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ONE OR MANY EUROPEAN UNION COTTON DEMANDS?

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Abstract

The 2005 Textile and Clothing import quota elimination will have important impacts on world cotton trade. Since the European Union is the world largest importer of cotton, evaluation of the 2005 quota liberalization requires appropriate and accurate EU cotton demand parameter estimation. This paper explores the cotton demand parameters of the aggregated European Union and some EU members at home consumption levels and calculates own and cross price elasticities and expenditure elasticities. Unlike previous studies, this research uses available for home use data and a demand system approach including wool as a cotton's competitive commodity. One of the advantages of a demand system approach is that it has proven to better capture the strong interrelationship between commodities, providing more accurate parameter estimates. The study concentrates on a pooled Almost Ideal Demand System model estimated over time series using country disaggregated annual data. Country differences in fiber consumption are separated from the error term by introducing dummy variables into the model. These dummy variables capture country differences in demographic and geographic characteristics and are incorporated into the model by using translating techniques. Results suggest that European Union cotton fiber demands are no homogeneous across the board and might need to be treated separately.

Introduction

The European Union has been the largest cotton importer for the last forty years and ranks among the six largest cotton consuming countries. According to the U.S. Department of Agriculture (2003b), the EU imports of cotton constitute about 14% of world total imports. In 2001, according to the European Commission, the European Union imported $64.73 billion in textiles and $3.7 billion in cotton. Of all textiles imported to the EU, eighteen countries accounted for two-thirds of all textile imports, worth approximately $45 billion. In order of major exports to the EU, those countries were China, Turkey, India, Bangladesh, Tunisia, Hong Kong, Romania, Morocco, Indonesia, Poland, Pakistan, and the U.S.

For crop years 1998/1999-2002/2003, the world's six largest cotton-consuming countries have been China, India, the United States, Pakistan, Turkey, and the European Union. Within the European Union itself, the five largest cotton-consuming countries for 1998/1999 to 2002/2003 were Italy, Greece, Portugal, Germany, and Spain. For the same period, the five largest cotton-importing countries were Italy, Portugal, Germany, France and Belgium-Luxembourg.

When analyzing the EU cotton demand, three important facts need to be considered: (a) cotton demand has been increasing in some countries and decreasing in others, (b) per capita cotton mill consumption and available for home use are different variables (the latter adjusted for exports and imports of textiles) and have different trends in some EU countries, and (c) the aggregated European Cotton demand offsets the increasing trends in some countries with the decreasing trends in others. Figure 1 illustrates how cotton mill consumption has been decreasing in France, while it has remained stable in Greece and Germany. Additionally, the cotton mill consumption trend in most cases differs from the trend of cotton available for home use. This is also the case for manmade fiber and wool. In general, it can be argued that the trends are different in France, Belgium-Luxembourg, Netherlands, United Kingdom, Denmark, Ireland, Greece, Austria, Finland, and Sweden; while they are similar in Germany, Italy, Spain, and Portugal. In the case of wool, the mill consumption trend and the available for home use trend are different in Belgium-Luxembourg, Denmark, Austria and Sweden, while they are similar in all other countries. Finally, in the manmade fiber case, the trends are different in Belgium-Luxembourg, Denmark, and Greece, while they are similar in all others (see Lopez, 2004 for more details).

Figure 2 shows how the aggregated EU cotton consumption offsets the increasing trends in some EU countries with the decreasing trend in others. Cotton mill consumption has been decreasing in the aggregated EU, but it has been increasing in countries such as Greece and Portugal. Given these country differences in cotton consumption, it might not be appropriate to treat the fifteen EU members cotton demand as an aggregate.

Previous studies have used only mill consumption to estimate the EU consumer demand for cotton with most of them using aggregated European Union cotton consumption data. Given that available for home use data is more consistent with demand theory, this data should be used when estimating the EU cotton demand parameters. Therefore, previous methodological choices might not be appropriate for the estimation of the true parameters of the European cotton demand. Additionally, given the 2005 final elimination of quotas by the Agreement on Textiles and Clothing (ATC), it is important that the demand of the world largest cotton importer be appropriately treated.

Since the European Union imports textiles and cotton from about 100 countries (European Commission, 2003). All countries involved in textile, clothing, and cotton trade with the EU will benefit from an appropriate estimation of the EU cotton demand parameters. The primary objective of this paper is to describe the EU countries' demands in terms of its elasticity values to determine if the demand aggregation is adequate.

