Do the Unemployed Pay Lower Prices?
A Reassessment of the Value of Unemployment Insurance*

Rodolfo G. Campos† Iliana Reggio‡

Date of this version: May 24, 2016

Abstract

It is well known that transitions from employment to unemployment reduce consumption expenditure, but is this fall driven by quantities or by prices? Using panel data on expenditure and quantities from the Spanish consumption survey we find that the unemployed pay prices that are, on average, 1.5% lower, and that this difference in prices accounts for roughly one sixth of the gap in consumption expenditure between the employed and the unemployed. The reduction in prices estimated with panel data is considerably lower than the existing estimates for the US, which rely on cross-sectional comparisons. Based on our estimates, and using economic theory, we reassess the value of providing unemployment insurance and show how the social value of providing unemployment insurance can be decomposed into a consumption-smoothing component and a component that depends on prices.

JEL classification: D12, J64, H11.

Keywords: consumption, expenditure, unemployment insurance, sufficient statistics, Spain.

*In writing this paper we have benefited from comments by Manuel Arellano and Steve Bond and by seminar participants in the FREE seminar and at the 40th Simposio of the Spanish Economic Association. R. Campos thanks CEMFI for its hospitality while working on this paper. The views expressed in this paper are those of the authors and do therefore not necessarily reflect those of the Banco de España or the Eurosystem. We gratefully acknowledge financial support by the Spanish Ministerio de Ciencia y Tecnología (Grant ECO2015-65204-P).

†Banco de España, Calle de Alcalá 48, 28014 Madrid, Spain; email: rodolfo.campos@bde.es.

‡Department of Economics, Universidad Carlos III, Calle Madrid 126, 28903 Getafe (Madrid), Spain; email: ireggio@eco.uc3m.es.
1 Introduction

Economic theory indicates that the consumption-smoothing benefits of unemployment insurance can be inferred from the gap in consumption between the employed and the unemployed. The measurement of this gap has received considerable attention and has been estimated, for example, by Cochrane (1991), Gruber (1997), Browning and Crossley (2001), and Stephens (2001). Because of data limitations, the consumption gap is usually estimated using consumption expenditure (price times quantity) rather than consumption (quantity).

Using consumption expenditure as a proxy variable for consumption is not innocuous. For instance, in a series of empirical papers, Aguiar and Hurst (2005, 2007) find that workers that are either retired or not employed pay lower prices, and that therefore changes in expenditure exaggerate changes in consumption. This has implications for optimal unemployment insurance, as shown by Campos and Reggio (2016): if the static model of Baily (1978) and Chetty (2006) is generalized to include price search, then the ‘sufficient statistics’ formula that determines the optimal degree of unemployment insurance depends crucially on the magnitude of the difference in prices paid by the employed and the unemployed.

Prior evidence on prices paid by the unemployed, and how they compare to prices paid by the unemployed relied on either purely cross-sectional data or data sets in which the unemployed cannot be distinguished from other forms of non-employment. In this paper we study the size of the difference in prices between the unemployed and the employed using a panel of Spanish households in which the unemployed can be distinguished from the non-employed. We find that differences in prices are substantially lower than in prior studies estimated on cross-sectional data. We then use our estimates to assess the social value provided by unemployment insurance using a model that links observed expenditure and price changes to changes in the marginal rate of substitution of a representative unemployed worker.

To interpret our empirical measurements in terms of economic theory we derive the expression for the marginal welfare gain provided by unemployment insurance in an environment representative of a wide class of models incorporating moral hazard and asymmetric information. We show that the value of unemployment insurance is composed of two parts: a consumption-smoothing component, which depends on the curvature
of the utility function, and a price component, which takes into account the return of transferring resources across different states of the world. If a CRRA utility specification is assumed, then the marginal benefit of unemployment insurance can be expressed as an additively separable function of these two components. With CRRA preferences it is possible to calculate the value of unemployment insurance as a weighted average of two ‘semi-elasticities’: the log-difference of consumption expenditure and the log-difference of prices between employed and unemployed states, which can be estimated if appropriate data are available.

We estimate the log-difference of consumption expenditure and the log-difference of prices between the employed and unemployed using data from the Spanish consumption survey, which is ideally suited for this purpose. There are three advantages of using these data. First, the Spanish consumption survey contains detailed household data on expenditure and quantities, a necessary requirement to disentangle consumption expenditure changes from price changes. Second, in this dataset it unemployment is precisely distinguished from other forms of non-employment, which is rarely the case in surveys with information on prices or quantities. Third, the survey contains repeated observations on the same household. Therefore, we are able to improve on existing studies that rely exclusively on cross-sectional data.

We find that unemployed households experience a large drop in total consumption expenditure, of 8.9%. Consumption expenditure of food items falls by 6.4%. Using a household-specific price index proposed by Aguiar and Hurst (2007), we find that unemployed households pay prices that are 1.5% lower than prices paid by employed households. This finding implies that roughly one-sixth of reduction in household expenditure at unemployment can be attributed to lower prices rather than to a change in quantities. Prices play a larger role in the case of food items consumed at home. We find that food prices paid by the unemployed are 2.0% lower. In the case of food items consumed at home, roughly one third of the difference of expenditure can be explained by prices.

The fraction of expenditure explained by price changes is considerably smaller than prior estimates based on the findings by Aguiar and Hurst (2005). This difference is mainly due to the fact that we are able to control for unobservable characteristics of the household through a fixed-effects estimation. In contrast, the evidence of Aguiar and Hurst (2005), on which the calibration of Campos and Reggio (2016) was based, relies on a comparison between employed and non-employed households in a cross-section
of US households. In their data set, it is not possible to observe the same household before and after the unemployment shock. Except under special assumptions, the cross-sectional difference across employed and unemployed households need not coincide with the within-difference for a household. We compare results from pooled cross-sections and panel data estimations and we find that pooled regressions overestimate the changes in prices associated to unemployment by a factor of between two and three.

Using the expression derived from our model, we combine our estimates of the relationship between unemployment and consumption expenditure and prices to recover the value of providing unemployment insurance. For standard levels of risk-aversion, we find that the bulk of the value of unemployment insurance is due to consumption-smoothing. According to a simple back-of-the-envelope calculation, the cost of providing unemployment insurance exceeds the value provided by the unemployment insurance scheme. The prevailing level of unemployment insurance exceeds the optimal level unless very high levels of risk-aversion are assumed.

The paper proceeds as follows. In Section 2 we review the relevant empirical literature. In Section 3 we present the model we use to interpret our results and derive an expression for the value of unemployment insurance that can be estimated given an appropriate dataset. In Section 4 we discuss our empirical strategy. In Section 5 we go over our results. We conclude in Section 6.

2 Related empirical literature

2.1 Unemployment and Consumption versus Expenditure

Recent research argues that declines in consumption expenditure may, in part, be due to a reduction in prices rather than reductions in quantities. The evidence suggests that the availability of time to use on activities such as shopping and searching for bargains plays an important role in lowering prices. Using supermarket scanner data, Aguiar and Hurst (2007) verify that increases in time used for shopping lowers the price paid for grocery items while maintaining quality constant in the general US population.

There are two transitions out of employment, retirement and unemployment, that allow for a sharp increase in the amount of time available for shopping and cooking at home.
Individuals may choose to use the time margin and substitute away from market goods, which appear in expenditure data, towards goods produced at home. By devoting more time for shopping, they are able to secure lower prices, implying that part of the fall in expenditure is not a fall in quantities.

The first of these labor market transitions, retirement, was the focus of the study by Aguiar and Hurst (2007). They find that the substitution of time towards home production is at work and that retired households pay lower prices in the US. In the case of Spain, Luengo-Prado and Sevilla (2013) obtain similar results. The conclusion of these empirical studies is that the surprisingly large drop in expenditure observed at retirement (the retirement puzzle) can, in part, be explained by lower prices.

Unemployment, the second labor market transition in which workers suddenly have more time on their hands, initially received less attention but the onset of the Great Recession increased this interest. For the US, there is evidence that non-employed households devote more time to shopping: using time use surveys, Aguiar, Hurst, and Karabarbounis (2013) find that roughly 7 percent of the time freed up by market hours of work is dedicated to activities such as shopping for groceries and other household items, comparison shopping, coupon clipping, and buying goods online. Using the Nielsen Homescan Dataset, Nevo and Wong (2015) find that purchases of sale items, coupon usage, buying generic products and large sized items, and shopping at discount increased during the Great Recession and that the rise in these activities led to lower prices.

Focusing specifically on the individual employment status of households, Aguiar and Hurst (2005) find that consumption by those out of work falls less than expenditure, suggesting a reduction in the price paid per unit of consumption. Closer to the methodology in our paper, Kaplan and Menzio (2015) use the price index of Aguiar and Hurst (2007) and find that households in the Kilts-Nielsen Consumer Panel Dataset with members that are not employed pay lower prices than those that are employed in a cross-sectional comparison.

