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A TRANSITORY INCOME APPROACH TO EXPORT INSTABILITY

The substantial literature on export instability is unambiguous about the relationship that is expected to hold between fluctuations in export earnings and economic development. From instability, and through the intermediate link of uncertainty, behavioral effects are predicted that are in general detrimental for economic development. But, despite its plausibility on a priori grounds, this hypothesis has fared poorly when confronted with empirical evidence. Coppock (*1*) dealt with the causes of instability and formulated policy prescriptions to reduce fluctuations in export proceeds, despite his consistent finding that the effects of instability on growth rates and other economic parameters were insignificant. MacBean (*14*) also set out to confirm the conventional hypothesis on export instability and indeed concluded with policy prescriptions for stabilizing export earnings. Yet, his empirical investigation revealed no evidence that export instability had damaging economic effects on development for the countries in his sample. Instead, he found a positive and significant coefficient in a multiple regression of the rate of growth of investment on instability. A long line of subsequent studies turned up results that were consistently at variance with extant theorizing.[1]

The consistency of such results suggests that they must not be written off lightly as statistical flukes or random movements into the region of significance. Alternative hypotheses of export instability can be formulated which view uncertainty of a certain kind as a stimulus to investment and growth. The permanent income hypothesis of consumption, for example, applies at the microeconomic level and predicts that the unexpected and transitory component of income contributes to savings more than does the permanent and predictable component.[2] Friedman (5, pp. 233-38) has suggested extension of the

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[1] For other examples of this literature, see Massell (*12*, *13*), Erb and Schiavo-Campo (*4*), and Glezakos (6).

[2] For example, Friedman finds that entrepreneurs, a group which has dispersions of transitory income of 40 to 50 percent of average income, have a lower propensity to consume than non-

hypothesis to the aggregate level by relating the rate of investment and growth of a less developed country (LDC) to the source of foreign exchange proceeds and the distinction between their permanent and transitory component.

The purpose of this paper is to adopt a transitory income approach to measuring export instability that is based on the distinction between permanent and transitory components of export earnings. The behavioral implications of adopting a permanent income framework for the study of export instability will be tested with time series data for the period, 1949-67, of an international cross section of 38 LDCs.

THE HYPOTHESIS

Export instability is conventionally measured with time series data in terms of deviations from an observed level of export earnings, defined as the average for a number of years or as a trend line.[3] An alternative way is to measure instability by deviations from a level of expected earnings. This approach has two important advantages. First, instead of arbitrarily defining the level of "normal" earnings from which deviations are measured, one lets the data, through the formation of permanent income, do the job. Second, a transitory income index of instability has a behavioral foundation, since it is not so much the difference between previously observed and currently attained earnings that affects behavioral components (such as consumption or investment and, through these, growth) as the difference between what was expected and what is realized. We therefore will base our index of instability on the concept of expected earnings.

The empirical specification of expected export earnings can be readily cast in a Nerlovian adaptive expectations model that includes errors in variables. We write

$$E_t^* = E_{t-1}^* + \alpha(E_t - E_{t-1}^*), \qquad 0 \leq \alpha \leq 1 \tag{1}$$

$$E_t = E_t^* + e_t \tag{2}$$

where t is a time subscript, E_t is measured export earnings in real terms, E_t^* is expected export earnings, or the permanent component of measured earnings which is an unobserved variable, and e_t is another observed variable, the transitory component of export earnings. In this formulation, α is the coefficient of adaptive expectations. A value of $\alpha = 0$ implies that current expectations, the permanent component of export earnings, have no relation to measured earnings because they are fully determined by past expectations. A value of $\alpha = 1$ implies that expected earnings, E_t^*, are equal to measured earnings, E_t, and the transitory component of export earnings, $e_t = 0$. While both are acceptable working hypotheses about the formation of expectations, a value of α between these two

entrepreneurs, who have changes in transitory income of only 20 to 25 percent of average income (5, pp. 77-78). On the effect of uncertainty Friedman argued that, "What is favorable to a high savings ratio is not inequality per se but uncertainty, provided, of course, it is uncertainty of a kind that does not reduce the average rate of return on capital—a qualification that is entered to allow for the clearly unfavorable effect on savings of increased uncertainty about the security of property such as might arise from fears of confiscation or close regulation by government" (5, p. 235).

[3] For examples see Reynolds (16), MacBean (14), Massell (12, 13).

bounds is more likely as it indicates that people learn from the deviation between expectations and realizations and they adjust their expectations accordingly. Finally, in order to allow for the possibility that the permanent component of export earnings is greater than measured earnings, or the level of previously expected earnings, we modify equation (1) as[4]

$$E_t^* = (1 + r_E)E_{t-1}^* + \alpha(E_t - E_{t-1}^*), \qquad 0 \leq \alpha \leq 1 \tag{3}$$

where r_E is the constant growth rate of the permanent component of export earnings computed for the entire period 1949-67.[5] Under this modification if $\alpha = 0$, the transitory component of export earnings is the deviation from an exponential growth trend in permanent earnings. On the other hand, if $\alpha = 1$, equation (3) can be written

$$E_t^* - E_t = rE_{t-1}^* = e_t$$

and the transitory component of earnings is equal to the permanent component of income for that particular year adjusted for the growth trend.[6]