Methods and Procedures

The Almost Ideal Demand System (AIDS), developed by Deaton and Muelbauer (1980) does not assume a particular utility function, but it does allow testing or imposing the classical theoretical demand restrictions and satisfies the axioms of choice exactly. In the AIDS model, the Marshallian demand function for commodity "i" in share form is specified as:

$$(1)\quad w_{it} = \alpha_i + \sum_j \gamma_{ij}\, log(p_{jt}) + \beta_i\, log[Y_t/P_t] + \varepsilon_{it}$$

where w_{it} = budget share of commodity i in period t,
p_{jt} = price of commodity j in period t,
Y_t = total expenditure on set of commodities,
α_i, β_i and γ_{ij} are parameters,
ε_i = disturbance term, and
P_t = a price index.

The price index P_t, in a nonlinear approximation of the AIDS model, is defined as:

$$(2)\quad Log\,(P_t) = \alpha_0 + \sum_k \alpha_k\, log\,(p_{kt}) + \frac{1}{2} \sum_k \sum_j \gamma_{kj}\, log(p_{kt})\, log(p_{jt})$$

The theoretical classical properties of demand are incorporated into the model by imposing restriction on the model parameters as follows:

(3) Adding-up: $\sum_i \alpha_i = 1$, $\sum_j \gamma_{ij} = 0$, and $\sum_i \beta_i = 0$;

(4) Homogeneity: $\sum_i \gamma_{ij} = 0$;

(5) Symmetry: $\gamma_{ij} = \gamma_{ji}$

Consequently, the use of this demand estimation methodology allows for the empirical estimation to be consistent with the restrictions of the modern consumer theory. The commodities considered in this study are cotton, manmade fiber, and wool. One equation is omitted in the estimation of this system, but the parameters of that equation are recovered by making use of the theoretical classical properties. Usually the equation excluded is the one holding the smallest budget share. Data on fiber home consumption and population for the European Union countries for the period 1979 to 1992 are taken from *World Apparel Consumption Survey* (United Nations, 1983, 1985, 1989, 1992, 1994). Greece's cotton price, the United States actual polyester price, and the United Kingdom wool price are representative of the cotton price, manmade fiber price, and wool price in each European Union country. The cotton price in Greece is reported in *Cotton: World Statistics* (International Cotton Advisory Committee, 2002) in SM 1-1/16 inches prior to 1981, and Middling 1-3/32 inches since. The United States polyester price is reported in *Cotton and Wool Situation and Outlook Yearbook* (U.S. Department of Agriculture, 2003a) at f.o.b. producing plants. The United Kingdom wool price is provided by the *International Monetary Fund.* This study uses the 64s c.i.f. EQ wool price. All three prices are converted to real prices in U.S. cents/kilogram.

Given data availability of home equivalent consumption, this study pools cross sectional (country disaggregated) and time series annual data. From the perspective of the consumer behavior it is more appropriate to use home equivalent consumption than mill (industry) consumption. When pooling data, dummy variables for each country are introduced into the country disaggregated model as intercept and real expenditure shifters (see Lopez, 2004 for more details). The aggregated European Union model only makes use of dummy variables as intercept shifters. Demographic translating techniques as explained by Pollak and Wales (1981) are used for the introduction of the dummy variables in the demand system. Medina's (2000) Ph.D. dissertation also uses demographic translating as part of the AIDS model specification.

Results

The nonlinear system of equations was estimated using maximum likelihood. The parameters were calculated using Shazam econometric software and the restrictions are imposed in the coefficients as indicated in (3), (4), and (5). Autocorrelation was successfully corrected.

For convenience parameter estimates are not reported in this study. However, most of the parameters are significant at a 90% statistical certainty level with parameters α_i, γ_{i1}, and γ_{i2} significantly different from zero with less than 0.01% probability of error. Additionally, the R squared in the aggregated model and the country-disaggregated model are about 0.80 in each equation.

Table 1 provides the elasticity results for France, Germany, Italy, Spain, and the United Kingdom from the country disaggregated model and the elasticity results for the European Union from the aggregated model. All other EU countries' elasticity estimates are reported in Lopez (2004).

