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Abstract

We use a simple analytical framework to study how idiosyncratic production shocks are smoothed through risksharing across Spanish provinces. By analyzing how production in the average province is successively smoothed until it is used as consumption, we find that half of the shocks have been smoothed in the period 1973–1993 and that this proportion is even higher in the last decade (1983–1993). Capital and credit market risksharing account for most of this result. Labor mechanisms play a negligible role and the smoothing due to the government tax-transfer system is quite small. Finally, we observe that the use of provincial prices instead of aggregate prices results in a reduction of the degree of smoothing in the economy.

I. Introduction

Regions or provinces in a country are deeply integrated through a network of economic links which facilitates the smoothing of idiosyncratic economic disturbances.[1] This smoothing is in part the consequence of risksharing mechanisms, deliberately or undeliberately built in the economy, that allow consumption in each period to be less volatile than production.[2] For instance, the national tax and transfers system may act as a "shock buffer" that allows provinces (or agents in general) to receive more net transfers in case of a higher-than-average negative disturbance to province production. Other risk sharing mechanisms are less obvious, and will be discussed in the next section; but we will use a simple econometric framework for quantifying their effects in the case of Spain. In particular, we will be able to isolate four complementary channels of risksharing, thereby integrating the disperse literature on the issue. Thus we convey labor market smoothing (Blanchard and Katz [1992] and Barro and Sala-i-Martín [1991] for the US, Bentolila [1992] and Bentolila and Dolado [1991] for Spain), capital market smoothing (French and Poterba [1991] for the international economy and Atkeson and Bayoumi [1993] for Europe), fiscal smoothing (Sala-i-Martín and Sachs [1992] for the US, von Hagen [1992], Bayoumi and Masson [1995], Goodhart and Smith [1993] for Europe, Císcar [1992] for Spain), and credit market smoothing. We will also pursue further decomposition of the labor, fiscal and credit channels in order to better explain each mechanism.
Finally, we will study the smoothing role of provincial prices, which — to our knowledge — had never been quantified before.

Our framework — based on Asdrubali, Sørensen and Yosha [1996] — will be applied to the Spanish case for the period 1973–1993. During this time, the Spanish economy has gone through a thorough transformation: the economic transition from a primary economy to an economy of services with more developed financial markets; the return of migration which fled to Europe in the previous decades, and the dramatic upsurge in unemployment.

But the most characteristic feature of Spain is that it has moved from an authoritarian regime to a democracy; this change has brought about the shift from a paternalistic state towards a western-style welfare state, and from a very centralist administrative structure to the current decentralized configuration.

Presumably, these changes have had a deep impact on the channels of risksharing. Thus, we would like to explore not only the degree of income and consumption smoothing across Spain, or the importance of the fiscal channel relative to market institutions, but also how they have evolved over time. To shed light on these issues, we study the patterns of risk sharing among Spanish provinces during the period 1973–1993, and then we repeat the analysis, separating the periods 1973–1983 and 1983–1993. The first roughly corresponds to the so called transition to democracy, from the first oil shock and the demise of Franco's regime to the consolidation of democracy after the failed coup in 1981 and the change in Government in 1982. The second period corresponds to the consolidation of the new economic and political structure, in which the Spanish economy becomes wholly inserted in the developed world and joins the European Union (1986).

Our results show that labor market smoothing has been very modest in either subperiod, suggesting that internal migrations have played a minor stabilizing role. On the contrary, capital markets have been a very relevant source of risksharing, reflecting a remarkable degree of financial integration within the country. Government smoothing is also small, although in the second period its importance has greatly increased, reflecting the deep changes in the structure of fiscal mechanisms. Investigating further into the fiscal components, we observe that the sizable stabilizing effects of transfers have been marginally reversed by government receipts. The role of credit markets also turns out to be very relevant, although in this case we are unable to discriminate between interprovincial and intertemporal effects. Finally, we isolate the role of provincial prices in smoothing shocks; interestingly enough, they appear to have had a dis-smoothing effect.

All in all we find that risksharing — predominantly through capital and credit markets — has allowed to absorb half of the disturbances to production in the period under consideration, and that its role has significantly improved in the last decade. Our finding of less than full risksharing is consistent with theoretical studies on the optimality of incomplete government risksharing (e.g. Asdrubali [1996]), as well as with empirical work on consumption smoothing in the United States (e.g. Cochrane [1991] and Crucini [1995]; see however Mace [1991]), in Spain (Cutanda [1995]) and with evidence of less than full risksharing in village India (Townsend [1994]).

In the next section we present the main idea of risksharing channels, in section III we illustrate the main variance decomposition, and discuss measurement and econometric issues. In section IV we present the results, and section V concludes.

II. Channels of risksharing

There are several channels through which risksharing can occur across different provinces. First, economic agents residing in a province can move to other provinces, either temporarily or permanently. In so doing, they diversify their income sources. To the same purpose, they can share their provincial risk via cross-ownership of productive assets in capital markets. Third, their income can be further smoothed by the tax-transfer system of the central government. Fourth, they may smooth their consumption by adjusting their asset portfolio, as long as national credit markets are well developed; that is, they can lend to and borrow from other provinces. For brevity we label these levels of smoothing as labor market, capital market, central government (or fiscal), and credit market smoothing.

