are levied, with an average rate $\tau_p = 1$ percent, 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 $\mu = 50$ percent,[21] an average price of a new house of 17 million pesetas (see Sociedad de Tasación SA 1996), and the 1995 average mortgage interest $i_m = 10.8$ percent, 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) or because their 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

$$\begin{aligned} RA_2 &= (1 - d)(1 + \tau_i) \\ &\quad \times [\mu i_m(1 - \tau_h) + (1 - \mu)(r_n + \pi) + \delta + m - (1 - \tau_g)g - \pi] \\ &\quad + (1 + \tau_i)[(1 - \tau_h)\tau_p z + \tau_h \beta z], \end{aligned} \tag{9}$$

where $r_n = 7.31$ percent is the real after-tax rate of return on other investments, $\tau_g = 11$ percent is the effective tax rate on real capital gains, $g = 1.1$ percent is the average real capital gain on housing between 1988 and 1995 according to Sociedad de Tasación SA (5.4 − 4.3 percent), and $\pi = 3.2$ percent is the true rate of inflation in 1995. The computed rental is thus $RA_2 = 8.21$ percent. In order to evaluate the real return associated with a 2 percentage point reduction in the rate of inflation, RA_1, we have that

$$\begin{aligned} \frac{dRA}{d\pi} &= (1 - d)(1 + \tau_i)\left[\mu(1 - \tau_h)\frac{di_m}{d\pi} + (1 - \mu)\frac{d(r_n + \pi)}{d\pi} - 1\right] \\ &= -0.29\%, \end{aligned}$$

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

21. 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.

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

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

The resulting cost is $RW_2 = 11.77$ percent. On the other hand, since $dRW/d\pi = (1 + \tau_1)(dr_n/d\pi) = -0.23$, a 2 percentage point reduction in inflation raises the user cost to $RW_1 = 12.23$ percent.

Next, 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 (1994a, 1994b) provide econometric estimates that 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 percent of GDP. Given that land values represent on average 30 percent of total cost (see Sociedad de Tasación SA 1996), the former estimate must be raised to 170 percent of GDP. An alternative calculation, based on data of average square meters per house and number of houses (see Instituto Nacional de Estadistica, various years) and average market prices per square meter (see Ministerio de Obras Públicas y Urbanismo 1996; Sociedad de Tasación SA 1996), yields an estimate of 158.3 billion pesetas, or 227 percent of 1995 GDP.[22]

In order to decompose this figure among alternative house uses we can refer to the shares of owner-occupied, non-owner-occupied, and rental houses: 76.55, 10.45, and 13 percent, respectively. Assuming that non-owner-occupied houses (second residences and empty houses) have a price that is on average one-half of the value of owner-occupied and rental houses, the adjusted shares in the housing stock are owner-occupied housing, 80.77 percent; non-owner-occupied housing, 5.51 percent; and rental housing, 13.72 percent. On the other hand, in 1994 there were 8.5 million taxpayers who declared housing income, of which 3.2 million (38 percent) claimed tax credits (see 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 (seeq Tasaciones Inmobiliarias SA TINSA, 1997), the average value of a house 10 years old or older is 30 percent lower than the value of an equivalent house built more recently. Thus the value of the housing stock enjoying tax-privileged treatment can be scaled upward to 46.7 percent of owner-occupied housing. Following

22. Help with these calculations was kindly provided by Angel Estrada.

these adjustments, stock values of owner-occupied houses with and without tax advantages are HA_2 = 85.6 percent of 1995 GDP and HW_2 = 97.8 percent of GDP. The remaining stock values are HN_2 = 12.5 percent of GDP for non-owner-occupied housing and HR_2 = 31.1 percent of GDP for rental housing.

