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Dynamics of the Current Account and Interest Differentials

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Abstract

In contrast to earlier work, we study the relation between the current account and interest rate differentials. To do so, we document the relation for international data. We then interpret this relation from a two-country, dynamic, general equilibrium environment. We finally confront the relation predicted by the environment to the relation observed in the data. We find that the environment correctly predicts that the current account is countercyclical; that the interest differential is procyclical; and that the current account is negatively correlated with current and future interest differentials, but positively correlated with past interest differentials.

JEL Classification Codes: F32, G15.
Keyword: International Real Business Cycle.

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1. Introduction

The analysis of the current account and interest rate di®erentials have been major, yet separate enterprises. In fact, most studies ignore the relation between the current account and interest di®erentials. This is most surprising since intuition suggests that current accounts and interest rates jointly adjust to ensure the equilibria of both the world capital and good markets.

To ¯ll this gap, we pursue three objectives. First, we document the relation between the business cycle °uctuations of the current account and of the interest di®erential for 10 developed economies over the post-1975 period. Our measure of the current account is the ratio of the current account to output. Our measure of the interest di®erential is the spread betwe

trade of one-period bonds only. This restriction is similar to the one used in Baxter and Crucini (1995), and allows a straightforward computation of the current account. Finally, trades in the world capital market are costly. This is in the spirit of the debt-elastic interest rate speci¯cation used in Schmitt-Groh¶e and Uribe (2002), and implies the existence of interest di®erentials.

For plausible parameter values, the environment generates dynamic responses that hint at features which qualitatively replicate those found in the data. Speci¯cally, following positive domestic shocks, the responses of the current account are generally negative, whereas the responses of the int eses pnavrses t lnh j enp TD 0.048 048 Tc (c) Tj 5.4 0 TD -0.048

2. Empirical Regularities

We investigate the relation between the business cycle °uctuations of the current account and of the interest di®erential using postwar quarterly data for 10 developed countries.

2.1 Description of the Data

The data are fully described in Appendix A. The quarterly data covers the post-1975 period. The countries are Australia, Austria, Canada, Finland, France, Germany, Italy, Japan, the United Kingdom, and the United States. These countries are often considered in international real business cycle studies (e.g. Backus, Kehoe, and Kydland 1994), current account studies (e.g. Glick and Rogo® 1995), and interest di®erential studies (e.g. Lane and Milesi-Ferreti 2002). As a group, they account for 55 percent of the overall 1990 real gross domestic product of the 116 countries for which data are available in the Penn World Tables (Mark 5.6a).

Our de¯nition of the current account is

$$x_t \equiv X_t / Y_t; \tag{1}$$

where X_t is the current account and Y_t is output. This measure is widely used in the current account literature (e.g. Taylor 2002).

Our de¯nition of the interest di®erential is

$$d_t \equiv R_t - R_t^w; \tag{2}$$

real gross return. The ex-ante real interest rate is the di®erence between the short-term nominal interest rate

is a weighted average of the country-specific interest rates, where the weights reflect the country's share of the overall real output of the 10 countries. This measure is useful since it yields one time series per country instead of several bilateral series per country.

Figure 1 plots the two variables for the United States and the Non-US Aggregate (the aggregate of the 9 remaining countries). The United States and the Non-US Aggregate are entities of roughly similar sizes. On average, the United States accounts for 43 percent of the 10-county output in our data, while the Non-US Aggregate accounts for 57 percent. The decomposition of the 10 countries into the United States and the Non-US Aggregate will prove useful in later sections.

As hoped, the current account of the United States and the Non-US Aggregate mirror each other well (the correlation is -0.70). By construction, the interest differential for the United State and the Non-US Aggregate also mirror each other well (the correlation is -1.00).

2.2 Features of the Data

We report the salient features of the business cycle fluctuations of the current account and of the interest differential. As is standard, we measure the business cycle using the fluctuations of the logarithm of output. As in Hodrick and Prescott (1997), the fluctuations correspond to the series detrended using the Hodrick-Prescott filter with a smoothing parameter of 1,600. In what follows, we report the features for the 10 countries, as well as for the Non-US Aggregate and the 10-Country Average (the mean statistic over the 10 countries).

