Consumption Smoothing and the Structure of Labor and Credit Markets

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Abstract

When borrowing is limited by possible insolvency, compression of labor income through taxation or other policies affords earlier consumption and higher welfare. And credit constraints also reduce the positive welfare effect of labor market turnover for workers whose labor income is temporarily low. These simple theoretical insights offer a rationale for the observed cross-country covariation of labor market regulation and consumer credit. Available evidence indicates that the volume of consumer credit depends importantly on supply conditions in the financial industry, but is also related to labor market institutions and outcomes: credit demand is lower, but credit tends to be more easily available, in more rigid and regulated labor markets. The proposed framework of analysis offers more general insights as to ways in which historically determined features and politico-economic interactions may jointly shape institutional aspects across labor and financial markets, and as to appropriate design of reform processes.

- "It's the middle-class moment of truth: two people have applied for a mortgage, one a machinist from Lindsay, Ontario, the other an employee at a high-tech firm in downtown Toronto. Both earn $50,000 a year, and both are applying for the same mortgage, from the same bank. Result? The techie's application goes through. The machinist's is turned down [...] because he's got a job in a failing industry, in a depressed area of the country, [...] he is potentially a less profitable and therefore less desirable customer for the bank." Rachel Pulfer, "Mining your business" *This Magazine*, 32(5), 1999, pp. 13-15.

1 Introduction

The structures of different markets interact importantly in determining the behavior and welfare of individual agents operating in all of them, and the operation of markets is in turn determined jointly by an economy's structural and political features (see Rodrik, Subramanian, and Trebbi, 2002, for a general and insightful discussion of theoretical and empirical relationship between policies, outcomes, and "deep" institutional quality features). In this paper, we focus on the behavior and welfare of workers-consumers whose labor income fluctuates over time, and we show how their desire and ability to borrow against future labor income upon receiving a bad draw of labor income depends on institutional features of both labor and credit markets.

There are of course many other institutional and structural differences across countries, and our analysis aims at illustrating general channels of interaction across different aspects of an economy's organization. Information about structural and policy features of labor and consumer credit markets, however, is relatively easier to collect and analyze, and their relationship is sufficiently clear to motivate our theoretical and empirical work's relevance. Figure 1 plots all available country observations for an index of labor market regulation (the OECD employment protection indicator, or EPL) and an index of borrowing opportunities (the loan-to-value collateral requirements, or LTV, compiled by Jappelli and Pagano, 1994) in the 1980s. Since the units of measurement of the two variables are not necessarily comparable, and there is little reason to expect their relationship to be linear, we also plot in Figure 2 their ranking across countries. While the relationship is rather noisy, the significant correlation of both levels and ranks indicate that stringent employment protection legislation tends to be associated with stringent borrowing constraints. This association motivates Fogli (2000) to study family-level interaction, arguing that in countries with stringent employment protection and scarce borrowing opportunities (like Italy), young people find it difficult to obtain employment, and live with their parents until older than is the case in countries (like the US) where labor markets are flexible and borrowing is easy.

In reality, credit supply reflects non only structural features of the credit market, but also more general considerations. Loans are more easily obtained by individuals whose jobs are secure. While credit scoring models are not publicly available, as credit suppliers rely on them to obtain competitive advantage, they typically and quite intuitively do take into account the applicant's occupation and
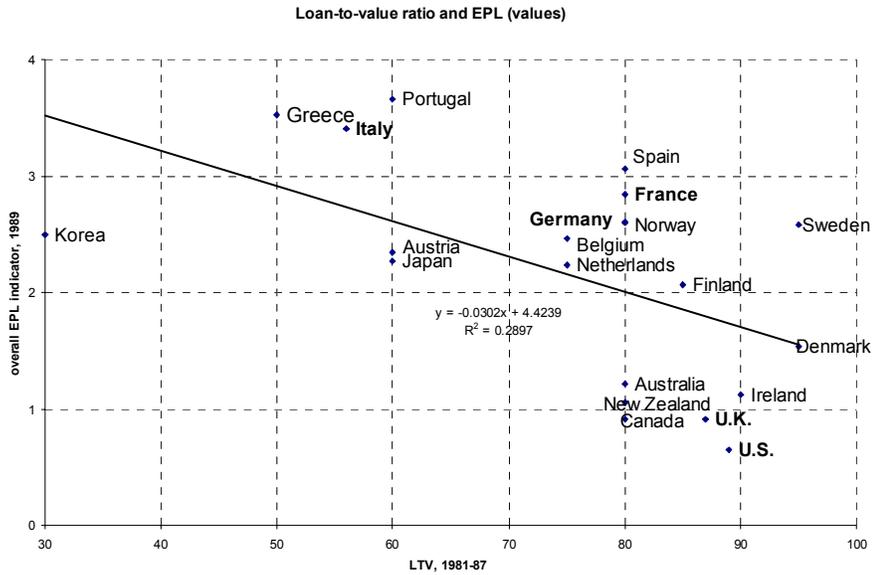
Loan-to-value ratio and EPL (values)

Figure 1: **Employment protection and loan-to-value ratio in OECD countries.** Sources: summary EPL indicator for 1989 from OECD (1999); loan to value ratio in the 1980s from Jappelli and Pagano (1994), Table 1, column 3.
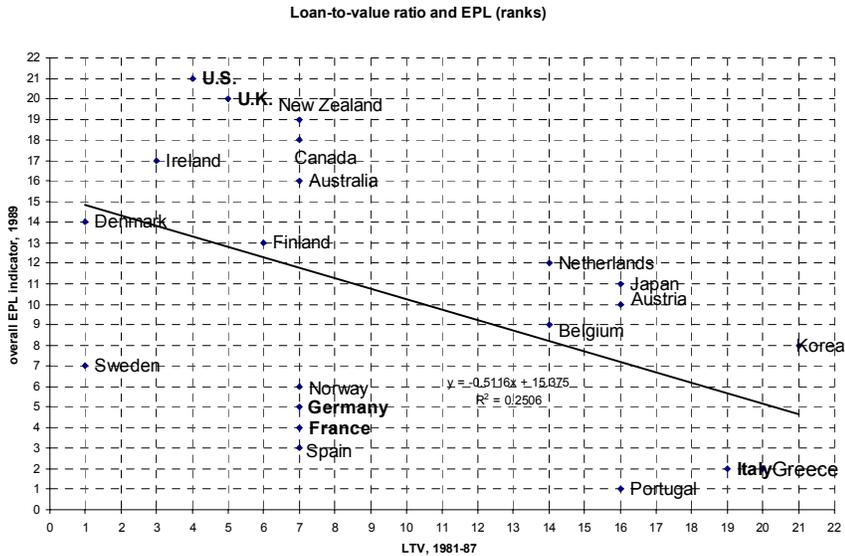

Loan-to-value ratio and EPL (ranks)

Figure 2: The axes refer to the ranking across countries of the same variables as in the previous figure.

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tenure prospects for credit-granting purposes. As illustrated by the paper's opening quote, within an economy future labor income prospects do play an important (if imperfect, in light of subsequent developments in the relative performance of high-tech and traditional industries) role in determining individual access to credit. In Italy and other countries where dependent employment is very secure loans can be explicitly collateralized by a portion of the borrower's wages, which will be paid directly to the creditor, and such loans entail lower interest rates: the benchmark rates collected by the Bank of Italy in the framework of the 1996 usury law indicate that benchmark rates for "cessione del quinto" loans to permanent employees are about 5 percentage points lower than for unconditional loans.

