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THE DYNAMICS OF UNCERTAINTY OR THE UNCERTAINTY OF DYNAMICS: STOCHASTIC J-CURVES

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Abstract

This paper characterizes the statistical distribution of the response of the US trade account to a dollar depreciation. To accomplish this task, the paper builds and estimates an econometric model of US bilateral trade. Given an exchange-rate shock, this distribution is generated empirically by stochastically simulating this model using random drawings for both innovations and trade elasticities. The paper finds that the distribution of trade-account responses is not stationary, that its variance is directly related to the size of the exchange-rate shock, that the dominant source of uncertainty lies with imports' price elasticities, and that the dispersion of these responses is more pronounced in the short run than in the long run. Based on these properties, the analysis applies Chebychev's inequality to the sample of trade-account responses and finds that hysteresis in price elasticities has a low probability of accounting for the persistence of the US trade deficit.

These findings have two practical implications. First, forecasts of trade-account responses to exchange-rate shocks should include the associated confidence intervals. Uncertainty in these responses is potentially large and omitting the corresponding confidence intervals is analogous to omitting standard errors of regression estimates. Second, deriving confidence intervals needs to recognize that parameter estimates are random variables and that they contribute, quite significantly in this application, to the width of these intervals.

The Dynamics of Uncertainty or
The Uncertainty of Dynamics:
Stochastic J-curves

Jaime Marquez[1]

1. Introduction

Recognizing that estimated trade elasticities are random variables means that the response of the trade account to a depreciation is a random variable. Very little, however, is known about the distribution of this response. What are the time profiles of the associated mean and variance? Are these moments systematically related to exchange-rate shocks? How wide are the confidence intervals of trade-account responses to alternative exchange rate developments? What are the main determinants of these confidence intervals? Are import responses more uncertain than export responses?

Although these questions are central for developing and implementing trade policies, judging the predictive accuracy of trade-account forecasts, and evaluating the role of speculation in stabilizing foreign exchange markets, they cannot be addressed using the available literature. Existing analyses treat estimated trade elasticities as though they were known with certainty, a treatment that undermines their usefulness in addressing

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practical questions in which uncertainty plays a central role.[2]

Deriving the distribution of trade-account responses would be a relatively straightforward task if the relation between exchange rates and trade were linear and static. This task is considerably more difficult when this relation is nonlinear and dynamic, two features of trade relations supported by 30 years of empirical research. To take these features into account, the paper relies on stochastic simulations of a nonlinear, dynamic model explaining US bilateral trade. Given an exchange rate shock, this model is repeatedly simulated with random drawings of both innovations and elasticity estimates. As a group, these simulations constitute a random sample of trade-account responses to an exchange-rate shock. Based on this sample, the analysis computes time series for both the mean and the variance, examines their time-series properties, and constructs confidence intervals for dynamic paths. The distinguishing feature of these confidence intervals is that the width in any period is influenced by the dispersion of trade-account responses in all periods.

The analysis begins in section 2 with the estimation of income and price elasticities for US bilateral trade with Canada, Germany, Japan, the United Kingdom, other industrial countries, OPEC, and non-OPEC developing countries. To evaluate the reliability of these estimates, the paper tests both the

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[2] Empirical analyses of the effects of changes in exchange rates on the trade account include Clark (1974), Wilson and Takacs (1980), Krugman and Baldwin (1987), Bryant and Holtham (1987), Helkie and Hooper (1987), Hooper and Mann (1987), Hooper (1988), and Meade (1988); see Dornbusch (1975) and Levin (1980) for theoretical analyses of trade-account responses to exchange-rate changes. See Williamsom (1972), Driskill and McCafferty (1980), and Levin (1983) for the relation between trade-account responses and the role of speculation in foreign exchange markets. Finally, see Krugman (1988) and United States Library of Congress (1988) for a survey of the policy issues associated with the trade imbalance of the United States. These papers, however, do not examine the statistical properties of the response of the trade account to changes in exchange rates.

properties of the error term and the choice of dynamic specification. Section 3 describes both the design of the sample and the construction of confidence intervals; section 4 presents the empirical results. Section 5 examines the sensitivity of these confidence intervals to both the source of uncertainty and the horizon over which they are constructed.

According to the results, the distribution of trade-account responses is not stationary, its variance is directly related to the size of the exchange-rate shocks, the dominant source of uncertainty lies with imports' price elasticities, and the dispersion of trade-account responses is greater in the short run than in the long run. Section 6 examines the implications of uncertainty in trade elasticities for the persistence of the US trade deficit. Based on Chebychev's inequality, the analysis finds that "hysteresis" in price elasticities is not a likely explanation for this persistence. Finally, section 7 concludes the paper by pointing out its main implications and limitations.

2. The Behavior of US International Trade Flows

2.1 Econometric Formulation

The analysis assumes that bilateral imports of country k (the United States) from country s behave according to the imperfect-substitute model (Goldstein and Khan, 1985):

$$(1)\quad \ln M_{kst} = \alpha_{0ks} + \alpha_{1ks}\ln Y_{kt}^{p} + \alpha_{2ks}(\ln Y_{kt} - \ln Y_{kt}^{p}) + \Sigma_j \alpha_{3ksj} \ln P_{ks,t-j}$$

$$+ \Sigma_j \alpha_{4ksj} \ln P_{kq|s,t-j} + \alpha_{5ks}\ln M_{ks,t-1} + u_{kst},$$

where M_{ks} = volume of imports of country k from country s,

Y_k = real income of country k,

Y_k^p = potential real income of country k,

P_{ks} = relative price for imports of country k from country s,

$P_{kq|s}$ = relative price for imports of country k from country q,

$\alpha_{3ksj} = \phi_{30} + \phi_{31}j + \phi_{32}j^2$, for $j=0,\ldots,j_3$,

$\alpha_{4ksj} = \phi_{40} + \phi_{41}j + \phi_{42}j^2$, for $j=0,\ldots,j_4$,

$u_{kst} \sim N(0, \sigma_{ks}^2)$; $E(u_{kst}u_{ks,t-h}) = 0 \; \forall h$.

Reliance on bilateral trade flows allows for differences in both income and price elasticities across US trading partners and avoids constraining the cross-price elasticity to zero.[3] To explain bilateral imports of country s from country k, the analysis uses (1) with the subscripts k and s replaced by s and k, respectively.[4]

According to (1), the response of imports to income has two components: a secular effect, measured by the parameter α_1, and a cyclical effect captured by the parameter α_2. The own-price elasticity is α_3 and the cross-price elasticity is α_4. The choice of a logarithmic formulation is based on the Box-Cox tests reported in Marquez (1988). Finally, (1) assumes homogeneity of

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[3] Previous bilateral trade models include Branson (1968), Houthakker and Magee (1969), Armington (1969), Hickman and Lau (1973), and Marwah (1976). For more recent work, see Cushman (1988), Thursby and Thursby (1987), and Haynes et al. (1986). See Goldstein and Khan (1985) and Magee (1975) for surveys of the literature.

[4] Differences in reporting practices across countries, shipment delays, and CIF/FOB differentials introduce a discrepancy between the value of exports of country k to country s and the value of imports of country s from country k. See Marquez (1988, section 4) for details on how to take into account these measurement problems.

degree zero in prices.[5]

The reliability of (1) depends on three factors: the properties of the disturbance term, the choice of dynamic specification, and the sensitivity of the estimates to alternative estimation methods.[6] The paper applies the Jarque-Bera statistic (Jarque and Bera, 1980) to test normality and the ARCH statistic (Engle, 1982) to test homoskedasticity. For serial independence, the analysis applies an F-test to the hypothesis that all the coefficients of an AR(4) for the residual are equal to zero. To test the choice of dynamic specification, the paper performs two F-tests. The first test involves estimating (1) with and without the Almon restrictions. The second test involves estimating both (1) and an "unrestricted" dynamic specification that eliminates the Almon restrictions and includes all predetermined variables lagged one period. For both F-tests, equation (1) is the null hypothesis.[7]

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[5] Note that (1) does not allow for uncertainty of exchange rates as a separate variable. In other words, the paper focuses on the uncertainty of exchange-rate effects and not on the effects of exchange-rate uncertainty. Hooper and Kohlhagen (1978) and Thursby and Thursby (1985) suggest that this uncertainty has no measurable effect on US bilateral trade. More recently, Cushman (1988) finds that exchange-rate uncertainty affects certain US bilateral trade flows. Though statistically significant, Cushman's estimates need not be economically significant because they are several orders of magnitude smaller than the associated own-price elasticities. Equation (1) also excludes expectations of exchange rates as a separate argument. Although important for certain applications (Driskill and McCafferty, 1980), Wilson and Takacs (1980, figure 6, p. 21) find that such an inclusion is of no empirical relevance for the United States. Finally, equation (1) does not show seasonal dummies for notational convenience.

[6] The reliability of (1) also depends on the constancy of the parameter estimates. Given that the focus is on the effects of parameter uncertainty, the paper does not present stability tests to save space. Marquez (1988) presents both Chow tests and Brown-Durbin-Evans tests for parameter stability.

[7] The paper relies on a 99 percent significance level for statistical inferences because j_3 and j_4 are empirically determined. Equation (1) also assumes that the speed of adjustment, once estimated, is fixed; Husted and Kollintzas (1984) allow a variable speed of adjustment. For equation (1), however, Brown-Durbin-Evans tests for parameter stability suggest a fixed speed of adjustment (See Marquez, 1988, appendix B, figure B17).

Appendix A examines the robustness of (1) using a Band Spectrum estimator (Engle, 1974).

2.2 Estimation Results

Estimating (1) involves testing whether the conditioning variables (income, prices, and exchange rates) are super exogenous with respect to trade elasticities and examining whether the import-supply import-demand system is recursive. After finding support for both of these propositions, the paper applies ordinary least squares to (1) using quarterly data for 1973Q1-1985Q2.[8]

Based on their Monte Carlo distributions, the long-run income elasticities for bilateral trade (table 1) vary between 0.5 and 4.11, and are generally twice as large as their standard errors. The associated aggregate income elasticities are 2.27 for imports and 1.52 for exports.[9] The estimated own-price elasticities range from -0.45 to -1.70, but they have relatively large standard errors, a finding that strengthens the case for quantifying the uncertainty in the response of the US trade account to changes

[8] Appendix B describes and presents the data. Testing for super exogeneity (Engle, Hendry, and Richard, 1983) asks whether treating prices and income as exogenous variables entails a significant loss of information for the trade elasticities. This task involves applying sequential Chow tests to both the conditional model (equation (1)) and the marginal processes (the exogenous variables). The latter are modeled as function of lagged policy variables (Marquez 1988, appendix B). The conditional processes exhibit parameter stability whereas the marginal processes do not, which implies that there is no loss of information by treating the conditioning variables as exogenous. To examine recursiveness, Marquez (1988, appendix B) estimates an export (relative) price equation for each bilateral trade equation. In 12 out of 14 cases, the coefficient of the volume of bilateral imports in this price equation is not significantly different from zero; the residual of each price equation is uncorrelated with the residual of the associated bilateral trade equation. Marquez (1988, appendix C) reports the complete specification for the equations in this paper.

[9] A one-tail test suggests that US imports have a greater income elasticity than US exports, a result first noted by Houthakker and Magee (1969).

Table 1

Income and Price Elasticities of US Bilateral Trade Flows

Long-Run Estimates and Test Statistics

1973Q1-1985Q2

		Elasticities[1]				Error Properties[2]			Dynamic Specification[3]		$\bar{R}^2$	SER
Trade Flow	Trading Partner	Income	Std Err	Price	Std Err	J.B.	AR(4)	ARCH	Almon	URDS		
Imports	Canada	1.87	0.3	-0.80	0.3	0.12	0.00	0.19	0.33	0.82	0.95	0.05
	Germany	2.90	0.7	-1.70	0.8	0.18	0.78	0.26	0.93	0.89	0.93	0.08
	Japan	3.56	1.0	-1.13	0.6	0.24	0.96	0.64	----	0.80	0.97	0.07
	UK	2.67	0.7	-0.34	0.4	0.62	0.57	0.45	----	0.16	0.90	0.09
	ROECD[4]	2.51	0.5	-1.17	0.4	0.40	0.49	0.93	0.58	0.76	0.95	0.06
	LDCs[5]	3.04	1.0	-0.45	0.3	0.08	0.31	0.58	0.61	0.68	0.98	0.05
	OPEC	1.11	0.7	-1.29	0.8	0.26	0.20	0.32	0.43	0.33	0.93	0.14
	Aggregate[6]	2.27	0.3	-0.92	0.2							
Exports	Canada[7]	2.01	0.3	-0.99	0.3	0.35	0.30	0.87	0.78	0.89	0.93	0.04
	Germany	1.95	0.3	-0.89	0.3	0.50	0.15	0.50	----	0.87	0.89	0.06
	Japan	0.79	0.3	-0.72	0.4	0.62	0.63	0.74	0.76	0.55	0.88	0.06
	UK	4.11	1.3	-0.88	0.6	0.77	0.49	0.23	0.49	0.72	0.86	0.08
	ROECD	2.32	0.6	-0.72	0.4	0.56	0.30	0.44	----	0.73	0.87	0.05
	LDCs	0.54	0.2	-1.45	1.2	0.57	0.60	0.43	----	0.63	0.95	0.05
	OPEC	0.96	0.3	-0.52	0.3	0.26	0.55	0.09	0.86	0.91	0.89	0.06
	Aggregate	1.52	0.2	-0.99	0.4							

[1] The long-run income and own-price elasticities associated with (1) are $\eta_{ks} = \alpha_{1ks}/(1-\alpha_{5ks})$ and $\xi_{ks} = \Sigma_j \alpha_{3ksj}/(1-\alpha_{5ks})$, respectively. The paper generates the probability distributions for both η_{ks} and ξ_{ks} using the Monte-Carlo procedure of Krinsky and Robb (1986). Entries for the elasticities are the median (left column) and the scaled median deviation (right column) of their Monte-Carlo distributions. These distributions are generated assuming that $\hat{\alpha}_{ks}(L) \sim N(\alpha_{ks}(L), \Sigma_{ks})$ and substituting the associated jth drawing $\hat{\alpha}^j_{ks}$ (j=1...4000) into η_{ks} and ξ_{ks}. The reliability of this procedure requires that $\alpha_5 < 1$, an assumption supported by the empirical evidence (Marquez 1988, table 6).

[2] The table shows the probability of rejecting the associated null hypothesis. Entries under J.B. belong to the test for normality; entries under AR(4) belong to the test of serial independence; entries under ARCH correspond to the test for homoskedasticity.

[3] The table shows the probability of rejecting the associated null hypothesis. Entries under Almon belong to the test for the Almon lags; entries under URDS correspond to the test for an unrestricted dynamic specification.

[4] ROECD stands for Rest of OECD countries.

[5] Cyclical income elasticity.

[6] The aggregate income elasticity for imports, η_k, is $\hat{\eta}_k = \Sigma_s \vartheta_{ks} \hat{\eta}_{ks}$, with $var(\hat{\eta}_k) = \Sigma_s \vartheta^2_{ks} \hat{\sigma}^2_{ks}$, where ϑ_{ks} is the mean of the share of nominal imports of country k from country s in total imports of country k; $\hat{\sigma}^2_{ks}$ = square of the scaled median absolute deviation of the elasticity for imports of country k from country s. The aggregate income elasticity for exports is constructed analogously.

[7] This equation includes a dummy variable equal 1 for 1977Q3 and zero otherwise.

in exchange rates.[10] The own-price elasticities for aggregate trade are at least twice as large as their standard errors and satisfy the Marshall-Lerner condition.

The results from the statistical tests (table 1) support the elasticity estimates associated with (1). The data are consistent with the assumptions of normality and homoskedasticity in all of the trade equations; the F-test for serial correlation supports the assumption of serial independence for the residuals in 13 out of 14 cases. For the nine equations in which they are used, the Almon restrictions are supported by the data. Finally, the F-test comparing (1) against an unrestricted dynamic specification supports the lag structure of (1) for all of the equations.[11] On the whole, the failure to reject either the conditions for classical inference or the dynamic specification of (1) are reassuring.

3. Statistical Analysis of J-Curve Uncertainty

3.1 Model Formulation

Based on the elasticity estimates, the analysis assembles the trade equations into a model of the U.S. trade account. The endogenous variables are the bilateral trade flows (14 equations), nominal exports, nominal imports, and the nominal trade account. The exogenous variables are income levels (actual

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[10] Houthakker and Magee (1969), Morgan (1970), Addler (1970), and Cushman (1988) also report relatively large standard errors for price elasticities.