For estimating α and therefore E_t^*, we resort to a behavioral hypothesis that provides the rationale for the distinction between the permanent and the transitory components of export earnings. More specifically, following Friedman (5), we specify that permanent or planned consumption is a constant proportion of permanent earnings, while the propensity to consume out of transitory earnings is zero. With this specification, however, we need to expand the model of export earnings to cover also domestic income, since consumption as commonly measured does not distinguish between the two sources of income. By analogy to equations (2) and (3) we write

$$D_t = D_t^* + d_t \tag{4}$$

$$D_t^* = (1 + r_D)D_{t-1}^* + \beta(D_t - D_{t-1}^*), \qquad 0 \leq \beta \leq 1 \tag{5}$$

where D_t is measured domestic real income, D_t^* and d_t are the permanent and transitory components of domestic income, respectively, β is the coefficient of adaptive expectations, and r_D is the constant growth rate of the permanent

[4] The proof of this proposition is given in Knudsen (9, Chapter 6).

[5] One would have ideally wished to estimate the trend growth rate, r_E, with data that refer to a period other than the 1949-67 period which is used for the formation of expectations. This estimation is impossible because of lack of data for two different time periods. In our use of the r_E trend line in equation (3) we follow the common practice in the literature in which the "normal" earnings are defined ex post for the whole period, with instability measured as deviations from that trend. We improve upon this practice by defining instability so as to include the difference between realized earnings at time t and expected earnings at time t-1, as adjusted by the coefficient of adaptation.

[6] For examples of instability indices based upon deviations from an exponential trend line (the case of $\alpha = 0$) see Massell (12). For indices based on the proposition that next year's expected export earnings are equal to this year's earnings (the case approximated by $\alpha = 1$) see United Nations (17).

component of domestic income. We furthermore define

$$Y_t = D_t + E_t \tag{6}$$

$$C_t = C_t^* + c_t \tag{7}$$

$$C_t^* = K_D D_t^* + K_E E_t^* \tag{8}$$

$$\frac{\partial C_t}{\partial d_t} = \frac{\partial C_t}{\partial e_t} = 0 \tag{9}$$

where Y_t is total measured real income that includes both domestic and export earnings, C_t is measured real consumption, C_t^* is permanent consumption, c_t is transitory consumption and K_D and K_E are the propensities to consume out of permanent domestic and export income, respectively.[7]

The model specified in equations (1) to (9) yields estimates of α and β, and therefore of E_t^* and D_t^*, through a maximum likelihood procedure based upon observations on consumption. Data then, and not a priori considerations, are used to determine the permanent components of export and domestic earnings, and through them the deviation of measured from expected earnings, which we will use in the definition of instability.

Despite the similarities of this model with Friedman's permanent income formulation, the points of departure are also significant. We diverge from Friedman's model in distinguishing the two components of income, one originating from domestic sources and another from export sources. We also allow for different propensities to consume out of these components of income.[8] Our estimated propensities to consume, therefore, are not comparable to the propensity to consume out of disposable domestic income that Friedman estimates. Finally, since our data on consumption are aggregates of current consumption and of consumer durables, our results are not strictly comparable to Friedman's who defines consumption as current consumption plus the use value of consumer durables.

[7] Alternatively, we could have adopted a rational expectations approach in establishing the index of instability. However, by using the rational expectations approach we would have lost the theoretical underpinnings of Friedman's permanent income theory and the hypothesis on savings behavior derived from it. Also, we would have had to establish a priori the time horizon on expectations, that is, the number of years of lagged expectations to include in determining expectations. This a priori specification of time horizons seems contrary to the concept that time horizons would vary with the level of uncertainty and hence vary between countries depending on the level of export instability. This consideration leads us to adopt a permanent income measure of expectations even though it complicates the estimation procedures.

[8] A number of reasons, such as differences in interest rates and differences in the ratios of nonhuman wealth to permanent income for the recipients of each kind of income, export and domestic, as well as different uncertainty levels associated with each source of income, could result in different propensities to consume out of domestic and export earnings. For example, Holbrook and Strafford (7) found that the propensities to consume out of several sources of income do indeed differ according to source. Using a multivariate-errors-in-variables model, they estimated propensities to consume from 0.907 to 0.344, depending on the source of income. They concluded that "a model of consumer behavior that constrains the propensity to consume to be the same for income from all sources tends to obscure important underlying relationships" (7, p. 19).

THE INDEX OF INSTABILITY

An obvious index of instability follows from our specification of the model. It basically consists of the sum of squares of the transitory components of income, normalized by their respective permanent income components. We thus define the export instability index,

$$I_E = \frac{1}{T}\sqrt{\sum_{t=1}^{T}\frac{(E_t - E_t^*)^2}{E_t^{*2}}} \tag{10}$$

and the corresponding domestic instability index,

$$I_D = \frac{1}{T}\sqrt{\sum_{t=1}^{T}\frac{(D_t - D_t^*)^2}{D_t^{*2}}}. \tag{11}$$

To obtain a measure of aggregate instability, the transitory income indices, I_D and I_E, can be combined by weighting each index by the portion of the income source in total income or,

$$AVGI = aI_E + (1 - a)I_D \tag{12}$$

where a is the ratio of export earnings to national income and $AVGI$ is the average index of instability.