Table 1 reports the relative volatility, the autocorrelation, and the correlation. The relative volatility corresponds to the ratio of the sample standard deviation of a variable to the sample standard deviation of output. The autocorrelation is the sample first-order serial correlation of a variable. Finally, the correlation is the sample contemporaneous correlation between variables.

First, the current

di®erential, Figure 2 displays the dynamic sample cross-correlation function between the two variables. The function shows an asymmetric shape for 9 out of the 10 countries. That is, the correlations between lags of the current account and e cuny etwbvaej 1010.8s 100.64 T8c0

Interestingly, the salient features remain for all combinations. First, both the current account and the interest differential are less volatile than output. Second, the current account and the interest differential are fairly persistent, but this persistence is less than that of output. Third, the current account is countercyclical and the interest differential is procyclical. Fourth, the current account is negatively correlated with the interest differential.

Figure 3 presents the cross-correlation function between the current account and the interest differential of the 10-Country Average for the four inflation processes and the two detrending methods. The S-curve prevails for all combinations. In particular, the asymmetric shape is pronounced when the different inflation processes are combined with the Hodrick-Prescott filter. The asymmetric shape, however, is less pronounced when the different inflation processes are combined with the linear-quadratic trend. For these cases, the correlations between lags of the current account and the interest differential are negative, while the correlations between leads of the current account and the interest differential rise, such that the overall shape is suggestive of the S-curve.

3. The Economic Environment

We study a symmetric two-country, dynamic, general equilibrium environment where costly international financial transactions are brokered by a financial intermediary. Foreign country variables are identified by an asterisk.

3.1 The Home Economy

The home economy is peopled by a representative consumer, a representative firm, and a government. The consumer's expected lifetime utility is

$$E_0 \left(\sum_{t=0} \beta^t U\left(C_t, N_t\right) \right); \tag{3}$$

where E_t is the conditional expectation operator, C_t is consumption, N_t is employment, and $0 < \beta < 1$. As in Schmitt-Grohé and Uribe (2002), the momentary utility is $U(C_t; N_t) = (C_t - \omega N_t^{\eta})^{(1-\gamma)}/(1-\gamma)$, where $\omega > 0$, $\eta > 1$, and $\gamma \geq 1$. We adopt this formulation because it has desirable properties. Correia, Neves, and Rebelo (1995) show that these preferences promote a countercyclical trade balance in small open-economies. Also, Devereux, Gregory, and Smith (1992) show that these preferences explain low cross-country consumption correlations in multi-country economies.

The consumer's budget constraint is

$$C_t + I_t + T_t + B_{t+1} = W_t N_t + r_t^k K_t + R_t B_t; \tag{4}$$

where I_t denotes investment, T_t is taxes, W_t is the wage rate, r_t^k is the rental rate of capital, K_t is the capital stock, B_t is the stock of short-term bonds, and R_t is the home gross return on bonds. The capital stock evolves according to

$$K_{t+1} = I_t + (1-\delta)K_t - \frac{\phi}{2}\left(\frac{I_t}{K_t} - \delta\right)^2 K_t; \tag{5}$$

where the last term is an adjustment cost with $\phi \geq 0$ and $0 < \delta < 1$. Baxter and Crucini (1993) show that adjustment costs limit the volatility of investment in open economies.

The competitive consumer chooses consumption, employment, capital and bonds to maximize expected lifetime utility (3) subject to the constraints (4) and (5). The first-order conditions of the consumer's problem are

$$\lambda_t = U_{ct}; \tag{6:1}$$

$$U_{nt} = -\lambda_t W_t; \tag{6:2}$$

$$\lambda_t = \beta E_t\{\lambda_{t+1} R_{t+1}\}; \tag{6:3}$$

$$\frac{\lambda_t}{1-\phi\left(\frac{I_t}{K_t}-\delta\right)} = \beta E_t\left\{\frac{\lambda_{t+1}}{1-\phi\left(\frac{I_{t+1}}{K_{t+1}}-\delta\right)}\left[r_{t+1}^k\left(1-\frac{\phi}{2}\left(\frac{I_{t+1}}{K_{t+1}}-\delta\right)\right) + (1-\delta) + \frac{\phi}{2}\left(\frac{I_{t+1}}{K_{t+1}}-\delta\right)^2 + \phi\left(\frac{I_{t+1}}{K_{t+1}}-\delta\right)\frac{I_{t+1}}{K_{t+1}}\right]\right\}; \tag{6:4}$$