[11] The estimates of (1) are also very close to both the Band Spectrum estimates and the estimates of Houthakker and Magee (1969) (appendix A).

and potential), nominal exchange rates, and price levels.[12]

The simulated response of the trade account to an exogenous change in the exchange rate can be expressed as

$$\hat{J}_t = \sum_h \sum_j [\partial(X_t - M_t)/\partial e_{j,t-h}] de_{j,t-h},$$

where X_t and M_t are nominal exports and nominal imports, respectively; e_j is the dollar price of country j's currency, and for simplicity, the analysis assumes that $de_{jt} = \lambda$ for all j and t. The J-curve associated with λ is $\{\hat{J}_t\}_{t=1}^{T}$.

Recognizing that the simulated response of exports and imports to exchange-rate changes depends on estimated elasticities and residuals, both of which are random variables, means that $\hat{J}_t$ is a random variable:

(2) $$\hat{J}_t = J_t[\hat{\boldsymbol{\alpha}}(L), \hat{\mathbf{u}}_t, \lambda],$$

where $\hat{\boldsymbol{\alpha}}(L)$ is the vector of parameter estimates for all of the bilateral trade equations and $\hat{\mathbf{u}}_t$ is the 1xm vector of estimated residuals associated with these equations. Note that $\hat{J}_t$ is nonlinear and that its dynamics are embedded in the lag distribution of the parameter estimates, $\hat{\boldsymbol{\alpha}}(L)$.

Given that $\hat{J}_t$ is nonlinear in its arguments, knowledge of the distributions of both $\hat{\boldsymbol{\alpha}}(L)$ and $\hat{\mathbf{u}}$ is not sufficient to estimate the associated moments. To bypass this difficulty, the paper applies an exchange rate shock to the trade model, which is repeatedly simulated by randomly drawing values for both the residuals and the parameter estimates. Taken together, these simulations constitute a random sample of J-curves which the analysis uses to study the associated statistical properties.

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[12] Trade flows with centrally planned economies account for less than five percent of US trade and are taken as exogenous. Marquez (1988) applies residual-based stochastic simulations to this model to both compute Mean Absolute Percentage Errors and estimate regressions of the actual on the (mean of) predicted values. The results (Marquez, 1988, table 13) indicate a fairly tight fit of the data.

3.2 Sample Space

Following Brown and Mariano (1984), the analysis takes the ith drawing of $\hat{\mathbf{u}}_t$, $\hat{\mathbf{u}}_{ti}$ as

$$(3)\qquad \hat{\mathbf{u}}_{ti} = T^{-\frac{1}{2}}\,\hat{\mathbf{u}}_t\,\|\delta_{pq}\,\boldsymbol{\varphi}_{pqti}\|,\ i=1,\ldots,N;\ t=1,\ldots,T;\ p,q=1,\ldots,m,$$

where δ_{pq} is the Kronecker delta, $\boldsymbol{\varphi}_{pqti}$ is an IN(0,1) variable, N is the number of drawings, and T is the simulation horizon. Reliance on (3) ensures that both the original and the alternative residuals have the same distribution.[13]

Given the uncertainty in the dynamics of price elasticities (see table 1), the analysis draws random values for the own-price elasticities, $\hat{\alpha}_{3ks}(L)$ and $\hat{\alpha}_{3sk}(L)$ $\forall s$, and for the speeds of adjustment, $\hat{\alpha}_{5ks}$ and $\hat{\alpha}_{5sk}$ $\forall s$. The ith drawing of these parameters is generated using Fair's approach (Fair, 1986):

$$(4)\qquad \hat{\boldsymbol{\alpha}}_i(L) = \hat{\boldsymbol{\alpha}}(L) + \mathbf{P}\,\mathbf{I}^*\boldsymbol{\varphi}_i,\ i=1,\ldots,N$$

where $\hat{\boldsymbol{\alpha}}(L) \sim N[\boldsymbol{\alpha}(L), \boldsymbol{\Sigma}]$, $\mathbf{P}$ is a Cholesky decomposition of $\hat{\boldsymbol{\Sigma}}$ ($\mathbf{PP}' = \hat{\boldsymbol{\Sigma}}$), $\boldsymbol{\varphi}_i$ is a vector of standard normal variables, and $\mathbf{I}^*$ is a perforated identity matrix (zeroes along the main diagonal except in the positions corresponding to the own-price elasticities and the speeds of adjustment).[14] Reliance on (4)

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[13] Bootstrapping does not require prior knowledge of the distribution of residuals. But recall that the data support the normality assumption for the residuals of (1) (table 1). The process of generating random numbers from the normal distribution uses two seeds. The first seed is the replication number and the second seed is twice the drawing of a standard normal with seed one. This procedure allows for different seeds across both equations and time periods. Fair (1986) reviews alternative procedures for evaluating model performance with stochastic simulations.

[14] By applying the Cholesky decomposition to the entire covariance matrix, the paper allows the random drawings of price elasticities and speeds of adjustment to be influenced by the uncertainty in all of the coefficients estimates. Also, the independence between the estimator of the variance of the residuals and the estimator of $\boldsymbol{\alpha}$ justifies shocking both the residuals and the parameter estimates.

ensures that the distributions of both the original and the randomly generated estimates are the same (Fair, 1986).

Given (3) and (4), the value of $\hat{J}_t$ generated by the ith drawing of residuals and parameters is

$$\hat{J}_{ti} = J[\hat{\boldsymbol{\alpha}}_i(L), \hat{\mathbf{u}}_{ti}, \lambda] = \hat{J}_{ti}(\lambda), \quad t=1,\ldots,T; \; i=1,\ldots,N,$$

and $\hat{J}_i = \{\hat{J}_{ti}\}_{t=1}^{T}$ denotes the ith J-curve for i=1,...,N. The sample mean and variance associated with $\{\hat{J}_{ti}\}_{i=1}^{N}$ are, respectively, $\hat{\mu}_t(\lambda) = \Sigma_i \hat{J}_{ti}(\lambda)/N$ and $\hat{\sigma}_t^2(\lambda) = \Sigma_i [\hat{J}_{ti}(\lambda) - \hat{\mu}_t(\lambda)]^2/(N-1)$ for t=1,...,T.

3.3 Confidence Intervals

The construction of confidence intervals for J-curves needs to recognize that the unit of observation is a dynamic path--that is, the whole J-curve--and that these paths differ in many respects: extreme values, adjustment delays, variability over time, and present discounted values. Instead of trying to aggregate these attributes into a single measure, the paper determines the frequency of J-curves enclosed by a confidence interval of width π:[15]

$$\hat{ß}(\pi, \lambda) = \{\hat{\mu}_t(\lambda) \mp \pi \, \hat{\sigma}_t(\lambda)\}_{t=1}^{T}.$$

Consequently, constructing a γ-percent confidence interval involves finding a π such that γ percent of the sample of J-curves belong to $\hat{ß}$.[16]

To determine the frequency of J-curves associated with a given π, the paper defines

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[15] If the focus were on a given attribute of the J-curve, for example its minimum value, then the computation of a distribution for this attribute would follow standard methods.

[16] Note that $\hat{ß}$ depends on λ because exchange-rate shocks interact with parameter shocks. Intuitively, the larger the coefficient shock the larger the associated effect on the trade response induced by a given exchange-rate shock, an interaction that affects the dynamic path of trade responses and thus the probability of finding a given J-curve inside a dynamic confidence interval.

$$\psi_i(\pi, \lambda) = \begin{cases} 1 & \text{if } \hat{J}_i \in \hat{ß}(\pi, \lambda) \\ 0 & \text{otherwise} \end{cases} \quad . \tag{5}$$

According to (5), the ith J-curve belongs to a confidence interval of width π if all of the observations of this curve fall within this interval. In other words, $\psi_i(\pi, \lambda)=0$ even if the ith J-curve exits $\hat{ß}(\pi, \lambda)$ for one period (i.e., one quarter).[17] This requirement ensures that $\hat{ß}(\pi, \lambda)$ is not a sequence of static confidence intervals for trade-account responses.

Based on (5), the relative frequency of J-curves belonging to $\hat{ß}(\pi, \lambda)$ is $[\sum_i \psi_i(\pi, \lambda)/N] = \psi(\pi, \lambda)$. By systematically changing π, the analysis finds the band width consistent with a given probability γ: $\psi(\pi_\gamma, \lambda) = \gamma$. The confidence interval associated with this π_γ is $\{\hat{\mu}_t(\lambda) \mp \pi_\gamma \hat{\sigma}_t(\lambda)\}_{t=1}^{T}$. Note that the estimation of π_γ, as given by (5), implies that the width of $\hat{ß}(\pi, \lambda)$ in any period depends on the dispersion of trade-account responses in <u>all</u> periods. Consequently, $\hat{ß}(\pi, \lambda)$ and π_γ are sensitive to both the horizon over which ψ_i is calculated--t and T--and the source of uncertainty--$\hat{\boldsymbol{\alpha}}(L)$ and $\hat{\mathbf{u}}$; section 5 examines this sensitivity.

4. Empirical Results

Given an exchange rate shock, the analysis performs 100 drawings of both residuals and elasticity estimates (N=100). For each drawing, the model is simulated from 1976Q2 to 1985Q2 (T=37), a horizon that allows the dynamics of the model to be operative.[18] Because the results might be sensitive to λ, the

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[17] Because a one-quarter exit from $\hat{ß}(\pi, \lambda)$ might be considered an insignificant departure, the analysis has also considered confidence interval allowing for a one-quarter departure. The results, available on request, indicate that allowing one exit from $\hat{ß}(\pi, \lambda)$ lowers the value of π consistent with a given γ.

[18] The US trade account in 1976Q2 recorded a deficit of $10 billion.

analysis considers four cases: no exchange rate shock (λ=1.00), 10 percent depreciation (λ=1.10), 25 percent depreciation (λ=1.25), and 50 percent depreciation (λ=1.50).[19] These shocks are applied at once and maintained throughout the simulation horizon. For λ=1.00, $\hat{\mu}_t(\lambda)$ is the sample mean of the model's prediction error of the trade account at time t and $\hat{\sigma}_t(\lambda)$ is the standard error of this prediction error.

Inspection of the sample moments (table 2) reveals that an exogenous depreciation of the dollar induces a quick, strong, and volatile response in the trade account. For example, the mean improvement has swings as high as $20 billion at annual rates, and after 37 quarters, reaches $29 billion for λ=1.10 and $103 billion for λ=1.50. That the mean response is highly uncertain is evident from the coefficient of variation of $\hat{\mu}_t(\lambda)$. For example, $\hat{\sigma}_t(\lambda)$ represents more than 10 percent of the mean response for λ=1.50 and this percentage is higher for the other exchange rate shocks. Finally, the dispersion of trade-account responses increases with the size of the exchange rate shock. Specifically, an increase in λ from 1.25 to 1.50 raises $\hat{\sigma}_t(\lambda)$ in each period by an average of 46 percent.[20]

Given $\hat{\mu}_t(\lambda)$ and $\hat{\sigma}_t(\lambda)$, the analysis uses (5) to construct confidence intervals for each value of λ. Based on the results (table 3), the probability of finding a J-curve inside a confidence interval is zero for π

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[19] The analysis uses the same drawings of residuals and coefficients for the four exchange rate shocks (see Fair, 1988).

[20] The analysis uses the data of table 2 to examine the time-series properties of $\hat{\sigma}_t(\lambda)$. The results, available on request, reveal that $\hat{\sigma}_t(\lambda)$ follows a stationary AR(1) process exhibiting parameters that are constant and innovations that are normal, serially independent, and homoskedastic; for λ=1.00, a Dickey-Fuller test suggests that $\hat{\sigma}_t(\lambda)$ follows a random-walk.

Table 2
US Trade Account Responses to Exchange Rates Shocks
Sample Mean and Standard Deviation
(US$ Billions, annual rates)
Alternative Exchange Rate Shocks

Simulation Periods	Sample Mean : $\hat{\mu}(\lambda)$ λ=1.00	λ=1.10	λ=1.25	λ=1.50	Sample Standard Deviation : $\hat{\sigma}(\lambda)$ λ=1.00	λ=1.10	λ=1.25	λ=1.50
1	-0.225	-8.774	-17.135	-31.629	2.963	4.368	6.766	11.134
2	0.181	-2.454	-9.669	-21.780	3.086	4.228	6.525	11.019
3	0.335	-3.876	-8.674	-17.246	3.160	3.934	5.928	9.737
4	0.045	8.852	5.863	-0.365	3.578	4.390	6.431	10.750
5	0.024	7.364	7.738	8.274	3.912	4.714	6.806	11.016
6	0.306	4.639	7.586	12.771	3.828	4.635	6.550	10.354
7	0.385	18.068	24.562	35.706	3.501	4.519	6.522	9.996
8	0.102	25.828	34.300	48.924	3.986	4.606	6.124	8.765
9	-0.014	18.697	30.204	49.989	4.849	5.534	7.337	10.713
10	-0.102	13.491	26.064	47.817	5.263	5.998	7.553	10.537
11	0.016	10.040	26.185	53.929	5.519	6.817	8.886	12.683
12	-0.112	10.845	29.312	61.104	5.698	7.204	9.200	12.631
13	-0.262	22.527	43.935	80.770	6.326	7.794	9.922	13.582
14	-0.505	14.926	36.163	72.823	6.530	8.121	10.326	14.149
15	-0.35	14.209	38.131	79.276	6.447	8.047	10.468	14.727
16	-0.425	12.524	37.842	81.196	7.182	8.638	11.023	15.202
17	-0.382	7.471	35.132	82.583	7.668	8.961	11.370	15.652
18	-0.266	-7.663	19.433	66.019	6.926	8.929	11.428	15.808
19	0.31	7.581	37.329	88.487	7.133	9.013	11.489	15.933
20	0.727	8.132	38.104	89.542	7.680	9.375	11.902	16.380
21	0.85	14.163	44.930	97.936	7.752	9.203	11.740	16.319
22	0.916	7.445	35.670	84.518	7.616	9.107	11.581	16.002
23	0.628	20.162	49.632	100.587	7.489	8.617	11.143	15.724
24	0.503	16.387	44.584	93.550	7.277	8.624	11.131	15.692
25	0.759	6.798	35.196	84.577	6.483	7.937	10.460	15.017
26	0.689	22.418	47.678	91.647	6.581	7.797	10.066	14.255
27	0.347	17.332	43.738	89.760	5.438	7.042	9.417	13.823
28	0.42	3.768	29.360	73.954	5.207	6.757	9.127	13.568
29	0.62	22.158	49.074	95.889	5.481	6.865	9.303	13.866
30	0.486	22.490	47.248	90.424	5.870	6.961	9.206	13.628
31	0.438	26.670	53.084	99.016	6.210	6.999	9.196	13.833
32	0.356	35.188	60.984	105.808	6.146	6.513	8.796	13.618
33	0.273	27.401	54.795	102.362	6.542	7.028	9.397	14.613
34	0.463	39.722	64.984	108.760	7.719	7.281	9.225	14.028
35	0.448	7.281	33.793	79.523	7.066	6.878	8.485	13.280
36	0.296	8.757	34.066	77.745	8.099	7.075	8.342	12.926
37	-0.394	29.474	56.665	103.488	8.928	8.022	9.227	13.982

Notes: For each exchange rate shock, there are 100 stochastic simulations with random draws for coefficients and residuals; for each draw, the simulation horizon is 1976Q2-1985Q2. The sample size is 100 for each period. The value of λ indicates the exchange rate shock in percentage terms: λ=1.50 means a 50 percent exchange rate shock.

Table 3

US Trade Account Response to Exchange Rate Shocks

Dynamic Confidence Intervals

Alternative Band Widths (π) and Exchange Rate Shocks (λ)

Band Width π	Percentage of J-curves in π-Bands			
	λ=1.00	λ=1.10	λ=1.25	λ=1.50
0.1	0.	0.	0.	0.
0.2	0.	0.	0.	0.
0.3	0.	0.	0.	0.
0.4	0.	0.	0.	0.
0.5	0.	0.	0.	0.
0.6	0.	0.	0.	0.
0.7	0.	0.	0.	0.
0.8	1.	1.	2.	1.
0.9	2.	3.	3.	3.
1.0	7.	8.	5.	7.
1.1	13.	12.	8.	12.
1.2	18.	20.	16.	18.
1.3	22.	27.	26.	19.
1.4	31.	32.	31.	22.
1.5	34.	38.	37.	29.
1.6	45.	45.	41.	36.
1.7	48.	54.	46.	45.
1.8	60.	62.	56.	52.
1.9	69.	69.	62.	62.
2.0	73.	73.	69.	66.
2.1	79.	77.	73.	75.
2.2	85.	81.	78.	78.
2.3	86.	86.	80.	81.
2.4	87.	87.	85.	84.
2.5	89.	90.	91.	88.
2.6	90.	91.	95.	94.
2.7	91.	94.	97.	96.
2.8	96.	95.	97.	97.
2.9	97.	96.	98.	99.
3.0	98.	96.	98.	99.
3.1	98.	99.	99.	99.
3.2	98.	99.	99.	99.
3.3	99.	100.	100.	99.
3.4	99.	100.	100.	100.
3.5	99.	100.	100.	100.
3.6	99.	100.	100.	100.
3.7	100.	100.	100.	100.
3.8	100.	100.	100.	100.
3.9	100.	100.	100.	100.
4.0	100.	100.	100.	100.