Let ap, rp, ri, di, and c denote net autarkic province product, net resident province product, province resident income, disposable province income, and province consumption,

all in real per capita terms. Table I displays a scheme of the stage at which each risksharing mechanism operates in the economy. Net autarkic province product, *ap*, is the value added to production of the province (net of depreciation) as if there were no migration flows. Net resident province product, *rp*, includes both net migration and commuters' income, thereby accounting for the effects on production of labor mobility. Province resident income, *ri*, includes dividend, interest, and rental income payments across province borders; disposable province income, *di*, includes transfers and is net of income taxes (personal and corporate) and of social security contributions; finally *c* is a measure of provincial private consumption. See the Appendix for a discussion on data construction.

If there is full risk sharing after labor mobility smoothing, *rp* should not comove with *ap*. If full risksharing is not achieved, there is scope for capital market smoothing, which will take place to the extent that *ri* does not comove with *rp* (or, alternatively, to the extent that $(rp - ri)$ comoves with *ap*). If full risksharing is not yet achieved, there is scope for further income smoothing by the central tax-transfer system. If full risksharing is achieved at this level, *di* should not comove with *ap*. Otherwise, there is scope for further consumption smoothing on asset markets. If full interprovince risksharing is achieved after all the channels of smoothing have operated, *c* will not vary with *ap* for a given level of aggregate output.

III. A Metric for Risksharing

In order to assess more formally the degree of risk sharing, in this section we develop a framework to measure the percentage of a shock absorbed at each level of smoothing. Before presenting it, a caveat is in order. Two dimensions of risksharing are implicit in our analysis: a spatial (interprovincial) and a time (intertemporal) dimension. This work is centered on the former, and our metric provides the means to abstract from the latter, but the nature of some variables in our data set renders difficult to do it neatly at each

level of risksharing, in particular in the credit channel, as we will observe below.

We regard the output (per capita) of each province as exogenous, and treat province production as a homogeneous non-durable good, so our analysis ignores capital as well as capital gains and losses. With full risksharing, consumption in each province is a fixed proportion of aggregate output, independently of the nature of the stochastic process governing shocks to province production.[3]

Although testing for full risksharing is implicit in our methodology, our main objective is to break down the observed risksharing (whether full or not) into its components. Such decomposition of the period by period cross-sectional variance in province production will provide a metric for quantifying risksharing at each level of smoothing. Consider the identity

$$ap^i = \frac{ap^i}{rp^i}\ \frac{rp^i}{ri^i}\ \frac{ri^i}{di^i}\ \frac{di^i}{c^i}\ c^i, \tag{1}$$

where i is an index of provinces and the time index has been dropped for simplicity. Smoothing takes place via labor mobility, capital markets, the tax-transfer system, and credit markets if $\frac{ap^i}{rp^i}$, $\frac{rp^i}{ri^i}$, $\frac{ri^i}{di^i}$ and $\frac{di^i}{c^i}$ vary positively with ap^i, namely if an increase in ap^i entails a smaller increase in rp^i, which in turn entails an even smaller increase in ri^i, and so forth.

If we take logs and differences, multiply both sides by $\Delta \log ap^i$ and apply the expectation operator, we will obtain the following decomposition of the cross-sectional variance in ap growth:

$$\begin{aligned}
\mathrm{var}\{\Delta \log ap\} \;=\; & \mathrm{cov}\{\Delta \log ap, \Delta \log ap - \Delta \log rp\} \\
& + \mathrm{cov}\{\Delta \log ap, \Delta \log rp - \Delta \log ri\} \\
& + \mathrm{cov}\{\Delta \log ap, \Delta \log ri - \Delta \log di\} \\
& + \mathrm{cov}\{\Delta \log ap, \Delta \log di - \Delta \log c\} \\
& + \mathrm{cov}\{\Delta \log ap, \Delta \log c\}\ .
\end{aligned}$$

Divide by the variance of $\Delta \log ap$ to get

$$1 = \beta_L + \beta_K + \beta_G + \beta_C + \beta_U, \tag{2}$$

where β_L is the ordinary least squares (OLS) estimate of the slope in the regression of $\Delta \log ap^i - \Delta \log rp^i$ on $\Delta \log ap^i$, β_K is the slope in the regression of $\Delta \log rp^i - \Delta \log ri^i$ on $\Delta \log ap^i$, β_G is the slope in the regression of $\Delta \log ri^i - \Delta \log di^i$ on $\Delta \log ap^i$, β_C is the slope in the regression of $\Delta \log di^i - \Delta \log c^i$ on $\Delta \log ap^i$, and β_U is the coefficient in the regression of $\Delta \log c^i$ on $\Delta \log ap^i$. We interpret β_L, β_K, β_G, and β_C as the percentage of smoothing achieved at each level, and β_U as the amount not smoothed. If $\beta_U = 0$, there is full risksharing and the coefficients β_L, β_K, β_G, and β_C sum to 1. Otherwise, they sum to less than 1. We do not constrain any of the β coefficients, at any level, to be positive or less than 1. Therefore, if there is dis-smoothing at some level, it will be reflected in a negative value of β. In the next section, we explain how we proceed to estimate the βs.

