NBER WORKING PAPERS SERIES

LABOR MARKET INSTITUTIONS, LIQUIDITY CONSTRAINTS, AND MACROECONOMIC STABILITY

Frank R. Lichtenberg

Working Paper No. 3926

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
December 1991

I benefitted from helpful discussions with John Donaldson, Kevin Hassett, Geoffrey Heal, Glenn Hubbard, and Jeffrey Perloff. I am responsible for any errors. This paper is part of NBER's research program in Labor Studies. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

NBER Working Paper #3926
December 1991

LABOR MARKET INSTITUTIONS, LIQUIDITY CONSTRAINTS, AND MACROECONOMIC STABILITY

ABSTRACT

The sensitivity of employment and real wages -- hence aggregate labor income -- to short-run fluctuations in output varies across countries. We develop a simple theoretical model to show that, if workers, but not capitalists, are liquidity constrained, the sensitivity of an economy to exogenous expenditure shocks is inversely related to the extent to which capitalists, rather than workers, bear fluctuations in income. We perform an econometric test of this proposition using cross-sectional, country-level data on elements of the (time-series) covariance matrix of output, employment, real wages, and investment. We argue that, for two reasons, our estimate of the elasticity of consumption with respect to labor income is likely to be biased towards zero. Nevertheless, our estimate of this parameter is highly significantly different from zero, and is also consistent with previous estimates (obtained from a completely different specification). The empirical results support the view that the lower the sensitivity of labor income to output fluctuations, the smaller the output fluctuations themselves will be. Low sensitivity contributes indirectly as well as directly to the stability of labor income.

Frank R. Lichtenberg
Graduate School
of Business
Columbia University
726 Uris Hall
New York, NY 10027
and NBER

Previous research has shown that the sensitivity of employment to short-run fluctuations in output varies across countries. Abraham and Houseman (1989, 500) found that "adjustment of employment [to demand changes] is significantly greater in the United States" than in Japan, and argued that "the differences we observe reflect differences in the two countries' industrial relations systems, not differences in prevailing demand conditions" (p. 510).[1] Mincer and Higuchi (1988, 97-8) argue that "the basic proximate reason for the strong degree of worker attachment to the firm in Japan" is "rapid technical change, which induces greater and continuous training."

Other studies have found significant

---

[1] On the other hand, Fry (1991) found that "the estimated speeds of employment adjustment and average hours worked adjustment among British manufacturing industries resemble those of North American [U.S. and Canadian] manufacturing industries.

inter-country variation in the adjustment of the real wage (employee compensation) to output fluctuations. Ito and Kang (1989) reported that "both bonuses and wages in Korea respond to economic conditions to a greater degree than their counterparts in Japan....the Korean labor market is much closer to a spot market than to a long-term contract (lifetime employment) market."

Thus the elasticities of employment and the real wage with respect to output both seem to vary across countries. One might conjecture that these two elasticities are negatively correlated, e.g. that countries with more flexible wages tend to have less variable employment.[2] According to data (described below) for 11 industrialized countries reported by Danthine and Donaldson

---

[2] Freeman and Weitzman (1987, 189) argue that the Japanese bonus system "helps to stabilize unemployment at relatively low levels" because bonuses are relatively "responsive to profits or revenues."

(1991), this correlation is negative, but insignificantly different from zero.[3] Even if there were a tradeoff between employment and wage flexibility, unless the slope of the tradeoff happened to be -1 (which appears not to be the case), the elasticity of real aggregate labor income with respect to output--the sum of the employment and wage elasticities--will vary across countries.[4]

In this paper we advance and test the hypothesis that the instability of an economy is positively related to the sensitivity of real labor income to GNP. Instability is defined as the standard deviation of (detrended log) output, relative to (or holding constant) the standard deviation of

---

[3] The sample correlation coefficient is -.27; the probability value of this coefficient is .43.

[4] Since real capital income equals real GNP minus real labor income, this also implies that the <u>relative</u> sensitivity of labor and capital income to GNP varies across countries.

exogenous shocks to the economy. Our hypothesis is that the lower the ratio of the standard deviation of labor income to the standard deviation of capital income, the lower is the "multiplier": the ratio of the standard deviation of GNP to the standard deviation of exogenous shocks. This hypothesis is based on the proposition that short-run changes in labor and capital income have different effects on aggregate consumption expenditure, or that the coefficients on labor and capital income in the aggregate consumption function are not equal.