All Marshallian and Hicksian own price elasticity estimates are negative as expected. The aggregated Marshallian cotton own price elasticity estimate is close to Meyer's (2002) elasticity result of -0.55. The Marshallian price elasticity provides the gross effect by taking into account the substitution and income effects while the Hicksian elasticity reports the net effect by taking into account only the substitution effect. The resulting cotton-manmade cross price elasticities reveal that cotton and manmade fiber are net complements in France, Germany, and Spain while they are net substitutes in Italy, and the United Kingdom. However, cotton and manmade fiber are gross complements in all six countries. These country differences in elasticity estimates are not captured when aggregating the European Union in one elasticity value. For instance, the aggregated Hicksian cotton-manmade cross price elasticity only reveals that cotton and manmade fiber are substitute products.

Negative Hicksian cotton-manmade cross price elasticities may be explained by the pressure in the European Textile and Clothing Industry for innovation, quality, creativity, design, and fashion, influencing fiber composition in textiles and clothing. Furthermore, the presence of the textile and clothing industry is different in each EU country. For example, some southern countries such as Spain, Portugal, and Greece have higher concentration on clothing, while countries such as the Netherlands, Sweden, Belgium, and Austria have focused their activities on the textile sector (Stengg, 2001). Additionally, labor productivity, value added per hourly wage cost, textile employment, and clothing employment vary from country to country in the European Union (Stengg, 2001).

Unlike cotton and manmade fiber price elasticities, wool elasticities are relatively higher, especially in the aggregated case. However, wool elasticities are expected to be higher than cotton or manmade fiber elasticities since wool only accounted for a 7% expenditure share, while cotton and manmade fiber accounted for a 43% and 50% expenditure share respectively.

The expenditure elasticities measure the percentage change in the demand of cotton for a 1% change in total expenditure. If the expenditure elasticity is positive, the commodity is normal; however, if it is negative the commodity is inferior. Similarly if the expenditure elasticity is greater than one, the commodity is a normal luxury commodity, while if it is less than one, the commodity is normal necessary commodity. Expenditure elasticities are reported at the bottom of Table 1. Cotton is a normal necessary commodity in Italy, while it a normal luxury commodity in France, Germany, Greece, Spain, and Portugal. Unlike the country-disaggregated case, the aggregated EU expenditure elasticity reveals that cotton is only a normal luxury commodity. On the other hand, wool is a normal necessary commodity, normal luxury commodity, or even an inferior commodity depending on the country. The aggregated cotton expenditure elasticity estimate is close to Coleman and Thigpen's (1991) elasticity of 1.08.

Figure 3 to Figure 6 show a comparison of the most relevant cotton elasticities: Marshallian cotton own price elasticity, Hicksian cotton own price elasticity, Hicksian cotton-manmade cross price elasticity, and cotton expenditure elasticity. The variability in the elasticity estimates reveal that a better approximation of the European Union elasticities can be obtained by calculating individual country elasticities. The Marshallian cotton own price elasticity ranges from -0.38 in Italy to -0.63 in Germany while the Hicksian cotton own price elasticity ranges from -0.020 in France to -0.044 in Greece and Germany. However, the Hicksian cotton-manmade cross price elasticity ranges from -0.30 in France to 0.36 in Italy, and the cotton expenditure elasticity ranges from 0.77 in Italy to 1.42 in France.

Conclusion

The European Union is the world largest cotton importer, purchasing textiles and cotton from about 100 countries. The country variability in the European Union Marshallian and Hicksian price elasticities and expenditure elasticities suggest that a better approximation of the EU cotton demand elasticities can be obtained by considering individual countries or group of countries. There seems to be important differences in the cross price and expenditure elasticities that are not captured when considering only the aggregated EU demand parameter estimates. Given that available for home use data is more consistent with demand theory, this approach should be used when estimating the EU fiber demand elasticities instead of mill consumption data.

Unlike previous studies, this research uses available for home use data, which allows a better estimation of the consumer demand of cotton in terms of its elasticity values. It also makes use of a demand system approach, which better capture the interrelationship among commodities, providing parameter estimates that are accurate and consistent with demand theory. Results from this study could be used in word cotton/textile trade models to more appropriately simulate changes induced by the ATC quota elimination agreement on world markets.

