Appendix

This Appendix provides details on the econometric evidence on the time series properties of labor and capital income in the four countries in our sample.

A. Behavior of log ratio of labor income to capital income

In each of the countries in our sample, there is substantial evidence that labor and capital income contain stochastic trends in the sense that Augmented-Dickey-Fuller (ADF) tests (not reported here) fail to reject the null hypothesis of unit roots in these variables. It is central to our investigation whether the logs of labor and capital income share a common stochastic trend, implying stationarity of the log ratio of labor income to capital income.

A key feature of the ratio of labor income to capital income in the all countries in our sample is that there is extensive serial correlation. In the U.S., for example, the estimated first-order serial correlation coefficient is 0.87. It is well known that it is difficult to distinguish econometrically between high persistence and a stochastic trend. However, this distinction is central to the economics of the problem at hand. Specifically, if the log ratio of labor to capital income is stationary but with high persistence, the level of the ratio is extremely important for forecasting future levels of each of the income variables.

Table A-1 presents econometric evidence on the behavior of the log ratio of labor income to capital income. First, we formed the variable $x_t = d_{Lt} - d_{Kt}$, where d_{Lt} and d_{Kt} are the logs of labor and capital income, respectively. We then ran ADF regressions of the following form:

$$\Delta x_t = const. + \phi(L)\Delta x_{t-1} + \beta x_{t-1} + \varepsilon_t \quad (12)$$

for various lag lengths in $\phi(L)$. The central question is whether $\beta < 0$, which would imply that x_t is stationary. In all cases, the point estimates of β are negative. However, ADF tests fail to reject the null of a unit root in x_t at standard significance levels. But ADF tests have known problems in terms of low power against an alternative hypothesis of stationarity but with highly persistent temporary components.

The Stock confidence intervals for $(1 + \beta)$ are 95% confidence intervals on x_{t-1} in a regression of x_t on x_{t-1} and lagged values of Δx_t (see James Stock, (1991)). The value of $(1 + \beta)$ reflects the persistence of x_t if x_t is stationary ($\beta < 0$). The Stock confidence intervals are based on "local to unity" asymptotics, and reflect the asymmetric distribution of the estimate about the point 1.0. These confidence intervals show that we generally could not reject null hypothesis that β is as low as 0.29 or as high as 1.15. These confidence intervals reinforce the notion that the log ratio plausibly follows a highly persistent but ultimately stationary process.

B. Estimation of VECM and testing for cointegration

Our next step was to estimate a bivariate error-correction model in the growth rates of labor and capital income with an error-correction term consisting of the ratio of labor to capital income. This specification of the equation reflects the fact that economic theory (and common sense) tell us that the cointegrating vector between the logs labor and capital income, if one exists, should be [1, -1].

Table A-2 summarizes the results of estimating the VECMs for the four countries. The Akaike and Schwartz criteria suggested that one lag of growth rates was appropriate, but the key results are not sensitive to lag length, as shown in Table 2. Key features of the estimated VECMs are that the R^2s are very high for both equations in all countries. The estimated coefficients on the error-correction terms are numerically small, on the order of 0.10 or less, although the standard errors are also quite small. Under the null hypothesis of cointegration, these standard errors are appropriate.

The VECM also provides a framework for conducting tests of cointegration versus no cointegration. These tests are based on the differences in the likelihood for systems with and without the error-correction terms. For example, the value of the likelihood ratio for the U.S. is 8.01. The standard practice is take no cointegration as the null hypothesis, which involves restricting the parameters on the error-correction terms to be zero. Large values of the likelihood ratio are interpreted as evidence against this null (i.e., evidence in favor of cointegration). If the likelihood ratio were distributed as a standard $\chi^2(2)$, then the p-value for the U.S. likelihood ratio of 8.01 would be 0.02. However, under this null, the test statistic has a nonstandard distribution. Michael Horvath and Mark Watson (1995) have tabulated this distribution, and the p-values for the likelihood ratio statistics are given in the last column of Table A-2. Their distribution differs from that used in standard cointegration tests as it reflects the fact that the cointegrating vector is known rather than estimated. Unfortunately, the Horvath-Watson test shares with the ADF tests problems of low power. Nevertheless, the Horvath-Watson test rejects no cointegration at the 10% level for two of the four countries (Japan and the U.S.).

Based on these tests and based on the fact that economic theory strongly suggests that the log ratio of labor income to capital income is stationary, we proceeded with our analysis under the maintained hypothesis of stationarity.

Table A-1: Testing for cointegration of logs of labor and capital income

Cointegration of log labor income, d_{Lt}, and log capital income, d_{Kt}, was tested by forming the variable $x_t = d_{Lt} - d_{Kt}$, and then running an Augmented-Dickey-Fuller regression of the form:

$$\Delta x_t = constant + \phi(L)\Delta x_{t-1} + \beta x_{t-1} + \epsilon_t$$

Country	Number of lags in $\phi(L)$	β	Stock confidence interval for $(1+\beta)$	ADF test statistic	Adjusted R^2
Japan	0	-0.03	(0.85, 1.14)	-0.89	-0.00
	1	-0.05	(0.72, 1.13)	-1.37	0.25
	2	-0.03	(0.86, 1.15)	-0.78	0.32
Germany	0	-0.12	(0.39, 1.08)	-2.41	0.14
	1	-0.08	(0.63, 1.12)	-1.72	0.21
	2	-0.09	(0.62, 1.13)	-1.71	0.21
U.K.	0	-0.22	(0.58, 1.11)	-1.93	0.08
	1	-0.29	(0.29, 1.06)	-2.59	0.19
	2	-0.19	(0.69, 1.14)	-1.52	0.24
U.S.	0	-0.13	(0.67, 1.12)	-1.60	0.05
	1	-0.16	(0.60, 1.12)	-1.83	0.05
	2	-0.19	(0.51, 1.11)	-2.04	0.04

* MacKinnon critical values for rejection of hypothesis of unit root:

1% Critical Value: -3.6496
5% Critical Value: -2.9558
10% Critical Value: -2.6164

Table A-2: Details of estimation of VECM

Country	Equation for:	Lagged labor income growth		Lagged capital income growth		Error-correction term		Adj. R^2	Testing the null hypothesis that the coefficients on the error-correction terms both equal 0		
		Coeff. Est.	Std. Error	Coeff. Est.	Std. Error	Coeff. Est.	Std. Error		Likelihood ratio statistic	Standard $\chi^2(2)$ p-value	Horvath-Watson p-value
Japan	labor	-0.02	0.16	-0.01	0.05	-0.13	0.02	0.99	24.41	0.00	0.00
	capital	-0.46	0.06	0.19	0.22	-0.11	0.10	0.98			
Germany	labor	0.39	0.15	0.27	0.12	-0.05	0.03	0.99	4.65	0.10	0.34
	capital	-0.84	0.16	0.16	0.13	-0.09	0.03	0.99			
U.K.	labor	0.36	0.15	0.14	0.07	-0.05	0.04	0.99	3.51	0.18	0.49
	capital	-1.00	0.39	0.30	0.18	0.12	0.11	0.95			
U.S.	labor	-0.13	0.17	0.38	0.11	-0.14	0.06	0.99	8.01	0.02	0.10
	capital	-0.64	0.35	0.32	0.22	-0.06	0.11	0.98			