whe

where $\phi(B_t; B_t)$ represents various costs faced by the intermediary. These costs are used to introduce international financial frictions. The costs are increasing in the net foreign asset positions of both countries (which corresponds to the amount of funds handled by the intermediary): $\phi(B_t; B_t) = (\psi/2)\left[B_t^2/Y_t + B_t^{*2}/Y_t^*\right]$, where $\psi \geq 0$. We adopt this formulation because it yields interest differentials that are consistent with those imposed in previous work. The intermediary lends all funds:

$$B_t + B_t^* = 0. \tag{12}$$

Finally, there is no entry in the intermediation sector. Note that our results are robust to alternative modeling of the financial intermediary. In particular, we obtain similar results if we introduce private ownership and free entry in the intermediation sector.

assets to output (Letendre 2002; Nason and Rogers 2002). Interestingly, Lane and Milesi-Ferreti (2002) find empirical support for interest differentials that are linearly decreasing in the net foreign assets to exports ratio.

Finally, the good market clearing condition is

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government expenditures in the United States. In addition, we set Á = 3tinÁ

4. Test Results

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0.49 (0.17) for the Non-US Aggregate, and 0.62 (0.04) for the 10-Country Average. The predicted relative volatility of the interest di®erential is 0.01. The relative volatility (p-value) observed in the data is 0.10 -

p-value from a $\hat{A}^2(1)$ distributed test that the di®erence between predicted and observed statistics is null.

The environment predicts a sharp S-curve: the predicted correlations between lags of the current account and the interest di®erential are negative, and the correlations between leads of the current account and the interest di®erential are positive, with the turning point occuring at the one-quarter lead. The observed cross-correlation function for the United States displays the overall shape, but the turning point occurs at the two-quarter lag. Thus, the predicted cross-correlations statistically match the observed cross-correlations only for large values of leads and lags. The observed function for the Non-US Aggregate displa7U S . rSscsisTan(

of a deterioration in the standard statistics.

4.3 Robustness

We finally verify the robustness of our results, and pay particular attention to the predicted features of the interest differential. For this purpose, we conduct several experiments with alternative calibrations of the key parameters. The different experiments are reported in Table 4 and Figure 6. In each case, the table (figure) also shows the p-value of the test that the difference between predicted and 10-Country Average statistics (correlations) is null.

The first experiment verifies the effects of changing the coefficient of relative risk aversion. Intuition suggests that an increase in the coefficient magnifies the volatility of the marginal utility of consumption. This should raise the volatility of the interest differential. We lower the coefficient to $\gamma = 1$ (the logarithmic utility) and raise it to a high of $\gamma = 10$. These values are consistent with the range studied in Mehra and Prescott (1985). Unfortunately, raising the coefficient of relative risk aversion has only negligible effects on the relative volatility and persistence of the interest differential. In addition, it makes the interest differential countercyclical and flattens the cross-correlation function. Finally, it has only small effects on the statistics of the current account.

The second experiment verifies the effects of changing the elasticity of labor supply. Raising the elasticity should make employment and the marginal utility of consumption more volatile. This should raise the volatility of the interest differential. We lower the elasticity to $1/(\phi - 1) = 0.2$ and raise it to $1/(\phi - 1) = 2.5$. These values are consistent with the range discussed in Greenwood, Hercowitz, and Huffman (1988). Unfortunately, changing the elasticity of labor sup

and thus the volatility of the interest differential. For this experiment, we lower the cost by setting $\phi = 0$ and raise it by setting $\phi = 7.5$. These values either eliminate the cost or double it (for a given investment). As expected, lowering the cost raises the relative volatility of the interest differential and lowers its persistence. It also makes the cross-correlation function steeper around the turning point. Unfortunately, lowering the cost unreasonably raises the relative volatility of the current account and makes it procyclical.

The last experiment verifies the effects of changing the responsiveness of the interest differential to the ratio of net foreign assets and output. An increase in the responsiveness should raise the volatility of the interest differential. We lower the responsiveness to $\psi = 0.001$ and raise it to $\psi = 0.01$. These values are consistent with those found in Lane and Milesi-Ferreti (2002) and used in Devereux and Smith (2003). The increase slightly raises the relative volatility of the interest differential and lowers its persistence. It also raises the steepness of the cross-correlation function and makes the interest differential more procyclical. Finally, it has only small effects on the statistics of the current account.