At the economy-wide level, labor-income security is largely determined by institutional features. We point out that these and other institutional determinants of real-life economic interactions are all jointly shaped by structural and policy interactions, and we study theoretically and empirically a specific explanation for observed cross-country patterns. We propose a simple model where labor income stability makes it easier for individuals to obtain credit, because safe jobs and stable wages make labor income (even when not explicitly collateralized) a good source of repayment ability. We move on to study how exogenous differences in the efficiency of financial markets may shape economic and political features across economies, showing that when a society finds it more difficult to supply credit efficiently, it also finds less turbulence in the labor market and compressed wages more appealing. Historically determined features of judicial systems may be an essentially exogenous source of financial market efficiency variation. From that perspective, we analyze empirically the cross-country indicators displayed in Figures 1-2 and other relevant institutional and economic data of industrialized countries. The results support our theoretical approach, and suggest more generally that the political feasibility and economic consequences of reforms in each of an economy's labor and financial markets depend on the other's structure.

2   A model

The model we propose and solve, while not fully dynamic, captures simple qualitative insights of broader generality. We consider the two periods in the life of consumers whose utility function reads

$$U = u(c_1) + \beta E\left[u(c_2)\right], \tag{1}$$

where U and $u(\cdot)$ denote lifetime and instantaneous utility, respectively; c_t denotes consumption in period t; the utility of uncertain second-period consumption is discounted by the factor β, and $E[\cdot]$ is a conditional expectation formed on the basis of possibly constrained saving behavior and of the individual's labor income process. In each of the two periods, labor income takes one of only two values, w_b and w_g, with $w_b < w_g$. If in the first period the labor income takes the low value w_b, then in the second period it still equals w_b with probability $1 - p$, and w_g otherwise. Symmetrically, a high first-period labor income persists with probability $1 - p$ and falls to w_b with probability p. A longer time

horizon would make it necessary to model wealth dynamics. Like more general wage distributions, this would introduce realistic but analytically intractable heterogeneity in the economy, which would have to be studied numerically. In the individual's budget constraint, let the interest rate on any borrowing or lending be r. This may depend on the economy's capital intensity, or on the lenders' cost of funds and of administering the contract, and might in general differ from the interest rate earned on assets. However, for our purposes it will suffice to treat it as a constant parameter of the consumer's problem.

If the individual borrows without constraint (or lends), the first order condition for maximization of (1) is a standard Euler equation, and aligns the first-period marginal utility with expected marginal utility upon loan repayment. In the model and in the real world, however, borrowing is constrained by the lender's repossession technology as well as by the individual's *ex post* resources. We will proceed under the following

Assumption 1: *Borrowing is constrained by the worker's second period repayment capacity. Specifically, since the lowest possible labor income is w_b for each and every individual, it is impossible to borrow more than $(\kappa + \xi w_b)/(1 + r)$.*

The parameter κ represents the extent to which the lender can legally enforce the borrower's repayment obligations, independently of labor-income realizations. The parameter ξ indexes instead the extent to which the lender may rely on the borrower's labor income as a source of repayment ability: multiplying it by the borrower's lowest possible labor income w_b yields the maximum amount of repayment the lender can count on with probability one, to imply that the interest rate r does not need to reflect any risk of non-repayment. We view both κ and ξ as technological or institutional feature of the financial market. It will be apparent below that the linkage we focus on, between labor markets and credit opportunities, depends crucially and intuitively on the fact that $\xi > 0$, i.e., that a consumer's repayment ability is impaired by low labor income.

Of course, both the assumption of a sharp lower bound for the consumer's future income and that of an equally sharp limit to the lender's loan-recovery power are just approximations to a much more complex reality in which, for example, the recoverable amount also depends on agents' wealth. Qualitatively, however, these assumptions capture realistic features of real-life economies, where bad luck in the labor market may be more or less extreme depending on the structure of labor markets, and may have more or less drastic consequences on borrower's repayments depending on the structure of credit markets and in particular, judicial efficiency and availability of information. Hence, comparative-static results on the parameters indexing the repayment limit offer results applicable to more general settings. It is important to note at the outset, however, that our simple Assumption 1 rules out default. While in reality the possibility of defaulting may offer some insurance in the face of particularly bad lifetime outcomes, in our simple framework of analysis it is impossible for the credit market to perform state-contingent transfers of resources.

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The simple structure of labor-income levels and transitions implies that the labor income of individuals who have high labor income in the first period cannot increase further.[1] These individuals only wish to borrow if the discount factor β is much lower than $1 + r$. Otherwise (as would need to be the case in general equilibrium versions of the model to ensure that the economy has positive capital) the initially lucky workers carry positive assets to the second period of their life: if $a > 0$ is the liquidation value of their wealth in the second period, their Euler equation reads

$$u'(w_g - \frac{a}{1+r}) = \beta(1+r)\left[pu'(w_b + a) + (1-p)u'(w_g + a)\right].$$

Symmetrically, we suppose that borrowing $-b/(1+r)$ and repaying $b < 0$ in the second period is optimal for workers who start at low labor income in the first period. If the borrowing constraint

$$c_1 \leq w_b + \frac{\kappa + \xi w_b}{1 + r}. \tag{2}$$

is binding for these individuals, then $b = -(\kappa + \xi w_b)$ and the consumption pattern fails to satisfy the Euler equation:

$$u'(w_b + \frac{\kappa + \xi w_b}{1+r}) > \beta(1+r)\left[pu'(w_g - \kappa - \xi w_b) + (1-p)u'(w_b - \kappa - \xi w_b)\right] \tag{3}$$

Of course, the constraint would not be binding if the pattern of resources and the utility function were such as to imply that the consumer would like to borrow less than the limit—which is necessarily the case if marginal utility tends to infinity at zero consumption: in this case Carroll's (1997) endogenous solvency condition applies, and it cannot be optimal to borrow so much as to make second-period consumption zero with any probability. In terms of our model, if $c_{t(i)}$ denotes the consumption level in period t upon realization of labor income w_i, then requiring that $c_{2(b)}$ be positive implies that credit constraints may only bind if $(1 - \xi)w_b - \kappa > 0$: we assume this to be the case, since parameter configurations conducive to endogenous solvency are not interesting for our purposes.

When the borrowing constraint binds and equation (2) holds with equality then slackness of the Euler condition, as in (3), implies that exchanging one unit of future consumption for $(1 + r)^{-1}$ units of current consumption improves a credit-constrained individual's welfare. Below, we illustrate formally how such welfare effects depend jointly on the character of the labor income process and the tightness of borrowing limits, since both can affect the maximum amount the individual can borrow and still repay with certainty.

2.1 On the attractiveness of labor-income compression

Clearly, better borrowing opportunities could be provided by a suitably structured financial market, and would be unambiguously beneficial if improving the performance of the credit market were costless.

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[1]It would be of course be possible to allow for expected growth of all labor incomes, to capture life-cycle consumption and savings patterns. The implications would be similar to those of heavy discounting of the future, and results would be akin to those we obtain below.

We take the credit supply constraint expressed by Assumption 1 to be exogenously determined, and explore the less obvious costs and benefits of relaxing (2) by increasing the worst-case labor income.