For purposes of comparing our results with those obtained by other researchers we must define an alternative index of instability. Fortunately, there exists high correlation between the variants of the conventionally used index of instability (11 6). It suffices therefore to define only one alternative index: the sum of the squared deviations from an exponential trend line which is fitted by minimizing the sum of squared residuals. We thus have

$$I = \frac{1}{\log \bar{E}}\sqrt{\frac{1}{N}\sum_{t=1}^{N}(\log E_t - \log \hat{E})^2} \tag{13}$$

where N is the number of annual observations (t=1, ..., N) and bar and hat indicate the mean and the fitted value of export earnings, respectively, with the latter estimated from

$$\log E_t = a + bt + u_t. \tag{14}$$

The instability index of (13) is simply the standard deviation of the observed u_t. It is the index used by Massell (13) and it becomes especially appropriate if it so happens that countries tend to plan in terms of absolute growth rates rather than in terms of constant increments to GNP. Expectations would then take a geometric form, and hence uncertainty could be measured in terms of deviations from an exponential line.

ESTIMATION

Equations (1) to (9) represent a two-variate distributed lag model with distinct geometric lags. Several procedures for their estimation have been developed, notably by Dhrymes, Klein, and Steiglitz (2) and by Knudsen (9, 10). Of these procedures, the simplest is an estimation technique in which the adjustment coefficients of the distributed lag model are iterated at prescribed steps between 0 and 1.

The formulation of this procedure requires the assumption that ϵ_t is $N(0, \sigma^2 I)$ and independent of E_t and D_t. Also, it is assumed that the rates of growth of permanent export and domestic income, r_E and r_D, are identical with the rates of growth of actual export and domestic income. This assumption allows r_E and r_D to be estimated from the growth of actual income before α, β, K_E, and K_D are estimated.

The iterative procedure consists of minimizing with respect to K_E, K_D, α and β the following expression:

$$\sum_{t=1}^{T} [C_t - K_E E_t^*(\alpha) - K_D D_t^*(\beta)]^2 \tag{15}$$

More specifically, the procedure is to:

1. Estimate r_E and r_D by fitting a least squares geometric trend line to the actual real export earnings and real domestic income for the entire data period.
2. Estimate E_0^* and D_0^* as the value of this trend line for t = 0.
3. Select an α and β and generate $E_t^*(\alpha)$ and $D_t^*(\beta)$ using (3) and (5).
4. Estimate K_E and K_D by minimizing (15).
5. Repeat step (3) and after iterating over the entire range of α and β select the $\hat{K}_E$, $\hat{K}_D$, $\hat{\alpha}$ and $\hat{\beta}$ which minimize (15).
6. Use the estimates of $\hat{K}_E$, $\hat{K}_D$, $\hat{\alpha}$, and $\hat{\beta}$, to calculate I_E, I_D, and $AVGI$.

For certain countries this procedure yielded estimates of K_E and K_D which were outside the limits considered reasonable for marginal propensities to consume. To correct for this deficiency in these country estimates, we used a priori constraints on K_E and K_D by iterating K_E and K_D between 0.3 and 1.2 at steps of .05. Such limits allow for dissaving out of one source of income or very high savings out of the other source of income.

In Table 1 the results of the estimation are given for the constrained and unconstrained estimates. Constraints imposed upon the propensities to consume do not appear to have a significant effect on the estimates of the instability indices, except in the case of six of the 38 countries in the sample. The test of the hypotheses proceeded with these countries included and also excluded from the sample in order to determine the sensitivity of the results to the specific value of the index of instability. The constraints, of course, had a major effect on some of the estimates of the propensities to consume. For 22 countries the constraints were necessary for the estimate of the propensities to consume. Experiments were again conducted to determine the sensitivity of the results to these specific values.

TABLE 1.—COMPARISON OF INSTABILITY INDICES AND RELATED STATISTICS, 38 COUNTRIES, 1949-67*

((i) = unconstrained, (ii) = constrained)