Let us return to owner-occupiers enjoying tax advantages. The welfare gain from a 2 percentage point reduction in the rate of inflation corresponds to the sum of rectangle C and triangle D under the compensated housing demand curve in figure 3.3 and can be expressed as

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

where ε_{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 into equation (11), we have GA = 0.41 percent 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 percent of GDP. Adding up these figures, the resulting total welfare gain from the reduced distortion of owner-occupied housing demand is 0.55 percent of GDP. This estimate is five times Feldstein's calculation for the United States (chap. 1 in this volume), 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 current taxes and inflation, the rental cost for owner-occupiers with tax advantages in 1995 was around 51 percent of the no-tax user cost (76 percent in the United States and 71 percent in the United Kingdom), and a 2 percentage point reduction in inflation would increase the rental cost of owner-occupied housing by nearly 7 percent (4.8 percent in the United States and 4.2 percent in the United Kingdom).

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

$$(12) \quad \begin{aligned} RN_2 = {} & (1 + \tau_i)[\mu i_m + (1 - \mu)(r_n + \pi) + \delta + m + \beta\tau_h z \\ & + \tau_p z - g(1 - \tau_g) - \pi], \end{aligned}$$

where we assume a mortgage-to-value ratio of μ = 30 percent. Note that here there are no tax credits or interest deductions, and that property taxes are not deductible. The resulting cost is RN_2 = 12.1 percent. Thus a 2 percentage point reduction in inflation raises the rental cost to RN_1 = 12.42 percent through its effect on the return of alternative investments. Computing the analog of expression (11) we obtain a welfare gain of GN = 0.01 percent 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

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

With an assumed mortgage-to-value ratio of $\mu = 20$ percent, $RR_2 = 8.64$ percent. A 2 percentage point reduction in inflation increases the rental cost to $RR_1 = 9.18$ percent, which in turn implies a welfare gain of $GR = 0.13$ percent of GDP.

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

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

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 percentage point reduction in the inflation rate are expected to be sizable and concentrated in the owner-occupied sector. Consider the effect of the inflation reduction on the stock of owner-occupied housing with tax advantages (from HA_2 to HA_1):

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

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 $\tau_p(1 - \tau_h)z\,\Delta HA = -0.0066$ 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 $\tau_h\mu[HA_2 i_m - HA_1(i_m - 0.02)] = 0.3192$ 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 $-i\,d\Delta HA = 0.0499$ billion pesetas, where i is the investor's discount rate ($i = 9.5$ percent). Fourth, taxes paid on imputed housing rentals fall by $\tau_h\beta\,\Delta HA = -0.0098$ billion pesetas. Fifth, as housing capital shifts to the business sector, revenues from taxes on capital income increase by $-(0.119 - 0.0772)\Delta HA = 0.1463$ billion pesetas, where the expression in parentheses is the difference between the pretax return to business investment and the after-tax return to savings when the rate of inflation is 2 percentage points lower. Finally, it should be noted that additional revenues arising from business investment must include sales tax and VAT, an effect that can be estimated as $-0.361\tau_s \Delta HA = 0.2022$ billion pesetas, where $\tau_s = 16$ percent is the standard VAT rate.[23] The total revenue gain is thus $d\text{REV}_A = 0.7012$ billion pesetas = 1.01 percent 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 percent, 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 VATs can be estimated at 0.1328 billion pesetas. The ensuing net revenue effect is $d\text{REV}_W = 0.2181$ billion pesetas = 0.31 percent 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 United States and as much as five times the U.K. figure.[24] 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 percent higher than Germany's stock, 31 percent higher than the U.S. figure, and 67 percent higher than the per capita stock in the United Kingdom (see Tödter and Ziebarth, chap. 2 in this volume; Bakhshi et al., chap. 4 in this volume).

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 percent, 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 $\tau_p \beta z \, \Delta HN = -0.0006$. Thus the resulting net revenue gain is $d\text{REV}_N = 0.0186$ billion pesetas = 0.03 percent of GDP.

Consider lastly the rental sector. Given an increase in the user cost of 0.54 percentage points, the implied decline in demand is −5.3 percent, 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;

23. New business investment generates additional sales and value added, which in turn implies more revenues in an amount that could be nonnegligible. Note that value added, VA, equals capital income, ρK, plus wage income, W. Given a fixed labor income share $W/VA = 0.66$, we get $VA/K = 3.03$, implying 36.1 percent (= 3.03×0.119) of the additional capital stock per year when $\rho = 11.9$ percent. 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 rate of 16 percent this translates into 0.2022 billion pesetas per year of additional revenue, or 0.29 percent of GDP per year.