If consumers (1) behaved according to the permanent income hypothesis, (2) formed expectations about future income rationally, and (3) were not liquidity constrained, then perfectly anticipated changes in income--either labor income or capital income--would have no effect on consumption. A large number of empirical studies, however, have cast doubt on the joint validity of these three assumptions: consumption expenditure has been shown to be ("excessively") sensitive to fluctuations in income. Several authors have concluded that the excess sensitivity of consumption to income is attributable to the failure of the third assumption, the absence of liquidity constraints. Auerbach and Hassett (1989, 2) conclude that "the observed significant excess sensitivity of consumption to predictable changes in disposable income is associated with liquidity constraints, rather than myopia or irrational behavior"; Jappelli and Pagano (1989) reach the same conclusion.

The evidence suggests that some agents are liquidity constrained, but all agents need not be constrained. A number of authors have postulated that workers--recipients of labor income--are liquidity constrained, whereas "capitalists"--recipients of capital income--are not. Blanchard and Fischer (1989, 429) note that a basic premise of the theory of "implicit contracts" is that "workers are risk averse but do not have access to the capital markets" whereas firms may have such access. Woodford (1986, 130) assumes that only workers face finance constraints: "future wage payments cannot be borrowed against, because of moral hazard problems." Auerbach and Hassett (1989, 2) argue that "shareholders can sell stock or borrow against it to relax liquidity constraints, while such transactions are severely limited with respect to human capital." They also provide evidence that "the distribution of share ownership is so concentrated among wealthy individuals that the aggregate importance of liquidity constraints within this group is implausible" (p. 4).

If the recipients of labor income are liquidity constrained, and recipients of capital income are not, consumption should be "excessively sensitive" to fluctuations in labor income but not to those in capital income. Auerbach and Hassett present evidence that is consistent with this implication. In their consumption function estimates, based on both quarterly and annual U.S. data, the "coefficients on capital income are insignificantly different from zero" (p. 13), whereas "predicted disposable labor income is consistently highly significant" (p. 14).

In section 1 we develop a formal but simple model that implies that the stability of an economy depends, *ceteris paribus*, on the extent to which workers, rather than capitalists, experience income fluctuations, and we derive an equation for testing this hypothesis. In section 2 we discuss issues concerning the estimation of this model using data for a cross section of countries. Empirical results are presented in section 3. A summary and concluding remarks are given in section 4.

1. A simple short-run income determination

<u>model</u>

To develop our model, we first establish notation and GNP accounting identities. Let Y = real GNP; P = output price index; W' = nominal wage rate; E = employment; R' = nominal rental price of capital; and K = real capital input. Then the equality between output and income is

$$Y\ P = W'\ E + R'\ K$$

Hence

$$\begin{aligned} Y &= (W' / P)\ E + (R' / P)\ K \\ &= W\ E + R\ K \\ &= Y_L + Y_K \end{aligned}$$

where $W \equiv W' / P$ = the real wage rate; $R \equiv R' / P$ = the real rental price of capital; $Y_L \equiv W\ E$ = real labor income; and $Y_K \equiv R\ K$ = real capital income. Since the variables tend to be nonstationary (exhibiting positive trend), it is useful to re-express this identity in terms of logarithmic differentials:

$$d \ln Y \approx \theta\ d \ln Y_L + (1 - \theta)\ d \ln Y_K$$

or $$y \approx \theta\, y_L + (1 - \theta)\, y_K \quad (1)$$

where $\theta \equiv Y_L / Y$ = labor's share of national income, and lower case letters represent logarithmic differentials of the corresponding variables, e. g. $y \equiv d \ln Y$. ($d \ln Y$ may be interpreted either as a log first difference (growth rate) or as a log deviation from trend.)

The "other" GNP identity--that between output and total expenditure--may be represented as

$$Y = C + Z$$

where C = real consumption expenditure and Z = all other types of expenditure (i.e. the sum of investment, government expenditure, and net exports). We will treat Z as an exogenous variable. This leads to the approximation

$$y \approx \pi\, c + (1 - \pi)\, i \quad (2)$$

where $\pi \equiv C / Y$ is the share of consumption expenditure in GNP.