Country	I	K_E	K_D	I_E	I_D	α	β
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Argentina	3.39						
(i)		-0.723	0.885	2.788	0.691	0	0.9
(ii)**		0.350	0.750	2.299	0.675	0.7	1.0
Bolivia	12.69						
(i)**		0.961	0.796	0.956	0.550	1.0	1.0
(ii)		0.950	0.800	0.956	0.550	1.0	1.0
Brazil	2.04						
(i)		-0.836	0.797	2.348	0.638	0	0
(ii)**		0.500	0.700	0.699	0.931	0.9	0.1
Ceylon	0.75						
(i)		1.489	0.517	0.692	0.891	0	1.0
(ii)**		1.100	0.650	0.479	0.891	0	1.0
Chile	1.04						
(i)**		1.057	0.745	1.228	0.904	1.0	1.0
(ii)		1.000	0.750	1.228	0.904	1.0	1.0
Colombia	1.52						
(i)**		0.822	0.692	1.307	1.079	0	1.0
(ii)		0.800	0.700	1.307	1.079	0	1.0
Costa Rica	3.40						
(i)**		0.978	0.704	1.880	0.600	0.4	0
(ii)		1.000	0.700	1.951	0.600	0.3	0
Cyprus	1.08						
(i)		0.223	1.202	2.027	1.540	0.1	0
(ii)**		0.300	1.150	2.027	1.540	0.1	0
Dominican Republic	18.89						
(i)		-0.526	0.985	2.903	1.092	0	1.0
(ii)**		0.300	0.800	2.630	1.092	0.1	1.0
Ecuador	2.03						
(i)**		0.358	0.762	0.826	1.075	1.0	1.0
(ii)		0.450	0.750	1.772	1.059	0	0.8
El Salvador	2.14						
(i)**		0.805	0.835	1.474	0.617	0.5	0
(ii)		0.900	0.800	1.474	0.617	0.5	0
Greece	2.72						
(i)**		0.464	0.747	2.916	1.264	0.3	0.9
(ii)		0.450	0.750	2.916	1.264	0.3	0.9
Guatemala	2.92						
(i)**		0.447	0.883	2.293	0.528	0.9	0
(ii)		0.350	0.900	2.280	0.528	1.0	0

TABLE 1.—COMPARISON OF INSTABILITY INDICES AND RELATED STATISTICS, 38 COUNTRIES, 1949-67* (CONTINUED)

((i) = unconstrained, (ii) = constrained)

Country	I	K_E	K_D	I_E	I_D	α	β
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Haiti	3.27						
(i)		-20.265	4.652	4.002	0.548	0	0
(ii)**		0.350	0.950	4.002	0.451	0	0.6
Honduras	3.88						
(i)**		0.994	0.746	3.981	0.721	0.1	0
(ii)		1.150	0.700	3.981	0.721	0.1	0
Iceland	1.52						
(i)**		0.975	0.447	1.942	1.553	0.6	0
(ii)		1.000	0.400	1.942	1.553	0.6	0
India	1.46						
(i)		7.477	0.381	1.840	0.867	0	1.0
(ii)**		0.900	0.750	1.840	0.867	0	1.0
Israel	2.16						
(i)**		0.452	0.728	4.043	1.826	0.7	0.9
(ii)		0.550	0.700	3.958	1.826	1.0	0.9
Jamaica	2.99						
(i)		-0.034	1.036	2.143	1.439	0	0.9
(ii)**		0.300	0.850	2.017	1.433	1.0	1.0
Kenya	3.01						
(i)		0.038	0.880	4.905	1.177	1.0	0.6
(ii)**		0.300	0.850	4.729	1.177	0.5	0.6
Malaysia	1.59						
(i)		-2.995	0.842	1.380	1.363	0.4	1.0
(ii)**		0.300	0.700	1.702	1.363	0	1.0
Mexico	1.41						
(i)		1.588	0.584	1.135	1.349	0	1.0
(ii)**		1.200	0.650	1.135	1.349	0	1.0
Morocco	1.75						
(i)		-8.753	4.192	1.490	1.292	0	0.1
(ii)**		1.000	0.600	0.790	1.085	0.9	0.3
Nicaragua	2.74						
(i)**		0.764	0.737	1.921	2.824	0.9	0.3
(ii)		0.750	0.750	1.921	2.824	0.9	0.3
Pakistan	2.38						
(i)		-0.890	0.917	2.428	0.890	0.2	1.0
(ii)**		0.300	0.850	1.582	0.890	0.6	1.0
Panama	3.69						
(i)		1.377	0.419	1.938	1.410	0	0.8
(ii)**		1.200	0.500	1.938	1.938	0	0.7

TABLE 1.—COMPARISON OF INSTABILITY INDICES AND RELATED STATISTICS, 38 COUNTRIES, 1949-67* (CONTINUED)

((i) = unconstrained, (ii) = constrained)

Country	I	K_E	K_D	I_E	I_D	α	β
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Paraguay	2.85						
(i)		2.300	0.508	3.139	0.811	0	1.0
(ii)**		1.100	0.700	3.139	0.807	0	0.9
Peru	1.95						
(i)**		1.075	0.564	1.990	1.081	0.1	1.0
(ii)		1.150	0.550	1.990	1.081	0.1	1.0
Philippines	1.79						
(i)		34.605	-3.519	2.973	1.283	0	0
(ii)**		1.150	0.700	2.434	1.290	0.2	1.0
Portugal	2.64						
(i)		0.150	0.906	1.900	0.710	1.0	0
(ii)**		0.400	0.850	2.647	0.710	0	0
Spain	2.65						
(i)		0.169	0.712	4.080	1.306	0.2	0.8
(ii)**		0.300	0.700	3.900	1.306	0	0.8
Sudan	3.77						
(i)		-23.700	5.661	4.698	1.179	0	0
(ii)**		1.100	0.700	2.050	1.179	0.7	0
Taiwan	4.14						
(i)		-0.173	0.752	3.985	1.617	0	1.0
(ii)**		0.350	0.650	3.985	1.617	0	1.0
Thailand	2.34						
(i)**		0.346	0.804	2.288	1.720	0.4	1.0
(ii)		0.350	0.800	2.054	1.720	0.5	1.0
Tunisia	2.76						
(i)		1.420	0.478	3.012	1.147	0	1.0
(ii)**		1.200	0.550	3.012	1.147	0	1.0
Turkey	3.15						
(i)**		0.478	0.723	2.178	1.294	0.8	1.0
(ii)		0.850	0.700	4.648	1.294	0.4	1.0
UAR (Egypt)	3.74						
(i)		-15.881	4.337	2.984	1.097	0	0.1
(ii)**		0.500	0.750	2.797	1.120	0.2	0.4
Uruguay	4.25						
(i)**		0.803	0.734	0.749	0.531	1.0	1.0
(ii)		0.700	0.750	0.749	0.531	1.0	1.0

*Data from United Nations, unpublished.