Together with the labor market, capital market and credit market smoothing constitutes the fraction of shocks smoothed through transactions on markets. An important distinction between these forms of smoothing is that capital market smoothing is a result of ex-ante arrangements, prior to the occurrence of shocks, whereas credit market smoothing takes place ex-post, after shocks occur. Finally, we must point out that the credit market smoothing has both an interprovincial and an intertemporal component; it is obvious that economic agents can smooth their consumption either by borrowing and lending from other provinces or by accumulating and decumulating wealth through saving; therefore, our consumption data also incorporate intertemporal smoothing effects. Lack of data on saving flows prevent us from filtering them out.

Econometric Issues

At the practical level, we apply the decomposition in (2) by running the panel regres-

regressions

$$
\begin{aligned}
\Delta \log ap_t^i - \Delta \log rp_t^i &= \nu_{L,t} + \beta_L \ \Delta \log ap_t^i + u_{L,t}^i \,, \\
\Delta \log rp_t^i - \Delta \log ri_t^i &= \nu_{K,t} + \beta_K \ \Delta \log ap_t^i + u_{K,t}^i \,, \\
\Delta \log ri_t^i - \Delta \log di_t^i &= \nu_{G,t} + \beta_G \ \Delta \log ap_t^i + u_{G,t}^i \,, \\
\Delta \log di_t^i - \Delta \log c_t^i &= \nu_{C,t} + \beta_C \ \Delta \log ap_t^i + u_{C,t}^i \,, \\
\Delta \log c_t^i &= \nu_{U,t} + \beta_U \ \Delta \log ap_t^i + u_{U,t}^i \,,
\end{aligned}
\tag{3}
$$

where $\nu_{.,t}$ are time fixed effects. The β coefficients will then be weighted averages of the year by year cross-sectional regressions.[4] The time fixed effects capture year specific impacts on growth rates, most notably the impact of the growth in Net Domestic Product. This will allow us to interpret the βs as the amount of smoothing of asymmetric shocks achieved domestically. Using these equations we measure the degree to which changes in ap affect, e.g., same year province consumption.

It is well known since the work of Nelson and Plosser [1982] that most macroeconomic time series exhibit unit root or near unit root behavior, and that time series regressions involving unit root processes may give results that are spurious in the sense of Granger and Newbold [1974] and Phillips [1986]. The time series in our data set are clearly best characterized as unit root processes and the time differenced specification is therefore appropriate.[5] The autocorrelation that would be induced by differencing a stationary series will in any case entail loss of efficiency, but not bias. Given the large cross-sectional dimension of the data set, this potential loss of efficiency is not serious. Further autocorrelation in each equation has turned out to be negligible.

Preliminary estimations suggest that our data exhibit a certain degree of heteroskedasticity, since the variance over time of each series fluctuates across provinces. The problem is partly reduced because we take logs of the variables, and successively deflate each of them by province population — obtaining per capita measures — as well as by province

cpi — obtaining real measures. In order to further reduce potential effects of heteroskedasticity and to guard against outliers, we estimated the relations (one by one) running Huber (robust) regressions which assign lower weight to observations with higher absolute residuals, and drop outliers altogether. We then estimated the corrected equations in (??) as SUR regressions. We adopted the same tecnique for the detailed panels in Tables III to VII.[6]

Since province level data may be measured with less precision than aggregate data, one may worry about measurement errors. The errors arise because some of the data used for constructing our variables are imprecise (see Appendix for details). It is well known that measurement errors in the regressor bias the estimates towards zero, while measurement errors in the regressand only lead to increased standard errors. The regressor, ap, is particularly likely to be measured with error for small provinces. To the extent that our coefficients are biased we would overstate the amount of labor market smoothing (since β_L is one minus the regression of $\Delta \log rp$ on $\Delta \log ap$) and understate the amount not smoothed. Potential bias in our estimates of capital, government and credit market smoothing may be positive or negative since, for example, β_G is the difference of the regression coefficients of $\Delta \log ri$ and $\Delta \log di$ on $\Delta \log ap$. Over longer horizons measurement errors are likely to be less serious.[7]

It should be kept in mind that measurement errors in consumption, as in any left hand side variable, do not result in biased estimates, only in higher standard deviations. However, our estimates of the fraction of shocks to province product not smoothed, β_U, exhibit standard deviations that are low enough to enhance our confidence in the main results.

IV. Results

In Table II we display the empirical results. Our breakdown shows that a considerable part of shocks to province output (22.5 percent) is absorbed by capital market smoothing.

We interpret this as a consequence of cross-ownership of capital, which reflects the financial integration between Spanish provinces.

The amount of smoothing accomplished by the labor market is 2.3 percent and is statistically significant. The small value of β_L is consistent with all the studies on migration in Spain (e.g., Bentolila [1992] and Bentolila and Dolado [1991]), which have underlined the negligible stabilizing role of labour mobility.

More intriguing is the scant risksharing effect of fiscal policy (2.5 percent), although this result is consistent with the study of Císcar [1992]. Indeed, the central tax-transfer system is not primarily intended to provide interprovincial risksharing; rather, stabilization is expected to occur mostly intertemporally, through the government's fiscal deficits or surpluses. However, we would have expected that the existence of automatic stabilizers and the redistributive role of fiscal mechanisms would have played an important role as a regional risksharing mechanism. We will turn to this point later.