Notes: For each exchange rate shock, there are 100 stochastic simulations with random draws of both coefficients and residuals; for each draw, the simulation horizon is 1976Q2-1985Q2. The value of λ indicates the exchange rate shock in percentage terms; λ=1.5 means a 50 percent exchange rate shock.

less than 0.8; for π greater than 3.3, this probability is one. For other values of π, the evidence reveals a direct and monotone association between $\psi(\pi, \lambda)$ and π, although the rate of change of this association does not exhibit a systematic pattern. The value of π consistent with a 95 percent confidence interval, π_{95}, varies between 2.6 for λ=1.25 and 2.8 for λ=1.10, a narrow range of variation.[21]

Based on the band widths of table 3, figure 1 presents the 95 percent confidence interval for a 50 percent depreciation (π_{95} = 2.7). Inspection of the evidence reveals several conclusions. First, the range of trade-account responses increases initially because of the cumulative effect of model uncertainty. This increase levels off after four years and ranges between \$70 billion and \$140 billion after 37 quarters. Second, the bias associated with deterministic simulations changes sign, lacks any obvious systematic pattern, and could be as large as \$30 billion.[22] Third, the delay in meeting the Marshall-Lerner condition ranges between 2 and 8 quarters.[23] Finally, to assess the sensitivity of this interval to the source of uncertainty, figure 1

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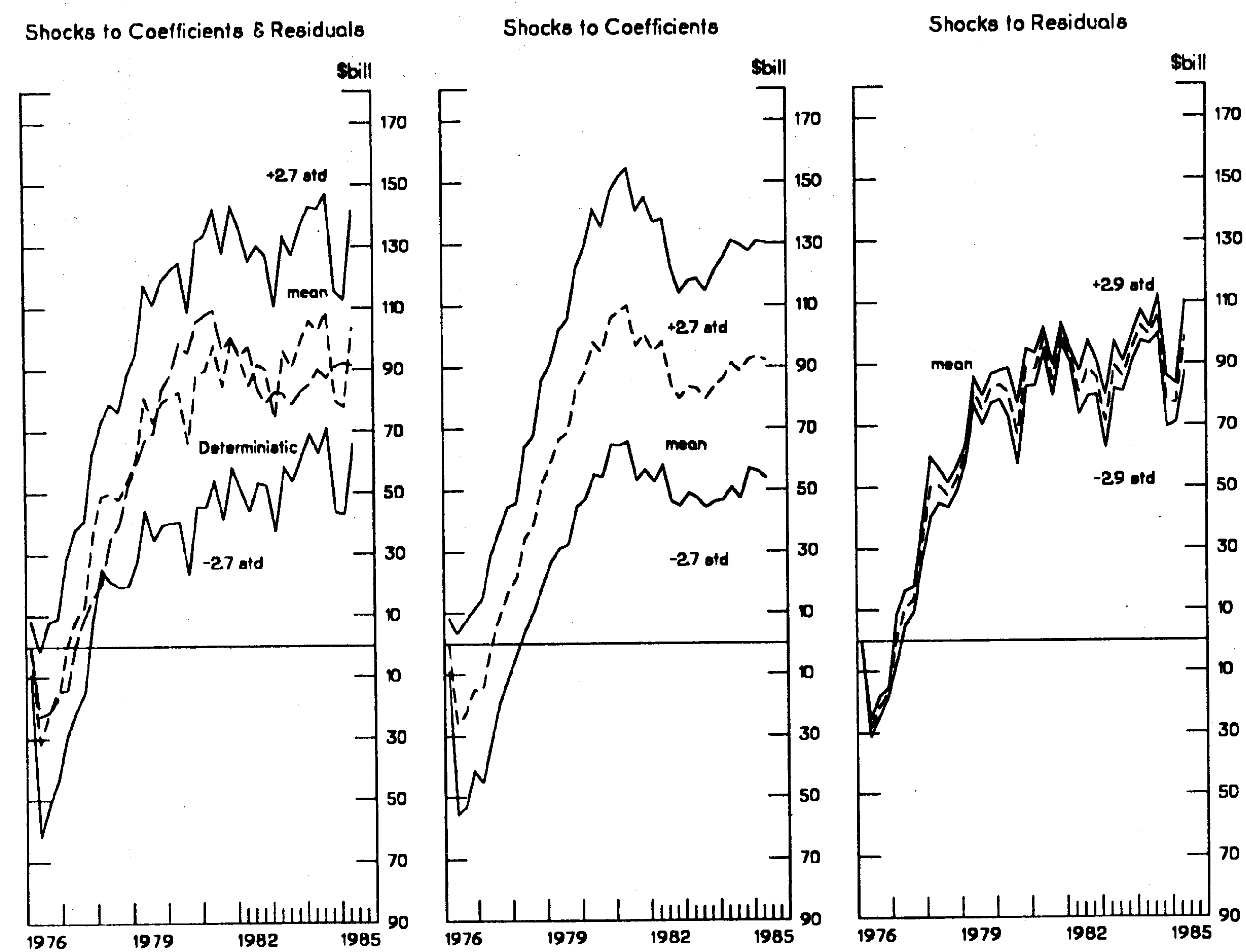
[21] If the band-width for one period is derived using the dispersion of trade-account responses of that period only, then the value of π consistent with a 95 percent static confidence interval is 2. Thus the application of static confidence intervals to a dynamic process is likely to underestimate the band width. The downward bias in the present application is 27 percent (0.7/2.6).

[22] In terms of the notation of this paper, the simulated value of the trade-account for the deterministic case is $\hat{J}_t = J[\hat{\boldsymbol{\alpha}}(L), \hat{\mathbf{u}}_t, \lambda]$.

[23] Goldstein and Khan (1985, p. 1077) report delays of 4 quarters in meeting the Marshall-Lerner condition, which is the delay associated with the mean response for a 50 percent depreciation (table 2). Based on the sample of J-curves, the mean delay varies from 5.4 quarters for λ=1.10 to 3.1 quarters for λ=1.25 with a standard error that ranges from 4.4 quarters for λ=1.10 to 1.0 quarter for λ=1.50. Note that the delay in meeting the Marshall-Lerner condition is the result of the partial-equilibrium nature of this model. Dornbusch (1975) examines the response of the trade account to a depreciation allowing for fiscal policies and one of the key findings is that the trade account need not deteriorate as a result of a depreciation.

Figure 1

95% Confidence Interval for US Trade Account Response to a 50% Depreciation



also presents confidence intervals when only parameter uncertainty is allowed and when only residual uncertainty is allowed.[24] The evidence reveals that parameter uncertainty dominates the uncertainty in the J-curve but that residual uncertainty determines the volatility in the J-curve.

5. Sensitivity Analysis

5.1 The Trade-Channels of Uncertainty

To isolate the channels through which uncertainty in coefficient and residuals operate, the analysis decomposes $\hat{\sigma}_t^2(\lambda)$ into the variances of export and import responses:

$$1 = \sigma_{xt} + \sigma_{mt} + \sigma_{xmt} \quad ,$$

where

$$\sigma_{xt} = \hat{\text{Var}}[\textstyle\sum_h \sum_j (\partial X_t/\partial e_{j,t-h})\lambda] / \hat{\text{Var}}(\hat{J}_t) \quad ,$$

$$\sigma_{mt} = \hat{\text{Var}}[\textstyle\sum_h \sum_j (\partial M_t/\partial e_{j,t-h})\lambda] / \hat{\text{Var}}(\hat{J}_t),$$

and σ_{xm} is the covariance between export and import responses ($\sigma_{xm} \lesseqgtr 0$). The results for a 50 percent depreciation (figure 2) suggest several conclusions. First, uncertainty in imports' price elasticities, σ_m, accounts for more than 70 percent of the variance of the trade account response to the depreciation. Second, the importance of σ_m diminishes considerably when the residuals are the only source of uncertainty. Finally, export and import responses have a negative covariance in periods where the dollar exhibits rapid changes, such as in 1978 and 1984.

5.2 The Dynamics of Uncertainty

Dynamic confidence intervals are time dependent because changes in the horizon over which they are constructed influence π_γ. Furthermore, as figure 1

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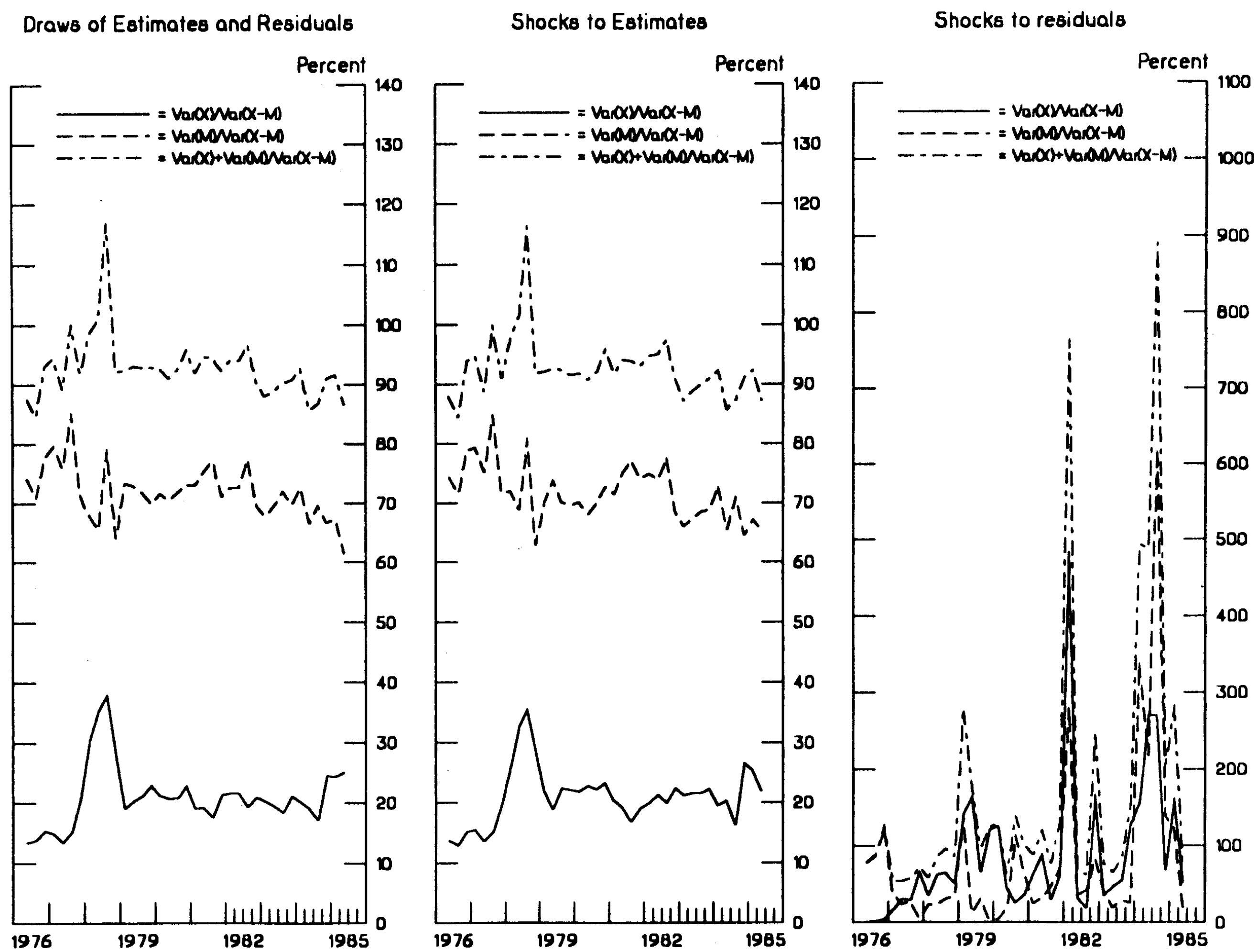
[24] The paper computes separate band widths for each of these two additional cases.

Figure 2

Sources of Export and Import Variability



suggests, π_γ is also sensitive to the source of uncertainty. To examine these dependencies, the analysis re-calculates the frequency distribution of J-curves using two alternative horizons: 1976Q2-1979Q1 (the first 12 quarters) and 1982Q3-1985Q2 (the last 12 quarters), and three forms of uncertainty: residual uncertainty, coefficient uncertainty, and both residual and coefficient uncertainty.[25]

To standardize the measure of dispersion of trade-account responses across these six cases, the analysis relies on the coefficient of variation associated with a 95 percent confidence interval:

$$CV_{t,95} = \pi_{95}\, \hat{\sigma}_t(\lambda)/\hat{\mu}_t(\lambda).$$

The numerator of CV_{95} gives the dispersion of trade-account responses associated with a 95 percent confidence interval.[26] By scaling the numerator relative to $\hat{\mu}_t$, CV_{95} measures the dispersion of trade-account responses per dollar of mean response. Note that CV_{95} might be negative because $\hat{\mu}$ might be negative, but the sign of this ratio does not affect its interpretation: Larger values indicate greater dispersion than smaller values.

Inspection of the evidence for a 50 percent depreciation (table 4) suggests three conclusions. First, CV_{95} is greater in the short run than in the long run, a pattern robust to the source of uncertainty. For example, when uncertainty in the coefficients is allowed, a one-dollar improvement in the mean of the trade account is associated with at least one dollar dispersion in the short run but with only 30-40 cents in the long run. This finding suggests that the properties of the adjustment process of this model

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[25] All of the simulations start in 1976Q2 and end in 1985Q2.

[26] Note that the analysis computes π_{95} for each of these six cases.

Table 4
US Trade Account Responses to a 50 Percent Depreciation
95 Percent Coefficient of Variation[1]
Alternative Horizons and Sources of Uncertainty[2]

$$CV_{95} = \pi_{95}\hat{\sigma}(\lambda=1.50) \;/\; \hat{\mu}(\lambda=1.50)$$

Source →	Coefficients		Residuals		Coefficients and Residuals	
Horizon →	First 12 (π_{95}=2.7)	Last 12 (π_{95}=2.3)	First 12 (π_{95}=2.6)	Last 12 (π_{95}=2.8)	First 12 (π_{95}=2.6)	Last 12 (π_{95}=2.3)
Periods	Quarters	Quarters	Quarters	Quarters	Quarters	Quarters
1	-1.14	0.39	-0.09	0.10	-0.92	0.36
2	-1.31	0.37	-0.14	0.06	-1.32	0.35
3	-1.72	0.35	-0.07	0.12	-1.47	0.42
4	-1.96	0.37	11.28	0.08	-76.61	0.33
5	-21.84	0.38	0.48	0.06	3.46	0.35
6	3.21	0.38	0.28	0.05	2.11	0.32
7	1.67	0.39	0.16	0.05	0.73	0.30
8	1.15	0.38	0.18	0.03	0.47	0.33
9	0.87	0.40	0.1	0.06	0.56	0.30
10	0.73	0.33	0.08	0.10	0.57	0.38
11	0.64	0.34	0.07	0.08	0.61	0.38
12	0.55	0.36	0.04	0.11	0.54	0.31

[1] For each period, an entry represents the dispersion of trade-account responses per dollar of mean response for a 95 percent confidence interval. Multiplying each of these entries by 2 gives the width of this interval per dollar of mean response.

[2] The first 12 quarters correspond to the period 1976Q2-1979Q1 and the last 12 quarters correspond to the period 1982Q3-1985Q2. All of the simulations start in 1976Q2 and end in 1985Q2. The data for the case of shocks to both coefficients and residuals are in table 2. The data for the other cases are available on request.

are subject to greater uncertainty than the properties of its steady state.[27] Second, CV_{95} reaches a maximum after 4 or 5 periods and declines steadily afterwards. This maximum value for CV_{95} occurs when the mean of the trade-account response changes from negative to positive because, at that time, $\hat{\mu}$ is very close to zero. For example, if only uncertainty in the coefficients is allowed, CV_{95} reaches $76 during the crossing date, a result confirmed by figure 1. Finally, coefficient uncertainty has the largest effect on CV_{95}--that is, treating estimated trade elasticities as though they were known with certainty amounts to ignoring the most important source of uncertainty.

6. Implications for Trade Deficit Persistence

That the persistence in the US trade deficit might stem from changes in price elasticities--"hysteresis"--is intuitively clear. As Baldwin (1988) and Krugman and Baldwin (1987) point out, large swings in exchange rates might affect trade elasticities through entry and exit of firms into domestic markets with a corresponding flattening of the J-curve. What is missing from the literature is an estimate of the probability associated with this flattening.