24. For homogeneity, this comparison does not include sales tax or VAT.

(2) additional revenue from VAT, $-0.361(0.16)(1.15) = 0.0664$ billion pesetas; (3) loss of interest deductions, $0.2[(0.108)(21.7) - (0.088)(20.55)] = 0.0455$ 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 $d\text{REV}_R = 0.1793$ billion pesetas = 0.26 percent of GDP.

The overall revenue change through all sorts of housing demand is the sum of the previous effects, yielding

$$\begin{aligned} d\text{REV}_2 &= d\text{REV}_A + d\text{REV}_W + d\text{REV}_N + d\text{REV}_R \\ &= 1.1172 \text{ billion pesetas} = 1.60\% \text{ of GDP.} \end{aligned}$$

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

In order to calculate the welfare effects of the above revenue gain we have to multiply it by λ. For $\lambda = 0.4$, it yields 0.64 percent of GDP; for $\lambda = 1.5$, 2.40 percent of GDP. As can be observed, the welfare revenue gains are quite significant. 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 3.3).

Finally, the net welfare gain arising from the effects of a 2 percentage point reduction in inflation on 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, given by

$$NG_2 = G_2 + \lambda\, d\text{REV}_2 = (0.69 + \lambda 1.60)\% \text{ of GDP.}$$

The overall gains are 1.33 percent of GDP for $\lambda = 0.4$ and 3.09 percent of GDP for $\lambda = 1.5$ (see row 4 in table 3.3 below). Not surprisingly, given our previous discussion of the magnitude of the subsidy to owner-occupied housing and of the size of the housing stock in Spain, the net welfare gains are quite large: around six times the figures for the United States.

Needless to say, there are large margins of uncertainty in our calculations. In this respect, two key parameter values are the housing demand elasticity and the mortgage-to-value ratio in the owner-occupied tax-advantaged sector. Suppose that the mortgage-to-value ratio were $\mu = 25$ percent instead of the maintained $\mu = 50$ percent. The resulting overall direct gain would fall by 0.1 percent of GDP to 0.59 percent, still a sizable improvement. Revenue gains would decline to 1.29 percent of GDP from 1.6 percent, which in turn implies net welfare gains of 1.11 percent of GDP for $\lambda = 0.4$ and 2.52 percent of GDP for $\lambda = 1.5$. Assume, in addition to $\mu = 25$ percent, that the true value of ε_{HR} were 0.45 instead of 0.90. Then the net gains in this case would be 0.84 percent of GDP for $\lambda = 0.4$ and 2.00 percent of GDP for $\lambda = 1.5$. Therefore, although

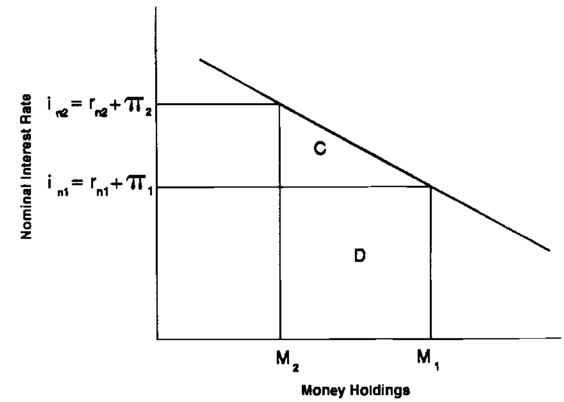

Fig. 3.4 Money demand and seigniorage

halving both μ and ε_{HR} reduces our reference estimates by about 35 percent, it still leaves welfare gains far larger than those found for the United States.

3.2.3 Inflation and the Demand for Money

Welfare Effects of Distorting Money Demand

Perhaps the best-known source of welfare loss resulting from inflation relates to 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 rate tends to lower the level of money holdings further below the optimum.

Assuming an initial situation characterized by inflation (π_2) and a positive nominal interest rate ($i_{n2} = r_{n2} + \pi_2$), reducing inflation entails a welfare gain. As shown in figure 3.4, which plots the demand for money as a function of the nominal interest rate, a reduction in inflation (from π_2 to π_1) leads to an increase in money demand (from M_2 to M_1) and to a welfare gain represented by area C plus area D between the money demand curve and the zero opportunity cost line. As can be seen, the size of the gain hinges on the interest elasticity of money demand.