In sum, the various experiments confirm that our results are robust. They also suggest that matching the anomalous volatility of the interest differential is a difficult task.

5. Conclusion

In contrast to earlier work, we document the business cycle fluctuations of the current account and interest differentials. We find that our

and government budgets. For example, Sachs (1981) ¯nds evidence that the exchange rate a®ects the current account, and Baxter (1994) ¯nds evidence that it a®ects interest di®erentials. Also, Normandin (1999 9 n (jo&Bon jt3.24(0 TD 0.048 Tc (n) Tj 10.8 0 TrD 0.012 Tc (

Appendix A: Data

The quarterly seasonally adjusted measures are constructed for 10 developed countries and a Non-US Aggregate over the post-1975 period. The measures are computed from the International Financial Statistics (IFS) released by the International Monetary Funds, as well as the Main Economic Indicators (MEI) and the Quarterly National Accounts (QNA) published by the Organization for(Qa(l) Tj 3.24 0 TD (i) Tj 3.36 0 TD -0.048 Tc (s) Tj 4.68

A.3 Interest Differential

For each country, the interest differential is the difference between the country-specific interest rate and the world interest rate. The country-specific interest rate is the nominal interest rate minus the expected inflation rate. The nominal interest rate is the one-quarter interbank rate (source: IFS). The expected quarterly inflation rate is the one-quarter ahead forecast formed from a univariate ARMA(1,1) process. The world interest rate is the sum of the country-specific interest rates weighted by the country's share of the total output of the 10 countries. The few missing values for Austria (from 1999-I to 2001-II), Finland (from 1975-I to 1977-IV), and France (from 1999-II to 2001-II) are replaced by zeros, and the shares of output are recomputed to exclude these countries. For the Non-US Aggregate, the interest rate is computed similarly to the world interest rate, but excludes the United States.

A.4 Consumption, Investment, and Government Expenditures

For each country, consumption is the output weight times nominal private final consumption expenditures in national currency (source: QNA), deflated by the CPI. Investment is the output weight times nominal gross fixed capital formation in national currency (source: QNA), deflated by the CPI. Government expenditures are the output weight times nominal government final consumption expenditures in national currency (source: QNA), normalized by the CPI. For consumption, investment, and government expenditures, German and Austrian data are regressed on quarter dummies to remove seasonality. For the Non-US Aggregate, consumption, investment, and government expenditures are constructed by summing over all countries, except the United States.

A.5 National Saving

For each country, national saving is the current account plus investment. For the Non-US Aggregate, national saving is constructed by summing over all countries, except the United States.

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(for the initial period), and investment. Employment is calculated as the civilian employment index for the baseyear 1995 (source: MEI) times the population in 1985 reported by Summers and Heston (1988) (source: variable 1 in their Table 3). For the Non-US Aggregate, technology is constructed similarly using the Non-US Aggregate measures of output, investment, and employment. The Non-US Aggregate's employment is constructed by summing weighted employment over all countries except the United States, where the weights re°ect each country's share of the Non-US Aggregate total population.

References

Hodrick, R.J. and E.C. Prescott, 1997, Postwar U.S.

Table 1. Empirical R

Table 3. Test Results: Baseline Statistics

	Relative Volatility		Autocorrelation			Correlation		
	x	d	y	x	d	(x; y)	(d; y)	(x; d)
Predicted	0.27	0.01	0.87	0.70	0.99	-0.22	0.18	-0.07
United States	0.30	0.10	0.90	0.65	0.54	-0.48	0.13	0.09
	(0.82)	(0.00)	(0.47)	(0.42)	(0.00)	(0.01)	(0.86)	(0.00)
Non-US Aggregate	0.49	0.14	0.76	0.59	0.52	-0.28	0.04	-0.09
	(0.17)	(0.00)	(0.01)	(0.09)	(0.00)	(0.55)	(0.57)	(0.03)
10-Country Average	0.62	0.19	0.74	0.51	0.54	-0.25	0.11	-0.08
	(0.04)	(0.00)	(0.00)	(0.00)	(0.00)	(0.77)	(0.71)	(0.08)

Note: Entries under relative volatility, autocorrelation, and correlation refer to the predicted and sample standard deviations of the variable relative to the predicted and sample standard deviations of y, the predicted and sample first-order autocorrelations, and the predicted and sample contemporaneous correlations. The predicted statistics are constructed from the baseline calibration. The variables are the detrended logarithm of output (y), the detrended ratio of the current account and output (x), and the detrended interest differential (d). Entries in parentheses are the p-values of the test that the difference between the predicted and sample statistics is null.