Our model of income determination consists of two behavioral equations, plus the income identity (2). The first is a relationship between labor income and GNP:

$$y_L = \beta_L \, y \qquad (3)$$

where β_L is the elasticity of labor income with respect to GNP.

Since $y_L = e + w$, $\beta_L = \beta_E + \beta_W$: β_L is the sum of the elasticities of employment and the real wage with respect to GNP. We suggested above that β_L varies substantially across countries. The income identity (1) implies, of course, that the elasticity of capital income with respect to GNP, β_K, is inversely related to β_L:

$$\beta_K = (1 - \theta)^{-1} \, (1 - \theta \, \beta_L)$$

Hence $\beta_K > 0 \iff \beta_L < 1 / \theta$, and $\beta_K > 1 \iff \beta_L < 1$.

The second behavioral equation is the consumption function. In view of the discussion above, we assume that only recipients of labor income are liquidity constrained, and therefore that consumption responds to fluctuations in labor income but not to those in capital income:

$$c = \alpha \; y_L \tag{4}$$

where α is the elasticity of consumption with respect to labor income.[5] Substituting eq. (3) into eq. (4),

$$c = \alpha \; \beta_L \; y \tag{5}$$

The elasticity of consumption with respect to GNP is equal to the product of the elasticity of consumption with respect to labor income and the elasticity of labor income with respect to GNP.

If we assume that nonconsumption expenditure is determined exogenously, then we can close the model by substituting eq. (5) into eq. (2):

$$\begin{aligned} y &= \pi \; \alpha \; \beta_L \; y + (1 - \pi) \; z \\ &= \frac{(1 - \pi)}{1 - \pi \; \alpha \; \beta_L} \; z \\ &= \delta \; z \end{aligned} \tag{6}$$

where $\delta \equiv (1 - \pi) \; / \; (1 - \pi \; \alpha \; \beta_L)$ = the

---

[5] We could generalize the model to include capital income, as follows:

$$c = \alpha_L \; y_L + \alpha_K \; y_K$$

The critical assumption is that $\alpha_L > \alpha_K$.

multiplier. Eq. (6) implies that

$$\sigma_y = \delta \, \sigma_z \qquad (7)$$

or $\sigma_y / \sigma_z = \delta$

where σ_y and σ_z are the standard deviations of y and z, respectively. The standard deviation of output, relative to that of exogenous expenditure, is equal to the multiplier, which is increasing in β_L.

Suppose that two countries, A and B, experience negative investment shocks of equal magnitude, have identical values of π and α, but y_L is more sensitive to y in country A (e.g., employment and/or wages are more likely to be reduced there). The initial ("first-round") decline in total income is the same in both countries, but labor income will decline more, and capital income will decline less, in country A. Since consumption responds only to fluctuations in labor income, consumption will decline more in country A; hence GNP will decline more in country A.

We can solve for y_L as a function of z by substituting eq. (6) into eq. (3):

$$y_L = \beta_L \, \delta \, z$$

Hence

$$\sigma_L \,/\, \sigma_z = \beta_L \, \delta$$

$$= \beta_L \, (1 - \pi) \,/\, (1 - \pi \, \alpha \, \beta_L) \qquad (8)$$

where $\sigma_L \equiv$ the standard deviation of y_L. Eq. (8) reveals that the standard deviation of labor income, relative to that of exogenous expenditure, is increasing in β_L for two reasons, direct and indirect: the lower is β_L, the less y_L will respond to given fluctuations in GNP (direct), and the less GNP will fluctuate (indirect).

One might wonder whether a decline in β_L could also have the "perverse" net effect of reducing the volatility of <u>capital</u> income. In this case the direct and indirect effects go in opposite directions, so the issue is whether the indirect effect could dominate the direct effect. One can show, however, that as long as the marginal propensity to consume out of labor income is less than one (i.e., $\alpha \, \pi <$

Θ), σ_K / σ_z is inversely related to β_L.