In the Nielsen data used in the US studies it is not possible to distinguish between consumers who become unemployed and those who leave the labor force and it is also not possible to exclude self-employed individuals. Whereas the difference between employment and non-employment is the relevant distinction for some purposes, other questions such as the question of unemployment insurance require to distinguish unemployment from other forms of non-employment.
None of the existing studies for the US answers the question posed in our title: whether the unemployed pay lower prices. Instead, they address the question whether non-employed households pay lower prices, where the non-employed category includes unemployed individuals and those out of the labor force. The reasons for doing that are sometimes related to economic theory and sometimes practical. Macroeconomic general equilibrium models often do not distinguish between unemployment and inactivity, and the estimations used to inform these models do not require that distinction. In contrast, Nevo and Wong (2015) state that they would like to distinguish between the unemployed and those out of the labor force, but cannot do so in their data from the Nielsen Homescan Dataset.\footnote{An additional critique of the Nielsen Homescan Dataset is that, because it is not a random sample, selection issues arise. Moreover, Einav, Leibtag, and Nevo (2010) report results from a validation study of the Nielsen Homescan consumer panel data. Although measurement error is comparable to other surveys, they find that recording errors lead to discrepancies that are largest for the price variable. Moreover, in the case of female heads of household, the quality of recording is influenced by employment status.}

### 2.2 Spain

The effect of unemployment shocks on household consumption expenditure in Spain has been studied previously by Castillo, Dolado, and Jimeno (1998) and by Bentolila and Ichino (2008). Both studies used consumption data from the Encuesta Continua de Presupuestos Familiares Base 1985 (ECPF85), a survey that was administered between the first quarter of 1985 and the first quarter of 1997. The results are interpreted in terms of risk-sharing and, notably, the evidence on risk-sharing from these studies is inconclusive.

Castillo, Dolado, and Jimeno (1998) find a drop of consumption in response to unemployment that, while being smaller than for Portugal, is statistically significant, which implies a rejection of full risk-sharing. Bentolila and Ichino (2008), who perform a comparative study including data from Italy, Spain, UK, and the US, find that the drop of consumption in response to an unemployment shock is smallest in Spain. In fact, their results imply that the effect of unemployment spells on consumption in Spain is not significantly different from zero. Thus, full consumption risk-sharing cannot be rejected.
3 Theory

In order to interpret our findings, in this section we model how unemployment insurance affects the decision problem of an unemployed worker. An important feature of the model is that the unemployed worker is able to expend effort to obtain lower prices for consumption and that the opportunity cost of searching for lower prices might be different depending on whether the decision maker is employed or unemployed. In this sense, our model is related to the model of Campos and Reggio (2016), which generalizes the static Baily-Chetty environment to include price search.

However, in comparison to the model of Campos and Reggio (2016), we strive for greater generality and try to obtain results that are applicable in a wider set of environments. In addition to expending effort for job search and price search, we allow for the decision maker to take any countable number of additional decisions which may impact household income. Moreover, it is not necessary to specify the exact relationship between these actions and income. Further, the calculation of the marginal value of unemployment insurance does not depend on how unemployment insurance is financed: the benefits of unemployment insurance can be studied in isolation from the costs. Therefore, although the model in this section is related to that of Campos and Reggio (2016), it is formally closer to that used by Hendren (2015) to study the existence of private unemployment insurance.

3.1 The model

There exists a unit mass of currently unemployed individuals who become employed with probability $\pi$ and stay unemployed with probability $1 - \pi$. The probability $\pi$ is affected by the individual’s behavior. We assume that individuals can deterministically control the probability of finding a job, $\pi$, as in the standard Baily-Chetty setting.

Individuals choose consumption in the event of being employed $c_e$ and consumption in the event of being unemployed $c_u$. They deterministically control prices paid per unit of consumption in the employed state and in the unemployed state, $p_e$ and $p_u$, by varying the time input for shopping, as in the model of Campos and Reggio (2016). This implies that in the background there are choices that are left unmodeled of how individuals
allocate their time to alternative uses, such as leisure, searching for a job, searching for goods (shopping), etc.\textsuperscript{2}

In addition to these choices, individuals also choose a vector $a$, which stands for variables such as, for example, saving or future consumption, labor effort, and spousal labor supply. Choices $(p_e, p_u, \pi, a)$ are restricted to lie in the choice set $\Omega$ that may be shaped by time constraints, technology, and existing forms of formal and informal insurance.

Consumption in the employed state is

$$p_e c_e = \Upsilon_e(a) - \tau$$

and in the unemployed state it is

$$p_u c_u = \Upsilon_u(a) + b.$$  \hfill (2)

The functions $\Upsilon_e(\cdot)$ and $\Upsilon_u(\cdot)$ are general ways of mapping choices into income that is available for consumption in the employed and unemployed state. Unemployment insurance is captured by the pair $(\tau, b)$. Through unemployment insurance, income available for consumption is reduced in the employed state by a tax $\tau$ that is imposed on those working and incremented in the unemployed state by a benefit level $b$ that accrues to those unemployed. The product of prices on the left hand side of the budget constraints (1) and (2) is consumption expenditure. For later use, we explicitly introduce notation for consumption expenditure: $\tilde{c}_s = p_s c_s$ for $s \in \{e, u\}$.

Agents in the model choose their actions optimally for any given pair $(\tau, b)$. Letting $u$ and $v$ represent preferences in the unemployed and employed state, the aggregate utility of an insurance policy pair $(\tau, b)$ is then given by

$$U(\tau, b) = \max_{(p_e, p_u, \pi, a) \in \Omega} \pi v(c_e(p_e, a; \tau)) + (1 - \pi) u(c_u(p_u, a; b)) - \Psi(\pi, p_e, p_u, a),$$  \hfill (3)

where $\Psi(\pi, p_e, p_u, a)$ is a term that embeds the impact of leisure, time spent shopping, and variables in the vector $a$ on utility. We do not assume any specific functional form for $\Psi(\pi, p_e, p_u, a)$.\textsuperscript{3} State-specific preferences $v$ and $u$ are functions only of consumption

\textsuperscript{2}We refer the reader to the model by Campos and Reggio (2016) for details.

\textsuperscript{3}However, it is usual to assume that $\Psi(\pi, p_e, p_u, a)$ is a convex function of $\pi$. Also, because obtaining lower prices requires the use of time for shopping it is also reasonable to assume that $\Psi(\pi, p_e, p_u, a)$ is non-decreasing in prices.
in each state and satisfy $u' > 0, u'' < 0$ and $v' > 0, v'' < 0$. Through the budget constraints (1) and (2) consumption depends on the vector $a$ and $(\tau, b)$, the parameters describing unemployment insurance.

The description of the environment given so far is very general. It encompasses the static models of Chetty (2006). The only difference is the introduction of prices $p_e$ and $p_u$ as in Campos and Reggio (2016). The problem solved by workers in the model of Chetty (2006) can be obtained as the special case in which $p_e = p_u = 1$.

### 3.2 The marginal value of unemployment insurance

The effect of unemployment insurance on utility can be obtained by differentiating (3). By the Envelope Theorem, the utility impact of buying unemployment insurance will be given by a relatively simple expression:

$$dU = \pi v'(c_e) \frac{\partial c_e}{\partial \tau} d\tau + (1 - \pi) u'(c_u) \frac{\partial c_u}{\partial b} db,$$

where $\pi$, $c_e$, and $c_u$ are at their optimal values and the partial derivatives $\frac{\partial c_e}{\partial \tau}$ and $\frac{\partial c_u}{\partial b}$ are evaluated at the optimum. The Envelope Theorem allows us to focus only on the direct effect of $b$ and $\tau$ on utility. Indirect effects through the other choice variables ($p_e, p_u, \pi, a$) do not appear in the expression because $U(\tau, b)$ is already maximized over these variables. In fact, as is well known, the Envelope Theorem does not require interior choices for these variables.

From the budget constraints (1) and (2), it is immediate that $\frac{\partial c_e}{\partial \tau} = -\frac{1}{p_e}$ and $\frac{\partial c_u}{\partial b} = \frac{1}{p_u}$, so that the utility impact of a marginal increase of insurance is

$$dU = -\pi \frac{1}{p_e} v'(c_e) d\tau + (1 - \pi) \frac{1}{p_u} u'(c_u) db.$$

Unemployment insurance will increase utility from an ex-ante perspective ($dU \geq 0$) if and only if

$$\frac{p_e u'(c_u)}{p_u v'(c_e)} \geq \left(\frac{\pi}{1 - \pi}\right) \frac{d\tau}{db}.$$

This expression compares the marginal value of unemployment insurance to the marginal cost. The left hand side is the ratio of marginal state utilities adjusted by state-prices.
measures the benefit of transferring consumption from the employed to the unemployed state in terms of utility. The right hand side is the cost per dollar of benefits of the insurance scheme taking into account the proportion of employed to unemployed workers.