The degree of smoothing at the last level, which we refer to as credit market smoothing, amounts to 23.3 percent. As we have mentioned, we cannot discriminate which is the contribution of interregional and intertemporal smoothing to this percentage.

Probably the most outstanding result is the importance of market mechanisms as opposed to the role of government. While the economy is able to stabilize roughly a half (50.8%) of any shock, the contribution of fiscal mechanisms to stabilization is meagre.

Sub-Periods

Two interesting related questions are whether these smoothing channels have changed over time, and whether more smoothing would have been undertaken by private markets had there been less government smoothing. One way of getting an indication of this is to see if the amount of government smoothing has varied over sub-periods and if the amount of market smoothing has varied correspondingly. As the time series dimension of our data

set is rather short (20 years of data, corresponding to eleven observations of differenced data, since the frequency is biannual), we chose to split it into two sub-periods, 1973–1983 and 1983–1993.

The results are reported in Table III. Smoothing due to labor mobility took place mainly in the seventies and declined in the following period. Capital market and, to a lesser extent, credit market smoothing increased considerably from one decade to the next reflecting, most probably, financial innovation and better access to securities markets. During the period 1983-93 almost 30% of a shock to province output was smoothed on capital markets, and roughly a quarter on credit markets. Government smoothing in the first period turns out not to be significant, while it improves dramatically (to 7.5%) in the second period, reflecting the deep changes in the fiscal mechanism, brought about in part by more western-style welfare state features.

Capital and credit markets smoothing on one hand, and fiscal smoothing on the other seem therefore to have moved together during the past decades, with no indication that one is a substitute for the other. However, capital market smoothing turns out to be the main channel in the second period, while credit market smoothing ranks first in the first period. Since credit market smoothing merges intertemporal and interregional mechanisms, we can infer that the capital market channel has probably been the most important mechanism of risksharing in the Spanish economy.

All in all our results show that the percentage of smoothing has increased dramatically between periods (from 43.3% to 63.3%); all the mechanisms but labour mobility have improved reflecting a definite gain in the capability of the country to absorb domestic idiosyncratic shocks. However, we still largely reject the hypothesis of full interprovince risksharing. This finding is consistent with most of the existing literature.

Detailed Breakdown

Further insights on the relative role of risksharing channels, overall and over time, can be gained by breaking down, when data permit, each channel of smoothing into its components. The procedure is the same as above, where we let the real rate of growth of autarkic product be the common regressor; but now we use as regressands the rate of growth of the components of each level of smoothing. The results for the estimation of the *betas* corresponding to each component of labor, fiscal and credit markets smoothing appear in Tables IV, V and VI, respectively.

Table IV shows that labour smoothing has been achieved essentially through migration and that commuters' income has played no significant role. The results do not vary much between periods.

Quite instructive is the analysis of fiscal smoothing in Table V; the risksharing effect of government policy has exclusively relied upon transfers (almost 5%), while the rest of the components (social security contributions, personal income taxes and corporate taxes) have contributed negatively, albeit scantly. These results conform with those of Císcar [1992], who however adopts a different methodology. When we turn to the sub-period analysis, the results are even more informative. In the first period, transfers play a minor smoothing role (2.7%), while — interestingly enough — the other components display a dis-smoothing effect (only personal income taxes are non significant). Second period transfers, instead, are able to smooth a round 10% of a shock, and only corporate taxes keep showing a significant negative sign. Behind this differential role of transfers may lay the shift of importance in the type of fiscal mechanisms adopted by the government, from pensions in the seventies to more standard unemployment subsidies in the eighties. As for personal income taxes, their behaviour can be defined as neutral, given their low value in any sample and lack of significance in the sub-period analysis.[8]

Finally, a decomposition of the sources of credit smoothing suggests that while household savings have greatly increased their already relevant role, on the contrary corporate

savings (i.e., retained earnings) exhibit, if anything, a dis-smoothing effect, although it is not significant in the second period.

The Smoothing Role of Prices

The price level across provinces may interact with risksharing patterns. There are sound theoretical reasons to expect both a smoothing and a dis-smoothing effect of provincial prices. Centering the discussion on relative supply shocks, as we have done up to now, open-economies real exchange rate models, as Obstfeld's [1985], suggest that positive productivity shocks create an excess supply which reduces relative prices; on the contrary, when differences between exposed and non-exposed sectors are considered, as in the Balassa-Samuelson hypothesis, positive productivity shocks, which mainly benefit exposed (tradables) sectors, result in relative price increases. To investigate the issue for the case of Spain, we started by running the same panel regressions as in (3), but deflating the variables by national cpi (denoted P_t) rather than by provincial cpi (P_t^i). This amounts to repeating the previous exercise without taking into account the effects of provincial prices. It is convenient to rewrite that system in terms of nominal rates of growth (upper case variables) minus national inflation:

$$
\begin{aligned}
\Delta \log AP_t^i - \Delta \log RP_t^i &= \nu_{L,t}^* + \beta_L^* \,(\Delta \log AP_t^i - \Delta \log P_t) + \eta_{L,t}^i \,, \\
\Delta \log RP_t^i - \Delta \log RI_t^i &= \nu_{K,t}^* + \beta_K^* \,(\Delta \log AP_t^i - \Delta \log P_t) + \eta_{K,t}^i \,, \\
\Delta \log RI_t^i - \Delta \log DI_t^i &= \nu_{G,t}^* + \beta_G^* \,(\Delta \log AP_t^i - \Delta \log P_t) + \eta_{G,t}^i \,, \\
\Delta \log DI_t^i - \Delta \log C_t^i &= \nu_{C,t}^* + \beta_C^* \,(\Delta \log AP_t^i - \Delta \log P_t) + \eta_{C,t}^i \,, \\
\Delta \log C_t^i - \Delta \log P_t &= \nu_{U,t}^* + \beta_U^* \,(\Delta \log AP_t^i - \Delta \log P_t) + \eta_{U,t}^i \,,
\end{aligned}
\tag{4}
$$

where $\beta_{\cdot}^*$ and $\nu_{\cdot,t}^*$ are, respectively, the corresponding smoothing coefficients and time fixed effects. Table VII shows the results for the whole sample (the sub-period analysis displays a similar profile). Using a common deflator now increases smoothing at every level;

as a consequence the percentage not smoothed decreases from 49.2% to 39.5%, suggesting that using provincial prices instead of aggregate prices reduces smoothing at every level.

We would like to test this hypothesis more formally. The left-hand terms in (3) and (4) are equal. Operating on the right-hand terms and performing some simple manipulations, we arrive at a system of regressions of the following type:[9]

$$(5) \qquad \Delta \log P_t^i - \Delta \log P_t = \mu_t + \gamma \ \Delta \log(AP_t^i - \Delta \log P_t) + \epsilon_t^i \ ,$$

where $\mu_t = \frac{\nu_{y,t}^* - \nu_{y,t}}{\beta_y}$ and $\gamma = \frac{\beta_y - \beta_y^*}{\beta_y}$ for $y = L, K, F, C$; and $\mu_t = \frac{\nu_{U,t}^* - \nu_{U,t}}{1-\beta_U}, \gamma = \frac{\beta_U^* - \beta_U}{1-\beta_U}$ for the last equation.

Note that a positive γ implies that $\beta_y^* < \beta_y$ and $\beta_U^* > \beta_U$, that is, that provincial prices have — across the four smoothing channels — a smoothing effect. Thus, by performing a single regression and testing the sign and significance of the coefficient we can check our hypothesis.

The result of this regression appears in the last row of Table VII; the negative sign and large significance of the parameter γ robustly confirms that provincial prices have played a dis-smoothing role.[10] . Note that expression (5) picks up the correlation between relative prices and relative output, and that this correlation is negative. This result is consistent with models like Obstfeld and rejects the Balassa-Samuelson hypothesis at the provincial level, which is not striking given the high level economic integration among Spanish provinces [11] .

V. Concluding Remarks

Several interesting findings emerge from the analysis.

First, in the period under consideration there has been a considerable amount of overall risksharing, predominantly via capital and credit markets (almost half of the shocks to province product are smoothed via these channels).

Second, fiscal policy smoothes only a small part of shocks to province product; but this is the result of the countervailing forces of taxes and social security contributions as opposed to transfers.

Third, the capability of the Spanish economy to smooth shocks has greatly increased in the last decade.

Fourth, while risk sharing through labor mobility is inevitably small, such a form of smoothing has lost importance in the eighties vs. the seventies; on the contrary, the fiscal and capital risksharing mechanisms have greatly improved their role.

Fifth, the increased role of credit market smoothing is due exclusively to household savings, rather than corporate savings.

Finally, the use of provincial prices instead of aggregate prices reduces the level of smoothing in the economy, suggesting that prices play a dis-smoothing role.

The analysis leaves many interesting issues open and some intriguing questions for further research. How much of the smoothing is achieved via inter-regional cross-ownership on organized stock markets, and what is the role of intermediaries in promoting interprovince income and consumption smoothing? Why is fiscal risksharing so small and some of its components dubious, while its theoretical effect should be unambiguous? Why do retained earnings appear to be countercyclical? What are the mechanisms behind the dis-smoothing role of relative prices? Clearly, there is need for more work on these issues.

Appendix: Data Construction

We describe the main sources of data and the methodology for constructing the various measures of smoothing. The biannual data are taken from B.B.V. (various issues), with the exception of the national and provincial cpi deflators, and the regional consumption series, which are published in I.N.E. (various issues). The provincial measures we construct are all in real per capita terms.

net autarkic product (ap): It is defined as the net "value added" of the industries of the province,[12] net of immigration, at cost of factors. We take the gross province product, and we subtract capital depreciation, since only net production is already available for consumption by the population of the province.[13] As all our measures are in per capita terms, we then divide the net province product by the province population short of the net migration of the period. We obtain therefore a "net of immigration", or "autarkic" product.

resident product (rp): It is defined as the net per capita value added, including net migration and commuters' income.

resident income (ri): Defined as the sum of earnings (wages and proprietors income) and distributed profits (including interest and rent) of residents of the province. Resident income equals net resident product plus net capital income. The resulting number is (ceteris paribus) what would have been available for consumption by the residents of the province had there been no fiscal intervention on the part of the central government.