To this end, this paper relies on Chebychev's inequality which, under the assumption that the distribution of J-curves is symmetric,[28] equals

(6) $$\text{prob}(\hat{J}_t < J^h_t) \leq (1/2\kappa^2_t),$$

---

[27] This empirical finding corroborates Levin's theoretical analysis of J-curves (Levin, 1980). By providing small perturbations to the price elasticities, Levin (1980, figure 2, p. 364) produces J-curves that exhibit very dissimilar responses in the short-run but that converge to a unique long-run equilibrium.

[28] The paper finds that $[\text{median}_i(\hat{J}_{ti}(\lambda)) - \hat{\mu}_t(\lambda)]/\hat{\sigma}_t(\lambda)$ is not significantly different from one.

where $J_t^h = \hat{\mu}_t(\lambda) - \kappa_t \hat{\sigma}_t(\lambda)$ is the J-curve associated with hysteresis and κ is a constant a time t.

For simplicity, the analysis considers two alternative cases for J_t^h. The first case assumes that hysteresis induces a permanent violation of the Marshall-Lerner condition, which precludes any improvement in the trade account. To implement this case, the analysis sets

$$\kappa_t = \begin{cases} \pi_{95} & \text{for } t = 1976Q2 \\ [\hat{\mu}_t - \min(\hat{\mu}_t - \pi_{95}\,\hat{\sigma}_t)]/\hat{\sigma}_t & \text{for } t = 1976Q3\text{-}1985Q2 \end{cases} .$$

Intuitively, J^h is equal to the lower bound of the 95 percent confidence band for the first quarter and to the minimum of this lower bound for the remaining 36 quarters.[29] For a 50 percent exchange rate shock (π_{95}=2.7), the upper bound on the probability of finding a trade-account response below J^h (left panel of figure 3) starts at 6 percent, diminishes to less than 5 percent after two quarters, and does not exceed 5 percent afterwards.

The second case assumes that hysteresis produces an additional delay in meeting the Marshall-Lerner condition, which is modeled as a downward shift in the path of $\hat{\mu}_t$. To highlight the nonlinearities of (6), the paper considers two shifts: \$20 billion and \$40 billion, which involves setting $\kappa_t = 20/\hat{\sigma}_t$ and $\kappa_t = 40/\hat{\sigma}_t\ \forall t$, respectively. Although the probability of a \$20 billion fall in the mean of the J-curve (right panel of figure 3) could be as high as 35 percent, doubling the value of κ cuts this probability to less than 10

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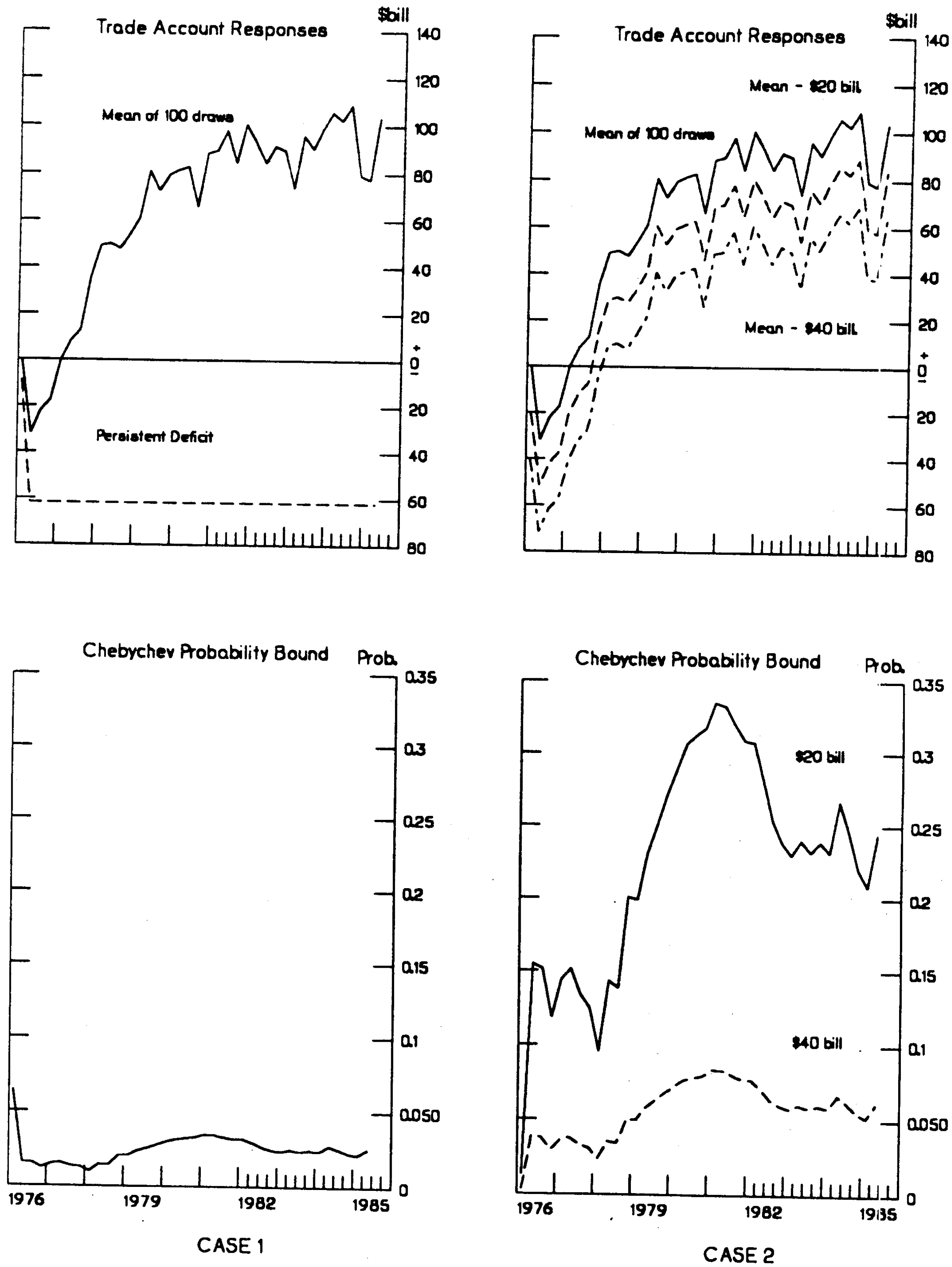
[29] Note that $\min(\hat{\mu}_t - \pi_{95}\,\hat{\sigma}_t)<0$. A permanent violation of the Marshall-Lerner is also consistent with alternative paths for κ_t, which might be generated using the data of tables 2 and 3.

Figure 3

US Trade Account Responses to a 50 % Depreciation

Chebychev's Probability Bounds for Hysteresis in US Trade



percent. Note that these probabilities start at zero, reach a global maximum after 6 years, and then decline afterwards.

Taken as a whole, these low probabilities do not deny the existence of a persistent trade deficit. Rather, they indicate that hysteresis in price elasticities is not the most likely source of this persistence, a finding conjectured by both Baldwin (1988) and Krugman and Baldwin (1987).

7. Conclusions

This paper characterizes the distribution of trade-account responses to exchange-rate shocks for the United States. To accomplish this task, the paper builds and estimates an econometric model of US bilateral trade. Given an exchange-rate shock, this distribution is generated empirically by stochastically simulating this model with random drawings for both innovations and trade elasticities. The paper finds that the distribution of trade-account responses is not stationary, that its variance is directly related to the size of the exchange-rate shock, that the dominant source of uncertainty lies with imports' price elasticities, that the dispersion of these responses is more pronounced in the short run than in the long run, and that hysteresis in price elasticities has a low probability of accounting for the persistence of the US trade deficit.

These findings have two practical implications. First, forecasts of trade-account responses to exchange-rate shocks should include the associated confidence intervals. Uncertainty in these responses is potentially large and omitting the corresponding confidence intervals is analogous to omitting standard errors of regression estimates. Second, deriving confidence intervals needs to recognize that parameter estimates are random variables and that they contribute, quite significantly in this application, to the width of these intervals.

This study and its conclusions are subject to several limitations, many of which arise because it is the first analysis that quantifies the uncertainty of the J-curve for the United States. First, there is no allowance for the response of income and trade prices to changes in exchange rates. Although there is evidence that these variables might be taken as exogenous for parameter estimation, they are not necessarily exogenous in model simulations. Current work is underway to derive the distribution of trade-account responses without conditioning on the exogeneity of prices and income.

Second, the results are conditioned on exchange rate shocks that take place exogenously with no modeling of the effects of uncertainty of exchange rates on the trade equations. Allowing for the effects of uncertainty is likely to increase the uncertainty of the effects. Fourth, because the J-curve is a partial equilibrium construct, the sample of J-curves generated in this paper is model dependent. Replication of this analysis with other models will determine how important is this dependency. Finally, although the number of drawings is not small, it is conceivable that outliers for either the coefficients or the residuals have not been taken into account.

Eliminating these limitations will, no doubt, affect the conclusions of the paper, but will also strengthen its main point: That trade responses are random variables and that very little is known about their distribution.

Appendix A: Sensitivity Analysis

To evaluate the sensitivity of the estimates to alternative estimation methods, the paper applies Engle's Band Spectrum estimator (Engle, 1974) to

$$\text{(A1)} \qquad \ln M_{kst} = \beta_0 + \beta_{1ks}\ln Y_{kt} + \beta_{2ks}\ln P_{kst} + \beta_{3ks}\ln P_{kq|st} + u_{kst}.$$

By estimating elasticities across spectral frequencies, the paper recognizes the criticism by Haynes and Stone (1983) that the time-series of income should not be decomposed into potential and deviations from potential.[30] Because of space considerations, the paper presents the estimates of (A1) with a spectral band of [0, 0.125) only, which encloses frequency components that take at least two years to complete a cycle.

A comparison of the estimates of (1) and (A1) (table A1) reveals that the OLS and the Band Spectrum estimates for the income elasticity are very close. The price elasticities, though similar, are less robust to the estimation method, a finding that reinforces the interest in determining the associated implications for trade deficit responses to exchange-rate changes.[31] Finally, table A1 presents the elasticity estimates of Houthakker and Magee (1969) to provide a well-known and independent basis for comparisons. Inspection of the evidence points to strong similarities among the three sets of parameter estimates.

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[30] Equation (A1) differs from the formulation of Haynes and Stone (1983) in three respects: it includes an intercept, allows for cross-price effects, and assumes homogeneity of degree zero in prices.

[31] Note that the Band Spectrum price elasticity for OPEC is not significantly different from zero, which is contrast to the OLS results. One probable explanation is that the Band Spectrum estimator identifies not an import demand schedule but an oil export supply schedule. A zero price elasticity would then be consistent with the non-renewable nature of oil.

Table A1

Income and Price Elasticities of US Bilateral Trade Flows

Band Spectrum Estimates and Alternative Studies

Trade Flow	Trading Partner	OLS[1] Income Elast	OLS[1] Income Std Err	OLS[1] Own-Price Elast	OLS[1] Own-Price Std Err	Band Spectrum[2] Income Elast	Band Spectrum[2] Income Std Err	Band Spectrum[2] Own-Price Elast	Band Spectrum[2] Own-Price Std Err	Houthakker-Magee[3] Income Elast	Houthakker-Magee[3] Own-Price Elast
Imports	Canada	1.87	0.3	-0.80	0.3	1.45	0.2	-1.01	0.2	1.94*	-0.92
	Germany	2.90	0.7	-1.70	0.8	1.86	0.5	-0.48	0.6	2.77*	-4.64*
	Japan	3.56	1.0	-1.13	0.6	3.68	0.4	-0.81	0.4	3.52*	-1.51
	UK	2.67	0.7	-0.34	0.4	2.76	0.4	-0.84	0.2	1.85*	-2.46
	OECD	2.51	0.5	-1.17	0.4	2.09	0.3	-0.88	0.2		
	LDCs	3.04	1.0	-0.45	0.3	3.39	0.3	-0.50	0.2		
	OPEC	1.11	0.7	-1.29	0.8	-2.10	2.0	-0.00	0.4		
Exports	Canada	2.01	0.3	-0.99	0.3	1.33	0.2	-0.13	0.3	1.13*	-1.45
	Germany	1.95	0.3	-0.89	0.3	1.66	0.3	-1.16	0.3	1.95*	-2.39*
	Japan	0.79	0.3	-0.72	0.4	0.81	0.2	0.04	0.3	1.10*	-0.41
	UK	4.11	1.3	-0.88	0.6	3.11	0.9	-0.74	0.2	2.58*	-1.69*
	OECD	2.32	0.6	-0.72	0.4	2.33	0.5	-0.61	0.2		
	LDCs	0.54	0.2	-1.45	1.2	0.52	0.1	-0.66	0.5		
	OPEC	0.96	0.3	-0.52	0.3	0.82	0.3	-0.90	0.2		

Notes

[1] Source: Table 1.

[2] Band Spectrum estimates of equation (A1) for a frequency band of [0, 0.125).

[3] Source: Houthakker and Magee (1969), table 4; the price elasticity corresponds to P_3 ; * denotes statistical significant.

Appendix B : The Data

B1. Definitions

All of the series indicated below are maintained in the databank of the Federal Reserve Board's MultiCountry Model. Data sources appear as underlined abbreviations and are described in section B.2.

All data for trade flows are in billions of U.S. dollars, quarterly at annual rates. To estimate the volume of imports, the analysis deflates the dollar value of imports by the associated dollar import price:

$$M_{ks} = MKSV / e_s P_s \ ,$$

where MKSV = goods imports of country i from country s (FOB), DOT .

e_s = U.S. dollar exchange rate index ($U.S./local currency) with 1972=1; MDL: quarterly average of series Canada (SXMBCD), Germany (SXMBDM), Japan (SCDBJY), and U.K. (SXDBUKP).

P_s = multilateral export unit value of country s in local currency with 1972=1; MDL: for Japan (JXPRICE75Q/value in 1972) and the United States (XTOUV72Q); Canada (BOC, D50501*100/D40587); U.K. (BOE, CGTOQU8080 0-); Germany (DBB, XU0110). For Industrial and developing countries: $P_s = \Pi_{\rho s}(e_{\rho s} P_{\rho s})^{\omega_{\rho s}}$, where s=i,l. The weights are historical means of exports of each member of the group in total exports of that group. The data for exports and export prices come from the IFS. See Marquez (1988, section 2.3 for a listing of the countries). For OPEC, P_s is the oil market price as reported by the IEA. Note that the export price of LDCs, OPEC, and other industrial countries is expressed in US dollar. Thus, under the assumption that these prices remain constant in their currencies, P(fx), a dollar depreciation raises their prices denominated in dollars, P($), because P($)=P(fx) e($/fx), where e($/fx) is the bilateral dollar exchange rate, which by assumption is increasing in value.

Data for the relative price of imports of country k (the United States) from country s, P_{ks}, are constructed as

$$P_{ks} = e_s(1+\tau)P_s/P_{yk},$$

where P_{yk} = US GNP Deflator: NIA Table 7.1, line 1.

τ = ad-valorem tariff rate constructed as the share of tariff receipts (US Treasury, Monthly Bulletin) in total US imports.

Data for the relative price of imports of country s from country k, P_{sk}, are constructed as $P_{sk} = P_k/e_sP_{ys}$,

where P_{ys} = GNP Deflator of sth country with 1972=1:

Canada: Nominal GNP divided by real GNP, CSR Table 1.2, series D40551 and D40593.

Germany: Nominal GNP divided by real GNP, (DIW).

Japan: Nominal GNP constructed from components, BOJ, divided by real GNP (BOJ).

U.K.: Nominal GNP, ET Table 2, divided by real GNP (ET).

In view of data difficulties, the paper assumes that the GNP/GDP deflator for the Rest of OECD, Non-OPEC LDCs, and OPEC is their export price.[32]

Real income (Y_k) for Canada, Germany, Japan, the United Kingdom, and the United States is defined as real GNP/GDP measured in local currency:

Canada: CSR series D40593.

Germany: constructed from components, DIW.

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32 Thus exports of the United States to OPEC, for example, use OPEC's export price as a proxy for OPEC's GNP price deflator.

Japan: constructed from components, BOJ.

U.K.: real GDP, ET, Table 4.

U.S.: NIA Table 1.2, line 1.

For both industrial and developing countries, real income is measured as a geometric mean of industrial production for selected countries. Finally, in view of data difficulties, the paper assumes that OPEC's income equals OPEC's real exports.

Data on potential output for Canada, Germany, Japan, the United Kingdom, and the United States are generated using Cobb-Douglas production functions. These functions include labor, capital, oil, and imports as inputs, and the associated parameters are estimated econometrically.[33] Data for potential output of LDCs and the bloc of industrial countries are generated as a trend of actual output.