Our interest will be on empirically measuring the expression on the left hand side of (6), the marginal benefit of providing unemployment insurance. The exact expression for the marginal cost of providing insurance, on the right hand side of (6), depends on the assumed economic environment. We consider two cases here. The first case is an environment without frictions and in the second case we allow for moral hazard. In Appendix A we consider a third case with asymmetric information.

### 3.3 The cost of providing unemployment insurance

#### 3.3.1 Frictionless benchmark

We first consider the case without moral hazard or adverse selection. In this case, individuals cannot affect $\pi$. Also, $\pi$ is common to all and known by the insurer. A self-financing insurance scheme requires that

$$\pi \tau = (1 - \pi)b. \tag{7}$$

By differentiating this expression, we arrive at

$$\frac{d\tau}{db} = \frac{1 - \pi}{\pi}, \tag{8}$$

which implies actuarially-fair insurance pricing. From (6), if insurance is priced in this way, then it has a positive impact on utility if and only if

$$\frac{p_e}{p_u} \frac{u'(c_u)}{u'(c_e)} \geq \left( \frac{\pi}{1 - \pi} \right) \left( \frac{1 - \pi}{\pi} \right) = 1. \tag{9}$$

In the first best, a benevolent planner would increase unemployment insurance up to the point at which (9) holds with equality. In this frictionless benchmark insurance is priced at the actuarially-fair value and by driving (9) to equality full insurance against unemployment can be achieved.
3.3.2 Moral hazard and optimal public insurance

The case with moral hazard has been studied extensively. Baily (1978) and Chetty (2006) are the benchmark models to study the optimal provision of public unemployment insurance in the presence of moral hazard.

The pair $(\tau, b)$ is constrained by the condition

$$\pi \tau = (1 - \pi)b$$

(10)

that says that benefits are exactly financed by revenue generated by taxing workers and is therefore fiscally neutral.

Because with moral hazard the probability of transitioning out of unemployment $\pi$ will be affected by the generosity of benefit levels $b$, i.e., $\frac{d\pi}{db} < 0$, differentiating the planner’s budget constraint in this case yields

$$\frac{d\tau}{db} = \frac{1 - \pi}{\pi} + \left[ \frac{d \left( \frac{1 - \pi}{\pi} \right)}{db} \right] b.$$  

(11)

After taking the derivative and collecting terms, this expression becomes

$$\frac{d\tau}{db} = \frac{1 - \pi}{\pi} \left( 1 + \frac{\varepsilon_{1-\pi,b}}{\pi} \right),$$

(12)

where $\varepsilon_{1-\pi,b} > 0$ is the elasticity of the probability of unemployment with respect to the benefit level $b$:

$$\varepsilon_{1-\pi,b} \equiv \frac{b}{1 - \pi} \frac{d(1 - \pi)}{db}.$$  

(13)

Therefore, the optimal provision of public unemployment insurance under moral hazard implies that (6) becomes

$$\frac{p_e u'(c_u)}{p_u v'(c_e)} \geq 1 + \frac{\varepsilon_{1-\pi,b}}{\pi}.$$  

(14)

When this equation holds with equality—as a benevolent planner would choose—this is the well-known “sufficient statistics” formula in the Baily-Chetty model adapted to include prices, as in Campos and Reggio (2016). The important distinction with the frictionless benchmark is that the optimal gap in the ratio of marginal utilities is larger than one, which implies that workers will not be fully insured due to the presence of
moral hazard.

3.4 Consumption-smoothing and prices

We now get back to the ratio on the left hand side of (6), which is a measure of the value of unemployment insurance. This ratio measures the willingness to pay for an additional unit of unemployment insurance. By taking the natural logarithm it can be expressed as a markup $\mu$:

$$
\mu \equiv \log \left( \frac{p_e u'(c_u)}{p_u v'(c_e)} \right).
$$

Because the natural logarithm of 1 is zero, the markup $\mu$ measures the gap in marginal utilities relative to full insurance in the frictionless benchmark case. The willingness to pay for unemployment insurance is now expressed in relative terms (the unit in which $\mu$ is measured is log-percentage points).

The value of unemployment insurance $\mu$ is a function of consumption, prices, and preferences. To give the markup defined in (15) empirical content it is necessary to specify preferences. A particularly appealing choice for preferences, and one that is frequently used in practice, is that of constant relative risk-aversion.

**Assumption 1 (CRRA)** The utility function is of the CRRA form $u'(c) = v'(c) = c^{-\gamma}$, with $\gamma > 0$.

For CRRA preferences with risk-aversion parameter $\gamma$, the value provided to the agent by unemployment insurance can be expressed as a linear function of the gap in log-consumption and the gap in log-price between employed and unemployed individuals:

$$
\mu = \gamma \Delta \log c + \Delta \log p.
$$

The log-differences are defined as $\Delta \log p \equiv \log p_e - \log p_u$ and $\Delta \log c \equiv \log c_e - \log c_u$. Thus, the value of unemployment insurance is composed of two components: the relative gap in consumption between the employed and the unemployed state, which is scaled by the risk-aversion parameter, and the relative gap in prices between the employed and the unemployed state.$^4$

$^4$Notice that this result is also obtained without assuming a CRRA specification by following the
The first term on the right-hand-side measures the value due to consumption-smoothing: \( \gamma \Delta \log c \) is the relative gap in consumption between those employed and unemployed, which is scaled by relative risk-aversion to translate this gap into utility terms. The second term, \( \Delta \log p \), which will be positive empirically, represents an additional reason for valuing unemployment insurance, a reason that does not stem from the preference to smooth consumption across states of the world. Instead, prices govern how individuals participating in an insurance scheme convert monetary payments into consumption. For any fixed level of insurance, a larger gap in prices implies that the same dollar buys more in the unemployed state than in the employed state. Therefore, larger gaps in prices lead to a desire to move monetary units from the employed to the unemployed state, and therefore increase the level of unemployment insurance.

In adopting Assumption 1 we have not only specified a CRRA form, but also forced the utility function to be the same in the two states. This is usual in empirical exercises. Specifying different utility functions is also possible. For example, consider a case in which marginal utilities in the employed and unemployed state are related through a (household-specific) preference shifter so that \( v'(c) = \exp(\beta' z) u'(c) \), where \( z \) is a vector of household characteristics and \( u'(c) \) has a CRRA specification. Then the result will be a version of (16) with an additional term on the right hand side involving \( \beta' z \).

Consumption and prices are not jointly observed in the usual data sources. However, by adding and subtracting \( \gamma \Delta \log p \), and collecting terms, it is possible to express the value of unemployment insurance as a function of observable consumption expenditure \( \tilde{c} \) and prices:

\[
\mu = \gamma \Delta \log \tilde{c} - (\gamma - 1) \Delta \log p.
\]

A similar expression involving expenditure and consumption also exists.

Re-expressing \( \mu \) in terms of consumption expenditure makes it very clear that the consumption-smoothing benefits estimated using consumption expenditure, without taking the usual approach of assuming \( u' = v' \) and taking a second order approximation around \( c_e \), \( u'(c_u) \approx u'(c_e) + u''(c_e)(c_u - c_e) \). Doing so yields the result:

\[
\exp(\mu) \approx 1 + \gamma \frac{\Delta c}{c} + \frac{\Delta p}{p}.
\]

Coupling this with the approximation \( \mu \approx \exp(\mu) - 1 \) delivers a version of (16) expressed in growth rates rather than log-differences. In many cases, the estimation of such an equation will require approximating growth rates with log-differences, which effectively takes us back to the expression in (16) but interpreted as an approximation.
ing into account prices, will be biased except in the special case in which relative risk
aversion $\gamma = 1$. This bias falls in one direction. Because the values assumed for $\gamma$ in
the literature on unemployment insurance usually exceed 1, the value of unemployment
insurance will in general be over-estimated if expenditure data are used. This echoes
the point made by Campos and Reggio (2016) for the special case of moral hazard and
public unemployment insurance. Also, unless $\gamma = 1$, at least two pieces of information
are needed to properly account for the benefits of unemployment insurance: consump-
tion expenditure and prices. However, the number of surveys that contain information
on both is limited.

4 Empirical Strategy and Data

We now turn to the estimation of the value of unemployment insurance using Spanish
survey data. From our model, the value of unemployment insurance $\mu$ can be recovered
from combining estimations of the effect of unemployment on consumption expenditure
and on prices:

$$E[\mu|X] = \gamma E[\Delta \log \tilde{c}|X] - (\gamma - 1) E[\Delta \log p|X].$$

(19)

Although $E[\Delta \log \tilde{c}|X]$ and $E[\Delta \log p|X]$ could be estimated separately, even from dif-
ferent surveys, there are clear advantages from using the same survey, covering the same
households, to estimate the relationship of consumption expenditure and prices with
employment status.