disposable income (di): Defined as resident income plus central direct transfers to individuals in the province (e.g. social security), minus total central taxes raised in the province (including social security contributions).

consumption (c): Consists of consumption of private goods by the residents of the province. There are no series on consumption available at provincial level (only at regional level from 1981 on), so taxes on consumption were used as a proxy.[14] Provincial shares in consump-

tion taxes were used as weights in national (or regional when available) consumption. However, since consumption tax payments are biased by the location of (nationwide) firms, we previously corrected for this 'location bias', controlling for the consistency between provincial shares in consumption taxes and in familiar disposable income (the closest magnitude to consumption which we have in our B.B.V. database). Such a procedure, if anything, would underestimate the amount of smoothing due to the credit channel. Such a bias, however, is likely to be negligible, because the provincial shares we recovered correspond very closely to the shares one would obtain for provincial consumption by using VAT revenues, by province.

Endnotes

1. The body of literature that stresses this point from the perspective of modern dynamic macroeconomics is extensive. For a few references, including the difference between international and interregional smoothing, see Obstfeld and Rogoff [1996, chaps. 2, 5 and 6]. Empirical tests of full consumption smoothing or risksharing include — among others — Cochrane [1991], Mace [1991], Obstfeld [1994], Crucini [1995], Canova and Ravn [1996], Townsend [1994] and the references in Lewis [1996]. Most of these papers will be referenced below.

2. Other smoothing mechanisms include intertemporal smoothing (for example through accumulated domestic wealth) and redistribution (which does not involve sharing of idiosyncratic short-term risks).

3. For detailed derivations of similar results, see e.g. Huang and Litzenberger [1988, chap. 5], Cochrane [1991], Attanasio and Davis [1996], Townsend [1994]. In most of our analysis we regard Spain as a closed economy, that is, we ignore all forms of international risksharing. If the central government borrows abroad and spends the money on transfers or grants to provinces, the resulting smoothing will be picked up as part of our measure of fiscal smoothing. If individual provinces (or citizens) borrow and lend internationally, our methodology will attribute the resulting smoothing to consumption smoothing. The consensus in the literature that there is very little international risksharing suggests that this is not a serious omission.

4. A typical coefficient of the time fixed effect regression is $\hat{\beta}_y = \Sigma_t\Sigma_i(ap_t^i - \overline{ap}_t)y_t^i/\Sigma_t\Sigma_i(ap_t^i - \overline{ap}_t)^2$, where y is a left hand side variable, and $\overline{ap}_t$ is average ap across provinces in period t. In a cross-sectional regression for period t, $\hat{\beta}_{y,t} = \Sigma_i(ap_t^i - \overline{ap}_t)y_t^i/\Sigma_i(ap_t^i - \overline{ap}_t)^2$. Thus, $\hat{\beta}_y$ is a weighted average of the $\hat{\beta}_{y,t}$

coefficients with weights $\Sigma_i(ap_t^i - \overline{ap}_t)^2 / \Sigma_t \Sigma_i (ap_t^i - \overline{ap}_t)^2$. The Least Squares estimator gives higher weight to years with larger cross-sectional variation in the regressor since they are more informative about risksharing.

5. We performed unit root tests on the series according to the methodology developed in Levin and Lin [1992].

6. This estimation tecnique is based on the weighting procedure suggested by Li [1985], which applies Huber weights until convergence and then uses bi-weights to deal with severe outliers. Asymptotically correct standard errors are calculated following Street, Carroll and Ruppert [1988].
Since the equations were corrected one by one, the coefficients in the SUR estimations of Tables II and III did not always sum exactly to 1, and those of the detailed Tables IV, V and VI did not sum to the value of the corresponding aggregate coefficient. We corrected for these minor imprecisions by rescaling the coefficients. An alternative solution, which would yield a sum of coefficients equal to one, would have been correcting for heteroskedasticity by using the same weights for all the equations; as it turns out, however, such correction — which changes slightly the results — does not reduce heteroskedasticity significantly.

7. Measurement errors due to misallocation of production to calendar year will be smaller, random i.i.d. measurement errors will tend to cancel out, and errors due to interpolation will become less severe.

8. Although — as we have underlined above — the main aim of the tax-transfer system may be redistribution rather than stabilization, it is nonetheless interesting to compare our results with the degree of progressivity and redistributive role of these mechanisms. The progressivity of transfers (Pazos and Salas [1996]) matches with its smoothing effect and the regressivity of social contributions (Manresa, Calonge and Berenguer [1996]) with its marginal dis-smoothing. However, the progressivity

of the IRPF (Spanish main personal income tax, see Argimón and Marín [1989]) does not fit with our results. We must stress though that shocks; furthermore, and also for this reason, the transfers which typically several factors might account for this discrepancy. If financial income in Spain is highly volatile as in the U.S. (Mankiw and Zeldes [1991]), then income tax progressivity only increases the variance of disposable income, to the extent that stockholders belong to high income households.

9. The regressions in (4), although of intuitive meaning, are not explicitly based on a variance decomposition such as (3). Yet their difference with (3) indeed originates equations like (5) that measure directly the smoothing effect of provincial prices.

