A Note on the Estimation of the Atemporal Elasticity of Substitution Between Tradable and Nontradable Goods

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The atemporal elasticity of substitution between tradables and nontradables plays an important role in the analysis of the dynamic macroeconomic equilibrium models of a small open economy. Various datasets and procedures were used in the literature to estimate this parameter, with values lying in the interval ranging from 0.43 to 1.50. Emerging market economies tend to have a smaller atemporal elasticity of substitution parameter relative to advanced economies. This note offers a comprehensive survey of the literature.

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1 Introduction

The atemporal elasticity of substitution between tradables and nontradables plays an important role in the analysis of the dynamic macroeconomic equilibrium models of a small open economy. Existing methodologies used to estimate this parameter can be broadly divided into three categories: (1) Single Equation Regression Models using the cross sectional dataset by Kravis, Heston and Summers (KHS, for short, thereafter), e.g., Stockman and Tesar (1995) and Mendoza (1992); (2) Generalized Method of Moments (GMM) using annual time series data pooled for a group of countries, e.g., Ostry and Reinhart (1992); (3) Vector-Error-Correction (VEC) Models using quarterly time series data, e.g., Rozada et al. (2004) for Argentina and Lorenzo et al. (2005) for Uruguay. In the remainder of this note, I will summarize the underlying macroeconomic models, construction of the dataset, the methodology used in the estimation, and the results of the leading studies in each these sub-groups.

2 Single Equation Regression Models Based on the KHS Dataset

2.1 Underlying Model/Preferences

Studies in this category, in general, consider the utility function given by the following functional form:

$$u(x, f, n) = \frac{\left[\left(x^{\alpha} f^{1-\alpha}\right)^{-\mu} + n^{-\mu}\right]^{1-\gamma}}{1-\gamma}; \qquad (1)$$

where x denotes exportable goods, f denotes importable goods, and n denotes nontradable goods. This expression can be rewritten for convenience as

$$u(t, n) = \frac{\left[t^{-\mu} + n^{-\mu}\right]^{1-\gamma}}{1-\gamma}; \qquad (2)$$

where t denotes a composite tradable good. The constant elasticity of substitution (CES) between tradable and nontradable goods is given by $\frac{1}{1+\mu}$.

2.2 Data

Following Kravis and Lipsey (1988), Stockman and Tesar (1995) estimate the elasticity of substitution between tradable and nontradable goods from cross-sectional data provided in the World Bank's Income Comparison Project. The data can be found in the book by Kravis et al. (1982), which is available online under the Research Papers sections of the Penn World Tables.[1]

Stockman and Tesar (1995) calculate the elasticity of substitution between traded and nontraded goods in a sample of 30 countries (17 developing and 13 industrialized) using data on per capita GDP, expenditure shares on traded and nontraded goods, and price indexes for traded and nontraded goods. Mendoza (1992) uses exactly the same data set in his analysis but includes only industrialized countries in the estimation of the elasticity parameter.

The data which can be found in Kravis et al. (1982) for all countries for the **year 1975** is summarized as follows :

- Per capita GDP (Kravis et al. (1982), p. 12, Tables 1-2, col.5)
- Expenditure shares on tradable and nontradable goods (Kravis et al. (1982), p. 194, Tables 6-10, cols. 8 and 9) (Ratio of nontradable goods expenditure to tradable goods expenditure is calculated by the authors)
- Price Index for traded and nontraded goods (Kravis et al. (1982), p. 196, Tables 6-12, cols. 8 and 9) (Ratio of nontradable good prices to tradable good prices, Index, U.S. =100, is calculated by the authors)

Figure 1 in the Appendix presents the scatter plot of the ratio of nontradable good prices to tradable good prices versus the ratio of nontradable goods expenditure to tradable goods expenditure for both developing and industrial countries in the KHS dataset.

[1] Data can be found at at http://pwt.econ.upenn.edu/papers/contents.html.