2. Econometric issues

In this section we develop a procedure to empirically test the hypothesis that the stability of a country's GNP depends upon the extent to which income fluctuations are borne by workers, as opposed to capitalists. We propose to do this by estimating a model based on eq. (7), using data for a cross-section of industrialized countries. The logarithmic transformation of equation (7) is

$$\log \sigma_y = \log \delta + \log \sigma_z$$

$$= \log \frac{(1 - \pi)}{1 - \pi \alpha \beta_L} + \log \sigma_z \qquad (9)$$

We regard σ_y, σ_z, and β_L as varying across countries, and assume that the parameter π (the share of consumption in GNP) is equal to 2/3 in all countries. β_L has a positive effect on σ_y if and only if α (the elasticity of consumption with respect to labor income) is greater than zero, so testing hypotheses about α is our primary concern. To perform empirical work, we need to maintain the assumption that α is invariant across countries, although below we consider the likely consequences of heterogeneity with respect to α.

Danthine and Donaldson (1991) present data derived from Backus and Kehoe (1989), from which we can calculate estimates of σ_y and β_L for 11 industrialized countries. They report the following statistics:

s_y = the sample standard deviation of output

s_e / s_y = the ratio of the standard deviation of employment to the standard deviation of output

r_{ey} = the coefficient of correlation between employment and output

s_w / s_y = the ratio of the standard deviation of the real wage to the standard deviation of output

r_{wy} = the coefficient of correlation between the real wage and output

Since $y_L = e + w$ and $\beta_L = \beta_e + \beta_w$, we can compute an estimate, b_L, of the elasticity of real labor income with respect to GNP as follows:

$$\begin{aligned} b_L &\equiv b_e + b_w \\ &= (s_e / s_y)\, r_{ey} + (s_w / s_y)\, r_{wy} \\ &= (s_e\, r_{ey} + s_w\, r_{wy}) / s_y \qquad (10) \end{aligned}$$

Suppose that $\log s_y$ is an unbiased estimate of $\log \sigma_y$, but is subject to error:

$$\log s_y = \log \sigma_y + \epsilon_1 \qquad (11)$$

where ϵ_1 is a classical disturbance term. This measurement error has two effects. First, it introduces a disturbance term into the estimating equation. Substituting (9) into (11),

$$\log s_y = \log \frac{(1 - \pi)}{1 - \pi\ \alpha\ \beta_L} + \log \sigma_z + \epsilon_1 \qquad (12)$$

Second, and more important, is that in order to estimate α in (12), we need to replace the unobserved β_L with the sample estimate b_L. As equations (10) and (11) reveal, output measurement errors will bias s_Y and b_L in opposite directions: a country with spuriously high output variance will have a spuriously low labor-income elasticity. This will bias downward our estimate of α, a.

A second reason why a may be biased downward is that α may vary across countries and be negatively correlated with β_L. To see why this would yield a downward bias, we rearrange terms in eq. (9) so that it becomes linear in β_L:

$$w_j = \alpha \; \beta_{Lj} \qquad (13)$$

where $w \equiv \log [\pi^{-1} \{1 - (1 - \pi) \; (\sigma_z \; / \; \sigma_Y)\}]$ and j indexes the country (j = 1,...,11). Suppose that α varies across countries; then instead of eq. (13) we have

$$w_j = \alpha_j \; \beta_{Lj} = \alpha' \; \beta_{Lj} + (\alpha_j - \alpha') \; \beta_{Lj}$$
$$= \alpha' \; \beta_{Lj} + v_j$$

where α' is the mean of the α_j's and $v_j \equiv (\alpha_j - \alpha') \; \beta_{Lj}$. The probability limit of a, the slope from the simple regression (without a constant) of w_j on β_{Lj} is

$$\text{plim } a = \alpha' + \text{plim } \frac{\Sigma_j (\alpha_j - \alpha') \beta_{Lj}^2}{\Sigma_j \beta_{Lj}^2} \tag{14}$$

In our sample, $\beta_{Lj} > 0$ for all j, so the second term on the RHS of (14) will be negative, and a will be a downward biased estimate of α', if the correlation across countries between α and β_L is negative.