10. The test is effectively assessing whether $\frac{\beta_y^*}{\beta_y} \neq 1$. An estimate of $\gamma = -0.107$ corresponds to an estimate of $\frac{\beta_y^*}{\beta_y} = 1.107$. Since β_y is robustly positive for all ys, our test states that β_y^* is also positive and significantly larger.

11. This result is confirmed by both panel and time series regressions of prices on production, and vice versa, which always generate for Spain strongly negative (and significant) coefficients.

12. Namely, sales or receipts plus inventory change minus consumption of goods and services purchased from other industries or imported from other provinces.

13. We only deal with allocative risksharing, that is with the smoothing that can be achieved after production has taken place. We leave the analysis of production risksharing to further research.

14. This series was constructed by José Manuel Marqués with the data provided by Agencia Tributaria.

Table I: Channels of Risksharing

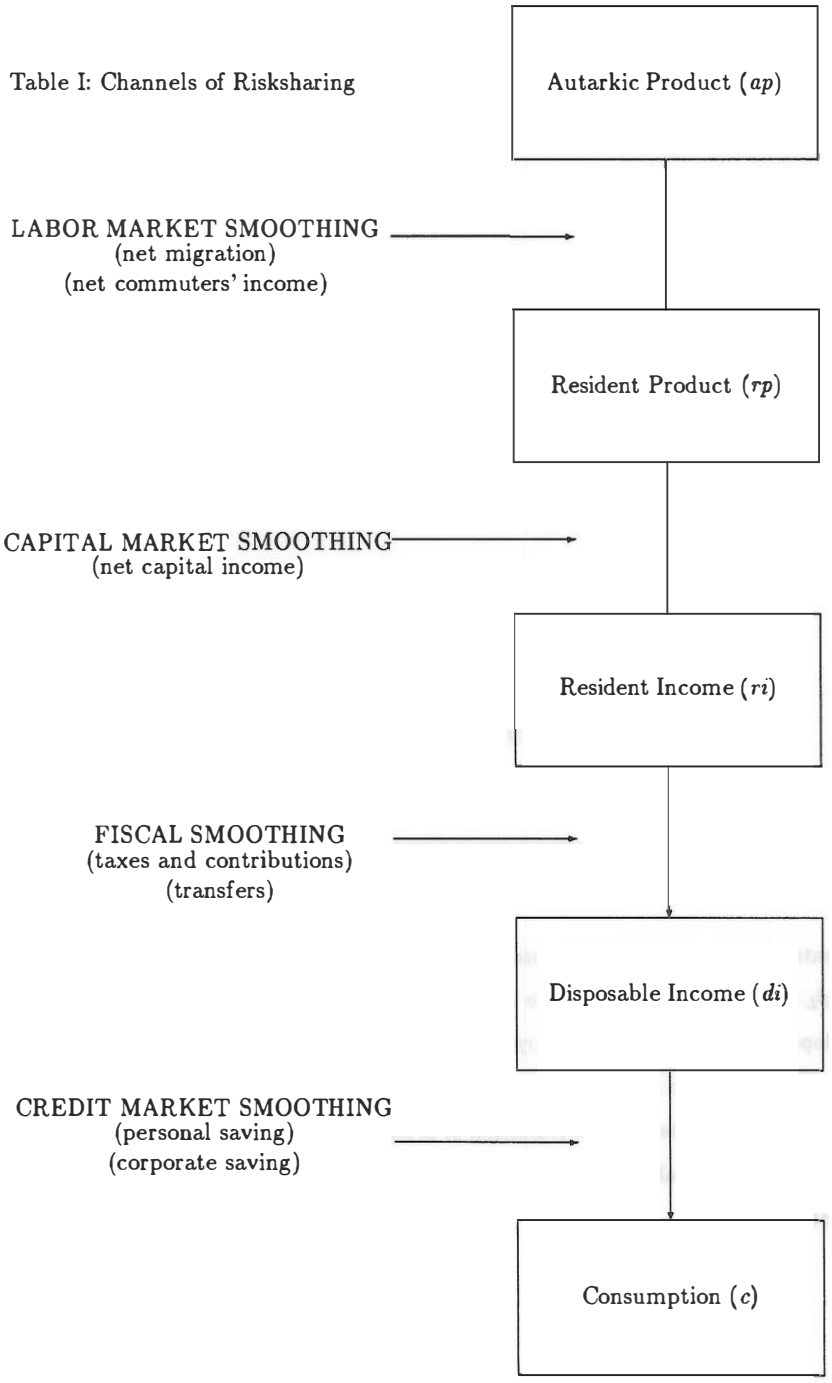

Table II: Income and Consumption Smoothing (%) – Whole Sample

	1973–1993
Labor markets (β_L)	2.3
	(4.2)
Capital markets (β_K)	22.5
	(11.0)
Government (β_G)	2.5
	(2.2)
Credit markets (β_C)	23.3
	(3.9)
Not smoothed (β_U)	49.2
	(9.4)

Percentages of shocks to province product absorbed at each level of smoothing. t-values in brackets. β_L is the estimate of the slope in the regression of $\Delta \log ap^i - \Delta \log rp^i$ on $\Delta \log ap^i$, β_K is the slope in the regression of $\Delta \log rp^i - \Delta \log ri^i$ on $\Delta \log ap^i$, β_G is the slope in the regression of $\Delta \log ri^i - \Delta \log di^i$ on $\Delta \log ap^i$, β_C is the slope in the regression of $\Delta \log di^i - \Delta \log c^i$ on $\Delta \log ap^i$, and β_U is the coefficient in the regression of $\Delta \log c^i$ on $\Delta \log ap^i$. We interpret β_L, β_K, β_G, and β_C as the incremental amount of smoothing achieved at each level, and β_U as the amount not smoothed.