2.3 Methodology

The atemporal elasticity of substitution between tradable and nontradable goods, $1/(1 + \mu)$, is found by running a logarithmic regression of relative expenditures on relative prices and GDP per capita adjusted for purchasing power.

$$ln\left(\frac{C^{75}_{n,j}}{C^{75}_{t,j}}\right) = \alpha_0 - \alpha_1 ln\left(\frac{P^{75}_{n,j}}{P^{75}_{t,j}}\right) + \alpha_2 ln\left(GDPC^{75}_j\right); \qquad (3)$$

where $C^{75}_{n,j}$ is the expenditure share on nontradable goods in 1975 for country j, $C^{75}_{t,j}$ is the expenditure share on tradable goods in 1975 for country j; the expenditure shares $C^{75}_{n,j} + C^{75}_{t,j} = GDP^{75}_j = 100$ for each country j. Similarly, $P^{75}_{n,j}$ is the price index for nontraded goods in 1975 for country j and $P^{75}_{t,j}$ is the price index for traded goods in 1975 for country j. The ratio of nontraded goods to the traded goods price index is calculated by the authors such that the U.S. relative price index=100. Finally, $GDPC^{75}_j$ is the per capita GDP data for country j in 1975 which is included in the regression to capture the income effect.

2.4 Estimation Results with Kravis et al. (1982) Data Set

Following Kravis and Lipsey (1988), Stockman and Tesar (1995) estimate the elasticity of substitution between traded and nontraded goods for 30 countries using KHS data set by running the regression in equation (3) and they find that there is a low degree of substitution in consumption with an elasticity of substitution $[1/(1 + \mu)]$ of 0.44. Mendoza (1992) estimates the elasticity of substitution between tradable and nontradable goods only for industrial countries (13 countries) using the same data set. This estimation exercise produces an estimate of $1/(1 + \mu)$ of about 0.74 for the year 1975.

Table 1: **Estimation Results with Kravis et al. (1982) Data Set**

	Stockman and Tesar (1995)		Mendoza (1992)		Emerging Countries (Akinci (2017))	
	Income Effect		Income Effect		Income Effect	
Parameters	w/	w/o	w/	w/o	w/	w/o
α_0	0.4655	0.2723	1.7144	2.2608	0.698	0.8772
(std error)	(0.498)	(0.502)	(1.612)	(1.244)	(1.008)	(0.974)
α_1	**0.4408**	**0.1106**	**0.7381**	**0.5561**	**0.4264**	**0.2777**
(std error)	(0.225)	(0.123)	(0.448)	(0.284)	(0.314)	(0.254)
α_2	0.1494	-	0.1572	-	0.1065	-
(std error)	(0.087)		(0.280)		(0.130)	

Table 1 summarizes the estimation results with and without the income effect taken into consideration for all the countries in the sample (Stockman and Tesar (1995)), for only industrial countries in the sample (Mendoza (1992)), and for emerging countries using the the KHS dataset. Using the same data set, after replicating these results, I re-run the regression only for developing countries in the sample (17 countries) and found that the elasticity of substitution between tradable and nontradable goods is 0.4264. Mendoza (1995) in another study also mentioned that running the regression suggested by Stockman and Tesar (1995) using KHS data for developing countries yields $1/(1+\mu) = 0.43$.

3 GMM Methodology (Ostry and Reinhart (1992))

3.1 Underlying Model/Preferences

Ostry and Reinhart (1992) consider a small, open, endowment economy with an infinitely lived representative household whose objective is to choose a consumption stream that maximizes

$$U = [\sigma/(\sigma-1)]E_0 \sum_{t=0}^{\infty} \beta^t \left(am_t^{1-1/\epsilon} + n_t^{1-1/\epsilon}\right)^{\frac{1-1/\sigma}{1-1/\epsilon}}, \tag{4}$$

subject to the series of budget constraints

$$p_t m_t + q_t n_t = p_t \bar{m}_t + q_t \bar{n}_t + \bar{x}_t + A_t - (1/R^*_{t-1})A_{t-1}. \tag{5}$$

and the tranversality condition, where $m_t(n_t)$ denotes consumption of importables (nontradables), p_t and q_t denote, respectively, the relative price of importables and nontradables, $\bar{m}_t$, $\bar{n}_t$, $\bar{x}_t$ show endowments of the importable, nontradable and exportable goods, respectively. The variable R_t^* denotes the world discount factor and A_t denotes the real level of debt carried from period t to period $t+1$.