We estimate the relationship between unemployment and the two outcomes of interest—
consumption expenditure and prices—by relating the log of each of these variables to a
dummy variable indicating whether the primary earner is unemployed:

$$\log \tilde{c}_{it} = \lambda c U_{it} + x_{it}' \theta^c + \delta^c_i + \alpha^c_i + \eta^c_{it},$$

(20)

and

$$\log p_{it} = \lambda p U_{it} + x_{it}' \theta^p + \delta^p_i + \alpha^p_i + \eta^p_{it}.$$  

(21)

The vector $x$ contains time-varying household characteristics, $\delta^c_i$ and $\delta^p_i$ are time dummies, and $\alpha^c_i$ and $\alpha^p_i$ are time-invariant household-specific effects. A pooled OLS spec-
ification corresponds to a special case of (20) and (21) in which we set $\alpha_i^c = \alpha^c$ and $\alpha_i^p = \alpha^p$ for all households $i$.

Identification of the parameters of interest, $\lambda^c$ and $\lambda^p$, does not require any assumption on the covariance between $\eta_{it}^c$ and $\eta_{it}^p$. In fact, because data correspond to the same households the error terms in both equations, $\eta_{it}^c$ and $\eta_{it}^p$, are likely to be correlated. This is not problematic because the same right-hand-side variables appear in both equations, so that estimating the system of equations is equivalent to estimating these equations separately (Zellner, 1962). The intuitive reason is the following. The error term in the first equation is orthogonal to the regressors in the first equation by construction. Because the second equation has the same regressors, the error in the first equation will also be orthogonal to the regressors in the second equation, and vice versa. Therefore, non-zero correlation between the errors will not influence any of the estimates in (20) or (21).\footnote{However, as we discuss in Section 4.1, estimating both equations jointly will be useful to obtain the standard error for $\hat{\mu}$.}

We compare the output of two estimation strategies: a pooled OLS and a fixed effects linear panel regression in which we are able to control for unobserved time-invariant individual heterogeneity. Comparing the results from pooled cross sections and panel data informs us about the practical importance of the potential bias we are avoiding by using a first difference or a fixed effects estimation. Prior results for the US did not use panel data, therefore they need to rely on pooled cross-section estimates. Because we have panel data we can avoid the potential bias due to household unobserved heterogeneity to some extent. In our case, the fixed effects estimation allows for correlation between unemployment status and unobserved household heterogeneity that is constant over the two waves.

### 4.1 Coefficient uncertainty in the calculation of the value of unemployment insurance

The point estimate of the value of unemployment insurance $\mu$ is given by

$$\hat{\mu} = \gamma(-\hat{\lambda}^c) - (\gamma - 1)(-\hat{\lambda}^p), \quad (22)$$
where $\hat{\lambda}^c$ and $\hat{\lambda}^p$ are the point estimates obtained from regressing (20) and (21) on the same sample of households.

As we discussed before, correlation between the error terms in (20) and (21) does not influence point estimates $\hat{\lambda}^c$ and $\hat{\lambda}^p$, and therefore does not influence $\hat{\mu}$. However, in order to construct standard errors around the estimated value of unemployment insurance, the correlation between the estimated coefficients $\hat{\lambda}^c$ and $\hat{\lambda}^p$ is informative and joint estimation of (20) and (21) will be useful: the standard error of $\hat{\mu}$ is given by

$$se(\hat{\mu}) = \sqrt{\gamma^2 \text{var}(\hat{\lambda}^c) + (\gamma - 1)^2 \text{var}(\hat{\lambda}^p) - 2\gamma(\gamma - 1)\text{cov}(\hat{\lambda}^c, \hat{\lambda}^p)}.$$  (23)

To obtain an estimate of $\text{cov}(\hat{\lambda}^c, \hat{\lambda}^p)$ we take advantage of the fact that our regressions are for the same households and estimate both equations simultaneously in order to obtain a variance-covariance matrix for all estimates. Because our panel data covers two periods, the joint estimation can be performed by first-differencing our level equations (and therefore effectively converting our equations into a cross-section form), and then estimating a system of otherwise standard seemingly-unrelated-regression (SUR) equations. We obtain standard errors and the covariance of interest by performing a bootstrap with 500 repetitions.

4.2 Data

Our household data are obtained from the EPF (Encuesta de Presupuestos Familiares. Base 2006). This yearly survey provides detailed information on consumption, unemployment, and socioeconomic characteristics at the household level. Households are interviewed in two consecutive periods. The EPF provides expenditure data and also quantities purchased for several consumption items. The data in the EPF is of higher quality than prior Spanish ECPF surveys due to a substantial increase in sample size, a lengthening of the period in which households complete a diary, and improvements in the data collection process (INE, 2008). Consumption in the EPF accounts for 87% of Spanish aggregate consumption (Campos and Reggio, 2015).

The Spanish EPF compares favorably to sources of consumption data from other countries. For example, it has a number of advantages over the CEX, the consumption survey commonly used for testing risk-sharing in the US. It is well known that consumption
measured in the CEX has important discrepancies with Personal Consumption Expenditure (PCE), the aggregate consumption series in the US (Slesnick, 1992; Garner, Janini, Passero, Paszkiewicz, and Vendemia, 2006; Heathcote, Perri, and Violante, 2010). In particular, consumption measured in the CEX is less pro-cyclical than aggregate consumption. Campos, Reggio, and García-Piriz (2013) show that consumption measured from the CEX underestimates the cyclical correlation of aggregate consumption (PCE) with GDP by 40%. It is therefore likely that consumption measured from the CEX underestimates its co-movement with unemployment, which is a very cyclical variable.

Consumption items in the EPF are classified using the COICOP/HBS classification. Our measure of consumption expenditure is defined as the expenditure on nondurable consumption goods and services, excluding rent (which is imputed for homeowners). We obtain real household consumption expenditure by adjusting for inflation using the Spanish price index (IPC Base 2006). As is usual in the literature, we adjust household consumption by using the OECD equivalence scale to take into account possible economies of scale in consumption.\(^6\)

### 4.3 Sample selection and construction of variables

The EPF follows households for two periods. Our panel data cover the period 2006–2014. We focus on the working-age population and restrict the sample to households in which the primary earner is aged 25–64. We exclude households with heads who are self-employed or inactive. Our final sample consists of 100,754 observations (household/year). For the fixed effects estimation we further restrict the sample to those households observed twice in which the identity of the primary earner does not change from one year to the other. We have a balanced panel of 31,697 households. For our computations using physical quantity data our sample is reduced by 30 households for which quantity data are missing, leaving us with a total of 31,579 households (of which 25,221 are couples).

All our specifications include time dummies \(\delta_t\) to capture aggregate shocks, or, stated more generally, to account for arbitrary changes affecting all households, such as the macroeconomic environment. Other controls \(x_{it}\) consist of standard demographic variables likely to affect the level of consumption and the consumption profile. Our control

\(^6\)Our conclusions do not rely on this adjustment.
variables include dummy variables for household size and the number of kids below 16 or dependents below 25, dummies for educational attainment, gender, and a polynomial in the age of the primary earner to capture life-cycle effects. We also include regional dummies to control for systematic geographic differences in the evolution of consumption expenditure and prices across regions.

Because our sample includes urban and rural households, we include a dummy for rural households who may, in principle, obtain their consumption from non-market sources or derive a substantial part of their income from agricultural activities. We also include the number of adults employed other than the primary earner as an additional control to capture differences in the exposure to individual unemployment shocks. We also experiment with restricting the sample to couples and, in that case, add the unemployment status for the spouse as an additional control.\footnote{The regression for couples is used only as a complementary specification. For our baseline specification we use the larger sample including all households.}

We use home ownership as a proxy for wealth and include dummies for owning a primary home or a secondary home as additional controls. We also control for whether the household has a mortgage. Having a mortgage proxies for access to credit and, since households with a mortgage are a subset of those who own a home, it also allows for a more flexible relationship between home ownership and consumption.

To address the dual nature of the Spanish labor market we include a dummy for when the primary earner has an indefinite labor contract. Previous research has argued that the dual structure of labor contracts is a key characteristic of the Spanish labor market that explains much of the evolution of unemployment (Costain, Jimeno, and Thomas, 2010; Bentolila, Cahuc, Dolado, and Barbranchon, 2012).