Data for the relative price for imports of country k from country q (the country competing with country s in exporting goods to country k) are constructed as

$$P_{kq|s} = [\Pi_{\rho}(e_{\rho}P_{\rho})^{\omega_{\rho}}]/P_{yk},$$

where ω_{ρ} is the share of the ρth country ($\rho \neq k,s$) in world exports. The aggregation of export prices of various countries into a single index makes two important assumptions: first, imports of country k from country s are strongly separable from country k's imports from countries other than s; second, the elasticity of substitution among imports from countries other than

[33] The estimates range from four to 14 percent for the share of capital; from 60 to 80 percent for the share of labor; from four to seven percent for the share of oil; and from eight to 18 percent for the share of imports. See Edison, H., J. Marquez, and R. Tryon, 1986, The structure and properties of the FRB MultiCountry Model, International Finance Discussion Papers, No. 293 (Federal Reserve Board, Washington D.C.).

s is one. These assumptions are needed to avoid the multicollinearity problem that arises when third-country prices are considered individually in (1).

B2. Sources

BOC Bank of Canada.

BOE Bank of England.

BOJ Bank of Japan.

CSR Canadian Statistical Review, published quarterly by Statistics Canada.

DBB Deutsche Bundesbank.

DIW "Lange Reihen der vierteljahrlichen volkswirtschaftlichen Gesamtrechnung fur die Bundesrepublik Deutschland", published quarterly by Deutsches Institute fur Wirtschaftsforshung, Berlin.

DOT Direction of Trade Statistics, published monthly by the International Monetary Fund.

ET Economic Trends, published monthly by U.K. Central Statistical Office.

IEA International Energy Agency.

IFS International Financial Statistics, published by the International Monetary Fund.

MDL Macro Data Library of the Federal Reserve Board of Governors.

NIA National Income Accounts in Survey of Current Business, published monthly by U.S. Department of Commerce, Bureau of Economic Analysis.

B.3 Data Series

The data appear after the references.

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		CEI	CGNP	CGNPPOT	CPGNP	CPXGUV	EEI	EGNP
72	1	0.987715	102.458	NA	0.981705	0.98665	1.03842	54.927
72	2	1.00274	105.116	114.373	0.989798	0.993149	1.03842	55.6471
72	3	1.00772	105.666	115.281	1.00376	1.00048	0.977856	55.8277
72	4	1.00181	107.694	116.167	1.02367	1.01971	0.945136	57.3543
73	1	0.993502	111.532	119.002	1.0459	1.05835	0.966872	60.7701
73	2	0.990759	112.045	120.343	1.0745	1.10901	1.01169	60.2397
73	3	0.986868	113.065	120.665	1.10177	1.16909	0.991219	60.6978
73	4	0.990848	116.055	122.195	1.14277	1.24423	0.951122	59.7597
74	1	1.01097	117.701	124.721	1.18834	1.389	0.911908	58.5996
74	2	1.02622	117.109	125.415	1.24254	1.50165	0.959131	59.899
74	3	1.01007	116.991	126.254	1.2882	1.57108	0.940138	61.0565
74	4	1.00458	117.13	127.205	1.31499	1.61401	0.931581	60.25
75	1	0.992158	117.205	129.032	1.34189	1.63243	0.955972	59.5532
75	2	0.969452	117.785	129.852	1.36969	1.65518	0.929742	59.6448
75	3	0.961066	119.141	131.125	1.41295	1.6986	0.85157	58.6641
75	4	0.97359	120.371	132.14	1.44908	1.70864	0.817223	60.2204
76	1	0.995481	124.272	133.568	1.47734	1.69007	0.798709	61.4269
76	2	1.01186	126.371	133.772	1.51879	1.69111	0.721857	61.0565
76	3	1.0135	125.628	134.767	1.53991	1.70798	0.706303	61.8076
76	4	0.998875	125.972	135.271	1.57533	1.70529	0.6602	62.7818
77	1	0.962332	126.816	137.313	1.59812	1.76782	0.685271	61.7185
77	2	0.941236	127.299	138.123	1.6303	1.78803	0.68735	62.0695
77	3	0.926072	128.483	139.403	1.65382	1.85285	0.693907	62.338
77	4	0.899197	129.621	140.574	1.68231	1.86263	0.725096	63.6697
78	1	0.889939	130.763	142.12	1.70497	1.91023	0.770759	63.2864
78	2	0.878868	131.931	143.904	1.73048	1.92287	0.733893	64.9124
78	3	0.866382	133.602	145.475	1.76674	2.00371	0.772479	64.1678
78	4	0.840634	134.228	146.255	1.79957	2.07351	0.793231	64.7627
79	1	0.835061	135.941	148.36	1.83709	2.20581	0.806107	63.6839
79	2	0.855534	136.327	148.942	1.90803	2.31236	0.832137	66.4196
79	3	0.849241	137.452	150.042	1.96222	2.48015	0.893195	66.4944
79	4	0.843186	137.662	151.947	2.01618	2.57917	0.862566	66.0634
80	1	0.851065	138.62	153.975	2.06473	2.75295	0.901352	64.9111
80	2	0.846483	137.251	153.996	2.12935	2.72894	0.914147	63.9381
80	3	0.85501	137.557	154.678	2.17806	2.79675	0.952453	64.44
80	4	0.836773	139.846	156.308	2.23209	2.86184	0.954533	63.8232
81	1	0.830061	142.819	158.637	2.29877	2.98977	0.923464	64.0994
81	2	0.826524	144.242	158.594	2.33965	2.88111	0.830538	63.1393
81	3	0.817811	142.781	159.465	2.40363	2.96072	0.735213	62.827
81	4	0.831385	141.668	160.196	2.47206	3.01858	0.753046	64.1316
82	1	0.819533	138.452	159.156	2.54399	3.01659	0.737811	64.2955
82	2	0.796198	136.949	159.192	2.59031	2.91904	0.711421	64.1097
82	3	0.792793	135.995	160.091	2.65215	2.98104	0.689829	63.7497
82	4	0.804449	134.74	159.977	2.71314	3.04041	0.65956	65.1795
83	1	0.807067	137.478	160.011	2.72059	2.97536	0.611897	66.6105
83	2	0.804604	139.905	161.047	2.75053	2.9069	0.621614	65.7679
83	3	0.803575	142.462	163.131	2.79455	2.98006	0.60342	67.0287
83	4	0.799939	144.33	162.997	2.78824	2.92645	0.588106	67.3771
84	1	0.789235	145.8	163.726	2.81095	2.95287	0.573911	67.8532
84	2	0.766475	146.871	163.99	2.84931	3.00063	0.558197	67.3074
84	3	0.754045	149.26	166.215	2.84296	2.9969	0.519531	67.6558
84	4	0.751329	150.528	166.924	2.86208	2.97237	0.486943	68.5152
85	1	0.731895	152.04	166.799	2.90114	3.05737	0.446038	69.2572
85	2	0.723352	153.257	167.109	2.9288	3.03151	0.502897	70.1166

		EGNPPOT	EPGNP	EPXGUV	EUPCOMP	GEI	GGNP	GGNPPOT	GPGNP
72	1	58.3354	0.967247	0.972319	0.983526	0.9974	807.782	NA	0.9765
72	2	58.3578	0.987797	0.986159	1.00213	1.00414	816.073	NA	0.995352
72	3	58.2278	1.01082	1.0173	1.00571	1.00257	826.3	NA	1.01004
72	4	58.7993	1.03413	1.02422	1.00734	0.995423	842.898	891.325	1.0181
73	1	60.1579	1.05295	1.06574	1.08344	1.06453	854.505	899.517	1.03985
73	2	60.0712	1.0585	1.09689	1.17655	1.16777	859.493	914.501	1.05699
73	3	59.819	1.0776	1.14533	1.29569	1.33153	862.998	926.186	1.07254
73	4	60.2079	1.13126	1.20069	1.29319	1.25219	867.538	934.455	1.0903
74	1	61.0665	1.16403	1.30104	1.34349	1.17528	869.71	935.51	1.10064
74	2	61.196	1.21171	1.41177	1.51805	1.27355	865.457	940.811	1.13308
74	3	61.4222	1.29336	1.48097	1.53014	1.22168	865.425	942.583	1.15245
74	4	62.0861	1.37195	1.55017	1.5864	1.26708	855.74	946.746	1.17353
75	1	61.6898	1.48654	1.67474	1.67497	1.36453	839.156	949.74	1.1962
75	2	61.8693	1.57626	1.71626	1.65783	1.35361	843.979	956.886	1.20301
75	3	61.5306	1.65273	1.78893	1.56579	1.24895	856.106	959.044	1.21157
75	4	62.381	1.71224	1.85813	1.53694	1.22752	867.018	960.778	1.22668
76	1	63.5715	1.75975	1.93426	1.53832	1.23839	884.75	965.365	1.23162
76	2	63.2416	1.8151	2.03806	1.51968	1.24595	897.591	976.346	1.24475
76	3	63.0578	1.85841	2.15917	1.55127	1.25992	901.674	987.468	1.26333
76	4	63.7451	1.91947	2.2872	1.5831	1.32395	914.617	995.314	1.25836
77	1	65.0517	1.9935	2.38062	1.62636	1.33046	916.393	998.832	1.27731
77	2	64.881	2.03307	2.47059	1.65759	1.34938	916.347	1008.98	1.2961
77	3	64.8474	2.08894	2.53633	1.70049	1.38193	925.542	1016.13	1.29532
77	4	65.5821	2.13986	2.57439	1.77641	1.43516	935.371	1023.64	1.31789
78	1	66.7012	2.24952	2.67474	1.8882	1.53619	941.383	1031.	1.33055
78	2	66.837	2.26989	2.6955	1.94352	1.53514	949.725	1042.59	1.34451
78	3	66.6225	2.34286	2.76125	2.05401	1.58895	960.115	1054.81	1.36221
78	4	67.5155	2.39002	2.80969	2.1569	1.7021	968.366	1064.33	1.36659
79	1	68.9216	2.46618	2.90311	2.21376	1.71823	973.651	1071.06	1.38045
79	2	68.4413	2.5457	2.97578	2.23234	1.68187	994.477	1082.79	1.39092
79	3	68.261	2.64967	3.0692	2.39488	1.75615	1001.63	1096.26	1.41198
79	4	68.6706	2.75923	3.17993	2.42375	1.807	1009.62	1107.12	1.42826
80	1	69.5608	2.90786	3.32872	2.53891	1.79853	1019.66	1115.19	1.43961
80	2	69.402	3.03881	3.46713	2.5811	1.76127	1008.38	1124.59	1.47048
80	3	69.1617	3.17504	3.52595	2.67847	1.79605	1007.85	1131.9	1.47882
80	4	69.7087	3.27993	3.51557	2.64594	1.67031	1004.51	1137.91	1.48857
81	1	70.768	3.34031	3.60208	2.59295	1.53069	1007.41	1142.88	1.50211
81	2	70.3546	3.39567	3.70934	2.40046	1.40154	1007.22	1146.	1.51887
81	3	69.9766	3.46399	3.83045	2.28164	1.31265	1010.66	1154.	1.53959
81	4	70.4054	3.50018	3.92042	2.43279	1.41909	1012.42	1158.78	1.56018
82	1	71.7519	3.53225	3.95502	2.3632	1.35919	1001.98	1164.14	1.57245
82	2	71.1927	3.64862	3.95848	2.31604	1.34063	1002.23	1175.5	1.58814
82	3	71.1096	3.69583	4.05536	2.22503	1.28388	1000.48	1183.24	1.60794
82	4	71.2357	3.75781	4.11765	2.20398	1.2753	995.248	1186.46	1.61411
83	1	72.2128	3.80174	4.25606	2.21424	1.32358	1001.67	1189.45	1.62976
83	2	72.4062	3.82843	4.3218	2.17022	1.28352	1020.4	1199.97	1.64295
83	3	72.4725	3.89547	4.391	2.09117	1.2061	1017.41	1208.1	1.65616
83	4	72.7391	3.94817	4.43599	2.02039	1.19068	1029.63	1214.99	1.66374
84	1	74.3798	3.99238	4.54671	2.02218	1.18136	1046.34	1216.79	1.66546
84	2	75.0634	4.02903	4.64706	2.00821	1.17623	1036.9	1230.35	1.67573
84	3	75.4389	4.05151	4.74395	1.90955	1.09206	1051.72	1242.56	1.68277
84	4	76.0255	4.11214	4.88927	1.84328	1.04341	1061.81	1251.29	1.69692
85	1	77.5927	4.21368	5.06574	1.76471	0.979715	1053.52	1258.97	1.69827
85	2	76.6175	4.23283	5.0346	1.87529	1.0324	1076.1	1265.96	1.70831

		GPXGUV	GUPCOMP	IGNPTRD	IPXGUV	EXUVI	JEI	JGNP	JGNPPOT
72	1	0.985468	0.979358	4.30799	0.974572	30.1	0.988028	8.92726E+04	NA
72	2	0.994165	1.00268	4.31633	0.988639	30.5	0.99894	9.05671E+04	NA
72	3	1.00835	1.00687	4.32467	1.00748	31.5	1.00651	9.28057E+04	NA
72	4	1.01201	1.0093	4.33301	1.0293	31.7	1.00651	9.52824E+04	NA
73	1	1.03307	1.06467	4.34135	1.10663	32.9	1.08471	9.96226E+04	1.04434E+05
73	2	1.03902	1.12897	4.34969	1.20373	33.9	1.14411	1.00878E+05	1.05188E+05
73	3	1.04634	1.18886	4.35804	1.33175	35.2	1.1432	1.00829E+05	1.06906E+05
73	4	1.06969	1.23193	4.36638	1.3314	36.6	1.10289	1.01129E+05	1.08795E+05
74	1	1.13331	1.3371	4.37472	1.36489	39.3	1.0444	9.82154E+04	1.08859E+05
74	2	1.2038	1.48805	4.38306	1.53823	42.3	1.08289	9.98238E+04	1.09595E+05
74	3	1.25644	1.51809	4.3914	1.59479	44.6	1.01924	1.00926E+05	1.10241E+05
74	4	1.27383	1.56306	4.39974	1.66024	46.8	1.01046	1.00447E+05	1.11088E+05
75	1	1.31136	1.61355	4.40808	1.79634	50.6	1.0344	9.94691E+04	1.11008E+05
75	2	1.3196	1.59402	4.41643	1.80351	51.9	1.03652	1.01467E+05	1.12076E+05
75	3	1.32326	1.56068	4.42477	1.69093	54.1	1.01682	1.02501E+05	1.14000E+05
75	4	1.32647	1.55775	4.43311	1.68307	56.2	0.998636	1.03891E+05	1.15036E+05
76	1	1.34844	1.56284	4.44145	1.65292	58.5	1.00287	1.05660E+05	1.16392E+05
76	2	1.35934	1.54687	4.44979	1.65567	61.5	1.0134	1.06926E+05	1.16915E+05
76	3	1.38115	1.59164	4.45813	1.70125	65.2	1.04219	1.08198E+05	1.19168E+05
76	4	1.39097	1.59511	4.46647	1.75456	69.	1.03214	1.08669E+05	1.20475E+05
77	1	1.40951	1.64457	4.47481	1.80028	71.8	1.06222	1.11543E+05	1.21838E+05
77	2	1.4106	1.68242	4.48316	1.82527	74.6	1.10167	1.12677E+05	1.22989E+05
77	3	1.40351	1.72828	4.4915	1.85477	76.5	1.13891	1.13422E+05	1.24997E+05
77	4	1.39697	1.79402	4.49984	1.88594	77.7	1.22867	1.14773E+05	1.25841E+05
78	1	1.40787	1.88096	4.50818	1.98024	81.1	1.27519	1.17017E+05	1.27449E+05
78	2	1.41005	1.94427	4.51652	2.01455	81.7	1.37433	1.17909E+05	1.29186E+05
78	3	1.41932	2.05383	4.52486	2.11519	84.	1.5735	1.19269E+05	1.30507E+05
78	4	1.43295	2.0846	4.5332	2.20558	85.7	1.59108	1.21269E+05	1.32689E+05
79	1	1.45531	2.14493	4.54154	2.29111	88.	1.50391	1.23000E+05	1.34211E+05
79	2	1.47276	2.21787	4.54988	2.34309	89.7	1.39187	1.24729E+05	1.35434E+05
79	3	1.50493	2.36636	4.55823	2.51958	91.5	1.38529	1.26162E+05	1.37337E+05
79	4	1.53765	2.34666	4.56657	2.6197	93.7	1.27335	1.27739E+05	1.38600E+05
80	1	1.59708	2.49355	4.57491	2.73257	97.1	1.24538	1.29538E+05	1.39071E+05
80	2	1.62434	2.58983	4.58325	2.76835	100.	1.30809	1.30313E+05	1.40389E+05
80	3	1.65051	2.68869	4.59159	2.85426	101.5	1.37921	1.31612E+05	1.41809E+05
80	4	1.67396	2.72646	4.59993	2.76226	101.4	1.44043	1.33188E+05	1.43047E+05
81	1	1.70122	2.78522	4.60827	2.62991	103.	1.47388	1.34658E+05	1.45164E+05
81	2	1.72412	2.64168	4.61661	2.48847	104.8	1.3788	1.36139E+05	1.45559E+05
81	3	1.75957	2.53955	4.62496	2.42079	107.8	1.30827	1.37233E+05	1.47598E+05
81	4	1.76611	2.66121	4.6333	2.55665	110.1	1.35095	1.37097E+05	1.49504E+05
82	1	1.78956	2.60451	4.64164	2.50084	111.7	1.29602	1.37981E+05	1.51278E+05
82	2	1.81082	2.51565	4.64998	2.44839	112.7	1.24151	1.40402E+05	1.51657E+05
82	3	1.83045	2.44707	4.65832	2.34857	115.	1.17022	1.40675E+05	1.53319E+05
82	4	1.82991	2.44056	4.66666	2.31055	116.	1.17703	1.42465E+05	1.55693E+05
83	1	1.83209	2.41364	4.675	2.36046	120.3	1.28571	1.42660E+05	1.58185E+05
83	2	1.83536	2.40807	4.68334	2.27851	123.	1.27594	1.43978E+05	1.58517E+05
83	3	1.83154	2.39413	4.69169	2.20597	125.1	1.24971	1.46173E+05	1.60720E+05
83	4	1.85444	2.29036	4.70003	2.21367	126.	1.29453	1.48686E+05	1.62867E+05
84	1	1.87407	2.29622	4.70837	2.25126	129.	1.31406	1.50892E+05	1.64587E+05
84	2	1.87135	2.27849	4.71671	2.26574	131.7	1.31943	1.53770E+05	1.65467E+05
84	3	1.92042	2.19291	4.72505	2.13797	135.2	1.24473	1.55127E+05	1.68790E+05
84	4	1.94059	2.1502	4.73339	2.07069	138.1	1.23118	1.58553E+05	1.69841E+05
85	1	1.97495	2.08637	4.74173	1.98503	142.2	1.17769	1.58863E+05	1.71523E+05
85	2	1.98803	2.18615	4.75007	2.08386	142.8	1.20814	1.61856E+05	1.71225E+05

