AN ALTERNATIVE MODEL FOR THE TRADE BALANCE OF COUNTRIES WITH OPEN ECONOMIES: THE SPANISH CASE

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Abstract:
The main aim of this work is to present an analytical reformulation of the Marshall-Lerner condition based on consistent microeconomics foundations for countries with open economies and also to present an alternative to the traditional models used to explain the behaviour of the trade balance in Spain: the specification highlights the simultaneous and direct interdependence of exports and imports flows, the counter cyclical impact of the domestic demand on exports and the impact of investment on imports and some of its theoretical implications. Non linear simultaneous estimation, co-integration techniques, and a battery of specification tests are the econometric tools applied in this part of the paper.

Introduction.
Many empirical analyses have been conducted into how exchange rate affects the trade balance of different countries and whether the Marshall-Lerner condition holds\(^1\). Despite the plethora of theoretical and empirical research, there is still considerable disagreement concerning the relationships between these economics variables and the effectiveness of currency devaluation as a tool for increasing a country’s balance of trade. Consequently, the effect of exchange rate changes on trade balance must be considered an open question from both analytical and empirical perspectives.

The primary purpose of this paper is to present an analytical reformulation of the Marshall-Lerner condition based on a microeconomic approach to the exports and imports flows in which is highlighted the simultaneous relationships between them and agree with empirical intuition observed in countries with open economies.

\(^1\) See for example, Wilson, 2001, on Malaysia, Korea and Singapore
A second purpose of the paper is to present and discuss econometric estimates of a two simultaneous equation model, intend to explain Spanish imports and exports of goods and services (excluding tourism) and to discuss specific features of the model, not found in other standard specifications of foreign trade equations that might be applicable in other cases. This problem has been studied previously (e.g. Mauleón I and Sastre L. 1994 and 1996). This model should be able to explain in a satisfactory way, not only the traditional determinants of this flows but also the main factors acting to explain the evolution of the trade balance evolution as a result of the transformation of the Spain in an highly open economy in the studied period.

The rest of this paper is organized as follows. Section III presents a brief summary and the conclusions. Finally, in the appendix the data which has been used are presented.

I. THE THEORETICAL MODEL.

I.a. A theoretical approach to the function of exports and imports in an open economy.

Generally in the modern macroeconomic literature, the exports and imports flows determinants of an small country are derived from models in which we assume two countries with a representative agent. The demand for exports and imports functions are obtained by a dynamic optimisation process, in which the agent obtained his inter temporary utility from the consumption of two sort of goods, one produced domestically (no tradable) and other import good (tradable) subject also by a inter temporary budget restriction.

The problem that the representative agent face is as follows

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2 See Reinhart (1995) and Misa, Ramirez and Silva (2001)
3 This problem was solved by Misas, Ramirez and Silva (2001) with an utility function Cobb-Douglas
\[ MaxU = \int_{t=0}^{\infty} e^{-\beta t} u(n_t, m_t) dt \]
\[ s.a \]
\[ g = d_t + x_t (p^x / p^f), + g_t (p / p^f), - n_t - m_t (p^m / p^f), \]

Where \( \beta \) is the subject discount rate of the representative agent. The inter temporary budget restriction is set by the budget variation \( g \), which movements are due to the differences between an initial budget \( g \), an amount of goods produced domestically \( d \) and the exports \( x \) minus the internal consumption expenditure on no tradable goods \( n \) and tradable \( m \). Exports and imports are deflected by the foreign level price; the ratio between exports price and the foreign level price \( (p^x / p^f) \) and the ratio between the import prices and the foreign level price \( (p^m / p^f) \), are measuring respectively the acquisition power of exports and imports in terms of foreign currency.

Assuming an utility function of the sort ESC\(^3\) (Constant Elasticity of Substitution), we have the following problem of dynamic optimisation:

\[ MaxU = \int_{t=0}^{\infty} e^{-\beta t} \left[ \frac{1}{p} Ln(\theta n_t^{-\theta} + (1-\theta)m_t^{-\theta}) \right] dt \]
\[ s.a \]
\[ g = d_t + x_t (p^x / p^f), + g_t (p / p^f), - n_t - m_t (p^m / p^f), \]

The problem can be solved by the optimal control theory, where the control variables are: no tradable goods demand and imports demand, besides the state variable is the budget and the variable co-state is the dynamic multiplier associated to the problem.