Notes: Asterisks (**) indicate the estimate used in the regression involving the entire sample.

As will be reported below, the basic results remained invariant in these experiments.

It should also be noted that out of the 76 estimates of α and β, in 19 cases, α or β was equal to zero, and in 24 cases, α or β was equal to one. To the extent that these are the correct values for α and β, the implication is that in just over one-half of the cases no adaptation of expectations takes place. Instead, current expectations are fully determined by past experience ($\alpha=0$) and in this case any index of instability based on observed trends would have been satisfactory. Conversely, the prior on expectations is flat and only the currently realized export earnings matter ($\alpha=1$). It is indeed true in these cases that countries "do not seem to learn" or "have no need to learn" from experience, since there is no deviation.[9] Even in this case, however, the usefulness of our model is evident. Instead of adopting a monolithic rule as to whether countries "learn," and how, we allow for variety, as determined by the data.

IMPLICATIONS OF THE HYPOTHESIS AND TESTS

The transitory income index of export instability was constructed by extending the permanent income hypothesis to export earnings. The intermediate link between the measurement of the phenomenon and the empirical implications of export instability is uncertainty. By interpreting the transitory index of instability as a measure of uncertainty we derive implications for economic development in two alternative ways.

The permanent income hypothesis predicts that it is not the level of income, absolute or relative, that determines savings, but rather the level of uncertainty. A certain kind of uncertainty, that does not reduce the average rate of return to capital, reduces the propensity to consume by requiring reserves for emergencies (5, p. 235). It is true that Friedman developed the permanent income hypothesis primarily to explain individual behavior. However, he also suggested extensions in the economics of development (5, pp. 233-36) that involve mere aggregation of individual relationships (for example, in predicting the impact of the inequality of income distribution on the savings ratio depending on whether the source of inequality is permanent or transitory income) or that operate directly on the aggregate level (for example, in predicting the impact of foreign assistance on

Col. (1) estimated from equation (20).
Col. (4) estimated from equation (17) x 100.
Col. (5) estimated from equation (18) x 100.
The data involved in the estimation of equations (13), (10) and (11) are defined as follows:
E_t = measured real export earnings, in 1960 prices, obtained by the use of an export price deflator.
D_t = measured real domestic income, in 1960 prices, obtained by the use of a GDP deflator.
Y_t = total measured real income, in 1960 prices, obtained by the use of a GNP deflator.
C_t = measured real private consumption, in 1960 prices, obtained by the use of consumer price deflator.
r = constant real rates of growth of the subscribed variables, calculated over the period 1949-67.
For definitions of other variables see text.

[9] We owe this point to a very careful anonymous referee.

savings ratios, depending on whether such assistance becomes a part of permanent or of transitory income). An increase or decrease in exports can be treated by analogy, depending on whether it is reflected mostly on the permanent or the transitory component of export earnings.[10]

The first implication of this transitory income approach to export instability that we test is that the transitory indices of export and domestic instability, as measures of uncertainty, must be negatively related to the (marginal) propensities to consume, K_E and K_D. Regressions were run relating the propensities to consume with the level of instability for the entire sample of 38 countries (the starred estimates in Table 1), for the sample of countries in which the constraints had insignificant effect on the instability indices, and for a reduced sample which included only the countries with satisfactory unconstrained estimates of the propensity to consume.[11] The results that appear in Table 2 have the expected negative sign and are significant with the exception of the results of K_D and the unconstrained sample. This first result might indicate that, in the case of domestic instability, other determinants of the marginal propensity to consume that we have omitted, such as the rate of interest and the ratio of nonhuman wealth to permanent income, may be more crucial when the marginal propensity to consume out of domestic income is concerned, while they may be ignored with impunity when one explains the marginal propensity to consume out of export income. The lack of significance of the unconstrained cases may well be due to the small size of the sample, or else it might indicate that the estimation technique of the constrained cases has influenced the results. In this latter case a more powerful test would have been to compare the instability indices with propensities to consume estimated from cross-section data. Unfortunately data do not exist to permit this comparison.