### 4.4 Price index

Following the methodology in \textit{Aguiar and Hurst} (2007), we define an index to measure whether a household is paying more or less than the average. For each good $j$ (where $j = 1, \ldots, J$) we compute $\hat{p}_{ijt}$, the unit value paid by household $i$ at time $t$, as the ratio of expenditure on $j$ to the quantity of $j$:

$$\hat{p}_{ijt} = \frac{\tilde{c}_{ijt}}{q_{ijt}}.$$  (24)
Using these household-specific unit values \( \hat{p}_{ijt} \) we construct a weighted average price \( p_{jt} \) that was paid for good \( j \) at time \( t \), using quantities purchased \( q_{ijt} \) as weights:

\[
p_{jt} = \frac{\sum_i \hat{p}_{ijt} q_{ijt}}{\sum_i q_{ijt}}.
\]

The price index measuring how much a household overpaid or underpaid for its consumption basket is then obtained by dividing true expenditure by the cost of the bundle valued at average prices:

\[
\tilde{p}_{it} = \frac{\sum_{j=1}^J \hat{p}_{ijt} q_{ijt}}{\sum_{j=1}^J p_{jt} q_{ijt}}.
\]

As Aguiar and Hurst (2007), we normalize this price index to have mean one in every year:

\[
p_{it} = \frac{\tilde{p}_{it}}{\frac{1}{N} \sum_i \tilde{p}_{it}}.
\]

This normalization implies that \( \log p_{it} \) measures log-deviations from the average across households. This index is measures whether households pay lower prices for the goods in their household basket relative to the average.

5 Results

We first discuss the results separately for expenditure and prices and then combine them to calculate the value of unemployment insurance.

5.1 Expenditure

Before turning to prices, we first study the relationship between unemployment and consumption expenditure and present the results in Table 1. We include all controls variables described in Section 4. The comparison presented in Table 1 provides a strong case for preferring panel data fixed-effects estimates.

The first column in Table 1 pools all years and does not make use of the panel dimension. Therefore, it captures the difference in consumption expenditure between a household whose primary earner is unemployed and a similar household (in terms of observable...
characteristics) in the same year whose primary earner is employed. The average estimated drop in consumption expenditure associated to unemployment is large: around 31%.

The second column in Table 1 shows the result of running this same pooled regression only for the sample of households that are observed twice (households for which we can perform a fixed effects estimation). Despite the substantial drop in sample size, we estimate a coefficient practically identical to the first column. This evidence implies that the sample of households for which there are two observations is comparable to the full sample.

Finally, in the third column of Table 1 we report the coefficient from a fixed effect estimation, our preferred specification. As is immediately apparent, the difference with respect to the pooled estimates is large: 22 percentage points. The estimated effect of interest drops to one third when time-invariant unobserved heterogeneity is taken into account: unemployment is related to a consumption expenditure drop of 8.9 percent.

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) Whole Sample Pooled OLS</th>
<th>(2) Panel Sample Pooled OLS</th>
<th>(3) Panel Sample Fixed Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>$U_{it}$</td>
<td>-0.314*** (0.007)</td>
<td>-0.313*** (0.009)</td>
<td>-0.089*** (0.011)</td>
</tr>
<tr>
<td>Observations</td>
<td>100,754</td>
<td>63,394</td>
<td>63,394</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.339</td>
<td>0.335</td>
<td>0.859</td>
</tr>
</tbody>
</table>

Coefficients in columns (1) and (2) are obtained from a pooled OLS estimation, the coefficient in column (3) from a fixed-effects estimation. The dependent variable is the log of total real expenditure on nondurables and services and $U_{it}$ is a dummy variable taking the value one when the primary earner is unemployed. Our estimations include household size, the number of kids below 16 or dependents below 25, the number of adults employed other than the primary earner, primary and secondary home ownership, a mortgage dummy, a rural dummy, regional and time dummies, and for the primary earner: educational attainment, gender, a polynomial in the age, and a dummy for indefinite contracts. Panel-robust standard errors in parentheses. *** represents 1% significance level.

In Table 2 we conduct a similar comparison between pooled OLS and fixed-effect estimations but, in this case, for expenditure on food. Again, a pooled regression overes-
Timates the effect of unemployment on food expenditure. In this case, the difference is
11 percentage points. The estimated effect drops about two thirds once we control for
household time-invariant unobserved heterogeneity: unemployment is related to a food
expenditure drop of 6.4 percent.

Table 2: Food expenditure by employment status of the primary earner.

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) Whole Sample Pooled OLS</th>
<th>(2) Panel Sample Pooled OLS</th>
<th>(3) Panel Sample Fixed Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>$U_{it}$</td>
<td>-0.169*** (0.009)</td>
<td>-0.174*** (0.012)</td>
<td>-0.064*** (0.018)</td>
</tr>
<tr>
<td>Observations</td>
<td>100,754</td>
<td>63,394</td>
<td>63,394</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.106</td>
<td>0.101</td>
<td>0.725</td>
</tr>
</tbody>
</table>

Coefficients in columns (1) and (2) are obtained from a pooled OLS estimation, the
coefficient in column (3) from a fixed-effects estimation. The dependent variable is the log of
total real expenditure on food and $U_{it}$ is a dummy variable taking the value one when the
primary earner is unemployed. Our estimations include household size, the number of kids
below 16 or dependents below 25, the number of adults employed other than the primary
earner, primary and secondary home ownership, a mortgage dummy, a rural dummy, regional
and time dummies, and for the primary earner: educational attainment, gender, a polynomial
in the age, and a dummy for indefinite contracts. Panel-robust standard errors in
parentheses. *** represents 1% significance level.

In Table 3 we verify what happens when we restrict the sample to couples. Because
households with couples have potentially two earners, a job loss by the primary earner
may be less important for aggregate resources available to the household. Roughly 80%
of the sample consists of couples. For couples, the point estimate of the relationship
between unemployment by the primary earner and consumption expenditure is slightly
lower than for the full sample (but still negative and significantly different from zero at
the 1 percent level).

The results presented in this section highlight the importance of using panel data rather
than relying only on cross-sectional data to estimate the effects of unemployment. For
consumption expenditure, not controlling for unobserved heterogeneity seems to be an
important drawback.
Table 3: Consumption expenditure by employment status of the primary earner for couples.

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) Whole Sample Pooled OLS</th>
<th>(2) Panel Sample Pooled OLS</th>
<th>(3) Panel Sample Fixed Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>$U_{it}$</td>
<td>-0.272*** (0.007)</td>
<td>-0.268*** (0.009)</td>
<td>-0.079*** (0.011)</td>
</tr>
<tr>
<td>Observations</td>
<td>77,897</td>
<td>49,370</td>
<td>49,370</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.364</td>
<td>0.354</td>
<td>0.860</td>
</tr>
</tbody>
</table>

Coefficients in columns (1) and (2) are obtained from a pooled OLS estimation, the coefficient in column (3) from a fixed-effects estimation. The dependent variable is the log of total real expenditure on nondurables and services and $U_{it}$ is a dummy variable taking the value one when the primary earner is unemployed. Our estimations include household size, the number of kids below 16 or dependents below 25, the number of adults employed other than the primary earner, unemployment status of the spouse, primary and secondary home ownership, a mortgage dummy, a rural dummy, regional and time dummies, and for the primary earner: educational attainment, gender, a polynomial in the age, and a dummy for indefinite contracts. Panel-robust standard errors in parentheses. *** represents 1% significance level.
5.2 Prices

In Tables 4 and 5 we present results for our regressions for prices. Tables 4 includes all prices available in our data and Table 5 is restricted to prices on food items. We perform the same comparison between pooled and fixed-effect estimates, as in the previous section. That is, coefficients in columns (1) and (2) capture the average conditional difference between households with unemployed versus employed primary earners for the whole sample and the sample with panel information controlling for a set of observable characteristics.

The restriction of the sample does not seem to have an important effect: a household with an unemployed primary earner pays average prices that are 3.7% lower than a household with an employed primary earner that is similar in terms of observable characteristics and food prices that are 5.5% lower.

Our preferred estimates are those in the third column of Tables 4 and 5. Once time-invariant unobserved household characteristics are taken into account, the point estimate becomes significantly smaller. It drops by more than half, from 3.8% to 1.5% for all available prices, and from 5.6% to 2.0% food prices.

Computing the difference between the drop in expenditure and the drop in prices, we obtain an estimate of the drop in consumption associated with unemployment. Relying on our pooled regressions the estimated drop in consumption associated to unemployment is about 27 percent, much higher than the 7 percent we obtain when exploiting the panel dimension of the data (if we use food consumption the figures are 11.8 percent against 4.4 percent).

5.2.1 Comparison with other estimates or the relationship between prices and employment status

Although the main focus of their paper is on price dispersion, Kaplan and Menzio (2015) also study how prices paid are affected by employment status in the Kilts Nielsen dataset for the US. In their data, unemployed individuals cannot be distinguished from non-participants. They control for age, household size, and education but do not report fixed-effects estimates. They consider alternative definitions of a good but are agnostic about which one they prefer. The definition of a good that is closest to ours is the one
Table 4: Prices by employment status of the primary earner.