		JPGNP	JPXGUV	LGNPTRD	LPXGUV	MCU_ERR	MCUV
72	1	0.974543	0.968726	3.56191	0.976578	NA	12.8324
72	2	0.990068	0.990084	3.59141	0.998956	NA	15.6056
72	3	1.01097	1.00992	3.62091	0.995375	NA	13.018
72	4	1.02431	1.03127	3.65041	1.02909	NA	15.9884
73	1	1.04969	1.01754	3.67991	1.15829	NA	16.4336
73	2	1.08321	1.01907	3.7094	1.27674	NA	19.4016
73	3	1.12636	1.10297	3.7389	1.38475	NA	16.2408
73	4	1.18706	1.19146	3.7684	1.46084	NA	20.5764
74	1	1.25567	1.37452	3.7979	1.69327	NA	21.44
74	2	1.31806	1.4569	3.8274	1.84305	NA	24.852
74	3	1.36301	1.55912	3.8569	1.84455	NA	22.6368
74	4	1.40249	1.61709	3.88639	1.8538	NA	26.3272
75	1	1.42304	1.56674	3.91589	1.90631	NA	23.7936
75	2	1.44084	1.53013	3.94539	1.82694	NA	27.1748
75	3	1.45622	1.5225	3.97489	1.71446	NA	23.3212
75	4	1.47649	1.5286	4.00439	1.72311	NA	27.2352
76	1	1.50027	1.50114	4.03389	1.76876	0.005671	27.6512
76	2	1.53248	1.49352	4.06339	1.84693	-0.044485	31.168
76	3	1.55847	1.50114	4.09288	1.92153	-0.026913	26.4112
76	4	1.57325	1.55301	4.12238	2.01671	-0.019874	29.7932
77	1	1.59597	1.52555	4.15188	2.11458	-0.000728	29.6972
77	2	1.61705	1.51487	4.18138	2.27868	0.024817	34.2616
77	3	1.63934	1.50114	4.21088	2.1835	-0.021712	27.7376
77	4	1.66169	1.47521	4.24038	2.12741	-0.019753	30.7732
78	1	1.67736	1.45538	4.26987	2.19215	-0.075444	29.3692
78	2	1.69836	1.52555	4.29937	2.18201	0.025459	38.1224
78	3	1.7176	1.40808	4.32887	2.24198	-0.067723	31.0036
78	4	1.72278	1.38825	4.35837	2.32612	-0.001863	37.4436
79	1	1.73147	1.45995	4.38787	2.42757	0.029971	39.7548
79	2	1.7435	1.56064	4.41737	2.54125	-0.030166	44.1792
79	3	1.74708	1.62319	4.44687	2.66149	0.029265	40.3816
79	4	1.74769	1.69336	4.47636	2.73281	0.050378	45.5552
80	1	1.75184	1.77879	4.50586	2.92824	0.02694	44.4136
80	2	1.78802	1.79252	4.53536	2.96792	0.015676	48.4336
80	3	1.81644	1.73761	4.56486	3.02104	-0.03029	39.8008
80	4	1.8247	1.72235	4.59436	3.05415	0.033529	48.6376
81	1	1.83151	1.74828	4.62386	2.973	-0.000599	48.3156
81	2	1.83304	1.79558	4.65336	2.91302	0.01151	55.784
81	3	1.84737	1.83219	4.68285	2.788	0.027604	46.3304
81	4	1.85668	1.87185	4.71235	2.80083	-0.000343	48.5576
82	1	1.86655	1.88558	4.74185	2.77577	-0.039207	43.0916
82	2	1.87487	1.93593	4.77135	2.69909	-0.033549	46.698
82	3	1.89474	1.90705	4.80085	2.65403	0.015398	40.1236
82	4	1.87935	1.88973	4.83035	2.62629	-0.071555	39.5736
83	1	1.89362	1.76502	4.85985	2.60242	0.009925	43.3176
83	2	1.89744	1.75117	4.88934	2.58243	0.008153	51.4776
83	3	1.89097	1.75635	4.91884	2.57914	0.036601	47.0152
83	4	1.87903	1.56064	4.94834	2.61913	-0.002723	52.698
84	1	1.88649	1.55149	4.97784	2.69909	0.080903	57.258
84	2	1.89618	1.53623	5.00734	2.72057	0.022258	63.3696
84	3	1.8968	1.56369	5.03684	2.60421	0.046888	55.9868
84	4	1.89488	1.56217	5.06633	2.51499	-0.050132	56.6972
85	1	1.90771	1.582	5.09583	2.46009	-0.017104	57.2628
85	2	1.90857	1.59268	5.12533	2.43384	-0.039885	64.896

		MEU_ERR	MEUV	MGU_ERR	MGUV	MJU_ERR
72	1	NA	3.2416	NA	3.72	NA
72	2	NA	2.7544	NA	3.208	NA
72	3	NA	2.4804	NA	2.98	NA
72	4	NA	3.3176	NA	3.6	NA
73	1	NA	3.748	NA	4.276	NA
73	2	NA	3.8852	NA	4.448	NA
73	3	NA	3.66	NA	4.588	NA
73	4	NA	4.5868	NA	5.068	NA
74	1	NA	4.7652	NA	5.156	NA
74	2	NA	5.4968	NA	5.516	NA
74	3	NA	4.9444	NA	5.216	NA
74	4	NA	5.9004	NA	5.748	NA
75	1	NA	5.8884	NA	5.96	NA
75	2	NA	5.26	NA	5.992	NA
75	3	NA	4.6388	NA	5.196	NA
75	4	NA	5.1296	NA	5.996	NA
76	1	-0.059257	5.4684	0.083202	6.9	-0.020031
76	2	-0.072815	5.3836	-0.015427	6.536	0.009499
76	3	0.011827	5.266	0.013371	6.16	0.056108
76	4	0.001273	5.8224	0.146974	8.388	-0.026536
77	1	0.047643	6.6828	-0.063793	7.188	0.016773
77	2	0.022324	6.9452	0.056874	7.776	-0.061151
77	3	0.011737	6.338	0.000001	4.428	-0.053887
77	4	-0.148746	5.8276	0.036399	7.7084	-0.077491
78	1	0.178114	8.2348	-0.122243	7.6652	-0.001452
78	2	-0.048795	8.2716	-0.025277	8.5948	-0.035136
78	3	-0.016126	7.6688	-0.087637	7.92	0.062806
78	4	-0.008615	8.5376	0.044148	10.7232	-0.039971
79	1	-0.105495	8.7748	-0.031008	10.6156	0.010191
79	2	-0.109375	9.236	-0.096678	10.3312	-0.06025
79	3	0.147568	11.0984	-0.047755	10.2552	0.036158
79	4	0.000003	11.7092	0.036261	13.1212	-0.016035
80	1	0.144465	14.614	0.108296	15.1296	0.017969
80	2	0.15655	16.1128	0.074988	14.7196	0.072829
80	3	-0.054465	12.8628	0.050665	13.2828	-0.028429
80	4	-0.022107	12.8856	-0.036749	13.514	-0.006083
81	1	-0.102414	12.5052	0.006893	13.5296	0.023533
81	2	-0.00704	12.6064	0.019034	12.85	-0.084621
81	3	0.057505	11.9552	0.003595	11.0648	-0.033527
81	4	-0.024309	11.878	0.00944	13.0024	0.08251
82	1	-0.059757	11.904	-0.019879	12.104	-0.063165
82	2	0.056952	12.746	0.084116	12.6956	0.008844
82	3	-0.005484	11.0224	0.016202	10.5896	0.008016
82	4	-0.026774	11.038	-0.018022	11.1732	-0.03922
83	1	-0.012998	11.9864	0.002738	11.3468	-0.009537
83	2	0.002546	12.2688	-0.046151	10.998	0.071234
83	3	-0.073918	10.62	0.01551	10.2952	0.04135
83	4	-0.061392	10.9552	-0.068405	10.8432	0.043361
84	1	-0.032263	12.0136	-0.011757	11.522	0.017226
84	2	0.007881	12.7892	-0.026821	11.0436	-0.038441
84	3	0.027649	11.99	0.030013	10.3512	0.048369
84	4	0.078211	13.3472	-0.045893	10.9188	-0.017458
85	1	0.048215	14.4648	0.051002	11.1468	0.025839
85	2	-0.017531	13.8344	-0.024789	11.0676	-0.041534

		MJUV	MUC_ERR	MUCV	MUE_ERR	MUEV	MUG_ERR	MUGV
72	1	5.7492	NA	14.984	NA	3.06	NA	4.436
72	2	5.6524	NA	16.716	NA	3.2	NA	4.5
72	3	5.6812	NA	13.956	NA	2.76	NA	4.388
72	4	6.34	NA	17.5	NA	3.624	NA	4.672
73	1	7.6896	NA	18.424	NA	3.692	NA	5.244
73	2	9.4304	NA	20.268	NA	3.824	NA	5.752
73	3	9.2924	NA	16.548	NA	3.832	NA	5.492
73	4	10.6984	NA	19.8	NA	4.144	NA	6.148
74	1	11.5196	NA	20.828	NA	3.732	NA	6.24
74	2	13.478	NA	24.66	NA	4.544	NA	7.724
74	3	12.0388	NA	23.16	NA	4.568	NA	6.46
74	4	13.6876	NA	26.44	NA	4.356	NA	7.1
75	1	12.6176	NA	21.328	NA	4.54	NA	6.684
75	2	11.85	NA	23.336	NA	3.876	NA	5.356
75	3	11.1384	NA	21.588	NA	3.664	NA	5.068
75	4	10.8652	NA	24.756	NA	4.108	NA	5.892
76	1	10.9748	-0.026504	24.8036	-0.002774	4.2524	-0.022667	5.6332
76	2	11.8192	0.051576	28.9936	-0.011577	4.5756	0.031055	5.9804
76	3	12.3276	0.104825	27.4416	-0.093024	4.6288	-0.032738	5.6364
76	4	12.3484	0.020162	29.0292	-0.068325	4.7456	0.009812	6.638
77	1	12.9932	0.01718	28.7848	0.022429	5.0248	-0.073336	6.5872
77	2	12.9228	0.042488	32.76	-0.057164	5.5748	-0.014118	7.58
77	3	12.0836	-0.028332	28.4856	-0.061742	5.814	0.039673	8.006
77	4	11.9096	0.031285	33.4452	-0.079541	5.468	0.025884	8.6308
78	1	13.05	-0.009371	31.9544	0.109175	6.5112	0.095159	10.2776
78	2	14.1824	-0.01507	36.4468	0.020369	7.3368	-0.039855	10.2628
78	3	15.788	-0.052351	32.31	-0.118756	6.882	0.015177	10.5724
78	4	16.6948	-0.034268	37.876	-0.064724	6.9828	-0.081676	11.1876
79	1	18.584	-0.017353	37.7296	-0.03296	6.9244	-0.154646	10.2136
79	2	19.7536	-0.052719	39.34	0.036832	8.526	0.07536	12.3908
79	3	21.1292	-0.055256	36.552	-0.099081	8.8244	-0.005289	11.6316
79	4	21.7856	-0.034034	42.26	0.110739	9.7744	0.004991	12.2592
80	1	23.1204	-0.002683	44.0664	0.010479	9.9728	0.004879	13.1872
80	2	25.7572	-0.113791	40.1368	-0.100795	9.9204	0.058698	13.522
80	3	24.278	-0.090755	37.5096	0.043716	10.604	0.013448	11.8212
80	4	25.1112	-0.022504	46.3072	-0.001307	10.6016	-0.080499	10.9996
81	1	26.2784	-0.079024	45.44	0.023152	11.8016	-0.045109	11.384
81	2	24.8596	-0.055926	48.9244	0.060713	13.65	0.036627	12.1572
81	3	23.6268	-0.06214	44.5384	0.131471	15.6004	0.026421	11.462
81	4	26.334	-0.035478	48.4032	-0.116735	12.2104	0.018336	12.6672
82	1	24.284	-0.046624	45.0788	-0.040129	11.478	0.062293	12.3836
82	2	25.284	-0.04198	49.1424	0.030839	13.146	0.059977	13.594
82	3	24.1196	0.055164	46.448	0.019698	14.2204	-0.069513	11.9264
82	4	23.0528	-0.033968	46.4976	0.154688	15.32	-0.010651	12.1072
83	1	22.5632	-0.004251	48.892	-0.138411	11.1376	-0.044141	12.2272
83	2	24.9724	-0.023904	54.2524	0.055692	13.1772	-0.048338	13.1928
83	3	24.9948	-0.000917	49.7508	0.090011	14.678	-0.044268	12.7636
83	4	26.6476	-0.018148	57.2884	-0.07842	12.6072	-0.015134	14.7332
84	1	26.9628	0.068069	64.946	0.05827	14.2916	0.069983	18.468
84	2	26.9236	0.064253	69.6132	-0.0602	14.752	-0.097427	17.4512
84	3	26.9704	0.089332	64.1832	0.079282	15.7216	0.090743	18.0352
84	4	26.6896	0.046371	68.9019	0.02434	15.412	-0.066958	17.286
85	1	27.0708	0.058043	68.1112	-0.11742	13.392	0.134247	21.1148
85	2	26.8164	0.055252	73.748	0.048581	15.7984	-0.015099	21.1268