Table III: Income and Consumption Smoothing (%) – Sub-Periods

	1973–1983	1983–1993
Labor markets (β_L)	2.7	1.6
	(3.2)	(2.1)
Capital markets (β_K)	18.3	29.5
	(7.7)	(8.4)
Government (β_G)	1.2	7.5
	(1.1)	(2.8)
Credit markets (β_C)	21.2	24.8
	(2.8)	(4.2)
Not smoothed (β_U)	56.7	36.7
	(8.6)	(3.8)

Percentages of shocks to province product absorbed at each level of smoothing for two sub-periods. t-values in brackets. β_L is the estimate of the slope in the regression of $\Delta \log ap^i - \Delta \log rp^i$ on $\Delta \log ap^i$, β_K is the slope in the regression of $\Delta \log rp^i - \Delta \log ri^i$ on $\Delta \log ap^i$, β_G is the slope in the regression of $\Delta \log ri^i - \Delta \log di^i$ on $\Delta \log ap^i$, β_C is the slope in the regression of $\Delta \log di^i - \Delta \log c^i$ on $\Delta \log ap^i$, and β_U is the coefficient in the regression of $\Delta \log c^i$ on $\Delta \log ap^i$.

Table IV: Components of Labor Market Smoothing (%) – Whole Sample and Sub-Periods

	whole sample	1973–1983	1983–1993
Migration	1.4	1.3	1.1
	(5.0)	(2.9)	(4.4)
Commuters' Income	0.9	1.4	0.5
	(1.6)	(1.5)	(1.7)
Total Labor Market Smoothing (β_L)	2.3	2.7	1.6

Percentages of shocks to province product absorbed at each level of labor market smoothing for the whole sample as well as for two sub-periods. t-values in brackets. The estimates are obtained from a regression of $\Delta \log ap^i - \Delta \log(rp^i + x^i)$ on $\Delta \log ap^i$, where x is a generic variable representing each of the above components. The estimates are interpreted as the incremental amount of smoothing achieved by each component.

Table V: Components of Fiscal Smoothing (%) – Whole Sample and Sub-Periods

	whole sample	1973–1983	1983–1993
Transfers	4.9	2.7	9.5
	(12.8)	(9.1)	(9.0)
Social Security Contributions	-0.8	-0.8	-0.4
	(-2.4)	(-3.7)	(-0.3)
Personal Income Taxes	-0.5	-0.3	-0.3
	(-2.3)	(-0.8)	(-0.3)
Corporate Income Taxes	-1.0	-0.5	-1.3
	(-6.0)	(-5.2)	(-2.3)
Total Government Smoothing	2.5	1.2	7.5

Percentages of shocks to province product absorbed at each level of fiscal smoothing for the whole sample as well as for two sub-periods. t-values in brackets. The estimates are obtained from a regression of $\Delta \log ap^i - \Delta \log(rt^i + x^i)$ on $\Delta \log ap^i$, where x is a generic variable representing each of the above components. The estimates are interpreted as the incremental amount of smoothing achieved by each component.

Table VI: Components of Credit Market Smoothing (%) – Whole Sample and Sub-Periods

	whole sample	1975–1983	1983–1993
Corporate Savings	-1.4	-1.7	-1.2
	(-3.6)	(-3.5)	(-1.5)
Household Savings	24.7	22.9	25.9
	(4.2)	(2.6)	(2.4)
Total Credit Smoothing	23.3	21.1	24.8

Percentages of shocks to province product absorbed at each level of credit market smoothing for the whole sample as well as for two sub-periods. t-values in brackets. The estimates are obtained from a regression of $\Delta \log ap^i - \Delta \log(di^i + x^i)$ on $\Delta \log ap^i$, where x is a generic variable representing each of the above components. The estimates are interpreted as the incremental amount of smoothing achieved by each component.

Table VII: Smoothing effects of provincial prices – Whole Sample

1973–1993	
Labor markets (β_L)	2.4
	(3.8)
Capital markets (β_K)	28.7
	(13.5)
Government (β_G)	3.0
	(2.3)
Credit markets (β_C)	25.2
	(3.8)
Not smoothed (β_U)	40.7
	(9.4)
Test: γ in (5)	-10.7
	(-6.7)

Percentages of shocks to province product absorbed at each level of smoothing, using national prices as common deflator. t-values in brackets. The last line reports the estimate of the parameter γ_U in the regression of $\Delta \log P_t^i - \Delta \log P^i$ on $\Delta \log ap^i$. A significant negative value of the parameter imply a dis-smoothing effect of relative prices.

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