In their model, the elasticity of substitution between tradable and nontradable goods is given by ϵ. The parameter β is the subjective discount factor and σ denotes the intertemporal elasticity of substitution. The first order conditions for an optimum (found by maximizing (4) subject to (5)) are given by

$$E_t\left\{\frac{p_t}{R_t^* p_{t+1}}\left[\frac{am_{t+1}^{1-1/\epsilon}+n_{t+1}^{1-1/\epsilon}}{am_t^{1-1/\epsilon}+n_t^{1-1/\epsilon}}\right]^{\frac{\sigma-\epsilon}{\sigma(\epsilon-1)}}\left[\frac{m_{t+1}}{m_t}\right]^{-\frac{1}{\epsilon}}\right\} = \frac{1}{\beta}, \tag{6}$$

$$E_t\left\{\frac{q_t}{R_t^* q_{t+1}}\left[\frac{am_{t+1}^{1-1/\epsilon}+n_{t+1}^{1-1/\epsilon}}{am_t^{1-1/\epsilon}+n_t^{1-1/\epsilon}}\right]^{\frac{\sigma-\epsilon}{\sigma(\epsilon-1)}}\left[\frac{m_{t+1}}{m_t}\right]^{-\frac{1}{\epsilon}}\right\} = \frac{1}{\beta}, \tag{7}$$

$$a(n_t/m_t)^{1/\epsilon} = p_t/q_t. \tag{8}$$

Since equation (8) must hold identically and since equations (6) and (7) are not independent, using rational expectations assumptions, they use equation (6) to define the first order condition to be estimated as the following:

$$u_t = \left\{\frac{p_t}{R_t^* p_{t+1}}\left[\frac{am_{t+1}^{1-1/\epsilon}+n_{t+1}^{1-1/\epsilon}}{am_t^{1-1/\epsilon}+n_t^{1-1/\epsilon}}\right]^{\frac{\sigma-\epsilon}{\sigma(\epsilon-1)}}\left[\frac{m_{t+1}}{m_t}\right]^{-\frac{1}{\epsilon}}\right\} - \frac{1}{\beta}. \tag{9}$$

3.2 Data

The parameters of the representative household's utility function $\mu = [\beta, \epsilon, \sigma]$ are estimated using annual pooled time-series, cross-section data for 13 developing countries. The countries examined in the analysis include four African countries-Egypt, Ghana, Cote d'Ivoire, and Morocco; five Asian countries-Sri Lanka, India, Korea, Pakistan, and the Philippines; and four Latin American countries-Brazil, Colombia, Costa Rica, and Mexico. Data coverage for each country begins in 1968 and ends somewhere between 1983 and 1987. As equation (9) highlights, estimation of the intertemporal and the intratemporal elasticities of substitution requires data on the household consumption of tradable and nontradable goods and the terms of trade. While time series on the terms of trade are readily available, authors construct data on consumption of the tradable and the nontradable goods using data from a variety of sources:

- The time series for **consumption of importables** are constructed as follows: The agricultural, mining, and industrial sectors produce traded goods; GDP originating in these sectors thus defines domestic production of traded goods. Private and public services comprise the nontraded goods sector. Domestic production of import substitutes is calculated as domestic production of traded goods less exports, on the assumption that exportables are not consumed at home. If markets clear, all domestic production of import substitutes is consumed at home. Consumption of import substitutes plus consumer goods imports, which are total imports less imports of intermediate and capital goods, make up the series of interest-consumption of importables.
- **Nontraded goods consumption** is residually calculated as total private consumption less consumption of importables.
- The relevant **price deflators** for the consumption of tradable and nontradable goods are price indices for imports and services, respectively.
- All consumption data are converted to a per capita basis by dividing the aggregates by the existing population.

3.3 Methodology

The parameter vector $\mu = [\beta, \epsilon, \sigma]$ is estimated by fitting the first-order condition defined in equation (9) to the panel data using GMM methodology. The estimation proceeds under the assumption that the parameters that characterize household preferences are identical across countries and regions. Two different sets of instruments are employed in the estimation. The first vector of instrumental variables $z1_t' = [constant, m_{t-1}/m_{t-2}, n_{t-1}/n_{t-2}, p_{t-2}/(R^*_{t-2}p_{t-1}), m_{t-1}, n_{t-1}]$, uses six instruments. The second instrument set replaces the levels of consumption of importables and nontraded with their ratio $z2_t' = [constant, m_{t-1}/m_{t-2}, n_{t-1}/n_{t-2}, p_{t-2}/(R^*_{t-2}p_{t-1}), m_{t-1}/n_{t-1}]$.