Why should this correlation be negative? In the theory of implicit contracts, workers prefer to have their income smoothed _because_ they are liquidity constrained. It is reasonable to postulate that the more binding are the liquidity constraints on workers (and, therefore, the higher is α), the greater the preferred degree of income smoothing (the lower is β_L). We have some very limited evidence that the degree of _employment_ smoothing is positively correlated across countries with the severity of liquidity constraints; the evidence concerning _labor_ income smoothing is more ambiguous, however. Jappelli and Pagano (1989) provide data for six countries on an (inverse) indicator of the severity of liquidity constraints: the ratio D / C of total consumer debt (the sum of personal consumer loans and housing mortgage loans) to total consumption spending. We have estimates of β_e, β_w, and β_L for four of those countries:

Country	D / C	b_e	b_w	b_L
U.S.	83.7	.71	.20	.91
U.K.	56.3	.42	.38	.80
Japan	33.8	.37	.96	1.33
Italy	9.9	.17	-.06	.11

Consistent with implicit contract theory, the rankings of countries with respect to D / C and b_e are identical: the more severe the liquidity constraints within a country, the greater the degree of employment smoothing there. The same ordering applies to labor income smoothing (b_L), with the notable exception of Japan. According to the Danthine and Donaldson estimates, Japan's real wage is so sensitive to output that its labor income is the most sensitive to output, even though liquidity constraints appear to be relatively high there.

We have provided two reasons why our estimate of α may be biased downward--errors in the measurement of output fluctuations, and heterogeneity of α--and therefore why our test of the hypothesis that β_L has a positive effect on σ_y (conditional on σ_z) may be a strong test. Before we turn to our estimates, we need to discuss one other potential source of bias, although not (primarily, at least) bias in the estimate of α. In eq. (12), σ_z denotes the standard deviation of exogenous (nonconsumption) expenditure "shocks" to the economy. Log σ_z is not directly observable, so we use the logarithm of s_i--the sample standard deviation of investment expenditure--as a proxy for log σ_z. We postulate that log s_i is a noisy indicator of log σ_z:

$$\log s_i = \log \sigma_z + \epsilon_2$$

Our theory implies that the "true" coefficient on log σ_z in eq. (12) is unity, but when we replace this unobservable by its indicator log s_i, the expected value of the coefficient on the latter is var (log σ_z) / [var (log σ_z) + var ϵ_2].[6] Therefore the equation we estimate is

$$\log s_{yj} = \log \frac{(1 - .67)}{1 - .67\ \alpha\ b_{Lj}} + \Gamma \log s_{ij} + (\epsilon_{1j} - \epsilon_{2j}) \qquad (15)$$

We should not constrain Γ to equal 1, and it would not be surprising for the estimate of this coefficient to be less than 1. Data for 11 countries on the variables included in eq. (15) are shown in table 1.

3. Estimates

Nonlinear least-squares estimates of the parameters α and Γ from eq. (15), based on the

---

6 Assuming log s_i and b_L are uncorrelated, which is true in our sample.

sample of 11 countries included in the Danthine and Donaldson dataset, are as follows:

	α	Γ
point estimate	.469	.877
asy. standard error	.184	.080
value under H_0	0	1
t-ratio to test H_0	2.55	1.54
prob.-value for H_0	.016	.079

The estimate of α is positive and highly significantly different from zero; the t-ratio is 2.55, and the (one-tailed) probability value for H_0: $\alpha = 0$ is .016. As anticipated, the point estimate of Γ is less than 1; the one-tailed significance level of this difference is .079.[7]

---

[7] The parameter estimates reported in the text are from a model in which the intercept is constrained to equal zero, since no intercept appears in eq. (15). If we relax this *a priori* restriction, the parameter estimates are as follows:

parameter	point estimate	asy. std. error
intercept	.909	.243
α	.290	.160
Γ	.386	.140

The estimated intercept is positive and highly

Our estimate of α is almost identical to Auerbach and Hassett's estimates of the elasticity of consumption with respect to labor income for the U.S., α_{US}, obtained using a completely different methodology (i.e., direct estimation of the consumption function from time-series data). Their estimates of α_{US} from quarterly and annual data were .458 (3.67) and .492 (4.83), respectively (t-ratios in parentheses). If (as Jappelli and Pagano's evidence suggests) liquidity constraints in the U.S. are lower than they are in most other countries, and α is positively related to the severity of these constraints, then one would expect α' (the mean of the α_j) to be greater

---

significant. The point estimate of α declines by more than a third. The t-ratio on α also declines, but only to 1.81, which implies that we can still reject H_0: $\alpha = 0$ at the .054 level of significance (one-tailed test). The estimate of Γ also declines, by more than half. However the correlation between the estimates of Γ and the intercept is negative and very large: -.92. This suggests that, despite the intercept's high t-ratio, the model containing all three parameters is close to being unidentified.

than α_{US}. We argued above, however, that for two reasons our estimate of α is likely to understate α', so the similarity of our estimate to Auerbach and Hassett's is not surprising.