The respective Hamiltonian is:

\[ H(g_t, n_t, m_t, \lambda_t) = e^{-\beta t} \left[ \frac{1}{p} Ln(\theta n_t^{-\theta} + (1-\theta)m_t^{-\theta}) \right] + \lambda_t (d_t + x_t (p^x / p^f), + g_t (p / p^f), - n_t - m_t (p^m / p^f), ) \]

The first order conditions are:

\[ \lambda_t (d_t + x_t (p^x / p^f), + g_t (p / p^f), - n_t - m_t (p^m / p^f), ) \]
\[
\frac{\partial H}{\partial n} = \ell^{-\rho} \left( -\frac{1}{p} \right) \frac{\theta(-p)n^{-\rho-1}}{\theta n^{-\rho} + (1 - \theta)m^{-\rho}} - \lambda_t = 0
\]
(4)

\[
\frac{\partial H}{\partial m} = \ell^{-\rho} \left( -\frac{1}{p} \right) \frac{(1 - \theta(-p)n^{-\rho-1})}{\theta n^{-\rho} + (1 - \theta)m^{-\rho}} - \lambda_t \left( \frac{p^m}{p^m} \right) = 0
\]
(5)

\[
\frac{\partial H}{\partial \lambda} = g = d_t + x_t \left( \frac{p^f}{p^f} \right)_t + g_t \left( \frac{p^x}{p^x} \right)_t - n_t - m_t \left( \frac{p^m}{p^m} \right)_t
\]
(6)

\[-\frac{\partial H}{\partial \lambda} = \dot{\lambda} = -\dot{\lambda}_t \left( \frac{p^m}{p^m} \right)_t
\]
(7)

\[\text{Lim}_{t \to \infty} \lambda_t g_t = 0
\]
(8)

The equation number (8) mean that at the end of this economy, the shadow price that the agents assign to the budget is zero (\( \lambda = 0 \)) or (\( g = 0 \))

Handling the (4) and (5) equations, we obtain the relationship between the no tradable goods and the import demand

\[m_t = \left\{ \frac{(1 - \theta)}{\theta} \left( \frac{p^f}{p^m} \right)_t \right\}^\sigma n_t
\]
(9)

In the steady state, the growth of the estate, co-estate and control variables is zero and assuming the “market cleaning” condition what imply \( d_t = n_t \), we have the domestic import demand function:

\[m_t \left( \frac{p^m}{p^f} \right)_t = g_t \left( \frac{p}{p^f} \right)_t + x_t \left( \frac{p^x}{p^f} \right)_t
\]
(10)

In logarithms, the equation (9) will be

\[\text{ln}_t = l \left\{ g_t \left( \frac{p}{p^f} \right)_t + x_t \left( \frac{p^x}{p^f} \right)_t \right\} + l \left( \frac{p^f}{p^m} \right)_t
\]
(11)

By symmetry, the domestic export demand is
Since we suppose two countries, the general equilibrium condition would be

\[
x_i = m'_{i}; \text{and;} \: x'_i = m, \text{ the equation (11) would be the follows:}
\]

\[
Ixx = l\left\{ g_{i}^{f} + m_{i} \left( \frac{p^{m}}{p'^{f}} \right) \right\} + l\left( \frac{p'^{f}}{p^{m}} \right), \quad (13)
\]


The theoretical model proposed in this work would have implications on the Marshall-Lerner condition, since:

Defining \( tcr = \frac{p'}{p'^{f}} * \frac{p'^{f}}{p'^{m}} \)

The exports function would be

\[
x = \phi(g, tcr, m) \quad (14)
\]

The imports function expressed in national production units, would be :

\[
m = tcr * \phi(g^f, tcr, x) \quad (15)
\]

TRADE BALANCE = \( BC = x - m = \phi(g, tcr, m) - tcr * \phi(g^f, tcr, x) \quad (16)\)