3.4 Estimation Results

Estimation results of Ostry and Reinhart (1992) for all the countries in the sample indicate that intratemporal elasticity of substitution, ϵ, lies in the 1.22-1.27 range. Estimation is repeated for each group of countries in the sample separately. Results show that $\epsilon = 1.279$ for Africa, $\epsilon = 0.655$ for Asia, and $\epsilon = 0.760$ for Latin America, when instrument set I is used in the estimation.

Table 2: Estimation Results with Ostry and Reinhart (1992) Data Set

	Instrument Set I				Instrument Set II			
Parameters	All Countries	Africa	Asia	L. America	All Countries	Africa	Asia	L. America
ϵ	1.279	1.279	0.655	0.760	1.223	1.441	1.152	1.107
std error	(0.154)	(0.474)	(0.105)	(0.172)	(0.351)	(0.771)	(0.270)	(0.383)
β	0.955	0.945	0.995	0.995	0.991	0.940	0.990	0.995
std error	(0.033)	-	-	-	(0.041)	-	-	
σ	0.383	0.451	0.800	0.373	0.504	0.443	0.803	0.430
std error	(0.087)	(0.159)	(0.201)	(0.111)	(0.228)	(0.178)	(0.235)	(0.135)
J-statistic	5.707	5.019	6.928	8.333	2.590	5.019	3.679	3.731
p-values	(0.127)	(0.170)	(0.140)	(0.080)	(0.274)	(0.170)	(0.298)	(0.292)
# of obs.	208	62	81	65	208	62	81	65

The estimation is repeated for the same group of countries using the second set of instruments and they find that $\epsilon = 1.441$ for Africa, $\epsilon = 1.152$ for Asia, and $\epsilon = 1.107$ for Latin America. Table 2 presents the parameter estimates for each instrument set and the minimized value of the objective function, J-statistic. The J-statistics are small relative to the degrees of freedom (for either instrument set), indicating that the overidentifying restrictions imposed by the model are not rejected by the data; that is, the three parameters estimated do a good job of satisfying either the five or six orthogonality conditions that depend on the instrument set.

3.5 Estimation Result for Industrial Countries

Cashin and McDermott (2003), by using very similar model and slightly different methodology, estimate the parameter vector $\mu = [\beta, \epsilon, \sigma]$ for a group of developed countries such as Austria, Canada, New Zealand, United Kingdom and United States for the period 1970-1975. Their results indicate that estimate of ϵ lies in the 0.63-3.50 range depending on the country examined.

4 Cointegration/VEC Method for Argentina and Uruguay

4.1 The Case of Argentina (Rozada et al. (2004))

4.1.1 Underlying Model/Preferences

Rozada et al. (2004) consider a small, open economy with tradable, T and non-tradable goods, N. Households maximize

$$E\sum_{t=0}^{\infty}\beta^t U\left(C_t^T(s^t), C_t^N(s^t)\right),$$

where

$$U(C_t^T, C_t^N) = \left(\omega(C_t^T)^{-\eta} + (1-\omega)(e^{u_t})(C_t^N)^{-\eta+\theta}\right)^{-1/\eta} \text{ for } n \neq \theta,$$
$$U(C_t^T, C_t^N) = \left(\omega(C_t^T)^{-\eta} + (1-\omega)(e^{u_t})lnC_t^N\right)^{-1/\eta} \text{ for } n = \theta,$$

subject to the budget constraint

$$A_0 + \sum_{t=0}^{\infty} p(s^t)(Y_t^d(s^t) - p_t^N(s^t)C_t^N(s^t) - C_t^T(s^t) - (K_{t+1}(s^t) - (1-\delta)K_t(s^t))) \geq 0, \tag{10}$$

where C_T, C_N denote the consumption of tradable and nontradable goods respectively, u_t is normally distributed preference shock, $p(s^t)$ is the price of a unit good T consumption in state s^t in terms of unit goods T at time 0, Y_t^d is household's disposable income measured in tradable goods and p_t^N is the relative price of non-tradable goods and $K_{t+1} - (1-\delta)K_t$ denotes the accumulation of capital and K_0 is given. If the parameter θ in the utility function differs from zero, preferences are not homothetic and there will be income effects in the relative demand for tradable and non-tradable goods.