To compute the welfare gain it is necessary to estimate the change in nominal interest rates induced by the reduction in inflation and the induced increase in money demand ($M_1 - M_2$). At a "true" initial inflation rate (π_2) of 2 percent

(3.5 − 1.5), the net-of-tax return on the debt-equity portfolio in Spain (r_{n2}) is 7.31 percent, thus leading to a nominal interest rate (i_{n2}) of 9.31 percent (7.31 + 2). When the "true" inflation rate (π_1) is zero (1.5 − 1.5), the real and nominal net-of-tax return ($r_{n1} = i_{n1}$) becomes 7.72 percent since $dr/d\pi = -0.21$. Thus the welfare gain corresponding to the area C + D in the figure is

$$
\begin{aligned}
G_3 &= i_{n1}(M_1 - M_2) + \frac{1}{2}(i_{n2} - i_{n1})(M_1 - M_2) \\
&= 0.0772[1 + 0.5(0.0931 - 0.0772)](M_1 - M_2) \\
&= -0.08515\varepsilon_M M \frac{1}{r_n + \pi}(0.0159)\text{GDP} \\
&= -0.00135\varepsilon_M \frac{M}{\text{GDP}}(r_n + \pi)^{-1}\text{GDP}.
\end{aligned}
\tag{13}
$$

In Spain, the long-run interest rate elasticity of money demand (ε_M) is estimated to be roughly 0.2, and in 1995 non-interest-bearing money balances amounted to 8.930 billion pesetas, or 12.8 percent of GDP (M). Substituting these values into equation (13) yields a total welfare gain of $G_3 = 0.04$ percent of GDP. Therefore, it follows that the size of the welfare gain associated with changes in money demand (Bailey effect) is rather small, although almost twice that for the United States. This is mainly due to the money-to-income ratio being twice as large in Spain.

Welfare Revenue Effects of Changes in Money Demand

Following Feldstein (1997), the reduction in inflation leads to changes in government revenue through several channels: (i) the loss of seigniorage associated with the lower "tax" on money holdings (the so-called Phelps effect), (ii) the loss due to the portfolio shift from other productive assets to money balances, (iii) 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 (1997) to be equal to

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

Thus the loss of seigniorage will be (0.02)(0.1236)GDP = 0.25 percent of GDP. As in the United States, the "Phelps revenue effect" is higher than the "Bailey money demand effect."

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

$$M_1 - M_2 = \varepsilon_M M \frac{i_{n2} - i_{n1}}{i_{n2}} = 0.0044\text{GDP}.$$

When these assets are invested in productive capital they earn a real pretax return of 11.9 percent but a net-of-tax return of only 7.72 percent. The difference between the two is the combined effective tax rate at the corporate and personal levels. Applying this difference to the reduction in productive capital yields a revenue loss of (0.119 − 0.0772)0.0044GDP = 0.02 percent 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 percent in 1995, a value for the personal tax rate (θ_m) of 0.3, and a "true" inflation rate in 1995 of 2.8 percent, the real net-of-tax interest rate on government debt would be (1 − 0.3)8.5 − 2.8 percent = 3.2 percent, and the reduced debt service in perpetuity r_{ng} ($M_1 - M_2$) = 0.01 percent of GDP.

Combining the above three revenue effects yields a total revenue loss of

$$d\text{REV}_3 = -0.25 - 0.02 + 0.01 = -0.26\% \text{ of GDP}.$$

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

$$NG_3 = G_3 + \lambda\, d\text{REV}_3 = (0.037 - \lambda 0.26)\% \text{ of GDP}.$$

For $\lambda = 0.4$, this yields −0.07 percent of GDP; for $\lambda = 1.5$, −0.35 percent 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 lost revenue more than outweigh the welfare gains resulting from reduced distortion of money holdings; that is, the Phelps effect dominates the Bailey effect (see row 5 of table 3.3 below).