Calculating the total impact of the exchange rate on trade balance, would have:

\[
dx / dtrc = dx / dtrc - dm / dtrc
dx / dtrc - dm / dtrc = (\partial x / \partial m) * (\partial m / \partial trc) + \partial x / \partial trc -
(m - tcr * ((\partial m / \partial x) * (\partial x / \partial trc) + (\partial m / \partial trc))

Taking into account that price-elasticity of exports and imports and elasticity imports- exports and exports-imports, would be:
\[
\epsilon_{x,tcr} = (\partial x / \partial tcr) \ast (tcr / x)
\]
\[
\epsilon_{m,tcr} = (\partial m / \partial tcr) \ast (tcr / m)
\]
\[
\epsilon_{m,x} = (\partial m / \partial x) \ast (x / m)
\]
\[
\epsilon_{x,m} = (\partial x / \partial m) \ast (m / x)
\]

and in the equilibrium \( BC=0 \), therefore \( x = tcr \ast m \)

\[
dBC / dtcr = m \ast (\epsilon_{x,tcr} (1 + \epsilon_{x,m}) + \epsilon_{m,tcr} (1 + \epsilon_{m,x}) - 1) = 0
\]

the trade balance would improve by an exchange rate devaluation, when

\[
dBC / dtcr > 0; \quad (\epsilon_{x,tcr} (1 + \epsilon_{x,m}) + \epsilon_{m,tcr} (1 + \epsilon_{m,x}) > 1)
\]

(17)

IF \( \epsilon_{m,x} = 0 \) and \( \epsilon_{x,m} = 0 \)

\[
dBC / dtcr > 0; \quad \text{When } (\epsilon_{x,tcr} + \epsilon_{m,tcr} > 1) \quad \text{then the Marshall-Lerner Condition holds}
\]

In economies with a high degree of openness \( \epsilon_{m,x} \neq 0 \) and \( \epsilon_{x,m} \neq 0 \) and taking into account (16).

To sum up: “in the long run, the impact of the exchange rate on trade balance, would depend not only of the elasticity’s-prices of _exports and imports but also of the cross elasticity’s between imports and exports”.

II. AN ECONOMETRIC MODEL FOR THE SPANISH TRADE BALANCE

II.a. Some of the main features of the Spanish trade balance.

The main characteristics of the trade balance evolution, during the period 1968-2002, as a result of the transformation of Spain in an highly open economy, have been: first, the strong correlation between exports and imports flows, and second the counter cyclical behaviour of the trade balance that has restrained the growing cycle of the Spanish economy.

Spain is a medium sized country in the European economy and is becoming increasingly open, according to a conventional measure of the degree of openness, (exports plus
imports over GDP). In the Fig nº 1, we can compute a growing trend in the period 1965-2002, from about ten per cent in 1965 to about sixty four per cent in 2000.

In the Fig nº.2, is shown the evolution of the import and export series expressed in logarithms and is possible to observe the clear correlation between the two series.
As is well known by the experts of the Spanish foreign sector, the trade balance has a negative effect on the growing cycle of the Spanish economy. This impact is produced, and proved in the econometric analysis, not only by the positive impact of the GDP growth on the imports but also through the negative effect of the domestic demand on exports.
In the Fig nº 3 it is shown the evolution of the exports and the domestic demand expressed in logarithm variation rates. In this period, we can observe that from 1976, year of the change in the former political system and the beginning of an important opening of the economic system, the evolution of the variation rate of exports shows an opposite behaviour to that of the domestic demand. This means that export firms are more actives when the domestic market is weaker.

**II.b. Empirical analysis**

Most of the empirical studies of the trade balance in Spain are based on a single equation model for exports and imports that does not include the simultaneous and direct interdependence between them, as reported by Escribano (1996). There exist a large set of studies of this type, among them can be emphasized Fernandez y Sebastian (1991) and Buisan y Gordo (1994), those works following co-integration techniques and estimating traditional equations to the no-energetic exports and imports. Mauleón and
Sastre (1994) applied co-integration analysis and outlined a model as a simultaneous problem using the imports as determinant of the exports and vice versa. Alonso (1999) tried to set the roll played by the trade balance as a restriction to the economic growth in Spain, the import and export equations used in this work shows, in the short run, exports and imports respectively as determinants what, in part, would confirm the viewpoint of Mauleón and Sastre.