The first order condition for this problem imply the following equilibrium condition:

$$ln\left(\frac{C_t^N}{C_t^T}\right) = \frac{1}{1+\eta}ln\frac{1-\omega}{\omega} - \frac{1}{1+\eta}lnp_t^N + \frac{\theta}{1+\eta}ln\left(C_t^N\right) + \epsilon_t. \tag{11}$$

The parameter of interest, the elasticity of substitution in the demand for nontradable goods relative to tradable goods, is given by $v = 1/(1+\eta)$.

4.1.2 Data

The estimation of the elasticity of substitution in the demand for nontradable goods relative to tradable goods in Argentina is performed with the data obtained from official sources. Rozada et al. (2004) created two data sets for the period 1993-2001. The first one, which is created based on *the National Accounts Procedure* described below, contains data on the consumption of tradable and non-tradable goods constructed from the national income and product accounts following the flow of goods approach (see equation (12)). The corresponding prices are the implicit prices in the national income accounts. The second data set, which is created based on *Simplified National Accounts Procedure*, uses data on the consumption of non-durable goods (tradable goods) and services (non-tradable goods) and price indices for these categories of goods computed from the consumer price index dataset. In the remainder of the this sub-section, I will briefly describe these two methodologies used in the construction of the data:[2]

National Accounts Procedure:

According to this procedure, total GDP is assumed to be the sum of total value added in the nine sectors of the economy (sectors are (i) Agriculture, Hunting and Fishing; (ii) Mining; (iii) Manufacturing; (iv) Public Utilities: Electricity, Gas and Water; (v) Construction; (vi) Wholesale and Retail Trade, Restaurants and Hotels; (vii) Transportation, Communication and Storage; (viii) Finance, Insurance, and Real Estate; (ix) Personal, Social and Community Services). As briefly mentioned before, Rozada et al. (2004) are able to get the final private consumption expenditure data for each of the nine sectors from the official sources. However, in the paper, they also construct their own data on the consumption of tradable and nontradable goods as a way of checking the data from the official sources.

Rozada et al. (2004) have time series for the nominal and the real GDP in terms of the nine sectors

[2] Rozada et al. (2004) construct their own series for the consumption of tradable and nontradable goods using the *National Accounts Procedure*, and obtain time series for consumption of tradable and non-tradable goods from the official sources which uses the same methodology in the construction of consumption and price data. In the estimation exercise, however, the use the latter because they argue that the levels of consumption look more plausible. An interested reader can refer to Appendix 2 of the working paper version this article (see Neumeyer and Rozada (2003)) for further discussion about the construction of the data.

of the economic activity for the period 1993-2002. Final private consumption for each of the nine sectors is available only for four points in time (1960, 1963, 1973 and 1997) in which Input-Output Matrix was estimated by National Institute of Statistics and Census (INDEC). The data is reliable but scarce and would not allow them to run the regressions. In order to obtain time series data for the final private consumption for each of the nine sectors in GDP, they use the following relation:

$$C_{i,t} = Y_{i,t} - \sum_{j} IC_{ij,t} - (X_{i,t} - M_{i,t}) - I_{i,t}. \tag{12}$$

where C_i, Y_i, X_i, M_i, I_i denote consumption, gross production, exports, imports and investment in sector i, and IC_{ij} denotes the intermediate consumption of good i in sector j. The corresponding prices are the implicit prices in the national income accounts. Final private consumption in sector i is GDP net of the consumption of intermediate inputs, investment and net exports. As they discuss in the paper, the first problem for implementing this equation is that there is no investment data for each sector. In Argentina gross fixed investment is divided into two sectors: non-residential construction and manufacturing. They assume that investment in every other sector is zero, so their series for consumption will include the change in inventories. $I_t = I_t^m + C_t^{nrc}$ where I_t^m and C_t^{nrc} denote Investment in Manufacturing and Consumption in Non-Residential Construction. The second problem is that they know the input-output structure of the economy only for four points in time. Assuming a constant input-output matrix for a long period of time in which relative prices suffer a large variations would be unsatisfactory. To solve this problem, they assume that final consumption and the demand for intermediate inputs behave similarly and write (12) as (13) assuming (14):

$$C_{i,t} + \sum_{j} IC_{ij,t} = Y_{i,t} - (X_{i,t} - M_{i,t}) - I_{i,t}, \tag{13}$$

$$\frac{C_{i,t}}{\sum_j IC_{ij,t}} = a_i. \tag{14}$$

They obtain a_i as an average of final private consumption for each sector out of intermediate consumption for each sector, from the Input-Output Matrix. Once the consumption data for the nine sectors are obtained, they assume the first four sectors are tradable and the last five are non-tradable, and construct the series for tradable and nontradable consumption. The correlation of nominal (real) nontradable to tradable consumption ratio, C_N/C_T, between the data calculated by the authors and the one obtained from the official sources is 0.64 (0.7). The authors argue that official sources data have a better estimation of the consumption of sectors (2) and (5) due to the fact that they use more disaggregate data. Therefore, they use the official source data in the estimation exercise. Figure 2 in the Appendix presents the time series data obtained from the official sources.