		MUI_ERR	MUIV	MUJ_ERR	MUJV	MUL_ERR	MULV	MUO_ERR	MUOV
72	1	NA	9.052	NA	8.864	NA	11.968	NA	2.664
72	2	NA	8.892	NA	9.184	NA	11.78	NA	2.456
72	3	NA	9.392	NA	10.152	NA	12.304	NA	2.644
72	4	NA	9.84	NA	10.196	NA	12.94	NA	3.064
73	1	NA	10.42	NA	9.748	NA	14.768	NA	3.452
73	2	NA	11.42	NA	10.192	NA	15.78	NA	3.984
73	3	NA	11.836	NA	10.68	NA	16.264	NA	4.924
73	4	NA	13.672	NA	10.372	NA	18.508	NA	6.352
74	1	NA	13.476	NA	10.332	NA	23.104	NA	10.356
74	2	NA	15.	NA	12.756	NA	26.948	NA	16.384
74	3	NA	14.748	NA	14.996	NA	27.388	NA	19.588
74	4	NA	16.112	NA	15.216	NA	26.784	NA	18.136
75	1	NA	13.88	NA	13.688	NA	23.968	NA	18.58
75	2	NA	12.704	NA	11.36	NA	23.3	NA	15.904
75	3	NA	12.636	NA	11.832	NA	25.664	NA	18.5
75	4	NA	13.976	NA	12.464	NA	25.772	NA	19.124
76	1	-0.048351	13.7732	0.105276	15.1176	0.03942	27.284	-0.057305	26.0884
76	2	-0.01546	14.434	0.062634	16.7324	0.027262	28.984	-0.192231	25.8708
76	3	-0.002426	14.7632	0.054996	17.842	-0.002657	30.804	0.013752	31.842
76	4	0.00983	15.67	0.022324	18.0212	-0.000678	32.372	-0.01975	32.3352
77	1	0.02233	16.2572	-0.072191	17.218	0.021916	35.848	0.192216	40.918
77	2	0.002541	17.1396	0.049315	19.9536	-0.047642	37.192	0.009189	36.8772
77	3	-0.028073	17.522	0.004272	21.0044	-0.03509	36.388	0.015766	38.1976
77	4	-0.041215	18.2328	0.061273	22.6352	0.010199	36.94	0.007374	35.114
78	1	0.056651	21.3852	0.067365	24.9396	0.020848	40.448	0.10576	35.4316
78	2	0.029645	23.2912	0.036415	27.0264	0.030149	42.416	-0.012762	32.9624
78	3	-0.015051	23.0884	-0.043256	27.4752	-0.021657	44.088	0.039835	35.6104
78	4	-0.032248	23.9644	-0.050928	26.4452	-0.017209	45.784	0.026734	35.7692
79	1	-0.065623	23.6508	-0.050673	26.1816	-0.053658	47.696	0.049481	37.0408
79	2	0.045817	27.1148	0.019906	28.7284	-0.019067	51.232	-0.025491	41.458
79	3	-0.055706	26.3384	-0.045143	28.5176	-0.017447	56.28	0.044693	52.4496
79	4	0.014198	28.734	-0.021086	29.2644	0.015322	60.008	0.016521	58.2304
80	1	0.010805	29.9636	0.002574	30.77	0.011102	66.86	-0.030977	63.2752
80	2	-0.006406	29.3	0.038232	34.0488	-0.009337	66.812	-0.012514	59.0624
80	3	-0.077083	26.7992	-0.048874	33.458	-0.096575	63.208	-0.162172	51.4048
80	4	0.016519	29.2004	-0.018342	33.6192	-0.01415	65.192	0.03314	54.9956
81	1	0.000681	29.9852	-0.004238	36.5812	0.028961	69.14	0.050575	59.3932
81	2	0.034061	31.5108	0.010882	39.9656	0.016902	69.976	0.016101	54.5348
81	3	0.006929	30.5104	0.009311	40.7008	0.021758	70.436	-0.184312	43.8804
81	4	0.043288	33.062	0.078213	42.3692	0.023521	71.796	0.05639	44.6052
82	1	0.008199	30.3512	-0.012455	42.3524	-0.059876	67.72	0.038313	39.3084
82	2	0.072671	32.156	-0.033093	40.8776	-0.00895	68.052	-0.246927	25.986
82	3	0.080018	31.4272	-0.021857	40.702	0.032925	73.808	0.21358	32.7464
82	4	-0.035869	29.722	-0.087364	35.7932	-0.041523	70.332	-0.0616	26.844
83	1	-0.060863	30.3436	-0.018055	39.3676	-0.034251	70.116	-0.143605	19.9096
83	2	-0.021249	33.1416	-0.06251	41.56	0.069444	78.028	0.08104	20.5452
83	3	-0.058112	32.638	-0.069407	42.9936	0.004126	81.46	0.322183	29.7952
83	4	-0.118364	32.7124	0.070364	50.3148	-0.003606	82.876	0.04718	28.4024
84	1	0.096952	43.0512	0.047548	54.9672	0.089825	96.508	-0.113857	23.9332
84	2	-0.06649	41.7156	-0.015481	59.348	-0.051397	90.856	0.142563	27.9552
84	3	0.138967	48.6684	0.08831	68.7956	0.090489	100.2	-0.051192	27.412
84	4	-0.093085	42.1697	-0.119467	58.3744	-0.035682	90.136	-0.153275	23.5816
85	1	0.057333	47.1953	0.083471	69.4908	0.040037	94.436	-0.315837	17.7832
85	2	0.007993	51.1925	0.025522	73.6504	-0.007742	92.3	0.084554	22.6248

		MUTV	MUZV	OPOIL72	ROWIPEEC	ROWIPLDC
72	1	56.4	1.37197	0.979766	80.9688	39.3305
72	2	58.2	1.47199	0.979766	82.9617	42.3418
72	3	57.332	1.73596	1.0181	83.559	42.7905
72	4	63.556	1.71995	1.02236	85.876	44.6428
73	1	67.612	1.86398	1.1033	86.7518	47.5726
73	2	73.332	2.11197	1.1885	88.5842	46.9021
73	3	71.972	2.39599	1.28647	91.2871	48.5465
73	4	81.516	2.51996	2.2066	91.7751	51.0885
74	1	90.608	2.53996	4.83919	94.1375	51.6272
74	2	110.828	2.81195	4.79233	94.1943	52.4268
74	3	113.904	2.99597	4.83067	94.0609	51.1529
74	4	116.708	2.564	4.75399	89.2997	50.4687
75	1	105.152	2.48398	4.60916	85.8343	51.0623
75	2	98.132	2.29596	4.59638	84.7829	55.6901
75	3	101.488	2.53598	4.57508	83.9154	57.2805
75	4	108.896	2.80399	5.00532	87.6059	59.8033
76	1	119.964	3.0116	5.00958	89.8081	62.1799
76	2	129.064	3.49323	5.00958	91.6555	65.4341
76	3	137.144	4.186	5.0181	93.0286	66.6722
76	4	142.684	3.87283	5.0181	93.2438	67.4348
77	1	154.472	3.83403	5.42705	94.1059	67.4126
77	2	161.8	4.72285	5.43557	92.1925	73.1592
77	3	160.28	4.86243	5.54207	90.1362	73.9653
77	4	165.504	5.03802	5.53355	91.9063	77.0996
78	1	176.408	5.46046	5.52077	92.0993	79.0598
78	2	185.98	6.23767	5.51225	93.562	87.0308
78	3	187.208	7.18164	5.50373	93.9249	89.6917
78	4	194.76	6.75087	5.49947	96.7526	90.8242
79	1	195.632	6.19524	5.87433	95.6006	91.8921
79	2	215.964	7.17406	7.27582	97.3759	95.2991
79	3	228.736	8.14244	8.57934	100.239	95.7121
79	4	249.008	8.47765	10.0319	100.768	97.9031
80	1	265.656	7.56081	12.2343	103.038	96.7177
80	2	260.64	7.83749	12.9542	100.208	99.4797
80	3	243.86	9.05524	13.5208	98.2397	100.262
80	4	258.8	7.88423	13.8914	98.4724	103.163
81	1	272.028	8.30264	14.8797	98.4373	102.887
81	2	279.28	8.56123	14.7561	98.9745	109.319
81	3	266.992	9.86356	14.4835	98.4569	110.938
81	4	275.124	10.0108	14.6752	98.7499	110.997
82	1	257.588	8.9155	14.5091	97.5367	108.022
82	2	252.916	9.96201	14.2194	97.5165	110.346
82	3	262.816	11.5375	14.3088	95.4826	108.564
82	4	246.208	9.59204	14.2833	94.7468	109.046
83	1	242.848	10.8545	13.2396	95.7302	114.137
83	2	265.424	11.5266	12.2556	96.9368	114.367
83	3	277.832	13.7528	12.2343	97.0314	117.947
83	4	293.416	14.4816	12.2343	98.163	119.513
84	1	331.668	15.5027	12.2556	99.9973	121.705
84	2	338.136	16.4447	12.2599	100.1	127.186
84	3	363.076	20.0595	12.2556	101.194	128.559
84	4	331.804	15.9422	12.1704	101.067	128.644
85	1	350.076	18.5525	12.0341	102.336	127.847
85	2	368.856	18.4148	11.9744	102.159	131.156

		UFPXFTW	UGNP	UGNPPOT	UGPCOMP	UJPCOMP	UPGNP	UPXGUV	UTARIFF
72	1	0.980799	1183.69	1221.78	0.979537	0.988605	0.985476	0.984326	1.06007
72	2	1.00108	1206.94	1235.11	1.00276	1.00502	0.991931	0.994701	1.05773
72	3	1.00834	1218.	1246.	1.00679	1.00571	1.00484	0.997494	1.05877
72	4	1.00846	1241.46	1255.83	1.00911	0.999062	1.01775	1.02348	1.05808
73	1	1.07741	1269.93	1275.88	1.06423	1.069	1.03281	1.07028	1.05572
73	2	1.15957	1273.7	1291.08	1.12846	1.15751	1.05433	1.1271	1.05325
73	3	1.26116	1272.86	1303.19	1.18801	1.26124	1.07585	1.19471	1.05252
73	4	1.27074	1282.87	1316.61	1.23121	1.25699	1.10167	1.27747	1.04955
74	1	1.33488	1277.12	1330.96	1.33664	1.30375	1.11673	1.36256	1.0474
74	2	1.5045	1279.47	1330.01	1.4876	1.4815	1.1404	1.40976	1.04632
74	3	1.52428	1262.88	1349.	1.5179	1.50381	1.17913	1.4889	1.04916
74	4	1.58183	1252.1	1356.5	1.56281	1.56527	1.2114	1.57271	1.04672
75	1	1.67739	1228.	1364.69	1.61359	1.69624	1.24153	1.64678	1.04728
75	2	1.66368	1240.	1364.54	1.59423	1.68969	1.26089	1.60709	1.05146
75	3	1.59495	1262.66	1375.23	1.56128	1.61045	1.28886	1.60737	1.05267
75	4	1.58444	1278.6	1383.32	1.55872	1.60371	1.31253	1.6245	1.05352
76	1	1.60299	1303.79	1403.93	1.56414	1.63597	1.32759	1.64781	1.04991
76	2	1.60121	1310.07	1419.61	1.54818	1.63075	1.34481	1.66821	1.05153
76	3	1.64651	1315.59	1438.77	1.59277	1.67405	1.36417	1.68139	1.052
76	4	1.68382	1328.47	1451.02	1.59573	1.71094	1.38784	1.71424	1.04779
77	1	1.72797	1345.44	1472.37	1.6452	1.76437	1.41151	1.73733	1.04885
77	2	1.76225	1367.78	1488.78	1.68262	1.79366	1.43948	1.75798	1.0493
77	3	1.80478	1394.66	1501.67	1.72846	1.83677	1.4567	1.75262	1.0549
77	4	1.86982	1391.15	1517.14	1.7932	1.88879	1.48252	1.7569	1.04774
78	1	1.98153	1403.82	1536.03	1.88016	2.0241	1.50403	1.79607	1.0487
78	2	2.02226	1447.67	1554.22	1.94138	1.99871	1.54061	1.85396	1.05347
78	3	2.12496	1459.6	1569.89	2.05043	2.09634	1.56858	1.87683	1.05567
78	4	2.20889	1478.96	1584.28	2.08137	2.20891	1.60086	1.93664	1.05332
79	1	2.27043	1478.22	1607.65	2.14265	2.29525	1.63744	2.01445	1.05029
79	2	2.31109	1478.18	1608.26	2.21693	2.35803	1.67402	2.11353	1.05065
79	3	2.46626	1490.3	1625.29	2.36601	2.54134	1.70844	2.16614	1.05
79	4	2.50076	1486.91	1635.39	2.34762	2.62399	1.74287	2.20436	1.04538
80	1	2.63071	1502.15	1652.53	2.49558	2.78161	1.77945	2.27251	1.03946
80	2	2.68888	1467.97	1652.18	2.59066	2.81105	1.82033	2.30872	1.04153
80	3	2.78974	1468.93	1658.05	2.68991	2.93072	1.86121	2.38331	1.04483
80	4	2.75267	1487.51	1660.95	2.72697	2.84709	1.91501	2.46432	1.0423
81	1	2.71605	1516.32	1683.16	2.78556	2.76285	1.9645	2.52614	1.0413
81	2	2.55496	1511.29	1690.23	2.64186	2.5812	1.99677	2.52615	1.04447
81	3	2.4513	1517.96	1694.5	2.5404	2.46919	2.04196	2.5303	1.04923
81	4	2.60235	1496.81	1702.15	2.66176	2.62669	2.08069	2.54226	1.04804
82	1	2.53914	1473.1	1711.44	2.60546	2.57089	2.11296	2.5575	1.04606
82	2	2.48232	1477.24	1720.54	2.51572	2.50846	2.13878	2.54943	1.04535
82	3	2.41134	1465.9	1735.15	2.44885	2.47269	2.16891	2.52017	1.04634
82	4	2.40135	1468.05	1739.53	2.44289	2.46179	2.18827	2.49645	1.04704
83	1	2.4188	1480.76	1737.35	2.41515	2.4694	2.20549	2.49627	1.03525
83	2	2.38919	1515.	1747.45	2.40951	2.4417	2.2227	2.49903	1.04497
83	3	2.32425	1536.04	1777.63	2.39626	2.36784	2.24206	2.51247	1.04694
83	4	2.26108	1563.48	1785.51	2.29351	2.34522	2.26788	2.54895	1.04225
84	1	2.26682	1600.42	1799.37	2.29915	2.34618	2.2937	2.56034	1.03956
84	2	2.25089	1620.05	1818.83	2.28127	2.32874	2.31092	2.58083	1.04345
84	3	2.15836	1630.57	1837.01	2.1959	2.232	2.33028	2.54521	1.04663
84	4	2.10406	1636.67	1842.64	2.15307	2.16629	2.34965	2.51053	1.04321
85	1	2.03017	1648.68	1860.83	2.08958	2.08754	2.37116	2.48095	1.04181
85	2	2.13672	1658.63	1864.1	2.18894	2.21062	2.39053	2.46672	1.04082

		UTRADE	XOTV	XUC_ERR	XUCV	XUE_ERR	XUEV	XUG_ERR
72	1	-8.22801	29.739	NA	11.236	NA	2.856	NA
72	2	-9.43199	29.739	NA	13.22	NA	2.4	NA
72	3	-10.408	29.739	NA	11.78	NA	2.456	NA
72	4	-8.14799	29.739	NA	13.424	NA	2.928	NA
73	1	-5.	43.513	NA	13.796	NA	3.192	NA
73	2	-3.056	43.513	NA	16.296	NA	3.488	NA
73	3	-3.06	43.513	NA	13.336	NA	3.32	NA
73	4	2.07201	43.513	NA	16.988	NA	4.256	NA
74	1	0.472	120.012	NA	17.876	NA	4.336	NA
74	2	-9.67599	120.012	NA	20.896	NA	4.616	NA
74	3	-20.408	120.012	NA	18.696	NA	4.184	NA
74	4	-8.34	120.012	NA	22.26	NA	5.16	NA
75	1	3.72	115.372	NA	20.112	NA	5.456	NA
75	2	8.76001	115.372	NA	23.336	NA	4.224	NA
75	3	-0.807999	115.372	NA	20.372	NA	4.108	NA
75	4	5.28	115.372	NA	23.216	NA	4.312	NA
76	1	-10.424	139.716	0.01787	22.896	-0.087264	4.504	0.004167
76	2	-10.24	139.716	0.03636	26.72	0.002481	4.724	0.022965
76	3	-27.356	139.716	0.008905	22.04	-0.009215	4.744	-0.019519
76	4	-20.52	139.716	0.012155	24.78	-0.06281	5.224	0.051304
77	1	-36.312	154.848	0.062697	25.626	-0.073699	5.6172	0.025362
77	2	-34.512	154.848	-0.003644	28.0872	0.015806	6.2292	0.042607
77	3	-43.784	154.848	0.001659	22.9236	-0.016107	5.706	0.460327
77	4	-42.772	154.848	0.049103	26.5156	0.115713	6.2508	-0.041544
78	1	-52.476	152.227	0.042917	24.8604	-0.113825	6.6964	-0.021607
78	2	-37.692	152.227	-0.01042	30.876	0.033572	7.5964	-0.103331
78	3	-45.964	152.227	0.027377	26.1444	-0.116949	6.282	0.111897
78	4	-33.176	152.227	0.038342	31.6064	-0.044762	7.9008	-0.077336
79	1	-31.128	214.538	-0.010416	31.4248	0.240085	10.1872	-0.084533
79	2	-37.984	214.538	-0.034886	34.6604	0.193529	9.9904	-0.060803
79	3	-49.728	214.538	-0.04381	31.2968	0.009957	10.4508	-0.087579
79	4	-42.488	214.538	-0.045928	35.0012	0.039157	11.9104	-0.096465
80	1	-53.492	301.246	-0.010804	34.9	-0.047498	12.9464	-0.08777
80	2	-34.2119	301.246	-0.052209	37.1744	0.006878	14.7348	-0.060998
80	3	-31.86	301.246	0.015366	32.7508	-0.107831	10.82	-0.127538
80	4	-26.2638	301.246	-0.059208	36.756	-0.029373	12.2784	-0.088326
81	1	-33.0798	271.748	0.017516	38.8928	0.140049	13.2936	-0.055788
81	2	-36.236	271.748	0.005283	45.0308	0.16738	13.424	-0.016644
81	3	-46.3559	271.748	0.007257	37.53	0.065969	11.936	0.026654
81	4	-42.784	271.748	-0.05634	36.804	-0.045853	11.1028	-0.066908
82	1	-36.3319	216.099	-0.019678	33.6128	-0.009158	10.8824	0.008122
82	2	-24.804	216.099	-0.027881	36.792	-0.013029	11.3364	-0.092223
82	3	-61.8599	216.099	0.001836	32.5596	0.02225	10.5052	-0.064157
82	4	-47.436	216.099	-0.004448	31.9168	-0.089279	9.8548	-0.033462
83	1	-42.546	187.108	0.033117	35.6116	0.000659	11.0684	-0.089395
83	2	-63.4078	187.108	-0.037527	39.9732	-0.015083	10.8756	-0.016149
83	3	-84.312	187.108	-0.038551	36.3528	-0.010715	9.7812	-0.013081
83	4	-87.14	187.108	-0.025167	41.0388	0.006344	10.7596	-0.011269
84	1	-116.516	179.676	0.010388	45.3772	0.061372	11.7888	-0.004966
84	2	-118.528	179.676	0.002603	50.6932	0.043788	12.0412	-0.011631
84	3	-149.972	179.676	-0.009324	44.1864	0.078426	12.122	-0.030829
84	4	-108.112	179.676	0.015981	45.84	-0.017423	12.8864	0.034215
85	1	-125.488	157.02	0.043947	46.9296	0.017409	13.6688	0.061758
85	2	-151.568	157.02	0.021443	52.8388	-0.126399	11.016	0.002349