Of course, a larger w_b also improves welfare by increasing the average (and reducing the variance) of lifetime consumable resources. To represent the effects of meaningful real-life trade-offs, such as unemployment or low-wage subsidies funded by payroll taxes, we consider the comparative welfare implications of increasing w_b while also decreasing w_g. Specifically, we consider an economy populated by many individuals, half of which earn each of the two possible wages in each of the periods, and a tax-and-subsidy scheme that decreases by $d\tau$ the take-home pay of each of the individuals earning w_g and distributes a fraction λ of the revenues to the individuals earning w_b. When a policy of this type is implemented, high-income workers earn $\tilde{w}_g = w_g - \tau$, while the low income is $\tilde{w}_b = w_b + \tau\lambda$. Of course, it must be the case that $\tau \geq 0$, because for $\tau < 0$ the proposed specification would absurdly imply that transferring resources from the poor to the rich generates aggregate gains rather than deadweight losses.

The welfare of initially unlucky (and liquidity constrained) individuals is given by

$$U_b = u(\tilde{w}_b + \frac{\kappa + \xi\tilde{w}_b}{1+r}) + \beta\left[pu(\tilde{w}_g - \kappa - \xi\tilde{w}_b) + (1-p)u(\tilde{w}_b - \kappa - \xi\tilde{w}_b)\right], \tag{4}$$

and that of the initially lucky workers who carry positive assets into the second period is given by

$$U_g = u(\tilde{w}_g - \frac{a}{1+r}) + \beta\left[pu(\tilde{w}_b + a) + (1-p)u(\tilde{w}_g + a)\right]. \tag{5}$$

Both depend on the tax rate, since varying τ subtracts $d\tilde{w}_g = -d\tau$ from the income of high-wage individuals in each of the periods, and adds $d\tilde{w}_b = (d\tau)\lambda$ to the income of each low-wage worker. For simplicity, the policy considered only features one and the same tax rate in both periods, but we argue below that more general specifications would not affect our qualitative results.

Suppose the policymaker's *ex ante* objective function weighs the two groups equally, and consider the case of interest where liquidity constraints are binding for all agents receiving a bad draw in the first period.[2] The aggregate welfare effect of taxation and subsidization is then

$$
\begin{aligned}
\frac{d\left(U_b + U_g\right)}{d\tau} &= u'\left(c_{1(b)}\right)\lambda - u'\left(c_{1(g)}\right) \\
&\quad + \left[u'\left(c_{1(b)}\right)\frac{1}{1+r} - \beta E\left[u'(c_2)|w_{1(b)}\right]\right]\xi\lambda \\
&\quad + \beta(1-p)u'(\tilde{w}_b - (\kappa + \xi\tilde{w}_b))\lambda - \beta pu'(\tilde{w}_g - (\kappa + \xi\tilde{w}_b)) \\
&\quad + \beta pu'(\tilde{w}_b + a)\lambda - \beta(1-p)u'(\tilde{w}_g + a),
\end{aligned}
\tag{6}
$$

where $w_{1(i)}$ denotes the first-period wage upon realization of labor income w_i.

It is then easy to establish the following:

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[2] The model could determine the incidence of borrowing constrained if initial income included a purely temporary idiosyncratic shock, or if discount rates were heterogeneous. The persistence of labor income shocks would be one of the determinants of the fraction of constrained individuals in such specifications.

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Result 1: *If the redistribution policy is not wasteful $(\lambda = 1)$ and utility is strictly concave, then it is optimal to set $\tau = (w_g - w_b)/2$.*

Proof: The proposed policy fully equalizes incomes cross-sectionally: $w_b + \lambda \tau = w_g - \tau \equiv \bar{w}$. Consider first the case where no agents are liquidity constrained. The expression in equation (6) reads

$$
\begin{aligned}
\frac{d\left(U_b + U_g\right)}{d\tau} &= u'\left(\bar{w} - \frac{b}{1+r}\right) - u'\left(\bar{w} - \frac{a}{1+r}\right) \\
&\quad + \beta(1-p)u'(\bar{w}+b) - \beta p\left[u'(\bar{w}+b\right] \\
&\quad + \beta p u'(\bar{w}+a) - \beta(1-p)\left[u'(\bar{w}+a)\right]
\end{aligned}
$$

which equals zero because lifetime income is identical (and flat) for both groups, to imply that saving behavior is also identical and $b = a$. This is the first order condition of the social optimization problem, and the second order condition is satisfied as long as $u(\cdot)$ is strictly concave. If liquidity constraints are binding, under the proposed fully egalitarian redistribution policy they must reflect impatience, $\beta(1+r) < 1$, and must be equally binding for all agents. This introduces a positive term in the expression above which, like the similar the term in square brackets in equation (6), indicates that redistribution achieves a constrained optimum at the fully egalitarian level. ∎

Intuitively, full insurance should be achieved if it is available at no cost: as long as utility is concave, equal consumption across states as well as across groups is optimal from the policymaker's *ex ante* perspective. As the proof makes clear, complete cross-sectional redistribution of income remains optimal if liquidity constraints are binding, and need not be able to relax them completely in the absence of intertemporal redistribution vehicles.

In the more realistic $\lambda < 1$ case, if there are no binding liquidity constraints the optimal tax rate should set

$$
\begin{aligned}
u'\left(w_b + \lambda\tau - \frac{b}{1+r}\right)\lambda - u'\left(w_g - \tau - \frac{a}{1+r}\right) & \\
+ \beta(1-p)u'(w_b + \tau\lambda + b)\lambda - \beta(1-p)\left[u'(w_g - \tau + a)\right] & \\
+ \beta p u'(w_b + \tau\lambda + a)\lambda - \beta p\left[u'(w_g - \tau + b)\right] &= 0,
\end{aligned}
\tag{7}
$$

where $b < 0$ and $a > 0$ as above. This optimality condition is fairly complex, but quite intuitive. The tax rate τ should be chosen to balance the redistribution policy's insurance benefits and deadweight losses: in a static environment, the ratio of marginal utilities should be set equal to λ, as would be implied by separately setting to zero each of the three lines of this equation. In the dynamic environment we are analyzing, however, redistribution that fails to offer perfect insurance (because $\lambda < 1$) affects saving behavior. The optimal tax policy would in general call for different tax rates in the two periods but, whether or not this is allowed, the deadweight losses represented by $\lambda < 1$ prevent policy from achieving perfect consumption smoothing.

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For our purposes, it is important to note that redistribution not only offers insurance from the *ex ante* point of view but also decreases the need to borrow. This is the case regardless of whether the tax rate is the same in the two periods, as we assumer for notational convenience. When agents cannot borrow as much as they would like, slackness of the Euler condition as in (2) implies that the term in square brackets on the right-hand side of (6) is positive. We can show that a higher income lower bound relaxes the borrowing constraint and makes it optimal to choose a more incisive redistribution policy.

It is helpful to first consider the case of linear utility, which usefully isolates the role of liquidity constraints in influencing the optimal redistribution policy:

Result 2: *If $u''(\cdot) = 0$ and*

$$\frac{\frac{1}{1+r} - \beta}{1 + \beta} > \frac{1 - \lambda}{\lambda \xi} \ , \tag{8}$$

then $\tau = \frac{w_g - w_b}{1 + \lambda} > 0$ is optimal.