Finally, it is important to point out that all of the above estimates 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 these 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 linear specifications, and it is not yet possible to know whether we are under- or overestimating the direct welfare gain on money holdings.

3.2.4 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 percentage points. This happens because inflation does not alter the real pretax interest rate on government debt while the inflation premium is taxed at the personal level. If the debt-GDP ratio is to be kept constant, an increase in taxes is required. This, in turn, implies welfare costs insofar as taxes are distortionary.

As shown in Feldstein (1997), 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 (θ_m), and the debt-GDP ratio (b): $dREV_4 = d\pi\, \theta_m b$. Considering that in Spain θ_m is 30 percent and the relevant[25] debt-GDP ratio is 40 percent (once we exclude debt in the hands of foreign investors and tax-favored 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 together yields −0.10 percent of GDP for $\lambda = 0.4$ and −0.36 percent of GDP for $\lambda = 1.5$ (see row 6 of table 3.3). These figures are in line with those obtained for the United States.

3.2.5 Total Benefits

Table 3.3 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 percent of GDP.[26]

The values reported in table 3.3 correspond to different assumptions regarding the marginal deadweight loss per peseta of additional revenue (λ) and the interest elasticity of saving (η), and some of these assumptions look more plausible than others. In particular, the empirical evidence available for Spain suggests that λ is very close to 0.4 and η is somewhere between 0 and 0.2. In this

25. If debt holders are tax exempt to begin with, there are no revenue losses.

26. 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 3.1 of the paper. In the case of Spain, our calculations show that this would amount, in welfare terms, to less than 0.1 percent of GDP in the more realistic scenario of $\lambda = 0.4$, and to 0.3 percent of GDP when $\lambda = 1.5$. These calculations are available on request.

Table 3.3 **Net Welfare Effect of Achieving Price Stability (percent of GDP)**

Source of Change	Direct Effect of Reduced Distortion (1)	Welfare Effect of Revenue Change λ = 0.4 (2)	Welfare Effect of Revenue Change λ = 1.5 (3)	Total Effect λ = 0.4 (4)	Total Effect λ = 1.5 (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	2.4	1.33	30.9
Money demand	0.04	−0.10	−0.39	−0.07	−0.35
Debt service		−0.10	−0.36	−0.10	−0.36
Total					
$\eta = 0$	**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

Note: Table reports changes due to a 2 percentage point reduction in inflation. η is the uncompensated interest rate elasticity of saving. λ is the marginal deadweight loss per peseta of additional revenue. Numbers in boldface show what we consider to be more realistic figures for Spain given the available empirical evidence on λ and η.

more realistic scenario, the annual welfare benefits are estimated to be still quite significant, ranging from 1.71 to 1.88 percent of GDP.

As can be seen, the four types of effects considered in the table contribute quite differently toward the total net welfare effect. While the changes induced by lower inflation on retirement consumption and housing demand contribute favorably to the total welfare effect, the induced changes in money demand and in the cost of servicing the public debt make negative contributions. Under the most realistic scenario, the first two factors amount to 1.88 to 2.05 percent of GDP and the remaining two to −0.17 percent 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, in the more realistic scenario, the direct effect ranges from 1.52 to 1.64 percent of GDP, while the indirect effect ranges from 0.20 to 0.25 percent of GDP. So while the conceptual framework employed in the paper has clearly gained from the inclusion of indirect revenue effects, together with traditional direct welfare effects, in 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 wel-

Table 3.4 Underlying Variables and Parameters in the Evaluation of the Benefits of Going to Price Stability, Spain versus the United States