		XUGV	XUI_ERR	XUIV	XUJ_ERR	XUJV	XUL_ERR	XULV	XUO_ERR
72	1	2.856	NA	9.928	NA	4.82	NA	12.768	NA
72	2	2.768	NA	9.56	NA	4.544	NA	12.664	NA
72	3	2.504	NA	9.14	NA	4.64	NA	12.8	NA
72	4	3.128	NA	11.116	NA	5.856	NA	14.364	NA
73	1	3.284	NA	13.756	NA	7.484	NA	15.62	NA
73	2	3.692	NA	14.044	NA	8.176	NA	18.136	NA
73	3	3.552	NA	13.412	NA	8.3	NA	20.308	NA
73	4	4.496	NA	16.976	NA	9.292	NA	23.832	NA
74	1	5.12	NA	19.324	NA	10.8	NA	26.616	NA
74	2	5.196	NA	21.104	NA	10.392	NA	29.964	NA
74	3	4.232	NA	18.472	NA	10.056	NA	29.52	NA
74	4	5.396	NA	21.184	NA	11.468	NA	30.892	NA
75	1	5.7	NA	22.496	NA	10.472	NA	32.532	NA
75	2	4.752	NA	19.948	NA	9.308	NA	31.816	NA
75	3	4.536	NA	18.38	NA	9.168	NA	29.624	NA
75	4	5.788	NA	21.804	NA	9.312	NA	31.952	NA
76	1	5.628	-0.037534	21.588	-0.006313	9.352	-0.041755	30.138	-0.00406
76	2	5.264	0.058846	23.3288	0.033866	9.9712	-0.028049	31.3116	0.030394
76	3	4.868	-0.033806	20.6132	-0.012198	10.4308	-0.002808	31.2648	0.006583
76	4	7.16	0.052209	25.592	-0.019036	10.844	-0.084404	30.218	0.072945
77	1	6.0064	-0.09005	24.2372	-0.000092	11.1652	-0.07609	29.0004	-0.064616
77	2	6.4684	-0.006019	24.4248	-0.023093	10.3104	-0.001507	32.8564	0.062389
77	3	5.5196	0.021981	22.4196	-0.047902	9.8632	-0.006054	33.358	-0.006464
77	4	5.9596	-0.094856	23.4124	0.01258	10.7896	-0.085524	32.3016	-0.026765
78	1	6.14	-0.103007	23.5696	-0.064641	10.5136	-0.031725	33.21	0.086423
78	2	6.224	0.036106	27.0904	0.042857	12.1012	0.037202	39.3384	0.096127
78	3	7.27	0.00708	26.0656	-0.017524	13.33	0.012261	41.112	-0.008447
78	4	8.194	0.005592	32.1516	0.038879	15.5952	0.004382	44.6012	-0.007104
79	1	8.1768	-0.020908	33.83	0.046094	16.8012	-0.048027	44.7484	-0.144094
79	2	7.912	0.013155	35.9968	0.006389	16.3204	-0.011043	50.356	-0.108793
79	3	7.858	-0.031755	33.7928	0.007143	18.3536	0.027991	53.6428	-0.031114
79	4	9.9824	0.074596	43.9016	-0.037831	18.9124	0.072654	60.8972	-0.068941
80	1	11.9204	0.041218	48.9924	-0.003602	19.9448	-0.017487	61.6384	-0.023252
80	2	11.5656	0.024395	47.9616	-0.014124	20.9196	0.035672	69.3688	-0.016536
80	3	9.9656	-0.035703	40.844	-0.01772	20.6076	0.030897	72.5076	-0.015612
80	4	10.3876	-0.045208	44.25	-0.044775	21.688	0.051412	79.2184	-0.062403
81	1	10.9168	0.029181	47.0372	-0.008488	22.5956	0.002787	77.8271	0.068423
81	2	10.4504	0.024337	45.4144	0.004094	20.5524	-0.010098	78.7631	0.046284
81	3	9.5572	0.072216	41.9236	0.013771	20.6892	-0.046141	71.2283	0.008085
81	4	10.182	0.052356	48.1084	-0.014617	23.4548	0.01043	71.8844	0.018591
82	1	10.3268	-0.027518	44.9396	0.017761	21.4144	-0.025823	67.6372	0.142764
82	2	9.5648	0.088245	46.4516	-0.017792	20.4552	0.036357	71.9028	0.053396
82	3	8.326	0.021441	38.6816	-0.025755	20.3076	-0.064718	63.1856	0.089862
82	4	8.9476	-0.006915	40.2216	0.04181	21.6872	-0.079523	57.6188	0.071023
83	1	8.74	0.041305	42.1972	-0.015765	19.2228	0.038427	59.1948	-0.040857
83	2	8.8476	-0.067329	37.6364	0.018153	20.9392	-0.028551	60.11	-0.047396
83	3	8.5012	0.008119	34.5772	0.048439	22.6756	0.007152	59.3356	0.017116
83	4	8.8588	-0.04077	38.0712	0.026723	24.7396	-0.035237	58.42	-0.053746
84	1	9.6676	0.017043	41.4152	-0.026436	22.7792	0.061328	61.8472	0.017568
84	2	8.9272	-0.082741	37.9952	0.059851	23.5592	-0.020212	64.054	-0.099724
84	3	8.4004	0.054492	37.1588	-0.000224	23.3284	0.075557	66.1308	0.022587
84	4	9.3404	-0.032649	39.5444	0.020802	24.6328	0.037092	66.7572	0.024116
85	1	9.974	0.024062	41.3944	0.062912	25.0092	0.044713	65.7188	-0.008309
85	2	9.074	-0.060398	38.32	-0.042033	21.1912	-0.014395	65.6444	-0.128166

		XUOV	XUTV	XUZV
72	1	2.64	48.172	1.06797
72	2	2.652	48.768	0.959969
72	3	2.296	46.924	1.30793
72	4	2.932	55.408	1.65996
73	1	3.22	62.612	2.25996
73	2	3.26	70.276	3.18398
73	3	3.24	68.912	3.44398
73	4	4.04	83.588	3.708
74	1	4.488	91.08	2.52
74	2	5.876	101.152	3.10798
74	3	6.5	93.496	1.83597
74	4	8.748	108.368	3.26001
75	1	9.324	108.872	2.77997
75	2	10.28	106.892	3.22798
75	3	10.492	100.68	4.
75	4	11.384	114.176	6.40798
76	1	10.6804	109.54	4.75359
76	2	12.0652	118.824	5.43921
76	3	12.012	109.788	3.81522
76	4	13.908	122.164	4.43799
77	1	12.1732	118.16	4.33444
77	2	14.232	127.288	4.67962
77	3	13.644	116.496	3.06202
77	4	13.8812	122.732	3.62124
78	1	14.4348	123.932	4.5072
78	2	17.1712	148.288	7.89041
78	3	15.9896	141.244	5.05039
78	4	16.4612	161.584	5.07364
79	1	13.586	164.504	5.74963
79	2	14.2696	177.98	8.47445
79	3	14.7064	179.008	8.90685
79	4	15.3168	206.52	10.598
80	1	15.0344	212.164	6.78724
80	2	16.8568	226.428	7.84648
80	3	17.4476	212.	7.05688
80	4	18.4444	232.536	9.51328
81	1	19.4492	238.948	8.93571
81	2	21.6376	243.044	7.77132
81	3	20.584	220.636	7.18768
81	4	21.2584	232.34	9.54527
82	1	22.0048	221.256	10.4381
82	2	22.7812	228.112	8.82806
82	3	21.8024	200.956	5.58807
82	4	21.8	198.772	6.72525
83	1	17.6	200.3	6.66525
83	2	16.7944	202.016	6.83965
83	3	15.9524	193.52	6.34403
83	4	15.33	206.276	9.05803
84	1	14.2888	215.152	7.98805
84	2	13.646	219.608	8.69201
84	3	13.4356	213.104	8.34165
84	4	14.0872	223.692	10.6036
85	1	12.6348	224.588	9.25843
85	2	11.6364	217.288	7.56724

ALPHABETICAL LIST OF VARIABLES FOR MODEL

MNEMONIC]	DEFINITION
CEI	US-CANADA EXCHANGE RATE (US$/C$)--INDEX 1972
CGNP	CANADIAN REAL GNP--DOMESTIC CURRENCY--1972
CGNPPOT	CANADAIA POTENTIAL OUTPUT--DOMESTIC CURRENCY--1972
CPGNP	CANADIAN GNP DEFLATOR--DOMESTIC CURRENCY--1972
CPXGUV	CANADIAN EXPORT UNIT VALUE--DOMESTIC CURRENCY--1972
EEI	US-UK EXCHANGE RATE (US$/POUND)--INDEX 1972
EGNP	BRITISH REAL GNP--DOMESTIC CURRENCY--1972
EGNPPOT	BRITISH POTENTIAL OUTPUT--DOMESTIC CURRENCY--1972
EPGNP	BRITISH GNP DEFLATOR--DOMESTIC CURRENCY--1972
EPXGUV	BRITISH EXPORT UNIT VALUE--DOMESTIC CURRENCY--1972
EUPCOMP	THIRD COUNTRY PRICE FOR UK-US TRADE
GEI	US-GERMANY EXCHANGE RATE (US$/DM)--INDEX 1972
GGNP	GERMAN REAL GNP--DOMESTIC CURRENCY--1972
GGNPPOT	GERMAN POTENTIAL OUTPUT--DOMESTIC CURRENCY--1972
GPGNP	GERMAN GNP DEFLATOR--DOMESTIC CURRENCY--1972
GPXGUV	GERMAN EXPORT UNIT VALUE--DOMESTIC CURRENCY--1972
GUPCOMP	THIRD COUNTRY PRICE FOR GERMAN-US TRADE
IGNPTRD	LOG OF OTHER OECD TREND OUTPUT--DOMESTIC CURRENCY--1972
IPXGUV	OTHER OECD EXPORT UNIT VALUE--DOMESTIC CURRENCY--1972
EXUVI	NON-OIL UNIT VALUE FOR THE UK--1972=1
JEI	US-JAPAN EXCHANGE RATE (US$/YEN)--INDEX 1972
JGNP	JAPANESE REAL GNP--DOMESTIC CURRENCY--1972
JGNPPOT	JAPANESE POTENTIAL OUTPUT--DOMESTIC CURRENCY--1972
JPGNP	JAPANESE GNP DEFLATOR--DOMESTIC CURRENCY--1972
JPXGUV	JAPANESE EXPORT UNIT VALUE--DOMESTIC CURRENCY--1972
LGNPTRD	LOG OF LDCS TREND OUTPUT--DOMESTIC CURRENCY--1972
LPXGUV	LDCS EXPORT UNIT VALUE--DOMESTIC CURRENCY--1972
MCU_ERR	RESIDUAL IN MCUV EQUATION
MCUV	CANADIAN IMPORTS FROM US ($)
MEU_ERR	RESIDUAL IN MEUV EQUATION
MEUV	UK IMPORTS FROM US--NOMINAL $
MGU_ERR	RESIDUAL IN MGUV EQUATION
MGUV	GERMAN IMPORTS FROM THE US --NOMINAL $
MJU_ERR	RESIDUAL IN MJUV EQUATION
MJUV	IMPORTS OF JAPAN FROM THE US --NOMINAL $
MUC_ERR	RESIDUAL IN MUCV EQUATION
MUCV	IMPORTS OF THE US FROM CANADA --NOMINAL $
MUE_ERR	RESIDUAL IN MUEV EQUATION
MUEV	IMPORTS OF THE US FROM THE UK --NOMINAL $
MUG_ERR	RESIDUAL IN MUGV EQUATION
MUGV	IMPORTS OF THE US FROM GERMANY --NOMINAL $
MUI_ERR	RESIDUAL IN MUIV EQUATION
MUIV	IMPORTS OF THE US FROM OTHER OECD--NOMINAL $
MUJ_ERR	RESIDUAL IN MUJV EQUATION
MUJV	IMPORTS OF THE US FROM JAPAN --NOMINAL $
MUL_ERR	RESIDUAL IN MULV EQUATION
MULV	IMPORTS OF THE US FROM LDCS --NOMINAL $
MUO_ERR	RESIDUAL IN MUOV EQUATION
MUOV	IMPORTS OF THE US FROM OPEC --NOMINAL $
MUTV	TOTAL IMPORTS OF THE US --NOMINAL $
MUZV	US IMPORTS FROM THE RESIDUAL REGION--NOMINAL $
OPOIL72	NOMINAL OIL PRICE INDEX FOR OPEC--1972=1

ROWIPEEC	OTHER OECD REAL GNP
ROWIPLDC	LDCS REAL GNP
UFPXFTW	US FOREIGN IMPORT PRICES
UGNP	US REAL GNP--DOMESTIC CURRENCY--1972
UGNPPOT	US POTENTIAL OUTPUT--DOMESTIC CURRENCY--1972
UGPCOMP	THIRD COUNTRY PRICE FOR US-GERMAN TRADE
UJPCOMP	THIRD COUNTRY PRICE FOR US-JAPAN TRADE
UPGNP	US GNP DEFLATOR--DOMESTIC CURRENCY--1972
UPXGUV	US EXPORT UNIT VALUE--DOMESTIC CURRENCY--1972
UTARIFF	MULTILATERAL US TARIFF--INDEX 1972=1
UTRADE	US TRADE BALANCE
XOTV	TOTAL EXPORTS OF OPEC -- NOMINAL $
XUC_ERR	RESIDUAL IN XUCV EQUATION
XUCV	EXPORTS OF THE US TO CANADA --NOMINAL $
XUE_ERR	RESIDUAL IN XUEV EQUATION
XUEV	EXPORTS OF THE US TO THE UK --NOMINAL $
XUG_ERR	RESIDUAL IN XUGV EQUATION
XUGV	EXPORTS OF THE US TO GERMANY --NOMINAL $
XUI_ERR	RESIDUAL IN XUIV EQUATION
XUIV	EXPORTS OF THE UNITED STATES TO OTHER OECD --NOMINAL $
XUJ_ERR	RESIDUAL IN XUJV EQUATION
XUJV	EXPORTS OF THE US TO JAPAN --NOMINAL $
XUL_ERR	RESIDUAL IN XULV EQUATION
XULV	EXPORTS OF THE US TO LDCS -- NOMINAL $
XUO_ERR	RESIDUAL IN XUOV EQUATION
XUOV	EXPORTS OF THE US TO OPEC -- NOMINAL $
XUTV	TOTAL EXPORTS OF THE US --NOMINAL $
XUZV	US EXPORTS TO THE RESIDUAL REGION--NOMINAL $

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