Proof: If utility is linear, $u'(\cdot)$ can be set to unity without loss of generality, and if individuals whose initial wage is low are liquidity constrained expression (6) reads

$$\frac{d(U_b + U_g)}{d\tau} = (1 + \beta)(\lambda - 1) + \left(\frac{1}{1+r} - \beta\right)\xi\lambda. \tag{9}$$

In the absence of liquidity constraints the second term vanishes, and the welfare effect of redistribution is unambiguously negative at $(1 + \beta)(\lambda - 1)$ for $\lambda < 1$. Hence, the corner solution $\tau = 0$ is optimal. But if $\left(\frac{1}{1+r} - \beta\right) > 0$, all individuals desire to borrow and consume only in the first period. Since borrowing is constrained by labor income's second-period lower bound, the marginal welfare impact of a policy that increases that lower bound is positive (under the parametric condition given in the statement of the result). The effect remains positive until the expression in (9) no longer holds: if τ is such that a further increase would imply that $\tilde{w}_b > \tilde{w}_g$ and that the borrowing constraint binds for individuals whose pre-tax wage is initially high, then aggregate welfare features $w_g - \tau$ rather than $w_b + \tau\lambda$ in the last term:

$$U_b + U_g = w_g + w_b + \tau(\lambda - 1)(1 + \beta) + \left(\frac{1}{1+r} - \beta\right)(\kappa + \xi(w_g - \tau)),$$

and unambiguously declines in τ as $\left(\frac{1}{1+r} - \beta\right) > 0$. The optimal τ is such that $\tilde{w}_b = \tilde{w}_g$ or $w_b + \tau\lambda = w_g - \tau$, which implies the result. ∎

The result's condition ensures that the risk-neutral consumers' impatience and inclination to borrow—indexed by the difference between the utility and market discount factors in the numerator of the left-hand side of equation (8)— is large relative to the efficiency of the redistribution policy (a large λ) and its efficacy in making borrowing possible (a large ξ), both of which imply a smaller level of the expression on the right-hand side of condition (8). As the proof makes clear, wasteful redistribution for insurance purposes should of course be ruled out in the case of risk-neutral consumers. But the form of

liquidity constraints in Assumption 1 allows cross-sectional redistribution to perform an intertemporal function. More redistribution reduces the desire to borrow for initially unlucky workers and improves their borrowing opportunities, and the fact that redistribution is wasteful need not offset this beneficial effect if consumers are impatient enough.

The result is qualitatively applicable for more general specifications of the income process. Moreover, it is also present in the more complex and realistic situation where utility is concave and the effect of redistribution is that shown in equation (6) above. In the concave utility case, we can show:

Result 3: *If $\xi > 1 - p$ and $u'''(\cdot) = 0$, and the initially low-wage workers are liquidity constrained, a larger κ implies a smaller optimal redistribution rate τ for any $\lambda < 1$.*

Proof: In the Appendix. ∎

The conditions for the result to hold are sufficient but, as may be seen inspecting the proof, not necessary. While it is possible to characterize less stringent conditions on ξ, p, and the third derivative of the utility function, the relevant expressions are complex and not insightful. As in the simple linear-utility case above, the qualitative message of derivations is that redistribution becomes more attractive if liquidity constraints are tight, provided that the desire to borrow is strong (which depends on both impatience, and the likelihood of positive income shocks for the initially low-wage individuals), and/or ξ is not so close to zero as to make safer labor income a very ineffective way to allow more borrowing.

The sufficient condition $\xi > 1 - p$ quite intuitively indicates that the effectiveness of "worst-case" labor income in relaxing credit constraints (a large ξ) is less crucial when less persistence (high p) increases the desire to borrow. It is necessary to condition the result on the third derivative of the utility function because if it is not zero then it can be the case that allowing individuals to borrow more increases their desire for second-period insurance, in that the need to repay the debt in the second period moves consumption to a more concave portion of the utility function.

2.2   Labor-income persistence and credit conditions

As we have just shown, redistribution tends to be less attractive if credit markets are relatively more developed ($d\tau/d\kappa < 0$), and since the condition $\xi > 1 - p$ for this to be the case in Result 3 involves the index p of labor income persistence, it is interesting to explore the role of that parameter in more detail. In reality, persistence of labor-market outcomes differs importantly across countries as well as occupations within a country, and labor market policy can affect it, for example, through the stringency and character of employment protection legislation (EPL). We do not provide an explicit model of this mechanism, and of the relationship between the wage-compressing and labor turnover implications of EPL (see Bertola, 2003). Rather, we just note that unemployed workers' job-finding probabilities are empirically related to EPL (see Bertola and Rogerson, 1997). Employment protection does not only

imply high persistence of the employment state, but also of the unemployment state, to imply that employment protection may alleviate borrowing constraints for employed workers and make them more binding for unemployed workers.

We now proceed to show how the welfare effects of persistence depend on the availability of credit. The effect of a higher p on the welfare of the initially unlucky and liquidity constrained individuals, in equation (4) above, is

$$\frac{\partial U_b}{\partial p} = u(\widetilde{w}_g - \kappa - \xi\widetilde{w}_b) - u(\widetilde{w}_b - \kappa - \xi\widetilde{w}_b) > 0 .$$

The derivative is clearly positive, since a larger p makes a high income more likely in the second period. Interestingly, the effect is more pronounced when agents can (and do) borrow more: formally, more borrowing puts them on a steeper portion of the future utility function; intuitively, the welfare effect of higher future income (a steeper expected labor income profile) is larger when consumption can be smoothed by borrowing. Moreover, the effect becomes less pronounced if $w_g - w_b$ is smaller, as implied by a more incisive tax-and-subsidy policy of the type considered above.

The effect of a higher p on the welfare of the individuals who have high wages and save initially, given by equation (5), is

$$\frac{\partial U_g}{\partial p} = u(\widetilde{w}_b + a) - u(\widetilde{w}_g + a) < 0,$$

where the envelope theorem allows us to neglect the effect of p on a. The effect is more negative when lucky agents do not bring large assets to the future, and less negative if $w_g - w_b$ is smaller (again, possibly as a result of tax-and-subsidy policy).

Adding the two effects, supposing that there are equal numbers of the two types and that the *ex ante* probability of drawing either wage is equal, we obtain

$$\frac{\partial (U_b + U_g)}{\partial p} = u(\widetilde{w}_g - \kappa - \xi\widetilde{w}_b) - u(\widetilde{w}_b - \kappa - \xi\widetilde{w}_b) + u(\widetilde{w}_b + a) - u(\widetilde{w}_g + a) . \tag{10}$$

and can show:

Result 4: *If $u(\cdot)$ is strictly concave and $\widetilde{w}_g > \widetilde{w}_b$,*

$$\frac{\partial (U_b + U_g)}{\partial p} > 0 \quad and \quad \frac{\partial (U_b + U_g)}{\partial p \partial [\kappa + \xi\widetilde{w}_b]} > 0.$$

Proof: Adding and subtracting $u(\widetilde{w}_b)$ and $u(\widetilde{w}_g)$, equation (10) can be rearranged to

$$\begin{aligned} \frac{\partial (U_b + U_g)}{\partial p} =& \ u(\widetilde{w}_g - \kappa - \xi\widetilde{w}_b) - u(\widetilde{w}_g) + u(\widetilde{w}_b) \\ & -u(\widetilde{w}_b - \kappa - \xi\widetilde{w}_b) + u(\widetilde{w}_b + a) - u(\widetilde{w}_b) + u(\widetilde{w}_g) - u(\widetilde{w}_g + a) . \end{aligned}$$

This must be a positive expression for the first part of the result: indeed, strict concavity and $\widetilde{w}_g > \widetilde{w}_b$ imply that $u(\widetilde{w}_b) - u(\widetilde{w}_b - \kappa - \xi\widetilde{w}_b) > u(\widetilde{w}_g) - u(\widetilde{w}_g - \kappa - \xi\widetilde{w}_b)$ and $u(\widetilde{w}_b + a) - u(\widetilde{w}_b) > u(\widetilde{w}_g + a) - u(\widetilde{w}_g)$. As to the second part of the result,

$$\frac{\partial (U_b + U_g)}{\partial p \partial [\kappa + \xi\widetilde{w}_b]} = u'(\widetilde{w}_b - \kappa - \xi\widetilde{w}_b) - u'(\widetilde{w}_g - \kappa - \xi\widetilde{w}_b),$$