The traditional theoretical approach to obtain the demand for imports and exports is based on the assumption of a small country, the national and rest of the world economies are price takers, which means that the elasticity of export supply by the national economy and the elasticity of import supply by the rest of the world are infinite. This assumption can be accepted to the imports but it is not reasonable to the exports to suppose that changes in the demand do not affect the price level. If the demand equation is estimated not taking into account the supply equation, the estimators obtained would be biased. To avoid this possibility would be necessary add in the specification of the equation a variable of supply (see Portugal 1993).

The basic features of the empirical model are:

- The introduction of the domestic demand in the specification of the demand for exports, what allow to consider the negative impact of the internal production, approached by the demand side, on the exports flows.
- The introduction of the national investment as an explicative variable of the import flows\(^4\), meaning the existence of a capital import good mechanism in an environment of exchange between open economies with the subsequent shock of productivity\(^5\).

\(^4\) To an theoretical justification see Obstfield and Rogoff(1995) and Mauleón and Sastre(1994 and 1996)

- The introduction of the exports as an explicative variable of the imports flows and the short and long run. The direct impact of exports on imports results from the fact that many industries import raw or intermediate products, and then export their final output (a typical example is the import of car parts, to build and export cars). This is what Krugman(1995) calls the “slicing up of the production process” and characterizes it as one of the main causes of the growing world trade, proposing for some countries with a high degree of openness, import equations such as,

\[ M = \phi(X, Z) \]

Where M is the imports, X is the exports and Z the rest of the determinants. Also other works, points out the necessity of considering the composition of the domestic demand to explain the growth of imports, knowing that each of the domestic demand components have a different composition of imports (see Giovanetti (1989) or Thirwall and Gibson (1991)).

- The introduction of the imports as explicative variables of the exports and the short and long run. Mauleón and Sastre (1994 and 1996), the argument to this decision, confirmed by the econometric estimates, rest also in the “slicing up of the production process”. The multinational firms would react to unexpected changes of abroad demand for their products not increasing its output, what would increase its costs of production, but reallocating stocks, what would be reflected in the national account as export and import in the same period. Castillo and Picazo (1995) propose an indicator to measure the “coincided trade” defined as the situation in which a firm export and import, simultaneously, the same kind of good product and conclude that this kind of trade supposed in Spain, in 1988, the twelve per cent of the total foreign trade. Another aspect of the problem is the direction of casualty between exports and imports because they are in the equations as endogenous and exogenous variables in the short and long run. This problem only can be treated with the simultaneous estimation of the model.
The model proposed to be estimated simultaneously for the import and export flows of goods and services (excluding tourism), in Spain, would be:

\[ x = \phi(r, tcr, m) \]  
\[ m = \phi(ir, x, pr) \]

The expected signs are

\[
\frac{\partial x}{\partial r} > 0 \quad \frac{\partial x}{\partial it} < 0 \quad \frac{\partial x}{\partial m} > 0 \\
\frac{\partial m}{\partial i} > 0 \quad \frac{\partial m}{\partial ir} > 0 \quad \frac{\partial m}{\partial pr} < 0
\]

Being: \( x \) exports of goods and services; \( m \) imports of goods and services; \( ir \) the national investment; \( r \) the GDP of the OECD countries; \( it \) and \( pr \), export and import prices competitiveness indicators.

II.c. The econometric model.

The LSE methodology was used with the issues of model specification and validation in a time series context (Hendry 1994). The description of the variables used in this section is presented in the Appendix.