Table 4. Test Results: Alternative Statistics

	Relative Volatility		Autocorrelation			Correlation		
	x	d	y	x	d	(x;y)	(d;y)	(x;d)
Baseline	0.27	0.01	0.87	0.70	0.99	-0.22	0.18	-0.07
	(0.04)	(0.00)	(0.00)	(0.00)	(0.00)	(0.77)	(0.71)	(0.08)
Risk Aversion								
Low(¾ = 1)	0.28	0.01	0.85	0.70	0.99	-0.24	0.28	-0.08
	(0.06)	(0.00)	(0.01)	(0.00)	(0.00)	(0.91)	(0.41)	(0.48)
High(¾ = 10)	0.21	0.01	0.92	0.70	0.99	-0.17	-0.12	-0.04
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.29)	(0.15)	(0.01)
Labor Supply Elasticity								
Low($\frac{1}{1^{o}}$ = 0:2)	0.28	0.01	0.84	0.68	0.99	-0.17	0.15	-0.07
	(0.09)	(0.00)	(0.04)	(0.03)	(0.00)	(0.63)	(0.82)	(0.46)
High($\frac{1}{1^{o}}$ = 2:5)	0.25	0.01	0.89	0.70	0.99	-0.22	0.15	-0.07
	(0.02)	(0.00)	(0.00)	(0.00)	(0.00)	(0.69)	(0.79)	(0.11)
Investment Adjustment Costs								
Low(Á = 0)	11.63	0.06	0.79	-0.10	0.78	0.34	0.79	-0.33
	(0.00)	(0.00)	(0.56)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
High(Á = 7:5)	0.13	0.01	0.86	0.66	0.99	-0.05	-0.06	-0.05
	(0.00)	(0.00)	(0.01)	(0.38)	(0.00)	(0.42)	(0.51)	(0.06)
Interest Di®erential Responsiveness								
Low(' = 0:001)	0.23	0.01	0.86	0.73	0.99	-0.16	-0.02	-0.03
	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)	(0.49)	(0.48)	(0.00)
High(' = 0:01)	0.32	0.02	0.87	0.65	0.98	-0.24	0.35	-0.10
	(0.12)	(0.00)	(0.00)	(0.03)	(0.00)	(0.93)	(0.12)	(0.24)

Note: Entries under relative volatility, autocorrelation, and correlation refer to the predicted standard deviation of the variable relative to the predicted standard deviation of y, the predicted ¯rst-order autocorrelation, and the predicted contemporaneous correlation. The variables are the detrended logarithm of output (y), the detrended ratio of the current account and output (x), and the deiables ar ables ble e

Table B1. Extensions: Baseline Statistics

	Relative Volatility		Within-Country Correlation			Cross-Country Correlation	
	c	i	$(c;y)$	$(i;y)$	$(s=y;i=y)$	$(c;c\ )$	$(y;y\ )$
Predicted	0.93	2.23	0.99	0.88	0.70	0.41	0.35
United States	0.88	2.23	0.91	0.92	0.43		
	(0.18)	(0.99)	(0.00)	(0.69)	(0.23)		
Non-US Aggregate	0.85	2.62	0.87	0.79	0.39	0.20	0.38
	(0.01)	(0.30)	(0.00)	(0.27)	(0.16)	(0.42)	(0.88)
10-Country Average	0.90	2.59	0.79	0.74	0.30	0.17	0.29
	(0.39)	(0.34)	(0.00)	(0.12)	(0.06)	(0.37)	(0.83)

Note: Entries under relative volatility, within-country correlation, and cross-country correlation refer to the predicted and sample standard deviations of the variable relative to the predicted and sample standard deviations of y, the predicted and sample contemporaneous correlations between home variables, and the predicted and sample contemporaneous correlations between international variables. The predicted statistics are constructed from the baseline calibration. The variables are the detrended logarithm of output (y), the detrended logarithm of consumption (c), the detrended logarithm of investment (i), the detrended ratio of national savings to output ($s=y$), and the detrended ratio of investment to output ($i=y$). The cross-country statistics refer to United States versus the Non-US Aggregate and to the average of all the bilateral statistics for the 10 countries. Entries in parentheses are the p-values of the test that the difference between the predicted and sample statistics is null.