Regressions (1.4), (2.4), and (3.4) in Table 2 pool the data from the domestic and the export income components. They also have the predicted negative and significant coefficients for the constrained estimates, and correct, although insignificant, coefficients for the unconstrained reduced sample. Finally, in regressions (1.5), (2.5), and (3.5) in Table 2 we modify the pooled regressions above by allowing for a dummy variable that takes the value of 1 for domestic and 0 for export instability. The results reveal that the propensities to consume from the two sources of income are not significantly different if one controls for the level of

[10] An alternative, and tentative, framework for extending a microeconomic hypothesis to the aggregate level may be provided by the monetarist approach to the balance of payments (which is summarized, for example, in Johnson, (8), or Dornbusch, (3). Uncertainty leads to an increase in precautionary foreign exchange reserves. Foreign reserves plus the domestic credit (or the domestic assets backing the money supply), which by hypothesis is exogenous, constitute the money supply. The demand for money is a function of the price level, the real output, and the interest rate. The disequilibrium between supply and demand for money that is created by an increase in foreign exchange reserves is restored by positive changes in the rate of domestic economic growth and the income elasticity of demand for money by negative changes of the rate of domestic credit expansion and/or by changes in the level of prices. It is therefore conceivable within the monetarist framework that uncertainty may also lead to higher rates of growth.

[11] Besides the sets of equations reported in Tables 2, 3, and 4, we have also run other regressions to check for the robustness of our results, such as by excluding, singly or seriatim, countries like Brazil, Morocco, Sudan, Ecuador, Pakistan, and Turkey. The negative signs of all the independent variables remained invariant; the level of significance only changed in a few cases.

TABLE 2.—INSTABILITY AND THE PROPENSITY TO CONSUME*

A. Regressions with Entire Sample (n = 38)								
1.1	K_E	=	0.92	−	10.54 (-2.11**)	I_E		R^2 = 0.110
1.2	K_D	=	0.79	−	4.82 (-1.08)	I_D		R^2 = 0.031
1.3	AVGK	=	0.81	−	5.19 (-2.53**)	AVGI		R^2 = 0.151
1.4	KTOT	=	0.85	−	7.97 (-2.77**)	ITOT		R^2 = 0.094
1.5	KTOT	=	0.90	−	9.67 (-2.79**)	ITOT	− 0.06 D (-0.88)	R^2 = 0.103
B. Regressions with Countries in Which Instability Indices Were Not Significantly Affected by Constraints on Propensities to Consume (n = 32)								
2.1	K_E	=	1.04	−	14.4 (-2.71**)	I_E		R^2 = 0.197
2.2	K_D	=	0.79	−	4.64 (-0.97)	I_D		R^2 = 0.031
2.3	AVGK	=	0.82	−	5.75 (-2.68**)	AVGI		R^2 = 0.194
2.4	KTOT	=	0.88	−	9.06 (-3.04**)	ITOT		R^2 = 0.130
2.5	KTOT	=	1.00	−	12.65 (-3.43**)	ITOT	− 0.12 D (-1.61)	R^2 = 0.165

instability. As hypothesized by the permanent income theory of consumption and as indicated by the consistently negative coefficients of the instability indices in the regressions of Table 2, higher levels of instability tend to reduce the propensity to consume out of permanent income.

Over the long term and as the mean dispersion of transitory income tends to zero, these lower propensities to consume should cause higher savings and hence induce investment.[12] This proposition is tested in Table 3 for the full sample and

[12] The linkages between savings and investment and savings and higher growth rates of course are not certain. For example, it would be consistent with the permanent income hypothesis if fluctuating income were to lead to higher savings rates which could be translated into accumulation of foreign assets. This process could lead to higher income streams in the future (if real interest rates on those savings were positive) but not necessarily to higher domestic investment or to higher growth rates (we owe this point to an anonymous referee). However, the empirical estimations of Tables 3 and 4 indicate that the lower propensities to consume induced by higher variances in transitory income tend to yield higher investments and higher growth rates. Apparently the uncertainty as reflected in income fluctuations is, as Friedman has previously indicated, not of a nature to reduce the average return on capital and hence not of a form to inhibit investment out of the increased supplies of savings. Furthermore, this investment appears to be of a form that yields increased capital formation and higher growth rates.

TABLE 2.—INSTABILITY AND THE PROPENSITY TO CONSUME* (CONTINUED)

C. Regressions with the Countries with Constrained Estimates of Propensities to Consume Removed (n = 16)

3.1	K_E	=	0.85	−	5.70 (-0.80)	I_E		R^2 = 0.044
3.2	K_D	=	0.77	−	4.14 (-0.97)	I_D		R^2 = 0.063
3.3	AVGK	=	0.80	−	4.47 (-1.98)	AVGI		R^2 = 0.218
3.4	KTOT	=	0.79	−	3.84 (-0.99)	ITOT		R^2 = 0.032
3.5	KTOT	=	0.84	−	5.26 (-1.18)	ITOT	− 0.05 D (-0.67)	R^2 = 0.046

* Derived from Table 1.