4. Summary and conclusions

A number of authors have hypothesized that workers, but not capitalists, are liquidity constrained, and one previous empirical study provided support for this view. We developed a simple theoretical model to show that, if this is the case, the sensitivity of the economy to exogenous expenditure shocks is inversely related to the extent to which capitalists, rather than workers, bear fluctuations in income. We developed a procedure for testing this proposition using cross-sectional, country-level data on elements of the (time-series) covariance matrix of output, employment, real wages, and investment. We argued that, for two reasons, our estimate of the key parameter α--the elasticity of consumption with respect to labor income--is likely to be biased towards zero. Nevertheless, our estimate of this parameter is highly significantly different from zero, and is also consistent with previous estimates (obtained from a completely different specification). The empirical results support the view that the lower the sensitivity of labor income to output fluctuations, the smaller the output fluctuations themselves will be. Low sensitivity contributes indirectly as well as directly to the stability of labor income.

Table 1

Data for 11 countries on variables included in eq. (15)

Country	s_y	s_i	b_L	b_e	b_w
Australia	2.07	3.93	0.80	0.37	0.43
Austria	1.48	4.91	0.26	0.32	-0.06
Canada	1.62	7.66	0.45	0.63	-0.18
France	0.99	1.92	0.40	0.30	0.10
Germany	1.75	5.88	0.53	0.77	-0.24
Italy	1.95	4.86	0.11	0.17	-0.06
Japan	1.71	4.00	1.33	0.37	0.96
S. Africa	1.67	6.50	0.37	0.07	0.30
Switz.	2.30	6.51	0.91	0.70	0.21
U.K.	1.91	4.45	0.80	0.42	0.38
U.S.	1.82	5.53	0.91	0.71	0.20

Source: Danthine and Donaldson (1991), Tables 2 and 4.

REFERENCES

Abraham, Katherine, and Susan Houseman (1989), "Job security and work force adjustment: how different are U.S. and Japanese practices?," Journal of the Japanese and international economies 3, 500-21.

Auerbach, Alan, and Kevin Hassett (1991), "Corporate savings and shareholder consumption," in Bernheim, B. Douglas, and John Shoven, eds., National saving and economic performance (Chicago: Univ. of Chicago Press), 75-98.

Backus, D., and P. Kehoe (1989), "International evidence on business cycles," Working paper 425, Federal Reserve Bank of Minneapolis Research Department.

Blanchard, Olivier Jean, and Stanley Fischer (1989), Lectures on macroeconomics (Cambridge: MIT Press).

Danthine, Jean Pierre, and John Donalson (1991), "Methodological and empirical issues in real business cycle theory," Unpub. paper, Columbia Business School, January.

Freeman, Richard, and Martin Weitzman (1987), "Bonuses and employment in Japan," Journal of the Japanese and international economies 1, 168-94.

Fry, Richard (1991), "Does North American labor demand adjustment differ from that in Britain?," unpub. paper, Univ. of Michigan, April.

Ito, Takatoshi, and Kyoungsik Kang (1989), "Bonuses, overtime, and employment: Korea vs Japan," Journal of the Japanese and international economies 3, 424-50.

Jappelli, Tullio, and Marco Pagano (1989), "Consumption and capital market imperfections: an international comparison," American economic review 79 (5), December, 1088-1105.

Mincer, Jacob, and Yoshio Higuchi (1988), "Wage structures and labor turnover in the United States and Japan," Journal of the Japanese and international economies 2, 97-133.

Woodford, Michael (1986), "Stationary sunspot equilibria in a finance constrained economy," in Nonlinear economic dynamics (Academic Press), 128-37.