Variable or Parameter	Spain	United States
Fiscal		
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
Financial		
Pretax real return to capital in corporate sector (%)	11.9	9.2
Debt-capital ratio in corporations (%)	50	40
Share of equity in individuals' portfolios (%)	66	60
Interest paid on mortgage (%)	10.8	7.2
Value of owner-occupied housing (% of GDP)	184	105
Currency plus bank reserves (% of GDP)	12.8	6.1
Relevant government debt (% of GDP)	40	50
Mortgage as a proportion of the value of owner-occupied housing (%)	50	20–50
Maintenance cost (%)	2	2
Rate of depreciation (%)	2.2	2
Macroeconomic		
Rate of growth of the wage bill (%)	2.8	2.6
Inflation average[a] (%)	5.6	4.7
Current inflation[b] (%)	3.5	2.9
Inflation bias (%)	1.5	2.0
GDP growth[c] (%)	2.5	2.5
Share of wages in GDP (%)	66	75
Saving of the young (% of GDP)	14	9
Behavioral		
Elasticity of saving with respect to real net-of-tax return	0, 0.2, 0.4	0, 0.4, 1.0
Compensated elasticity of housing demand with respect to rental pricing	0.9	0.8
Elasticity of demand for money with respect to interest rate	0.2	0.2
Propensity to save	0.21	0.12

Sources: Feldstein (1997) and authors' elaboration.
[a]1985–95 for Spain; 1960–94 for the United States.
[b]1996 for Spain.
[c]1964–95 for Spain; 1970–94 for the United States.

fare revenue gain. The other reason is that the more interest elastic saving is, the larger the favorable effect of a reduction in inflation on the amount of retirement consumption purchased by individuals and the lower the revenue loss.

Table 3.4 presents the values of the underlying variables and parameters used in evaluating the benefits of going to price stability in Spain (and, for

Table 3.5 **Net Welfare Effects: Spain versus the United States (percent of GDP)**

	Direct		Revenue		Total		Difference
	Spain	U.S.	Spain	U.S.	Spain	U.S.	
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
Total	1.52	0.85	0.20	−0.21	1.71	0.65	+1.06

Source: U.S. figures from Feldstein (chap. 1 in this volume).
Note: Table reports changes due to a 2 percentage point reduction in inflation. $\eta = 0$ and $\lambda = 0.4$.

comparative purposes, in the United States), and table 3.5 presents a comparison of our results with those obtained by Feldstein for the United States within the same conceptual framework (chap. 1 of this volume). For the sake of comparability, we take $\lambda = 0.4$ and $\eta = 0$, which correspond to values for our more realistic scenario. As can be seen by looking at the last row of table 3.5, the total net welfare gain is almost three times larger in Spain (1.71 percent of GDP) than in the United States (0.65 percent 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 percent of GDP in Spain vs. 0.22 percent in the United States). 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 Spain mainly reflect the much higher ratio of housing values to GDP in this country and the huge implicit subsidy that tax rules and inflation give to the purchase of owner-occupied houses. Naturally, both factors are deeply interrelated from a general equilibrium viewpoint.

3.3 Costs and Benefits Compared

3.3.1 Benefits Minus Costs

The most important difficulty economists face 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 focus only on those channels that we consider most relevant.

Table 3.6 summarizes our estimates of both the costs and the benefits of achieving price stability in Spain. As regards the costs, we have relied on esti-

Table 3.6 **Summary of Benefits and Costs of Achieving Price Stability (percent of GDP)**

	$\lambda = 0.4$	$\lambda = 1.5$
Benefits		
$\eta = 0$	**1.71**	2.29
$\eta = 0.2$	**1.88**	2.57
$\eta = 0.4$	2.04	2.87
Costs	0.60–1.00	0.60–1.00
Benefits minus costs		
$\eta = 0$	**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

Note: Table reports permanent annual benefits and costs due to a 2 percentage point reduction in inflation. Numbers in boldface show what we consider to be more realistic figures for Spain given the available empirical evidence on λ and η.

mates 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 in the range of 0.6 to 1 percent of GDP per year on a permanent basis. As regards the benefits, we have adopted Feldstein's (1997) 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 3.3—are quite sizable by international standards, ranging from 1.7 to 2.9 percent 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 in the range of 1.7 to 1.9 percent 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 percent 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 (1997) methodology to Spain, it is useful to compare our results to those he obtained for the United States. If we take Feldstein's more realistic scenario, then the estimated output costs of achieving price stability in the United States are equivalent to 0.16 percent of GDP per year on a permanent basis,[27] while the estimated benefits are 0.6 to 1 percent of GDP per year, again on a permanent basis. This yields an annual

27. While Feldstein finds the output costs of disinflation to be transitory in the United States, the figure mentioned in the text corresponds to an annuity that has the same present value as the cumulative transitory output costs.

net benefit of 0.5 to 0.8 percent of GDP, which is similar to, although somewhat smaller than, the 0.7 to 1.3 percent of GDP we find for Spain. Excluding the revenue effects from VAT, which does not exist in the United States, the annual net benefit for Spain would fall to 0.5 to 1.0 percent of GDP, a figure that is almost identical to the U.S. range of estimates.