Simplified National Account Procedure:

The second data set employed in this study is constructed as dataset for non-durable goods (tradable goods) and services (non-tradable goods) and the price indices for these categories of goods computed from the consumer price index dataset. They did not give detailed explanation about the construction of this data set in the paper.

4.1.3 Methodology

After getting the data series, they estimate the equilibrium relationship given in (11) to find the intratemporal elasticity of substitution, v. The first step in their estimation procedure is to transform the data by computing the relevant variables in logs; that is, they calculate the log of the real tradable and nontradable consumption, the log of the implicit prices of non tradable and tradable goods. The time trend in the ratio of the consumption of nontradable to tradable goods motivate the flexible functional form for preferences that allow for the non-homothetic case. Since the dataset comprises variables varying with time, second step is to check the order of integration by implementing the standard augmented Dickey-Fuller test on each variable. Augmented Dickey-Fuller test on the variables shows the presence of a unit root in each of the series. Then they check the presence of the cointegrating vector by using Johansen's cointegration test among the ratio between consumption of non tradable and tradable goods, the ratio between the prices of the non tradable and tradable goods and the consumption of non tradable goods in logarithms and expressed in real terms. They find an evidence of cointegration among the variables as predicted by the theoretical model.

Finally, they estimate a VEC model for the three variables. The specification of the error correction model corresponds to the lags, six, and it includes three dummy variables to account for the seasonal cycles.

4.1.4 Estimation Results

They present the results of VEC model for each of the time series they used:

VECM using data from NIPAS

$$ln\left(\frac{C_t^N}{C_t^T}\right) = 14.96 - \underset{(0.20)}{0.4034 lnp_t^N} + \underset{(0.05)}{0.5954 ln\left(C_t^N\right)} \tag{15}$$

All estimated coefficients are statistically significant at the usual significance levels. Equation (15) indicates that the long-run elasticity of substitution between tradable and non tradable goods is about 0.40, which is closer to the estimate of 0.44 obtained by Stockman and Tesar (1995) The coefficient on C_t^N is tightly estimated and indicates strong income effects.

VECM using data from simplified NIPAS

$$ln\left(\frac{C_t^N}{C_t^T}\right) = 13.41 - \underset{(0.366)}{0.4987 lnp_t^N} + \underset{(0.005)}{0.072 ln\left(C_t^N\right)} \tag{16}$$

In order to have an alternative estimation of the elasticity of substitution, they repeat the procedure described above but use the consumption of nondurable goods as a proxy for the consumption of tradable goods and the consumption of services as a proxy for the consumption of nontradable goods. The implicit prices of nondurable and services goods are used to construct the ratio between the prices of nontradable and tradable goods. Equation (16) shows that the long-run elasticity of substitution between tradable and nontradable goods is about 0.50.

Robustness: Different time span

The working paper version of this study by Neumeyer and Rozada (2003) also presents the estimation results based on the data covering the period 1980 first quarter to 1988 fourth quarter for consumption of nondurable goods and services. Using the same approach, the consumption of nondurable goods is used as a proxy for the consumption of nontradable goods, while the consumption of services is used as a proxy for the consumption of nontradable goods. The prices for non durable goods and services are constructed using a geometric price index from the CPI.

$$ln\left(\frac{C_t^N}{C_t^T}\right) = \underset{}{0.0955} - \underset{(0.21)}{0.3882 lnp_t^N} \tag{17}$$

The long run elasticity of substitution between tradable and nontradable goods is about 0.39, which is close to the estimate of the long-run elasticity of substitution for the nineties and it is also close to the 0.44 obtained by Stockman and Tesar (1995).