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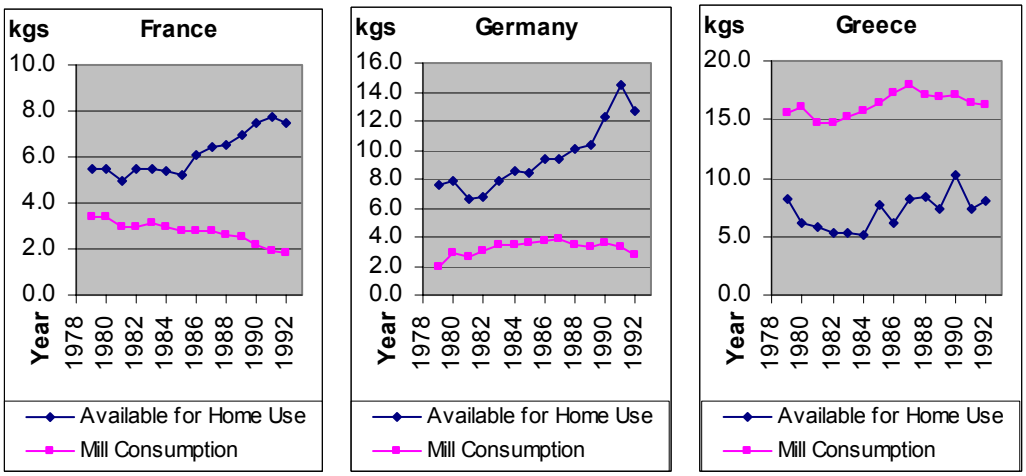
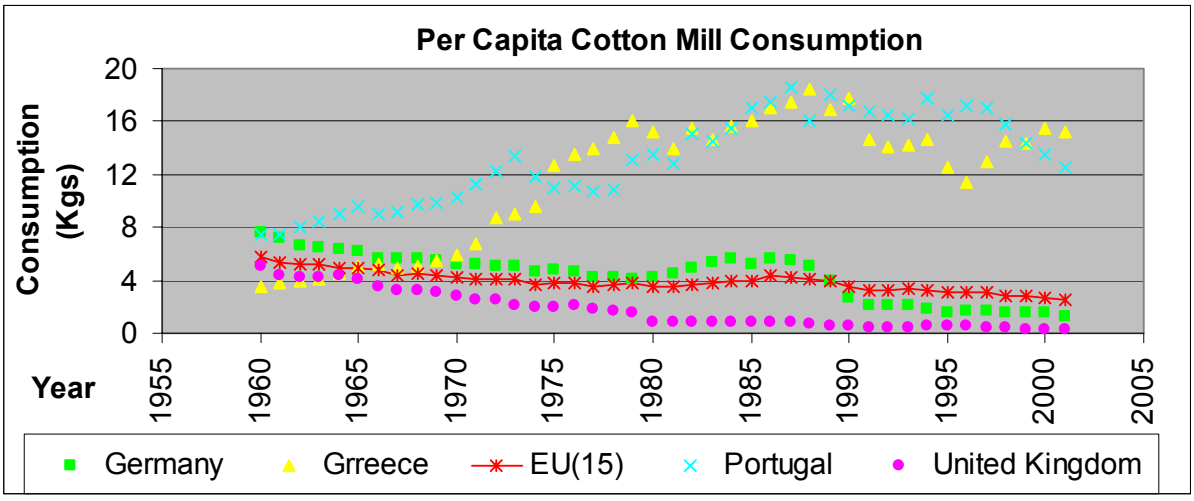
Table 1 Aggregated and Disaggregated European Union Countries Elasticity Estimates, Available for Home Use Data.