The two equation model is estimated, according to the theoretical approach, simultaneously by Three Stage Least Squares in the context of multiple non-linear equations to the functions of imports and exports of goods and services (excluding tourism). The results as follows:

**EQ1. Equation for exports of goods and services (excluding tourism)**

\[
(1 - L)lx = 0.60(1 - L)lm + 0.89(1 - L)lr - 0.348(1 - L)lt - 1.84(1 - L)ldi - 0.20\left[ lx(-1) - 1.27 lr(-1) + 1.80 lt(-1) - 0.64 lm(-1) \right] - 0.095 d86 - 0.09 d75
\]

\[ R^2 = 0.80; D - W = 2.04; \sigma = 0.023 \]

**EQ2. Equation for imports of goods and services (excluding tourism)**

\[
(1 - L)lm = 0.82(1 - L)lir + 0.51(1 - L)lcp + 0.30(1 - L)lx - 0.50\left[ lm(-1) - 0.51 lx(-1) - 0.84 lir(-1) + 0.35 lpr(-1) \right] - 0.667 d76
\]

\[ R^2 = 0.92; D - W = 1.89; \sigma = 0.020 \]
Where the estimated t-ratio is given in parentheses, $\sigma$ is the residual standard error and $D-W$ is the Durbin-Watson statistic. All variable are measured in logarithms and expressed in real terms, with the following meanings:

$L$ = first order difference operator

$x$ = exports of goods and services (excluding tourism)

$m$ = imports of goods and services (excluding tourism)

$r$ = GDP of the OCDE countries.

$it$ = Indicator of competitiveness of exports. (Increasing mean a loss of competitiveness)

$di$ = Domestic demand.

$d75$ = Dummy with value 1 in 1975 and 0 in the rest of the period.

$d86$ = Dummy with value 1 in 1986 and 0 in the rest of the period.

$Ir$ = National Investment.

$cp$ = National Consumption.

$pr$ = Indicator of competitiveness of imports. (Increasing mean a loss of competitiveness)

The model estimated has the following features:

- The parameters have the expected sign, as discussed previously in the theoretical approach.
- This is a simultaneous model since the exports and imports are, respectively, endogenous and explicative variables in the two equations.
- The exports show a high elasticity to the competitiveness indicator in the long run (-1.79), that is considerably reduced in the short run (-0.35).
- The domestic demand has a significant negative impact on the exports, in the short run, (-1.85).
- The imports show a high positive elasticity to the investment in the long and in the short run (0.85 and 0.82).
The imports are not sensitive to the competitiveness indicator, in the short run, but are significant sensitive in the long run (0.35).

The dummies variables introduced in the model correspond, basically, with the change of the political system in Spain, (1975-1977), and the incorporation of Spain to the European Economic Community in 1986. The elimination of the dummies would not affect the estimators or the strength of the model.

The check of the model (Table 1) shows the absence of autocorrelation (Lagrange test) in the residuals of the equations of exports and imports. There is no evidence of autocorrelation in the square residual (Engle test). The autocorrelation function of the residuals shows stationary process and the Box-Pierce test does not detect evidence of autocorrelation in the first eight lags. The cross residual autocorrelation function of the two equations also shows absence of autocorrelations. Therefore, it is possible to conclude that there is no evidence against the validity of the estimations and these can be interpreted economically.

The first step in the implementation of the co-integration approach to modelling requires testing the existence of trends in variance in all variables considered. Standard ADF tests accept the existence of a unit root in all variables under study. The second step would be to test for co-integration of the relevant variables in both exports and imports equations. The ADF test applied to the residuals of the co-integrating vector accepted the null of no co-integration for imports and rejected it for exports. The power of all this tests is somewhat disputed (see for example Crochane, 1991). This is why, finally, the long run estimates of both equations and the co-integration tests have been derived from the standard Three Stage Least Squares estimates of the error correction mechanism specification. This is an advisable procedure according, for example, to the simulations reported in Brett (1993) or Benarjee et all. (1993). Therefore it is possible to maintain the existence of a long run relationship between the variables considered.
The simultaneity of the model is strong since the endogenous variables appear as explicative variables in the short and in the long run (no recursive model).

In Figs 4, 5 and 6 are shown the original (DLX1, DLM1, BC) and simulated (DLX1S, DLM1S, BCS) series of the two equations and the trade balance as a final result of the estimated model. The fit is clearly good and provides a further check on the model specification for the period 1968-2002.