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) Whole Sample Pooled OLS</th>
<th>(2) Panel Sample Pooled OLS</th>
<th>(3) Panel Sample Fixed Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>$U_{it}$</td>
<td>-0.037*** (0.002)</td>
<td>-0.038*** (0.003)</td>
<td>-0.015*** (0.004)</td>
</tr>
<tr>
<td>Observations</td>
<td>100,443</td>
<td>63,158</td>
<td>63,158</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.161</td>
<td>0.164</td>
<td>0.744</td>
</tr>
</tbody>
</table>

Coefficients in columns (1) and (2) are obtained from a pooled OLS estimation, the coefficient in column (3) from a fixed-effects estimation. The dependent variable is the log of the price index $p_{it}$ and $U_{it}$ is a dummy variable taking the value one when the primary earner is unemployed. Our estimations include household size, the number of kids below 16 or dependents below 25, the number of adults employed other than the primary earner, primary and secondary home ownership, a mortgage dummy, a rural dummy, regional and time dummies, and for the primary earner: educational attainment, gender, a polynomial in the age, and a dummy for indefinite contracts. Panel-robust standard errors in parenthesis. *** represents 1% significance level.

Table 5: Prices in food items by employment status of the primary earner.

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) Whole Sample Pooled OLS</th>
<th>(2) Panel Sample Pooled OLS</th>
<th>(3) Panel Sample Fixed Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>$U_{it}$</td>
<td>-0.055*** (0.003)</td>
<td>-0.056*** (0.004)</td>
<td>-0.020*** (0.006)</td>
</tr>
<tr>
<td>Observations</td>
<td>100,405</td>
<td>63,118</td>
<td>63,118</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.155</td>
<td>0.157</td>
<td>0.751</td>
</tr>
</tbody>
</table>

Coefficients in columns (1) and (2) are obtained from a pooled OLS estimation, the coefficient in column (3) from a fixed-effects estimation. The dependent variable is the log of the price index $p_{it}$ and $U_{it}$ is a dummy variable taking the value one when the primary earner is unemployed. Our estimations include household size, the number of kids below 16 or dependents below 25, the number of adults employed other than the primary earner, primary and secondary home ownership, a mortgage dummy, a rural dummy, regional and time dummies, and for the primary earner: educational attainment, gender, a polynomial in the age, and a dummy for indefinite contracts. Panel-robust standard errors in parenthesis. *** represents 1% significance level.
they term “Brand and Size Aggregation”. With this definition of a good, they find that the non-employed pay prices that are 2.6% lower than employed households in the case of one-head households. For two-head households they find that, relative to a household with two employed heads, prices paid are 1.5% lower if one head is not employed and 4.6% lower if both heads are not employed.

These effects on prices are larger than the ones we found for Spain. However, they are not as large as we would have expect given that the results by Kaplan and Menzio (2015) rely on a cross-sectional estimation. This might in part be explained by the fact that they cannot distinguish between the unemployed and those who are out of the labor force. In Table 6 we estimate the response of consumption expenditure and prices for all goods and for food but replacing the unemployment dummy with a non-employment dummy. We find lower effects on prices.

Table 6: Expenditure and Prices by employment status of the primary earner.

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) Expenditure All</th>
<th>(2) Expenditure w/quantities</th>
<th>(3) Price Index w/quantities</th>
<th>(4) Food Price Index w/quantities</th>
<th>(5) Price Index Food</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-employed</td>
<td>-0.076*** (0.009)</td>
<td>-0.063*** (0.010)</td>
<td>-0.010*** (0.004)</td>
<td>-0.047*** (0.014)</td>
<td>-0.013*** (0.005)</td>
</tr>
<tr>
<td>Observations</td>
<td>78,159</td>
<td>78,159</td>
<td>78,159</td>
<td>78,136</td>
<td>78,136</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.860</td>
<td>0.781</td>
<td>0.749</td>
<td>0.738</td>
<td>0.757</td>
</tr>
</tbody>
</table>

All columns correspond to fixed-effects estimations. The dependent variable is the log of real expenditure on nondurable and services in column (1), the log of real expenditure on nondurables and services for which quantity data are available in column (2), the log of the price index $p_{it}$ in column (3), the log of real expenditure on food items in column (4), and the log of the price index $p_{it}$ restricted to food items in column (5). The coefficient shown corresponds to a dummy variable taking the value one when the primary earner is not employed. Our estimations include household size, the number of kids below 16 or dependents below 25, the number of adults employed other than the primary earner, primary and secondary home ownership, a mortgage dummy, a rural dummy, regional and time dummies, and for the primary earner: educational attainment, gender, a polynomial in the age, and a dummy for indefinite contracts. Panel-robust standard errors in parenthesis. *** represents 1% significance level.
5.3 The value of unemployment insurance

Using the expression derived from our model, we combine our estimates of the relationship between consumption expenditure and prices to recover the value of providing unemployment insurance. The value of unemployment insurance depends on the assumed level of relative risk aversion. Values used in practice hover around $\gamma = 2$, although it is common to present results for a range of values.

Figure 1 exhibits the value of unemployment insurance calculated for levels of risk-aversion between 0 and 3. The bars on the left (in black and gray) correspond to our calculations and the bars on the right (in white) show the result that would be obtained by erroneously attributing the whole change in expenditure to consumption. In the figure, we have also decomposed the value of unemployment insurance into the two components uncovered in Section 3: the consumption-smoothing component (in gray) and the price component (in black). The vertical bars at the top of each bar indicate estimated standard errors.

![Figure 1: Decomposition of the value of insurance into a consumption and price component.](image)

The figure shows that the value of unemployment insurance calculated exclusively from expenditure data under-estimates the true value if $\gamma < 1$ and over-estimates it if $\gamma > 1$. In the special case $\gamma = 1$ the value of unemployment insurance calculated from
expenditure data happens to be the correct one, albeit for the wrong reasons: whereas
the expenditure-based calculation assigns the whole value of unemployment insurance
to consumption-smoothing, the theoretical result in Section 3 shows that part of this
value is due to the price effect.

The conceptual mistake from expenditure-based calculations becomes particularly clear
in the boundary case where $\gamma = 0$. In this case, agents in the model do not value
consumption-smoothing. Therefore, consumption-smoothing benefits are zero. But even
in this case, the social value of providing unemployment benefits is not zero because a
dollar in the hands of an unemployed buys more consumption because they obtain
consumption goods at lower prices.

Overall, the total value of providing unemployment benefits in the correct calculation
and the expenditure-based calculation as measured from the total heights of the bars
in Figure 1 in the case of Spain are not so different. This is a stark difference with
the calibration results presented by Campos and Reggio (2016) for the US. The main
reason for this is that our estimates for price changes are significantly smaller than those
obtained for the US. We find that prices make up for only one-sixth of the difference
in expenditure between employed and unemployed households. In their calibration for
the US, Campos and Reggio (2016) use smaller price changes than those implicit in the
findings of Aguiar and Hurst (2005) but still assume that prices explain 50% of the fall
in expenditures. Our empirical findings in Section 5.2 strongly suggest that the use of
cross-sectional data in the existing studies for the US leads to an overestimation of the
role of prices.

The gap between the true calculation and the expenditure-based calculation is larger if
food items are used. In Figure 2 we repeat the same exercise but restricted to food items.
Now prices explain a larger share of the variation in expenditure and the gap becomes
larger. However, standard errors estimated for food items are, in general, larger.

5.3.1 Optimal unemployment insurance

We now turn to the implication of estimation of $\mu$ for the optimal level of public unem-
ployment insurance. The value of unemployment insurance $\mu$ needs to be compared to
an expression for the cost of providing unemployment benefits. The appropriate ‘suffi-
cient statistics’ formula in the case of moral hazard is given by (14). Assuming that the
Figure 2: Decomposition of the value of insurance into a consumption and price component using food expenditure

left hand side is constant with respect to the benefit level $b$, a benevolent planner would choose to increase unemployment benefits up to the point of equality:

$$\mu = \log \left(1 + \frac{\varepsilon_{1-\pi,b}}{\pi}\right).$$  

(28)

This expression can be confronted with data. If the left hand side is smaller than the right hand side, then this is evidence of unemployment benefits that are too generous. If the left hand side is larger than the right hand side, then benefits are too low. When the equation holds with equality, then benefits are at their optimal level.

The value of unemployment insurance expressed as a markup is 0.163 for a level of risk aversion of $\gamma = 2$ and 0.237 for a level of risk aversion of $\gamma = 3$. This needs to be compared to $\log \left(1 + \frac{\varepsilon_{1-\pi,b}}{\pi}\right)$. The value usually assumed for the elasticity of unemployment duration to the level of benefits is $\varepsilon_{1-\pi,b} = 0.5$, based on the study by Krueger and Meyer (2002). If we use a long-run value of $1 - \pi = 0.1$ for Spain, then the moral-hazard-related cost of providing unemployment benefits is $\log \left(1 + \frac{0.5}{0.9}\right) \approx 0.442$. Therefore, benefits at the current implicit level of unemployment insurance fall short of the cost, leading to the conclusion that unemployment benefits in Spain are too generous.
This calculation does not take into account uncertainty around the estimated value of \( \mu \). One of the advantages of our methodology is that we not only obtain point estimates but also confidence intervals for our estimates.