	France	Germany	Greece	Italy	Spain	U Kingdom	EU
Marshallian Price Elasticity							
Cotton-Cotton	-0.63022	-0.63354	-0.48293	-0.37557	-0.48467	-0.48345	-0.4786952
Cotton-Manmade	-0.62049	-0.62382	-0.47320	-0.36585	-0.47494	-0.47372	-0.4831041
Cotton-Wool	-0.22741	-0.23074	-0.08012	0.02723	-0.08187	-0.08065	-0.684242
Manmade-Cotton	-0.22588	-0.30528	-0.44183	-0.61998	-0.35380	-0.39517	-0.4651607
Manmade-Manmade	-0.35392	-0.43332	-0.56987	-0.74801	-0.48184	-0.52320	-0.5262918
Manmade-Wool	0.09794	0.01853	-0.11801	-0.29616	-0.02999	-0.07135	-0.7096752
Wool-Cotton	0.87649	1.02248	0.98990	1.16412	0.83332	0.90151	-5.8235969
Wool-Manmade	-0.49211	-0.34612	-0.37870	-0.20447	-0.53528	-0.46709	-8.1041854
Wool-Wool	-1.34895	-1.20296	-1.23554	-1.06131	-1.39212	-1.32393	-1.7620277
Hicksian Price Elasticity							
Cotton-Cotton	-0.02016	-0.04241	-0.04441	-0.04441	-0.02295	-0.03491	-0.0240276
Cotton-Manmade	-0.29927	-0.22186	0.06758	0.35605	-0.02366	0.01961	0.0421931
Cotton-Wool	-0.15869	-0.22383	-0.05942	-0.02583	0.00513	-0.02252	-0.6642068
Manmade-Cotton	0.38417	0.28585	-0.00331	-0.28881	0.10791	0.05337	-0.0104931
Manmade-Manmade	-0.03269	-0.03137	-0.02909	-0.02612	-0.03056	-0.02987	-0.0009946
Manmade-Wool	0.16666	0.02545	-0.09731	-0.34922	0.05701	-0.01322	-0.6896400
Wool-Cotton	1.27681	1.06274	1.11051	0.85502	1.34012	1.24013	-5.7068851
Wool-Manmade	-0.02899	-0.29955	-0.23917	-0.56207	0.05102	-0.07536	-7.9691662
Wool-Wool	-1.28023	-1.19605	-1.21484	-1.11438	-1.30512	-1.26580	-1.7419925
Expenditure Elasticity							
Cotton	1.42052	1.37647	1.02110	0.77113	1.07512	1.04443	1.0587044
Manmade	0.64656	0.80905	1.08848	1.45303	0.90834	0.99298	1.0573164
Wool	0.93216	0.09375	0.28085	-0.71977	1.18010	0.78848	0.2717661



Source: World Apparel Consumption Survey, FAO.

Figure 1. France, Germany, and Greece Per Capita Cotton Mill Consumption and Available for Home Use for the Period 1979 to 1992.



Source: Mill Consumption from USDA-ERS-PSD Database. Population from IMF.

Figure 2. Per Capita Cotton Mill Consumption for the Aggregated European Union and Selected European Union Countries.

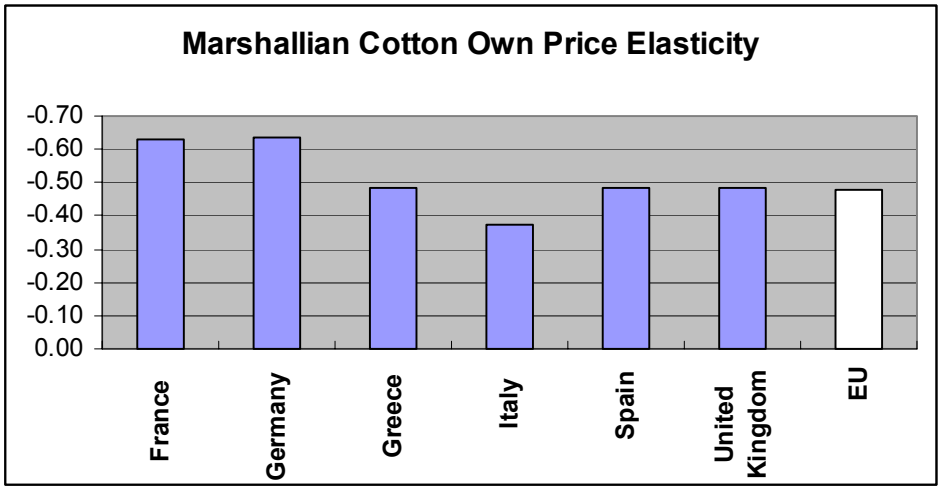


Figure 3. Marshallion Cotton Own Price Elasticity Results for the Aggregated European Union and Selected European Union Countries.