4.2 The Case of Uruguay

Lorenzo et al. (2005) employ the same methodology to estimate the atemporal elasticity of substitution. Authors create quarterly time series of consumption and prices of tradable and nontradable goods for Uruguay for the period 1983-2002. In the creation of the database, similar procedures described for the case of Argentina are followed; that is, the consumption of tradables and nontradables and the corresponding prices are created using data from official resources according to national accounts procedure and simplified national accounts procedure.

The econometric estimation of the parameter of interest is performed with VEC models. The estimation exercise gives a long-run elasticity of substitution of 0.46. Parametric stability tests are performed on the principal model, and the predictive ability of the model is also tested. They conclude that not only is the parameter of interest stable over time, but the model also has good predictive properties.

5 Conclusion

The existing studies for the estimation of the atemporal elasticity of substitution show that using the KHS cross section data, estimates lie in $[0.43, 0.74]$ range according to the specific subgroup of countries included in the estimation when the income effect is taken into account. The estimated value of the elasticity using annual data for 13 developing countries by Ostry and Reinhart (1992) varied in $[0.75, 1.50]$ range according to the specific subgroup of countries studied and the instrument set used. The research project by Inter American Development Bank for the estimation of the intratemporal elasticity of substitution for the Latin American countries (Argentina and Uruguay) indicates that the elasticity lies in $[0.4, 0.5]$ range.

6 Appendix

6.1 KHS Dataset

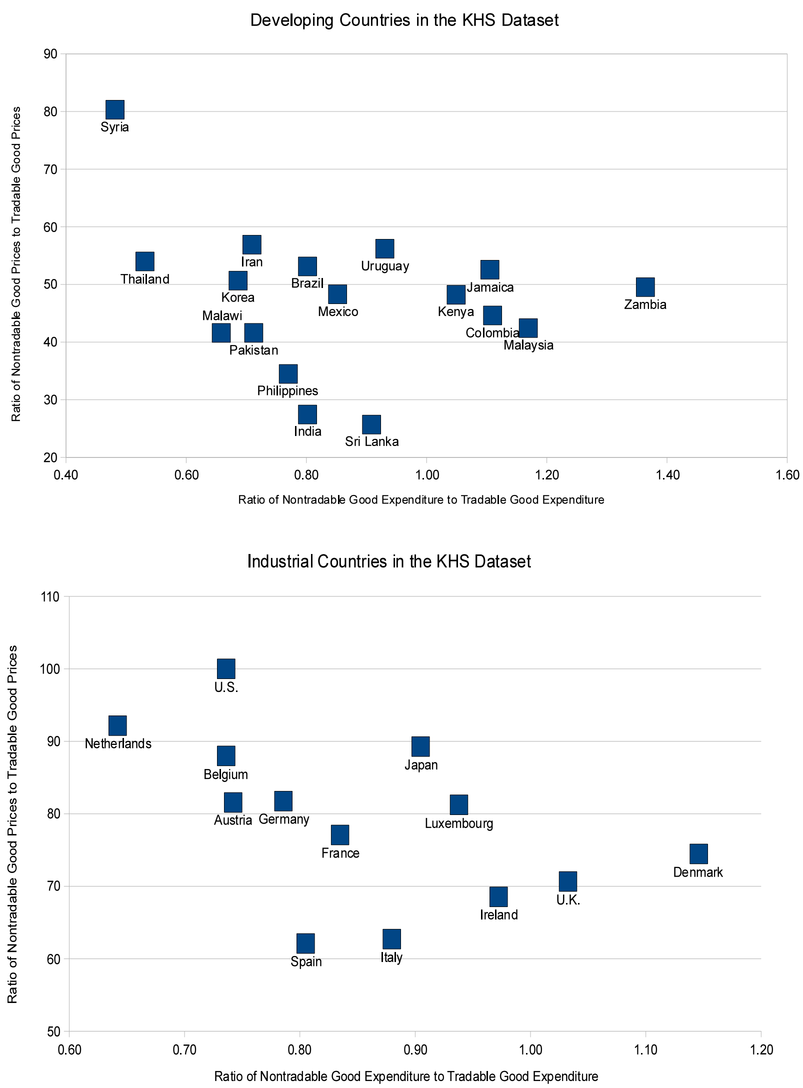

Figure 1: Scatter Plot of the Ratio of Nontradable Good Prices to Tradable Good Prices versus the Ratio of Nontradable Good Expenditure to Tradable Good Expenditure for Developing Countries (upper panel) and Industrial Countries (lower panel) in the KHS Dataset.

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