Applying Johanssen methodology to the relationship f (lm, lr, lx, lpr) and supposing that the vector has a VAR(2) structure, the co-integration vector obtained was:

\[ Lm1 = 0.96 \times Lr - 0.1525 \times Lpr + 0.5429 \times Lx1 \]

Osterwald-Lenum 95 %

<table>
<thead>
<tr>
<th>Test</th>
<th>λ-max</th>
<th>22.8</th>
<th>20.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test trace</td>
<td>30.5</td>
<td>29.7</td>
<td></td>
</tr>
</tbody>
</table>

The CUSUM and CUSUM of squares tests have been obtained for testing the stability of the model over time. The series of values are plotted against time (see Fig 7 and 8). Upper and lower confidence bounds are the lines connecting the points.
Table 1. Validation contrasts.

<table>
<thead>
<tr>
<th>Test</th>
<th>Equation</th>
<th>Equation</th>
<th>Critic Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td></td>
<td>5%</td>
</tr>
<tr>
<td>Box-Pierce</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q(4)</td>
<td>0.53</td>
<td>0.73</td>
<td>7.81</td>
</tr>
<tr>
<td>Q(8)</td>
<td>1.02</td>
<td>1.67</td>
<td>14.07</td>
</tr>
<tr>
<td>Autocorrelation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lagrange test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LM(1)</td>
<td>0.452</td>
<td>0.779</td>
<td>3.84</td>
</tr>
<tr>
<td>Heterocedasticity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Engle test)</td>
<td>0.4</td>
<td>2.5</td>
<td>3.84</td>
</tr>
<tr>
<td>Residual normality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bera-Jarque Test</td>
<td>1.6</td>
<td>4.3</td>
<td>5.99</td>
</tr>
<tr>
<td>T-Ratio</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>error correction coefficient</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benarje et al.(1993)</td>
<td>-7.07</td>
<td>-6.67</td>
<td>-3.91 and -3.03</td>
</tr>
</tbody>
</table>
Fig n°4. Export equation. Original and simulated series

(Logarithms variation rates) 1
Fig n°5. Import equation. Original and simulated series

(Logarithms variation rates) 2

Fig 6. Trade balance in Spain (original and simulated series in levels)

Fig n°7 1
II.d. – Post sample period forecast and contribution of each explanatory variable to the endogenous variables evolution.

To show the contrast of the stability of the simulated model in the period 1998-2002, the dynamics forecasts have been derived for this period with the model estimated to the period 1968-2002, with the following results:
<table>
<thead>
<tr>
<th>Equation 1</th>
<th>Equation 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed</td>
<td>Forecast</td>
</tr>
<tr>
<td>7.5</td>
<td>5.0</td>
</tr>
<tr>
<td>7.0</td>
<td>6.0</td>
</tr>
<tr>
<td>10.5</td>
<td>8.5</td>
</tr>
<tr>
<td>3.4</td>
<td>5.5</td>
</tr>
<tr>
<td>3.0</td>
<td>5.2</td>
</tr>
</tbody>
</table>

A test of extra sample forecast, which is asymptotically equivalent to a stability test, is calculated from the dynamics forecasts. If $e'_t e_t$ is the sum of the square residuals of forecast in the period, it is possible to see that

$$\frac{(e'_t e_t)}{\sigma^2} \approx \chi^2(5)$$

<table>
<thead>
<tr>
<th>Equation 1</th>
<th>Equation 2</th>
<th>Critical value 5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extra sample</td>
<td>3.93</td>
<td>4.33</td>
</tr>
<tr>
<td>Forecast test</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The null hypothesis about the existence of parameter structural changes in the model can be accepted.
If we use the obtained forecasts with the simultaneous model to compare the forecast and real trade balance, in the period 1998-2002, would have the following results:

<table>
<thead>
<tr>
<th>Years</th>
<th>Real Trade Balance</th>
<th>Estimated Trade Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>-22567</td>
<td>-23231</td>
</tr>
<tr>
<td>1999</td>
<td>-31385</td>
<td>-30767</td>
</tr>
<tr>
<td>2000</td>
<td>-34121</td>
<td>-34999</td>
</tr>
<tr>
<td>2001</td>
<td>-35285</td>
<td>-36075</td>
</tr>
<tr>
<td>2002</td>
<td>-35433</td>
<td>-35931</td>
</tr>
</tbody>
</table>

A descriptive, but otherwise powerful check of the model is provided by its ability to track the growth rate of the variables that the model intends to explain, over a long period. In this case, the years spanning from 1998 to 2002 have been selected. The results are presented in tables 1 and 2