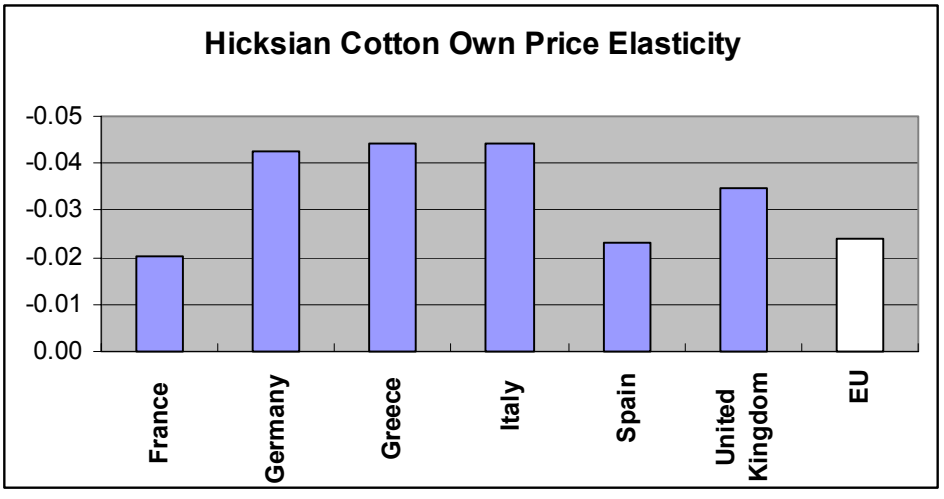


Figure 4. Hicksian Cotton Own Price Elasticity Results for the Aggregated European Union and Selected European Union Countries.

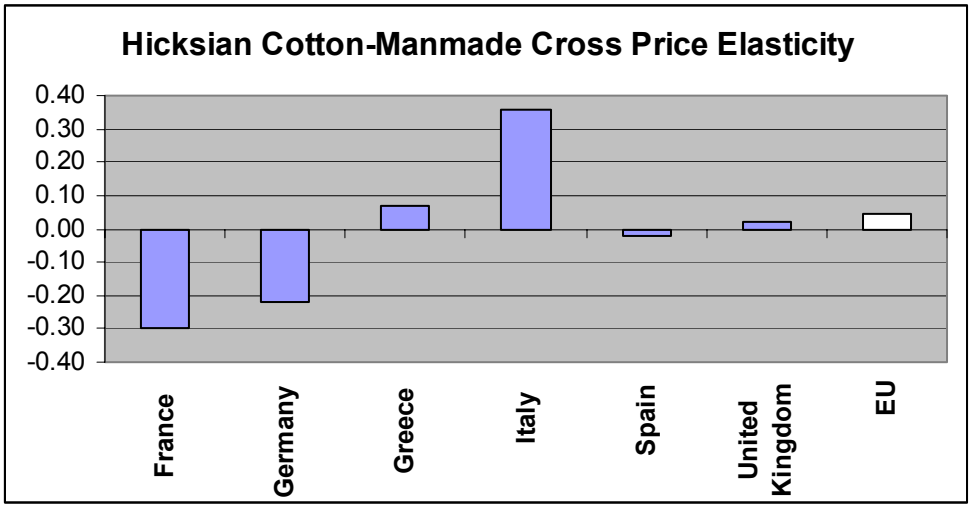


Figure 5. Hicksian Cotton-Manmade Cross Price Elasticity Results for the Aggregated European Union and Selected European Union Countries.

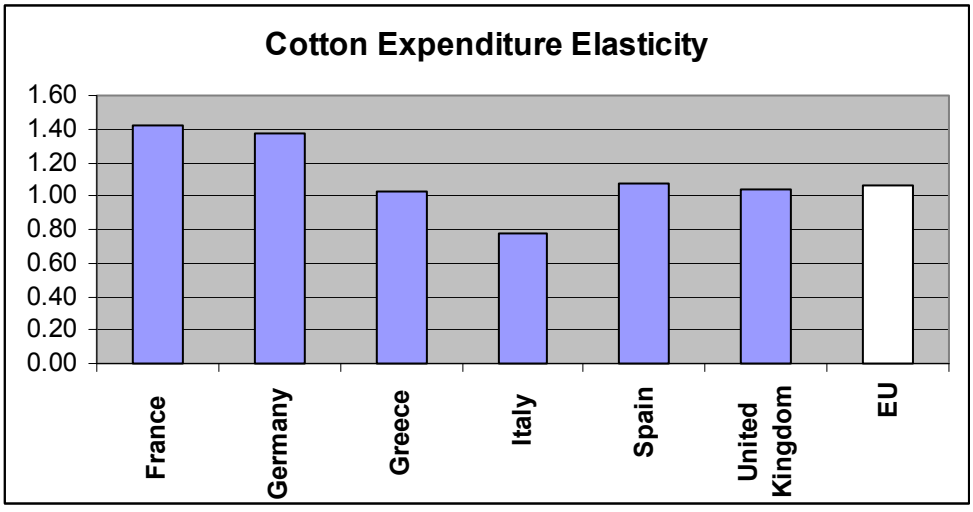


Figure 6. Cotton Expenditure Elasticity Results for the Aggregated European Union and Selected European Union Countries.