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which is again positive when $u''(\cdot) < 0$ and $\widetilde{w}_g > \widetilde{w}_b$. ∎

Intuitively, our simple model of labor-income dynamics unambiguously associates high marginal utility with the expectation of income improvement. As pointed out by Flinn (2002), when heterogeneity is not permanent and labor income shocks are mean-reverting with different persistence, then faster turnover decreases lifetime inequality. This has beneficial effects on our inequality-averse *ex ante* welfare objective, but Result 4 shows that policies that increase labor market turnover or otherwise destabilize labor incomes are less desirable when binding liquidity constraints on currently low-income workers dilute the welfare benefits of steeper expected labor-income profiles. This line of reasoning implies that credit volume should be larger in more flexible and turbulent labor markets, where workers need to access credit more extensively: but it also implies that when credit supply conditions are underdeveloped, as represented by a low κ value in our model, labor market turbulence should not be encouraged by policy measures.

2.3 Credit demand

Our simple two-state model focuses on constrained borrowing, and implies that only supply conditions determine the volume of credit: agents borrow more when κ is larger, and redistribution reduces borrowing and lending only inasmuch as it relaxes supply conditions through the repayment-ability effect indexed by ξ. As mentioned above, however, stability of labor income also reduces the initially unlucky workers' desire to borrow. In reality, the observed volume of credit is in general the result of institutional influences on both demand and supply, and this should be taken into account when bringing our simple model's insights to bear on a more complex reality where some borrowing is performed by unconstrained agents.

In the absence of liquidity constraints, the amount borrowed is implicitly determined by the Euler equation

$$u'(\widetilde{w}_b - \frac{b}{1+r}) = \beta(1+r)\left[pu'(\widetilde{w}_g + b) + (1-p)u'(\widetilde{w}_b + b)\right] \ .$$

Totally differentiating,

$$\frac{db}{dp} = \beta(1+r)\left[\frac{u'(\widetilde{w}_g + b) - u'(\widetilde{w}_b + b)}{-u''(\widetilde{w}_b - \frac{b}{1+r})\frac{1}{1+r} - \beta(1+r)\left[pu''(\widetilde{w}_g + b) + (1-p)u''(\widetilde{w}_b + b)\right]}\right] < 0 \ . \qquad (11)$$

The inequality follows because the numerator is negative as long as $\widetilde{w}_g > \widetilde{w}_b$ and the denominator is positive for strictly concave utility. Since $b < 0$, this means that less persistence (a larger p) implies more borrowing. This is quite intuitive because average lifetime income is relatively higher than current resources when the labor income is more unstable and agents have received a bad draw in the first period. Symmetrically, the unconstrained desired lending of currently lucky individuals is larger when p is larger.

For given persistence, similar derivations establish that wider fluctuations in wages imply more credit demand:

$$\frac{db}{d\widetilde{w}_g} = \beta(1+r)\left[\frac{pu''(\widetilde{w}_g + b)}{-u''(\widetilde{w}_b - \frac{b}{1+r})\frac{1}{1+r} - \beta(1+r)\left[pu''(\widetilde{w}_g + b) + (1-p)u''(\widetilde{w}_b + b)\right]}\right] < 0 \ . \qquad (12)$$

and

$$\frac{db}{d\widetilde{w}_b} = \beta(1+r)\left[\frac{(1-p)u''(\widetilde{w}_b + b) - u''(\widetilde{w}_b - \frac{b}{1+r})}{-u''(\widetilde{w}_b - \frac{b}{1+r})\frac{1}{1+r} - \beta(1+r)\left[pu''(\widetilde{w}_g + b) + (1-p)u''(\widetilde{w}_b + b)\right]}\right] > 0 \ , \qquad (13)$$

where the last inequality follows if $u'''(\cdot) \leq 0$. Higher wages in the bad state of the world imply less borrowing when they are realized in the first period, because the agents who borrow have higher first-period income. But they imply higher borrowing if realized in the second period, since higher expected income leads agents to desire more borrowing. Whether the first or the second effect dominates depends on p and, noting that $\widetilde{w}_b + b < \widetilde{w}_b - b/(1+r)$, on the sign of $u'''(\cdot)$. If labor markets are more turbulent (a larger p), it is easier for a larger $\widetilde{w}_b$ to decrease borrowing, because agents who receive a bad draw in the first period are less likely to earn low wages also in the second period.

3 Cross-country empirical patterns

We now bring the previous section's insights to bear on cross-country evidence regarding observed policy mixes. We have shown formally that when the possibility of low labor incomes implies that lenders restrict borrowing opportunities, then *ex ante* maximization of borrowing constrained workers' welfare justifies more *ex post* redistribution of labor income across them than would be optimal from an insurance-oriented perspective. In reality, of course, not all individuals are liquidity constrained: some find it optimal to borrow less than the limit, as in the derivations of Section 2.3, and some lend (possibly at a different rate).

To assess a redistribution policy's appeal, a fully specified model would need to account for the population weight of constrained individuals, which itself depends on the institutional structure of financial and labor markets, and for redistribution across borrowing and lending groups as well as within the group of would-be borrowers constrained by the mechanism we focus on. The evidence, however, suggests that borrowing constraints are important at the aggregate level: Jappelli (1990) finds that at least 20% of US households are credit rationed, and Gross and Souleles (2002) show that credit card borrowing limits appear to influence strongly the behavior of typical US consumers. For our purposes, it may suffice to focus on the sign and magnitude of the cross-market effects discussed above, and on the policies that would be chosen behind a veil of ignorance by all agents concerned with the possibility of finding their intertemporal consumption profile constrained by labor market outcome uncertainty.

Our simple model offers a variety of statements regarding the signs of structural and policy-driven covariation between its parameters and variables, summarized in Table 1. In light of Result 3, if policy

	p	w_g/w_b	κ	$|b|$
p	1	+	+	+
w_g/w_b	.	1	+	+/−
κ	.	.	1	+
$|b|$	.	.	.	1

Table 1: Theoretical correlation signs

can affect wage differentials these should be more compressed if credit markets are less perfect, or the labor income process is less persistent. And if policy can influence earnings instability, Result 4 and equation (10) indicate that earnings should be less stable when credit supply conditions are better, or wage differentials are less compressed. The model has implications also for the volume of credit, but these depends on whether observed credit is determined by demand or supply conditions. As shown by equation (11), credit demand increases with earnings instability, and is also an increasing function of wage differentials by equations (12) and (13); by Assumption 1, credit supply is increasingly related to wage differentials, and also depends on the efficiency of the credit market's collection technology as indexed by κ.

Of course, all these statements should be qualified by "all else equal" disclaimers. And all of them should be made precise by explicitly identifying exogenous sources of variation in the model's solution, as distinct from endogenous behavioral and policy responses. We propose an admittedly oversimplified qualitative interpretation of cross-country evidence that views credit conditions as determined by a country's exogenous judicial efficiency, and focuses on labor market policies as an endogenously determined feature of each economy.