From our bootstrapping procedure we obtain an estimate for the covariance \( \text{Cov}(\hat{\lambda}^c, \hat{\lambda}^p) = 4.34 \times 10^{-6} \), which given estimated standard deviations, implies a correlation coefficient of 0.166. This positive correlation implies that confidence intervals around the central point estimate \( \hat{\mu} \) are narrower than those that we would have obtained by (mistakenly) assuming independence across equations.

In Figure 3 we use our estimate of the dispersion around the point estimate of the value of unemployment insurance to make probabilistic statements about whether the level of unemployment insurance in Spain is close to optimal for a given elasticity of unemployment duration with respect to unemployment benefits. In Panel (a) we plot the density around point estimates for different levels of risk-aversion assuming a Normal distribution of errors. In Panel (b) we graph the probability that the value of unemployment insurance exceeds its cost for different levels of \( p_i \). If benefits were at their optimal level, given the symmetry of the Normal distribution, we would expect the density of \( \hat{\mu} \) to be centered around \( \log \left( 1 + \frac{\varepsilon_{1-\pi,b}}{\pi} \right) \), so that

\[
\Pr \left[ \mu \geq \log \left( 1 + \frac{\varepsilon_{1-\pi,b}}{\pi} \right) \right] = 1 - F \left( \log \left( 1 + \frac{\varepsilon_{1-\pi,b}}{\pi} \right) \right) = 0.5, \tag{29}
\]

where \( F(\cdot) \) represents the cumulative density function (CDF) of \( \hat{\mu} \).

![Figure 3: Uncertainty around \( \hat{\mu} \) and optimal unemployment insurance](image)
The densities in Figure 3a show that as the level of risk-aversion increases, not only does the point estimate of the value of unemployment insurance increase, but also the uncertainty regarding this value. From (23), and given the relatively small covariance term, the standard deviation of $\hat{\mu}$ increases with $\gamma$ in an approximately linear way. This implies that for larger values of risk-aversion the probability that unemployment benefits are at the right level increases for two reasons: because the point estimate of the value of unemployment insurance increases and because the density of likely values around this point estimate becomes larger. However, Figure 3b shows that it is unlikely that unemployment benefits are at their optimal level except for degrees of risk-aversion that are much higher than those usually assumed.
6 Concluding remarks

We have derived a formula for the marginal welfare gain provided by unemployment insurance in an environment that is general in that it encompasses a wide class of models incorporating moral hazard and asymmetric information. The formula we use is exact in the case of CRRA preferences but can also be interpreted as an approximation in the case of other utility functions. The formula allows us to decompose the value of unemployment insurance into a consumption-smoothing component and a price component. For standard levels of risk-aversion, we find that the bulk of the value of unemployment insurance is due to consumption-smoothing.

On the empirical side we find that transitions to unemployment have a sizable impact on a household expenditure. We find evidence that prices paid by the unemployed are lower, so that the relative response to unemployment of expenditure overstates the response of actual consumption: consumption is more stable than expenditure. However, we find that prices play a smaller role than that suggested by previous estimates using cross-sectional data for the US. We find that differences in prices paid between households with employed and unemployed households are mostly due to time-invariant unobservable household characteristics and that the gap in prices becomes significantly smaller once this unobserved heterogeneity is accounted for. This also implies that the marginal benefit of unemployment insurance estimated exclusively from expenditure data is not that different from the correct value that takes into account price changes.

We show how estimates of prices and expenditure can be combined to obtain an estimate of (and confidence interval for) the marginal value of unemployment insurance. In a simple calculation for Spain, our estimation implies that the marginal benefit of unemployment is small relative to the moral hazard costs induced by providing insurance. An important point to have in mind is that once other factors, such as, for example, the role that unemployment insurance plays in allowing for better job matches, are taken into account, results may change. Nevertheless, we expect that in models that are enriched with details covering additional benefits and costs of unemployment insurance, the decomposition of the marginal value of unemployment insurance into a consumption and price component will be of relevance, and our methodological contribution and empirical findings will be informative for these more general settings.

More generally, the evidence that consumption may diverge from expenditure highlights
the importance of considering other decisions of members of the household that influence consumption. In particular, economists need to be aware of non-market activities, such as the choice that households have to devote time to price search. An increased emphasis to include shopping, and also house work, into economic models may prove fruitful. The recent availability of time use surveys will allow to do so systematically. We expect that careful modeling of the additional margins available to household will allow to shed light on the value of social insurance and, more generally, on how income fluctuations impact welfare.
References


Appendix

A. Asymmetric information and the provision of private insurance

The provision of private unemployment insurance is hindered if individuals have private information on their probabilities of becoming unemployed, because only those with high probabilities will self-select into the insurance scheme. Hendren (2013) studies this problem and shows how the presence of private information leads to empirically testable no-trade theorems that imply that private insurance markets do not exist. Hendren (2015) then applies these no-trade results to unemployment insurance and shows that the markup required for the existence of a private insurance market cannot be reconciled with the consumption-smoothing benefits it provides.

In the model of Hendren (2015) agents start out employed rather than unemployed. However, in the static model this distinction is irrelevant because the initial state is not used anywhere to derive (6). They transition into unemployment with individual probability \(1 - \pi\), which privately known to the agent but not known to the insurer. If only agents with high probabilities of becoming unemployed buy insurance, then insurance can be profitably sold if and only if

\[
\frac{d\tau}{db} \geq \frac{E[1 - \tilde{\pi}|\tilde{\pi} \leq \pi]}{E[\tilde{\pi}|\tilde{\pi} \leq \pi]}.
\]

(30)

The expression resembles the cost of providing an additional monetary units of benefits in the frictionless benchmark in (8) but with \(\pi\) and \(1 - \pi\) replaced with their conditional expectations because of the self-selection problem.\(^8\)

Plugging this result into the expression in (6) yields

\[
\frac{p_e u'(c_u)}{p_u v'(c_e)} \geq T(\pi) \equiv \left(\frac{\pi}{1 - \pi}\right) \frac{E[1 - \tilde{\pi}|\tilde{\pi} \leq \pi]}{E[\tilde{\pi}|\tilde{\pi} \leq \pi]}.
\]

(32)

Therefore, with asymmetric information, the right hand side is also larger than one, indicating that full insurance will again not be possible.

\(^8\)With asymmetric information only those with a high probability of unemployment (i.e., low \(\pi\) in our notation) self-select into unemployment insurance. Hendren (2015) assumes uni-dimensional heterogeneity in the type-space. If so, expected profits to a private insurer are given by

\[
\text{Profits} = E[\tilde{\pi}|\tilde{\pi} \leq \pi] \tau - E[1 - \tilde{\pi}|\tilde{\pi} \leq \pi]b.
\]

(31)

In order to earn positive profits on the first dollar of insurance, and for a private insurance market to exist, the condition in (30) must hold.
B. The dynamic model

The model is an extension of the dynamic model of Chetty (2008), whose model in turn is closely related to the model of Lentz and Tranaes (2005), a dynamic model in which savings decisions are combined with a job search model with variable search intensity.

Time is discrete and an agent, who starts out unemployed, lives for $T$ periods: $t = 0, 1, \ldots, T - 1$. An agent who is unemployed in period $t$ decides how much effort $s_t \in [0, 1]$ to exert in that period. Once the agent finds a job, employment lasts forever, i.e., employment is an absorbing state. The value function for an individual who finds a job at the beginning of period $t$, conditional on beginning the period with assets $A_t$, is

$$V_t(A_t) = \max_{A_{t+1} \geq L, p_t^u \in [p, 1]} u \left( \frac{1}{p_t^u} (A_t - A_{t+1} + w - \tau_t) \right) + V_{t+1}(A_{t+1}) - \phi_e \left( \frac{1}{p_t^e} \right)$$

(33)

The value function for an individual who fails to find a job at the beginning of period $t$ and remains unemployed is

$$U_t(A_t) = \max_{A_{t+1} \geq L, p_t^u \in [p, 1]} u \left( \frac{1}{p_t^u} (A_t - A_{t+1} + b_t) \right) + J_{t+1}(A_{t+1}) - \phi_u \left( \frac{1}{p_t^u} \right)$$

(34)

where

$$J_t(A_t) = \max_{s_t} s_t V_t(A_t) + (1 - s_t) U_t(A_t) - \psi(s_t)$$

(35)

is the value of entering period $t$ without a job and with assets $A_t$. We assume $u' > 0$, $u'' < 0$, $v' > 0$, $v'' < 0$, $\psi' > 0$, $\psi'' > 0$, $\phi'_e > 0$, $\phi''_e > 0$.