Notes: Asterisks (**) indicate significance at the 5 percent level.
Numbers in parentheses are values of t-statistics.
Variables are defined as follows:

K_E = propensity to consume out of export income instability.
K_D = propensity to consume out of domestic income instability.
I_E = transitory index of export income.
I_D = transitory index of domestic income.
AVGK = weighted average of K_E and K_D.
AVGI = weighted average of I_E and I_D.
KTOT = pooled sample of K_E and K_D.
ITOT = pooled sample of I_E and I_D.
D = dummy variable (1 for domestic income; 0 for export income).

the two reduced samples of countries. Regressions (1.2), (2.2), and (3.2) indicate that export instability alone is not systematically related to higher levels of investment. The coefficients of domestic instability in regressions (1.3) and (2.3) are positive and significant at the 5 percent level while in regression (3.3) the coefficient is insignificant. When the indices of export and domestic income are weighted by their portion in total income and combined to form an average level of instability, the effect is to increase the level of significance of all coefficients indicating that income instability on the level of the economy tends to lead to higher investment. Including GNP per capita as a measure of development further improves the statistical significance of the regressions in Table 3. Once we take account of instability, investment—as would have been expected—is also a function of the level of development, crudely measured by GNP per capita.[13]

[13] This last finding may appear inconsistent with Friedman's model, the essence of which is, after all, that the propensity to save (or invest in our formation) is independent of the level of income. It must be noted, however, as in footnote 8 above, that Friedman has also allowed for other factors to affect propensities to consume, some of which may be correlated with GNP per capita. To the extent, for example, that ratios of nonhuman wealth to permanent income or the average rate of return on capital may vary systematically with GNP per capita, one should not be surprised to find that IGNP also depends on GNPC, once we control the level of instability.

TABLE 3.—INSTABILITY AND INVESTMENT*

A. Regressions with Entire Sample (n = 38)								
1.1	IGNP	=	15.77	−	0.01 (-0.45)	I		R^2 = 0.006
1.2	IGNP	=	13.69	+	80.08 (1.26)	I_E		R^2 = 0.270
1.3	IGNP	=	10.93	+	405.21 (2.95**)	I_D		R^2 = 0.195
1.4	IGNP	=	9.03	+	499.03 (3.65**)	AVGI		R^2 = 0.270
1.5	IGNP	=	8.55	+	298.20 (2.90**)	AVGI	+ 0.01 GNPC (6.03**)	R^2 = 0.642
B. Regressions with Countries in Which Instability Indices Were Not Significantly Affected by Constraints on Propensities to Consume (n = 32)								
2.1	IGNP	=	16.47	−	0.14 (-0.60)	I		R^2 = 0.012
2.2	IGNP	=	14.88	+	47.90 (0.65)	I_E		R^2 = 0.014
2.3	IGNP	=	11.52	+	398.86 (2.79**)	I_D		R^2 = 0.207
2.4	IGNP	=	9.76	+	471.87 (3.17**)	AVGI		R^2 = 0.251
2.5	IGNP	=	8.83	+	298.63 (2.64**)	AVGI	+ 0.01 GNPC (5.24**)	R^2 = 0.616
C. Regressions with the Countries with Constrained Estimates of Propensities to Consume Removed (n = 16)								
3.1	IGNP	=	17.55	−	0.34 (-0.73)	I		R^2 = 0.037
3.2	IGNP	=	233.18	+	233.18 (2.04)	I_E		R^2 = 0.229
3.3	IGNP	=	12.39	+	359.23 (1.96)	I_D		R^2 = 0.215
3.4	IGNP	=	10.26	+	480.97 (2.60**)	AVGI		R^2 = 0.325
3.5	IGNP	=	9.59	+	242.34 (1.89)	AVGI	+ 0.01 GNPC (4.65**)	R^2 = 0.747

* Derived from Table 1.

Notes: Asterisks (**) indicate significance at the 5 percent level.
Numbers in parentheses are t-statistics.
Variables are defined as follows:
I = conventional index of export earnings instability.
IGNP = ratio of investment in GNP.
GNPC = per capita GNP.

As distinct from our results, in regressions (1.1), (2.1), and (3.1) of Table 3 the ratio of investment to GNP is negatively and nonsignificantly related to the conventional index of export earnings instability. Positive and significant results were obtained by MacBean (*14*, pp. 111-12) who regressed the rate of growth of net capital formation on his version of the conventional index of import instability (which is the five-year moving average). He was led to consider this result as a peculiarity, since he had no analytical framework that was consonant with it. Our analytical framework makes our positive results consistent with a priori expectations.

The regressions of Table 3 also indicate the difficulty in explaining aggregate parameters, such as investment, with a variable that represents only a portion of the aggregate, such as export instability. Regressions (1.2), (2.2), and (3.2) in Table 3 suggest that the insignificant or contradictory results of the other studies we have alluded to may well be explained by the fact that differences among countries in aggregate quantities, such as investment, were analyzed without properly accounting for instability in other sectors of the economy, such as instability of domestic income.

The overriding interest of the export instability hypothesis is the relationship between instability and economic growth. This relationship can be investigated by using the rate of growth in GDP as the dependent variable. A subsidiary and lower level hypothesis relates export instability to domestic economic instability. A shortfall in export proceeds decreases domestic consumer demand which, through the operation of the multiplier effect, leads to recession in the domestic production sector.

MacBean (*14*, p. 65) investigates the latter hypothesis by regressing an index of instability of national income on his index of export instability. The results were not significantly different from zero. Similarly insignificant are the results we obtain by regressing our transitory index of domestic income instability on the index of export instability in equations (1.1), (2.1), and (3.1) of Table 4.