Table B2. Extensions: Alternative Statistics

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Figure 1. Current Account and Interest Differential

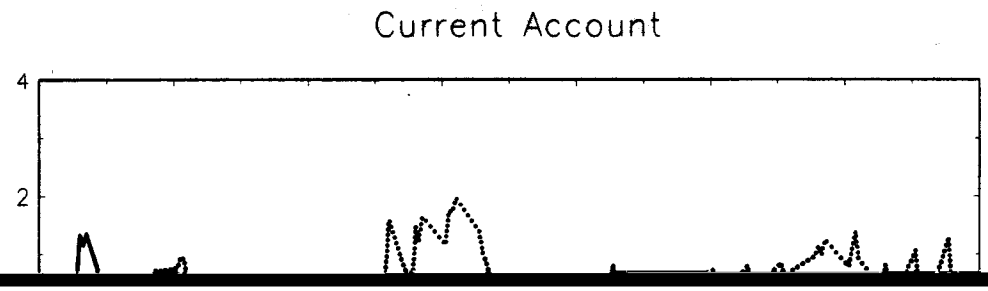

Figure 2. Empirical Regularities: Baseline Cross-Correlation Functions

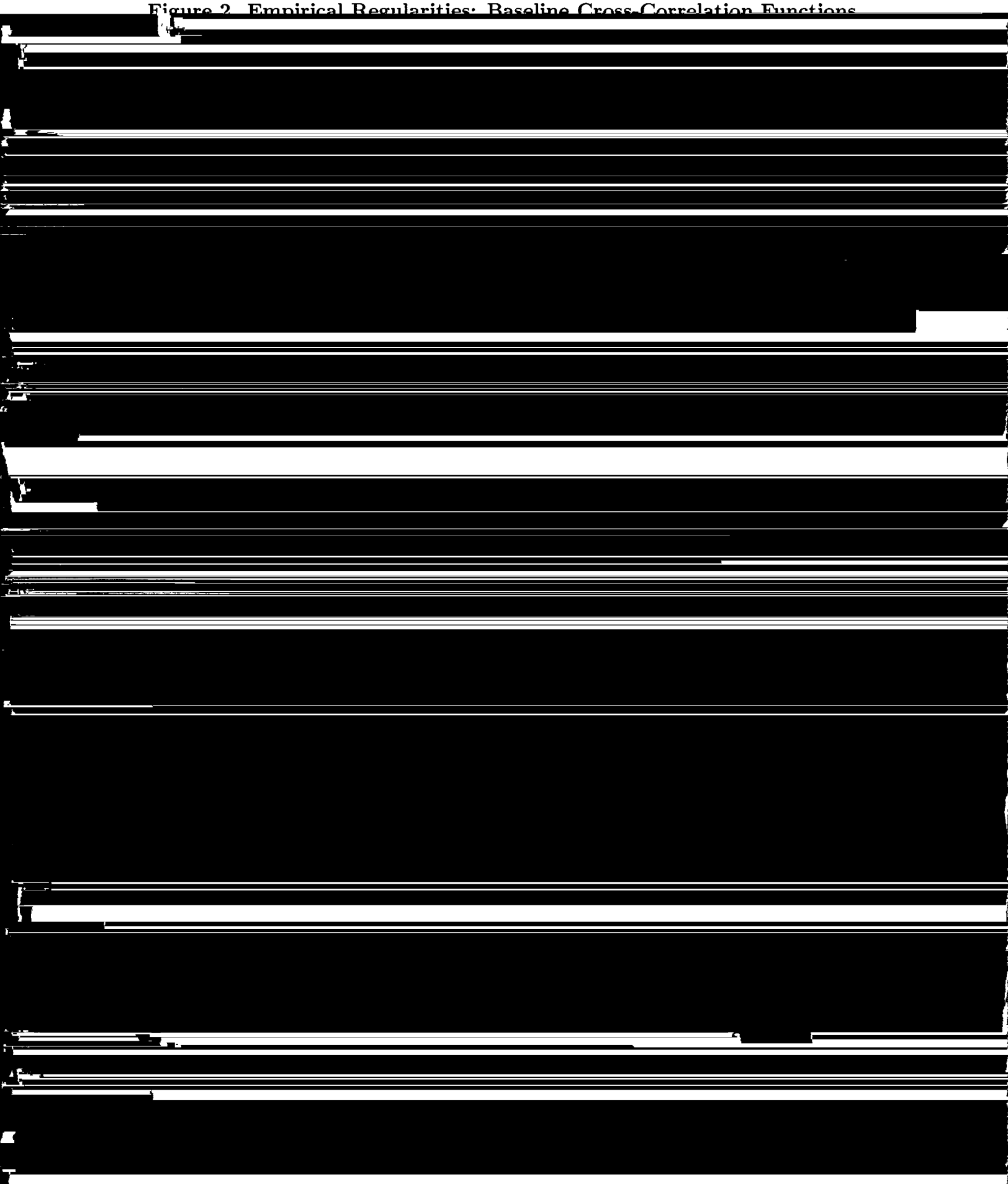