In reality, a variety of policy interventions do limit the extent of labor-income variability at the cost of efficiency losses. The simplest real-life counterpart to the formal analysis above is perhaps progressive taxation or unemployment insurance schemes. Such policies reduce uncertainty about each worker's disposable income at the same time as they decrease individual incentives to exert on-the-job or search effort. The latter efficiency-reducing effects can be represented by our model's "leaky bucket" parameter λ or, at the cost of analytic complication, by a nonlinear version where efficiency losses become larger as τ increases. As noted by Bertola (2002), the employment protection legislation measures that motivates our paper (see Figure 1) have similar implications, as they try to protect uninsured workers from "unfair" consumption fluctuations but, due to the same informational imperfections that prevent markets from delivering appropriate insurance, cannot do so without burdening employers and employees with judicial and administrative costs.

Observable policy and outcome empirical indicators are available as regards the extent of *ex post* labor income inequality across OECD economies. As shown by the correlations reported in Table 2, stringent employment protection legislation tends to be associated with small wage differentials in the

	Overall EPL in the late 1990s	Mean tenure, all jobs, 1995	1990s earnings d5/d1	Overall EPL rank, 1989	Mean tenure, all jobs, circa 1985	1980s earnings d5/d1
Mean tenure, all jobs, 1995	0.77					
1990s earnings d5/d1	-0.52	-0.65				
Overall EPL rank, 1989	0.95	0.86	-0.64			
Mean tenure, all jobs, circa 1985	0.83	0.72	-0.16	0.75		
1980s earnings d5/d1	-0.41	-0.43	0.96	-0.49	-0.34	
Earnings correlation 1986-91	0.77	0.77	-0.65	0.88	0.93	-0.10

Source: OECD, *Employment Outlook,* various years. All available data are used to compute
each of the correlation (sample size varies across entries, see the Appendix) for OECD countries.

Table 2: Correlation of employment protection indicators with wage inequality (median to first decile ratio, all jobs), mean complete tenure (all jobs), and earnings instability (Pearson's Rho) indicators.

lower portion of the overall wage distribution, with more persistence in realized wages, with longer job tenures—and, in general, with lower labor income risk for workers. To the extent that those economies are characterized by similar technological structure and hit by similar shocks, the different extent of labor income security observed across industrialized economies can be viewed as institutional in origin.

To assess the empirical relevance of our theoretical perspective, we explore the relationship of these labor market features with the structural features of the credit market summarized by the loan-to-value ratio plotted in Figure 1, and with the volume of credit observed in each of the countries. It should be noted at the outset that the evidence can at best be suggestive, because information is scarce.

We use OECD data on the index for the strictness of EPL and data on earnings instability as measures for p (see the Appendix for exact data sources). The wage differential is measured by the ratio of gross wages between the 50th and 10th percentile of the wage distribution. It would be better to measure inequality on the basis of household disposable income, but cross-country data is only available for the differential between the 90th and 10th decile as reported in Gottschalk and Smeeding (1997). However, the two measures turn out to be highly correlated which suggests that in countries in which redistribution is more pronounced gross earnings are more compressed. Financial market imperfection is measured by the loan-to-value ratio as in Jappelli and Pagano (1994). The loan-to-value ratio is a measure for supply constraints in the credit market and, in light of the empirical evidence discussed by Jappelli et al. (2002) and La Porta et al. (1998), it may be treated as determined exogenously by judicial system inefficiency. Indeed, the correlation between their indicator of judicial efficiency and the loan-to-value ratio is significant. The data on credit volumes is drawn from ECRI (2000). The sample size for the calculation of the correlations depends on the variables used which we document in the Appendix together with other details on the data. Further, financial and labor market regulation indicators are based on 1980s evidence, but data on household credit is available for all countries only for the 1990s. This is not problematic because, while both credit volume and credit market conditions

	Emplo. Prot. Legisl.	Wage Differential D5/D1	House-hold income D9/D1 after tax	Earnings Instability: Pearson's Rho	Spearm. rank corr.	Average Quintile Move	LTV	Judicial Effic.	Total Credit	Consum Credit
Wage Differential D5/D1	-0.6402*									
	0.0076									
Household income D9/D1 after tax	-0.5469*	0.7676*								
	0.0349	0.0005								
Pearson's Rho	0.8571*	-0.4857	-0.1429							
	0.0137	0.3287	0.7599							
Spearman Rank correlation	0.7027	-0.2319	0.1081	0.9009*						
	0.0782	0.6584	0.8175	0.0056						
Average Quintile Move	-0.6429	0.5429	0.1429	-0.8214*	-0.8829*					
	0.1194	0.2657	0.7599	0.0234	0.0085					
Loan-toValue ratio	-0.5694*	0.1163	0.0847	-0.7819*	-0.8257*	0.5274				
	0.0137	0.6354	0.7552	0.0378	0.0221	0.2238				
Judicial Efficiency	-0.681*	-0.1857	-0.1819	-0.7881*	-0.7754*	0.6108	0.6259*			
	0.0020	0.4332	0.4847	0.0353	0.0405	0.1451	0.0014			
Total Credit	-0.8064*	0.3182	0.2727	-0.7714	-0.6377	0.6000	0.8325*	0.6457*		
	0.0027	0.3403	0.4458	0.0724	0.1731	0.2080	0.0008	0.0233		
Consumer Credit	-0.4146	0.2000	0.2000	-0.4286	-0.6088	0.2000	0.8854*	0.2986	0.7483*	
	0.2049	0.5554	0.5796	0.3965	0.1997	0.7040	0.0001	0.3458	0.0051	
Mortgage Credit	-0.7973*	0.3545	0.2485	-0.7714	-0.6377	0.6000	0.7337*	0.6457*	0.9790*	0.6294*
	0.0033	0.2847	0.4888	0.0724	0.1731	0.2080	0.0066	0.0233	0.0000	0.0283

Table 3: Spearman rank-correlations across policy and outcome indicators (see the Appendix for definitions and sources). Sample sizes used to calculate the correlations vary depending on data availability. P-values are reported below the correlation coefficients. Coefficients that are significant at the 5 percent level are marked with a star.

have varied over time, the relative position of countries is quite stable: as shown in Table 2, labor market outcomes and institutions are highly stable over time, and the relationships we illustrate are very similar when 1980s credit volume measures (available for a subset of countries) are used instead of the more recent ones.

Table 3 displays the cross-correlogram for the main variables of interest; p-values are reported below the correlation coefficients, and correlations significant at the 5% level are marked with a star. Given the maximum sample size of 23 cross-country observations, it is not surprising that only about half of the correlations are significant on a 5% level.

It is remarkable, however, to find that the bivariate correlation evidence uniformly supports the sign predictions of our model and empirical perspective. When our theoretical results summarized in Table 1 and its discussion offer an unambiguous sign prediction, almost all of the empirical correlations that we view as empirical counterparts have the predicted sign. There are only two exceptions, both

insignificant: the empirical correlation between the judicial efficiency and income or wage inequality indicators is negative, while our model would make the former (to the extent that it affects borrowing opportunities) conducive to less regulation or less redistribution of labor income inequality; and the empirical correlation between one of the available measures of income instability (the rank correlation of earnings) and the extent of income inequality is negative, rather than positive as the welfare interaction based on borrowing opportunities would indicate.

The model does not have unambiguous predictions regarding the relationship between labor market configurations and credit volumes, which reflect both demand and supply channels of influence. But the relevant correlations reported in Table 3 offer insights as to which of these channels prevails empirically, and as to the limitations of bivariate correlation evidence. The significantly positive correlation between the loan-to-value (LTV) ratio and credit volume indicates that, as Jappelli and Pagano (1994) emphasize, credit supply conditions importantly influence aggregate borrowing. Our model assumes that credit supply conditions should in turn be influenced not only by an economy's judicial efficiency, but also by labor market conditions: wage differentials should be more compressed if influenced by policy, and allow a relaxation of the borrowing constraint in any case, if supply conditions as summarize by the LTV ratio are more stringent.