With respect to the question of instability and the rate of growth, the results are negative but again statistically nonsignificant when the conventional index of instability is used as the independent variable in equations (1.2) and (2.2). (In equation (3.2), however, a negative and significant relation emerges.) Such results are not different from Coppock's (*1*, p. 106), although MacBean (*14*, p. 122) found a positive and significant relation by regressing on his instability index the capital-output ratio, interpreted as an index of productivity. He also considered this finding a statistical fluke.

On the other hand, when the transitory indices of export and domestic income instability are used, a strong positive relationship with the rate of growth of GDP (RGDP) is obtained. While regressions (1.3), (2.3), and (3.3) in Table 4 consider only export earnings instability, the other regressions include the transitory component of domestic income as well and indicate a positive and generally significant relation between instability and growth although some variation in significance emerges between different samples of countries. Similar results are obtained in regressions (1.6), (2.6), and (3.6) of Table 4 where the rate of growth of GDP per capital (RGDPC) is used as the dependent variable. This outcome suggests that the growth-enhancing effects of export instability, through higher

TABLE 4.—INSTABILITY AND GROWTH*

A. Regressions with Entire Sample (n = 38)								
1.1	I_D	=	0.10	+	0.06 (0.86)	I_E		$R^2 = 0.020$
1.2	RGDP	=	4.93	−	0.09 (-1.08)	I		$R^2 = 0.005$
1.3	RGDP	=	3.45	+	54.00 (2.25)	I_E		$R^2 = 0.123$
1.4	RGDP	=	1.53	+	42.27 (2.08**)	I_E	+ 194.47 I_D (4.07**)	$R^2 = 0.404$
1.5	RGDP	=	1.58	+	237.40 (4.81**)	AVGI		$R^2 = 0.392$
1.6	RGDPC	=	-0.47	+	199.16 (4.04**)	AVGI		$R^2 = 0.312$
B. Regressions with Countries in Which Instability Indices Were Not Significantly Affected by Constraints on Propensities to Consume (n = 32)								
2.1	ID	=	0.01	+	0.06 (.68)	I_E		$R^2 = 0.015$
2.2	RGDP	=	5.08	−	0.11 (-1.19)	I		$R^2 = 0.045$
2.3	RGDP	=	3.45	+	53.93 (1.93)	I_E		$R^2 = 0.110$
2.4	RGDP	=	1.49	+	42.60 (1.85)	I_E	+ 193.29 I_D (3.99**)	$R^2 = 0.426$
2.5	RGDP	=	1.56	+	239.28 (4.53**)	AVGI		$R^2 = 0.406$
2.6	RGDPC	=	192.21	+	52.98 (3.63**)	AVGI		$R^2 = 0.305$

savings rates, dominate the other growth-inhibiting effects. The combined effect is higher rates of investment and income growth in countries with higher instability indexes.

CONCLUSIONS

The transitory income approach to export instability measures uncertainty in terms of the unexpected or transitory component of export earnings. The behavioral implication of this approach is that higher levels of instability tend to induce lower propensities to consume out of permanent income, because higher reserves are necessary to maintain permanent consumption during shortfalls in income. These lower propensities to consume are reflected in higher rates of investment in GDP and in turn tend to provide for higher levels of growth. This

TABLE 4.—INSTABILITY AND GROWTH* (CONTINUED)

C. Regressions with the Countries with Constrained Estimates of Propensities to Consume Removed (n = 16)

3.1	I_D	=	0.01	+	0.18 (1.09)	I_E			$R^2 = 0.078$
3.2	RGDP	=	5.85	−	0.34 (-2.25**)	I			$R^2 = 0.265$
3.3	RGDP	=	2.36	+	121.03 (3.38**)	I_E			$R^2 = 0.449$
3.4	RGDP	=	1.55	+	102.69 (3.00**)	IE	+ 104.09 I_D (1.92)		$R^2 = 0.570$
3.5	RGDP	=	2.16	+	202.59 (3.18**)	AVGI			$R^2 = 0.420$
3.6	RGDPC	=	0.06	+	155.83 (2.78**)	AVGI			$R^2 = 0.356$

* Derived from Table 1.

Notes: Asterisks (**) indicate significance at the 5 percent level.
Numbers in parentheses are t-statistics.
Variables are defined as follows:
RGDP = rate of growth of gross domestic product.
RGDPC = rate of growth of gross domestic product per capita.

version of the hypothesis of export instability is diametrically opposed to the traditional treatment of the subject that predicts detrimental effects of instability on the rate of economic growth.

Our empirical results suggest that instability, both of export and domestic income, measured as the dispersion of the transitory component of the respective income sources, tends to have effects that are conducive to economic growth.[14] We conclude that previous studies of export instability that reached opposite results may have been incomplete in assessing the effects on aggregate economic parameters by not accounting for other income instability in the economy.

[14] Many directions for inquiry are opened by these results. As suggested by an anonymous referee and the results of Holbrook and Strafford (7), the nature and source of instability is likely to influence the behavioral characteristics of the various recipients of income. Furthermore, the production characteristics, factor utilization, ownership arrangements, etc., are all going to affect the diffusion effects of the effects of lower propensities to consume and the conversion of savings to investments and growth.

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