We consider only a flat unemployment benefit $b_t = b$ for the first $B$ periods and zero afterwards. The tax on the employed is constant $\tau_t = \tau$ and is only paid if employed.

The agent starts out unemployed. Ex-ante welfare, $J_0$, increases for infinitesimal changes in $\tau$ and $b$ if and only if

$$dJ_0 = \frac{\partial J_0}{\partial \tau} d\tau + \frac{\partial J_0}{\partial b} db \geq 0,$$

(36)

from where

$$- \frac{\partial J_0}{\partial b} \geq \frac{d\tau}{db}.$$  

(37)

The derivatives $\frac{\partial J_0}{\partial b}$ and $\frac{\partial J_0}{\partial \tau}$ are needed for the left hand side of the equation. Using the Envelope Theorem, they can be calculated as

$$\frac{\partial J_0}{\partial b} = \sum_{t=0}^{B-1} \frac{\partial J_0}{\partial b_t} = \sum_{t=0}^{B-1} \prod_{j=0}^{t} (1 - s_j) \frac{\partial U_t}{\partial b_t}$$

$$= \sum_{t=0}^{B-1} \prod_{j=0}^{t} (1 - s_j) \frac{1}{p_t^u} u'(c_t^u)$$

(38)
\[
\frac{\partial J_0}{\partial \tau} = \sum_{t=0}^{T-1} \left( 1 - \prod_{j=0}^{t} (1 - s_j) \right) \frac{\partial V_t}{\partial \tau} = -\sum_{t=0}^{T-1} \left( 1 - \prod_{j=0}^{t} (1 - s_j) \right) \frac{1}{p_t} v'(c^e_t).
\] 

(39)

Substituting these derivatives into (37) yields
\[
\frac{\sum_{t=0}^{B-1} \prod_{j=0}^{t} (1 - s_j) \frac{1}{p_t} u'(c^u_t)}{\sum_{t=0}^{T-1} \left( 1 - \prod_{j=0}^{t} (1 - s_j) \right) \frac{1}{p_t} v'(c^e_t)} \geq \frac{d\tau}{db}.
\] 

(40)

A balanced budget requires that
\[
D_{b} b = (T - D) \tau,
\] 

(41)

where we define the expected duration of unemployment, which is
\[
D = \sum_{t=0}^{T-1} \prod_{j=0}^{t} (1 - s_j),
\] 

(42)

and the expected duration receiving unemployment benefits, which is
\[
D_{b} = \sum_{t=0}^{B-1} \prod_{j=0}^{t} (1 - s_j).
\] 

(43)

Differentiate the government budget constraint to obtain:
\[
\frac{d\tau}{db} = \frac{D_{b}}{T - D} \left( 1 + \varepsilon_{D_{b} b} + \frac{D}{T - D} \varepsilon_{D,b} \right).
\] 

(44)

After substituting this result into into (37) we obtain the dynamic counterpart to (14) in the static model in the main text:
\[
\frac{\sum_{t=0}^{B-1} \prod_{j=0}^{t} (1 - s_j) \frac{1}{p_t} u'(c^u_t)}{\sum_{t=0}^{T-1} \left( 1 - \prod_{j=0}^{t} (1 - s_j) \right) \frac{1}{p_t} v'(c^e_t)} \geq \frac{D_{b}}{T - D} \left( 1 + \varepsilon_{D_{b} b} + \frac{D}{T - D} \varepsilon_{D,b} \right).
\] 

(45)
Relationship to the static model

Notice that in the case \( T = B = 1 \), durations are \( D_B = D = 1 - s_0 \), and the expression becomes:

\[
\frac{(1 - s_0) \frac{1}{p_0} u'(c_0^u)}{(1 - (1 - s_0)) \frac{1}{p_0} v'(c_0^e)} \geq \frac{1 - s_0}{1 - (1 - s_0)} \left( 1 + \varepsilon_{1-s_0,b} + \frac{1 - s_0}{1 - (1 - s_0)} \varepsilon_{1-s_0,b} \right),
\]

which simplifies to

\[
\frac{1}{p_0} u'(c_0^u) \geq \left( 1 + \frac{1}{s_0} \varepsilon_{1-s_0,b} \right),
\]

which is the same as our static model with \( s_0 = \pi \).

Time-averaging

Both the numerator and the denominator on the left hand side of (45) can be written as weighted averages by using the ratio of survival rates to duration as weights. That these weights sum to one can be verified from the definitions of the durations.

Define

\[
E_B \left[ \frac{1}{p_t} u'(c_t^u) \right] \equiv \sum_{t=0}^{B-1} \frac{\prod_{j=0}^{t} (1 - s_j)}{D_B} \frac{1}{p_t} u'(c_t^u)
\]

and

\[
E_T \left[ \frac{1}{p_t} v'(c_t^e) \right] \equiv \sum_{t=0}^{T-1} \frac{\prod_{j=0}^{t} (1 - s_j)}{T - D} \frac{1}{p_t} v'(c_t^e)
\]

Then, the condition in (45) can be re-stated as

\[
\frac{E_B \left[ \frac{1}{p_t} u'(c_t^u) \right]}{E_T \left[ \frac{1}{p_t} v'(c_t^e) \right]} \geq \left( 1 + \varepsilon_{D,b} + \frac{D}{T - D} \varepsilon_{D,b} \right).
\]

Euler equations

Assuming an internal optimum for \( A_{t+1} \), the Euler equation for an individual who is employed at date \( t \) is

\[
\frac{1}{p_t} v'(c_t^u) = \frac{1}{p_{t+1}} v'(c_{t+1}^u)
\]

For an individual who is unemployed at date \( t \), the Euler equation is

\[
\frac{1}{p_t} u'(c_t^u) = s_{t+1} \frac{1}{p_{t+1}} v'(c_{t+1}^e) + (1 - s_{t+1}) \frac{1}{p_{t+1}^{u_e}} u'(c_{t+1}^u)
\]
Assume that \( c_t^e \approx c^e \) for all \( t = 0, 1, \ldots, T - 1 \). The static nature of the price decision implies that \( p_t^e \approx p^e \) for all \( t = 0, 1, \ldots, T - 1 \). Then the expression simplifies to

\[
E_B \left[ \frac{p^e}{p^u} u'(c^u) \right] \geq \left( 1 + \varepsilon_{D,b} + \frac{D}{T - D} \varepsilon_{D,b} \right). \tag{53}
\]

**Relationship with hazard rates**

The first order condition for search effort at date 0 is

\[
\psi'(s_0) = V_t(A_0) - U_t(A_0) \tag{54}
\]

By implicit differentiation,

\[
\frac{\partial s_0}{\partial b_t} = -\frac{1}{\psi''(s_0)} \left[ \frac{\partial V_0(A_0)}{\partial b_t} - \frac{\partial U_0(A_0)}{\partial b_t} \right] \tag{55}
\]

By the Envelope Theorem,

\[
\frac{\partial V_0(A_0)}{\partial b_t} = 0 \tag{56}
\]

and

\[
\frac{\partial U_0(A_0)}{\partial b_t} = \begin{cases} \frac{1}{p_t^u} u'(c_t^u) & \text{if } t = 0 \\ \left( \prod_{j=1}^t (1 - s_j) \right) \frac{1}{p_t^u} u'(c_t^u) & \text{if } t \geq 1 \end{cases} \tag{57}
\]

Therefore,

\[
(1 - s_0) \frac{\partial s_0}{\partial b_t} = -\frac{1}{\psi''(s_0)} \left( \prod_{j=0}^t (1 - s_j) \right) \frac{1}{p_t^u} u'(c_t^u) \tag{58}
\]

Summing over the first \( B \) periods:

\[
- (1 - s_0) \psi''(s_0) \sum_{t=0}^{B-1} \frac{\partial s_0}{\partial b_t} = \sum_{t=0}^{B-1} \left( \prod_{j=0}^t (1 - s_j) \right) \frac{1}{p_t^u} u'(c_t^u) \equiv D_B \left( \frac{1}{p_0^u} u'(c_0^u) \right) \tag{59}
\]

Using \( \psi''(s_0) \frac{\partial s_0}{\partial b_0} = -\frac{1}{p_0^u} u'(c_0^u) \):

\[
E_B \left[ \frac{1}{p_0^u} u'(c_0^u) \right] = -\frac{1}{p_0^u} u'(c_0^u) \frac{(1 - s_0)}{D_B \frac{\partial s_0}{\partial b_0}} \sum_{t=0}^{B-1} \frac{\partial s_0}{\partial b_t} \tag{60}
\]

Therefore, we can express

\[
E_B \left[ \frac{1}{p_0^e} u'(c_0^e) \right] = \frac{p_0^e}{p_0^u} u'(c_0^u) \left[ \frac{(1 - s_0)}{D_B \frac{\partial s_0}{\partial b_0}} \sum_{t=0}^{B-1} \frac{\partial s_0}{\partial b_t} \right] \tag{61}
\]