Empirical assessment of this intuitive, if intricate, theoretical prediction would not only need to rely on the identifying assumption of judicial efficiency exogeneity, but should also be implemented in partial correlation terms. In Table 3, the bivariate correlations between judicial efficiency, LTV, and credit volumes are positive; the correlation between LTV and income or wage inequality measures is positive, supporting the idea that an efficient financial market makes labor income instability more socially appealing; and the correlation between credit volume measures and measures of income inequality and volatility is positive, indicating that demand effects prevail in determining the outcome. Ideally, we would like to assess the extent to which credit volume is (through demand effects) related to the characteristics of labor income processes after conditioning on supply features (as indexed by the LTV ratio).

In practice, the amount and character of available cross-country information is far from being amenable to formal econometric modelling. For example, the bivariate correlation between wage differentials and the LTV ratio is positive but small, and completely insignificant. However, it is interesting to find that the correlation becomes much stronger if the sample excludes Korea, and stronger still if Finland, Norway, and Sweden are excluded as well. As is apparent in Figure 3, these countries are outliers: Korea features an unusual combination of high wage inequality and extremely low LTV in the 1980s, while the very compressed wage differentials of Nordic countries were associated with high LTV ratios.

Clearly, this and all other bivariate correlations are polluted by failure to control for a host of other observable and unobservable characteristics. In theory, considering evidence from other East Asian
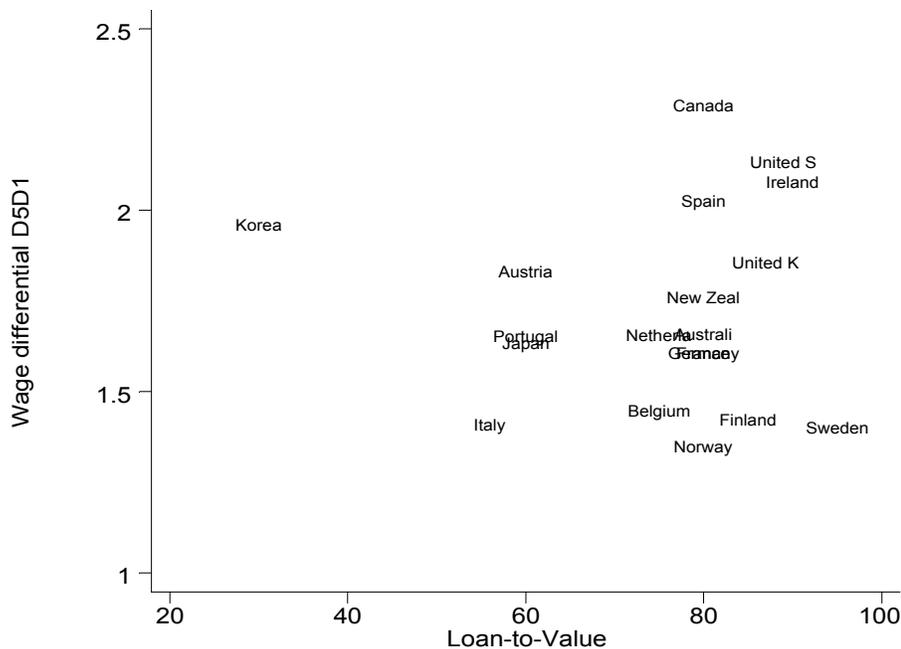
Figure 3: **Wage differentials and loan-to-value ratios.** Sources and definitions: see Appendix.

countries, or accounting for additional institutional differences that set Nordic countries apart from the rest of the sample (such as the degree of social homogeneity, reflected in pre-policy labor incomes, or the structure of public-employment policies), could help obtain more informative and cleaner empirical relationships. In practice, lack of information prevents formal estimation.

4 Discussion

The complex phenomena and evidence we analyze could of course be explained by many other theories, but the evidence is remarkably coherent with our theoretical perspective on policy interactions. We show theoretically that labor markets should tend to be more regulated in countries where credit supply constraints are exogenously more binding; we find empirically that judicial efficiency is very tightly related to credit supply conditions, as summarized by loan-to-value ratios, and that countries with poor judicial efficiency and tight credit also tend to feature more labor market regulation and less volatile labor-income profiles.

If judicial efficiency is indeed an important exogenous determinant of the phenomena we observe and explain, policy should of course aim at loosening liquidity constraints by improving the efficiency of judicial procedures, and of the credit market. But judicial and legal traditions are largely determined

by historical circumstances (see La Porta et al., 1998, and the large relevant recent literature). To the extent that their reform is likely to be difficult, slow, and expensive, it is possible to rationalize the observed tendency to regulate labor markets instead. And to the extent that labor market regulation entails deadweight losses, it is only an imperfect substitute for a better judicial system. It should not aim at delivering the same credit access and welfare as more direct policies would, and indeed we observe empirically a positive bivariate correlation between credit volume and judicial system efficiency.

Of course, the costs and the benefits of many other institutional features interact importantly in reality, within as well as across markets. As noted by Coe and Snower (1997), different policies have complementary effects on labor market performance, and reforms that target more than one aspect simultaneously can have much larger (positive, or negative) effects than reforms acting on specific margins in isolation: for example, wage rigidity certainly increases the impact of EPL on employment and labor mobility patterns (Bertola and Rogerson, 1997). And other policies are substitutable to each other. Unemployment benefits and EPL, for example, certainly aim at similar objectives through different means (see Boeri et al., 2001), and the relative merits of each depend on details of their implementation and of the economy's structure.

But if labor market institutions are a partial substitute for judicial efficiency and other market failures, a wider perspective on the assessment of structural and reform issues is needed. If more flexibility in the labor markets would further constrain workers' access to consumption smoothing instruments, as implied by our assumptions, then it need not improve the economy's ability to deliver welfare to its citizens unless accompanied by financial-market reforms aimed at easing borrowing constraints. Of course, labor market institutions should be updated when an economy's credit markets develop but, from this perspective, it is not surprising to witness heavy resistance to labor market liberalization in countries in which credit supply remains relatively constrained, such as Italy, while the United Kingdom's high level of financial market development may well have allowed that country to drastically reform its labor market in the 1980s (Koeniger, 2001). And the structural and policy implications of financial market conditions may be wider still: for example, the empirical evidence studied by Fogli (2000) shows that in countries with stringent EPL unemployment is particularly concentrated among young people who live with their parents and, since within-family transfers can perform some of the functions of formal financial markets, the structure of labor and credit markets can indeed influence family structure.

Needless to say, additional work could flesh out our model's implications in more realistic terms. It would be interesting to analyze the feedback between institutions and wealth accumulation in a fully dynamic model, although closed form solutions would not be available. It might be more immediately insightful to extend the model and empirical work to aspects of credit markets functioning and regulation, considering for example the extent to which consumer credit bureaus (in turn influenced by privacy and competition concerns) may improve credit opportunities, or how bankruptcy rules may make credit more difficult to obtain while at the same time allowing credit constraints to offer some

insurance against bad labor market outcomes—yet another way in which economies with sophisticated credit markets, like the United States, may find a deregulated labor market appealing. Further work could also adopt a political-economic perspective instead of this paper's *ex ante* evaluation criterion. Of course, labor income stability and credit access do not have uniformly desirable welfare implications across a heterogeneous population. Each policy configuration's *ex post* political support need not reflect welfare assessments formed behind a veil of ignorance and, as in Hassler et al. (2002) and related work, feedback effects from policy-induced outcomes to the same policies' political appeal may support more than one steady-state configuration for structurally similar economies.