The similarity between the estimated net benefits of achieving price stability in Spain and in the United States is rather striking considering the very significant differences between the two countries' 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.

3.3.2 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 stick to the methodology that we have followed here, a number of factors 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 as the inflation rate gets lower, thus making it costlier to achieve a given reduction in inflation.[28] 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 possibly 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 because 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

28. As recently suggested by Akerlof, Dickens, and Perry (1996), reaching an inflation rate that 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.

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 et al. for Sweden suggests that, overall, our benefits could be overestimated.

On the other hand, a number of benefits also associated with lowering inflation are not related to the tax system and have not been considered in our analysis: for example, the saving from not having constantly to revise prices (menu costs), the more efficient allocation of resources that comes with lower—and thus generally more stable—inflation rates, and the redistribution of income and wealth in favor of those with fewer resources to protect themselves against inflation. While these benefits are quite hard to quantify reliably, they may nevertheless be significant (see, e.g., Andrés and Hernando, chap. 8 in this volume; Gylfason and Herbertsson 1996).

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 time profiles of costs and benefits in our calculations. Regarding the costs, timing considerations have been taken fully into account when computing, in section 3.2, the "cost annuity" that is equivalent in present value to the transitory output losses resulting from disinflation. Nevertheless, regarding the benefits we have followed Feldstein (1997) 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 one. 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 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 to 1.9 percent of GDP per year in our more realistic scenario (see table 3.3), this downward revision might be nonnegligible.

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 five or ten years rather than instantly. If we take, for simplicity, the more realistic scenario of $\lambda = 0.4$ and $\eta = 0.0$ or 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 to 1.1 percent of GDP relative to costs

Table 3.7 **Sensitivity Analysis: Benefits Minus Costs (percent 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 are 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 percent of GDP per year in annuity terms) and the second to the case of transitory output costs (0.6 percent of GDP per year in annuity terms).

of 0.6 to 1 percent of GDP.[29] Consequently, it seems that our conclusions would continue to hold even when considering significant delays in the benefits accruing from housing.

Next, to check how robust our results are, we have carried out a sensitivity analysis by allowing some of the parameters to take on a range of values containing those reference estimates considered above.[30] In particular, we have specified the following ranges for the key parameters: $\eta = 0.0, 0.1, \ldots, 0.4$; $\varepsilon_{HR} = 0.5, 0.6, \ldots, 0.9$; $\lambda = 0.4, 0.5, \ldots, 1.5$; 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 3.7 for three alternative values of T (the number of years after which the housing benefits accrue). As can be seen from table 3.7, if 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 borne—if there were a tax reform of the sort described above, there would then be no more benefits to reap from having achieved price stability after the reform is in place, thus leading to an unfavorable "ex post" relationship between benefits and costs. A reply to this would be that as long as a fully comprehensive tax reform does not come very early in time, it will still be worthwhile to undertake demand poli-

29. 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 is annual benefits other than housing and x_H is annual housing benefits starting to accrue after T years ($T = 5, 10$).

30. While, for the sake of comparability with the other country studies contained in this volume, we have omitted from our benefits calculations summarized in table 3.3 the impact of the net revenue losses arising from the output costs due to disinflation (i.e., payments for unemployment compensation), these nevertheless were taken into account when elaborating table 3.7.

cies oriented toward price stability. In fact, for Spain we have calculated that in the case of temporary output costs—which are borne mainly during the first five years—going to price stability would be justified on benefit-cost grounds as long 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 as long as the tax reform does not take place during the first eleven years.

To conclude, it is evident from the above discussion that our cost-benefit analysis of achieving price stability in Spain is merely a rough and preliminary attempt to study a very complex phenomenon. Still, because 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 percent of GDP per year in the more reasonable scenarios.

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