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Figure 4. Theoretical Properties: Dynamic Responses

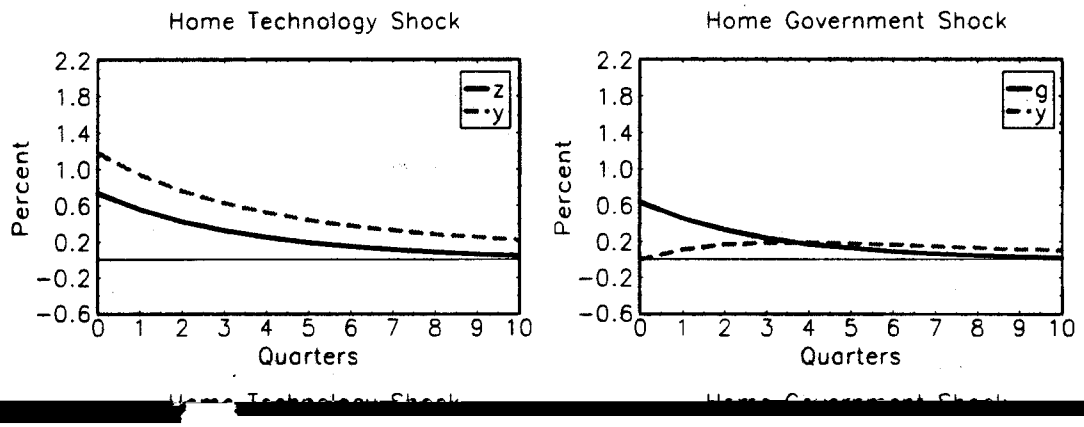

Figure 5. Test Results: Baseline Cross-Correlation Functions

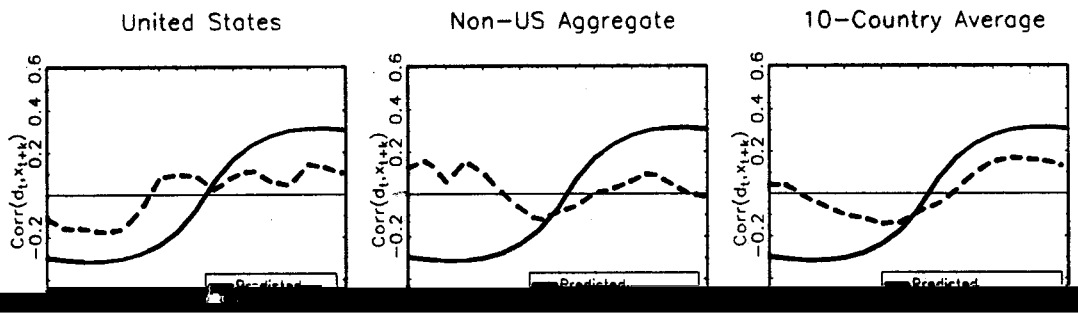

Figure 6. Test Results: Alternative Cross-Correlation Functions