Appendix

Proof of Result 3:

The optimal redistribution policy for any given κ satisfies the first-order condition $f(\kappa, \tau, ...) = 0$ for

$$
\begin{aligned}
f(\kappa, \tau, ...) &= u'\left(w_b + \lambda\tau + \frac{\kappa + \xi(w_b + \lambda\tau)}{1+r}\right)\lambda - u'\left(w_g - \tau - \frac{a}{1+r}\right) \\
&\quad + \mu(\kappa, \tau, ...)\xi\lambda \\
&\quad + \beta(1-p)u'(w_b + \lambda\tau - (\kappa + \xi(w_b + \lambda\tau)))\lambda - \beta p u'(w_g - \tau - (\kappa + \xi(w_b + \lambda\tau))) \\
&\quad + \beta p u'(w_b + \lambda\tau + a)\lambda - \beta(1-p)u'(w_g - \tau + a).
\end{aligned}
$$

This is the marginal welfare effect of a larger τ where

$$
\mu(\kappa, \tau, ...) \equiv u'\left(w_b + \lambda\tau + \frac{\kappa + \xi(w_b + \lambda\tau)}{1+r}\right)\frac{1}{1+r} - \beta E\left[u'(c_2)|w_{1(b)}\right]
$$

is the Kuhn-Tucker multiplier of the liquidity constraint. Totally differentiating, the effect of a larger κ on the optimal τ is given by

$$
\frac{d\tau}{d\kappa} = -\frac{\partial f(\kappa, \tau, ...)/\partial\kappa}{\partial f(\kappa, \tau, ...)/\partial\tau}.
$$

To prove the assertion, we will show that both partial derivatives in this equation are negative under the conditions given. Since $u'''(\cdot) = 0$ implies that $u''(\cdot) = x < 0$,

$$
\begin{aligned}
\frac{\partial f(\kappa, \tau, ...)}{\partial\tau} &= x\lambda^2\left(1 + \frac{\xi}{1+r}\right) + x + \frac{d\mu(\cdot)}{d\tau}\xi\lambda \\
&\quad + \beta(1-p)x\lambda^2(1-\xi) + \beta p x(1 + \lambda\xi) \\
&\quad + \beta p x\lambda^2 + \beta(1-p)x .
\end{aligned}
$$

This expression is guaranteed to be negative if

$$
\begin{aligned}
\frac{\partial\mu(\kappa, \tau, ...)}{\partial\tau} &= x\left(\lambda + \frac{\xi\lambda}{1+r}\right)\frac{1}{1+r} + \beta p x(1 + \lambda\xi) - \beta(1-p)x\lambda(1-\xi) \\
&= x\left(\lambda + \frac{\xi\lambda}{1+r}\right)\frac{1}{1+r} + \beta p x + (\xi - (1-p))\beta x\lambda < 0 .
\end{aligned}
$$

The inequality holds if $\xi > 1 - p$. Moreover,

$$
\frac{\partial f(\kappa, \tau, ...)}{\partial\kappa} = x\frac{\lambda}{1+r} + \frac{d\mu(\cdot)}{d\kappa}\xi\lambda - \beta(1-p)x\lambda + \beta p x,
$$

and

$$
\frac{\partial\mu(\kappa, \tau, ...)}{\partial\kappa} = x\left(\frac{1}{1+r}\right)^2 + \beta p x + \beta(1-p)x .
$$

Since $u''(\cdot) = x < 0$ is constant, the sign of $\frac{\partial f(\kappa, \tau, ...)}{\partial\kappa}$ is the opposite of that of

$$
\begin{aligned}
&\frac{\lambda}{1+r} + \left[\left(\frac{1}{1+r}\right)^2 + \beta[(1-p) + p]\right]\xi\lambda - \beta(1-p)\lambda + \beta p \\
&= \frac{\lambda}{1+r} + \left(\frac{1}{1+r}\right)^2\xi\lambda + \beta\lambda(\xi - (1-p)) + \beta p,
\end{aligned}
$$

which is positive as long as $\xi > (1 - p)$.

Hence if $\xi > 1 - p$ and $u'''(\cdot) = 0$ both the denominator and the numerator of the implicit derivative (*) are negative, and the proof is complete. ∎

Data sources and definitions

Employment protection legislation indicator (EPL)   This indicator summarizes legislation for fixed-term and regular employment contracts and is reported for the late 1990s in OECD (1999), Table 2.5, last column. The OECD indicator for 1989 is not explicitly listed in the Tables but is available from the OECD on request. It is very similar to the rank indicators reported in Table 2.6. For 1989 data are available for Australia, Austria, Belgium, Canada, Denmark, France, Finland, Germany, Ireland, Italy, Netherlands, New Zealand, Portugal, Spain, Sweden, UK, US. The EPL indicator for the late 1990s is available for all these countries and Japan, Korea, Norway, Switzerland and Turkey.

Wage differentials   We use data on gross-wage differentials between the 50th and 10th decile of the distribution for the 1980s and 1990s. The data can be found in OECD (1996), Table 3.1. Data are available for Australia, Austria, Belgium, Canada, Denmark, France, Finland, Germany, Italy, Japan, Korea, Netherlands, New Zealand, Portugal, Sweden, UK, US.

Household income inequality   We use data on differentials of household disposable income per equivalent adult between the 90th and 10th decile of the distribution as reported in Gottschalk and Smeeding (1997), Figure 2, column 3. The data are from the 1980s or early 1990s depending on the country and are available for Australia, Austria, Belgium, Canada, Denmark, France, Finland, Germany, Ireland, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, UK, US.

Earnings instability   We use three alternative measures of earnings instability: Pearson's rho, the Spearman rank correlation and the average quintile move. Note that the first two measures are larger if income is more stable whereas the opposite holds for the third measure. The data are from OECD (1996), Table 3.5, and cover the time period 1986-91. Data are available for Denmark, France, Germany, Italy, Sweden, UK, US.

Mean tenure   The data on mean tenure for all jobs in 1985 and 1995 is reported in OECD (1997), Table 5.7, column 4 and Table 5.5, column 9, respectively. Data for 1985 are available for Australia, Canada, France, Finland, Germany, Greece, Japan, Netherlands, Spain, UK, US. The data for 1995 is available for the same countries plus Austria, Belgium, Denmark, Ireland, Italy, Korea, Portugal, Sweden, Switzerland.

Loan-to-value (LTV) ratio   The loan-to-value ratio measures the maximum fraction of house value financed by collateralized mortgages in 1981-87. It is reported in Jappelli and Pagano (1994), Table 1, column 3. Data are available for Australia, Austria, Belgium, Canada, Denmark, France, Finland, Germany, Greece, Ireland, Italy, Japan, Korea, Mexico, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Turkey, UK, US.

Judicial efficiency   This variable is a summary indicator for the efficiency of the judicial system which measures the quality of law enforcement. It is constructed for the early 1990s and reported in La Porta et al. (1998), Table 5, column 1. Data are available for a total of 49 countries among which for the same developed countries as for the LTV ratio plus Switzerland.

Credit volumes   The data for mortgage and consumer credit cover the time period 1990-97 and are constructed by the European Credit Research Institute, ECRI (2000), Table A9. Data is available for Belgium, Finland, France, Germany, Greece, Italy, Japan, Netherlands, Spain, Sweden, UK, US. The data for Finland are averages for 1993-97.

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