**Table 1. Growth rate of exports of goods and services (excluded tourism).**

<table>
<thead>
<tr>
<th>Contribution</th>
<th>GDO of OECD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contribution of Domestic Demand</td>
<td>-16.8</td>
</tr>
<tr>
<td>Contribution of Imports</td>
<td>34.5</td>
</tr>
<tr>
<td>Contribution of competitiveness</td>
<td>-1.0</td>
</tr>
<tr>
<td>Total explained</td>
<td>34.0</td>
</tr>
<tr>
<td>Total observed</td>
<td>34.6</td>
</tr>
</tbody>
</table>
The trade balance suffered, in Spain, a meaningful deterioration during the period 1998-2002, due to the higher growth of imports compared to the exports.

Table 2 shows the important growth of the imports in the period analysed; the contribution of the investment, consumption and exports has been important while the competitiveness deterioration had a slight impact.

III. CONCLUSIONS

In this work, we display an alternative model for the traditional exports and imports functions that involves a different perspective about how exchange rate affects the trade balance. The reformulation of the Marshall-Lerner condition in countries with open economies take us to the following conclusion: “In the long run, the impact of the exchange rate on trade balance, would depend not only of the elasticity’s-prices of exports and imports but also of the cross elasticity’s between imports and exports”.
On the other hand an investigation is presented to show the important role that exports of goods and services (excluding tourism) have, in Spain, as determining factor of imports of goods and services (excluding tourism) and vice versa. In this work a two equation simultaneous model is developed to show the interrelations between the two variables and also to consider the rest of the determining factors. Also, the contribution of each explanatory variable to the evolution of the endogenous variables has been considered. The use of the exports as an explanatory variable of the imports, the interdependence between them and the simultaneous estimation of the two variables introduces a new viewpoint in relation with the traditional analysis, improving meaningfully its explanatory capacity. In this work is tested the existence of a long run relation between exports, GDP of OECD, imports and an indicator of the competitiveness. Also is tested the existence of a long run relation between the imports, investment, exports and an indicator of the competitiveness.
References


APPENDIX: STATISTIC SOURCES AND ELABORATION OF VARIABLES.

In this section is shown a descriptive analysis of the series, determining the existence of unit root for the variables in level terms by the graphic analysis.

Exports of goods and services (excluding tourism).

The exports series is obtained from two sources:

Until 1980 are dates from National Account in base 1980. Since 1980 are dates from National Account in base 1995. The series, expressed in real terms and excluding the tourism revenues, is shows in logarithms (level and variation rate) in Fig A1

![Fig A1. Exports of goods and services in real terms](image)

Imports of goods and services (excluding tourism).

The imports series is obtained from two sources:

Until 1980 are dates from National Account in base 1980. Since 1980 are dates from National Account in base 1995. The series, expressed in real terms and excluding the tourism revenues, is shown in logarithms (level and variation rate) in Fig A2
Fig A2. Imports of goods and services in real terms

GDP of the OCDE countries.

The source of information for this series has been the foreign sector area of the Spanish Economy Ministry. The series, expressed in real terms, is shown in logarithms (level and variation rate) in Fig A3

Fig A3. GDP of the OCDE countries 1
Exports competitiveness.

The series used has been the Spanish exports competitiveness against the industrialized countries, issue by the Spanish Central Bank. The competitiveness exports conveys a real exchange rate against the industrialized countries, defined in the way that increases would mean a revaluation against the industrialized countries and therefore a loss of competitiveness of the exports. The series is shown in logarithms (level and variation rate) in Fig A4.

**Fig A4. Exports competitiveness**

Investment.

The series are dates from National Account, INE. Is shown in logarithms (level and variation rate) in Fig A5.
Import Competitiveness.

As import competitiveness indicator is used the relation between the imports deflector and the Spanish GDP deflector measured in national currency (both series are dates from National Account, INE. The competitiveness imports is defined in the way that increases would mean a loss of competitiveness of the imports. The series is shown in logarithms (level and variation rate) in Fig A6.
Fig A6. Import competitiveness indicator 1