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Comparing the macroeconomic Influence in the Japanese and the German Manufacturing Profitability, Acording to the E.U. Database B.A.C.H. (1983-1996)*

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Abstract

The E.U. database B.A.C.H. («Bank for the Accounts of Companies Harmonized») homologues the financial aggregated accounts of the enterprises of different countries collected yearly by the cooperators European Central Banks. Thus, it allows making comparisons between countries. Due to this information referred to the Net Operating Assets Profitability of the Japanese and the German manufacturing industry, which is disposable for fourteen years, it is tried to estimate the influence that some macroeconomic variables could have had over it. According to some pro-

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posals of Hakura (1998) and Van Ees (1997), in the theoretical model it has been considered as profitability's explanatory variables the manufacturing production, the industrial prices (the row materials ones), the interest rate and the exchange rate. The econometric equations have been estimated considering an initial multiplicative dummies variables model.

The results obtained allow establishing a positive relationship between industrial production and profitability (with a double impact in the German manufacturing than in the Japanese one). A neutral effect of industrial prices over both profitabilities. An influence of the raw materials prices for both countries. A negative relationship between interest rate and profitability (only significant in the German manufacturing) and, finally, no relationship between the exchange rate and the two considered profitabilities.

1. The theoretical model

The analysis starts from a simple model, considering some contributions: Hakura (1998) and Van Ees et al. (1997), which previously had found inspiration in Sherman (1991) and Hall (1990). Thus, the production's function of the manufacturing industry might be represented by the following expression:

$$X_t = X\,(K_t,\ L_t,\ M_t)$$

in which X_t represents the manufacturing production in the period t, K_t the capital stock, L_t the quantity of labour and M_t the quantity of raw materials. Thus, the profitability of the manufacturing industry could be approximated by the following expression:

$$R_t = (\,X_t - w_t L_t - r_t K_t - m_t M_t)$$

Moreover, starting from an investment function, it is possible to consider in that profitability's expression the influence of the interest rate. As a matter of fact, in the economic literature the studies that try to relate profitability and investment are abundant. Even though the correlations between the temporary series of these two variables use to present quite elevate values, this fact doesn't imply to establish necessarily a causation relationship (and also we couldn't determinate, with accuracy, the direction of the relationship between profitability and investment).

At any rate, the enterprises' expectations are the last foundation of investment. It is reasonable to accept that the benefits obtained in the past can explain the current investment. But it is used to suggest that, if there were a relationship between profitability and investment, this would be the direction's causality, whereas it could be much more difficult to find evidences in the other sense. Thus, the profitability is contemplated in the model as one of the manners that companies have of financing its investment.

Finally, and more especially because of the fact that manufacturing industries sell a considerable percentage of their production abroad (just as these industries use to import a part of the raw materials they use), it has been considered in the model the next expressions:

$$P_X = EP^* \, ; m_t = Em_t^*$$

which reveal the role that the exchange rate, E, has in linking the prices of the national manufacturing output (P_X) in front of the prices of the other European manufacturing industries (P^*). Moreover, E also facilitates the connection between the national raw material prices in the period t (m_t) with the same prices and in the same period of another country (m_t^*).

The sequence started by an exchange rate variation establishes that an appreciation of the national currency would cause a loss of competitiveness. This gain in the value of a currency would damage the national production, and would also have negative effects in the national manufacturing industry's profitability. Moreover, if the exchange rate suffers depreciation, that loss of the national currency would improve the competitiveness: in this case, it would happen the inverse sequence, improving the national manufacturing production and also the national manufacturing profitability.

Thus, for to estimate the profitability's function it has been considered the following expression:

$$R_t = \vartheta_0 + \vartheta_1 X_t + \vartheta_2 P_t + \vartheta_3 M_t + \vartheta_4 I_t + \vartheta_5 E_t + U_t$$

The notation of endogenous and exogenous variables considered in the model is:

R, profitability	JAP, Japan
Q, industrial production	GER, Germany
P, industrial prices (outputs)	
M, raw material prices (inputs)	
I, interest rate	
E, exchange rate	

Thus, it is tried to estimate the influence on the Net Assets Operating Profitability, as it is provided by the B.A.C.H. European database *(see Appendix 1),* that would be originated on the evolution of the described variables, which belong to the macroeconomic ambit. The E.U. database B.A.C.H. («Bank for the Accounts of Companies Harmonised») homologue the financial aggregated accounts of the enterprises of different countries collected yearly by the co-operators European Central Banks. Thus, it allows making comparisons between countries

2. Statistical sources and variables definition

The dependent variable of the model will be profitability of manufacturing industry. This profitability, calculated homogeneously for Japan and Germany *(see Graphic 1)* according to the B.A.C.H. Project *(see Appendix 2),* is disposable for the period 1983-1996.

In accordance with the independent variables, for the industrial production and the industrial prices there has been elaborated two index, calculated from the growth rate series supplied by the «Historical Statistics» (O.E.C.D.).

The raw material index, on the other hand, comes from «The Economist», and it is referred to the industrial, non-energetic raw material. This is a global index, because of these raw material have to be considered as homogeneous goods in a global scale (mineral and vegetal raw materials); thus, the value of this index is the same for all the countries (the value 100 starts in 1990).

For the interest rate, it has been considered in every country an annual average of the different intervention rate, which are periodically determined by every Central Bank (in the periodic meetings with the banks and saving banks to lend and to auction them money; source: «Historical Statistics», O.E.C.D.).

Finally, for the exchange rate it has been taken for the European currencies the reference of the US dollar. Thus, it has been considered an annual average of every exchange rate (source: «Historical Statistics», O.E.C.D.).

3. Variables transformation

Most of the economic series use to present trend in a temporal horizon. Before specifying the econometric models, and having analysed the variables, it has been detected a growing trend in the profitability, the industrial production, the industrial prices, the raw material prices and the interest rate. Because of this, these variables have been differentiated once.

Thus, it has been considered the variations, in terms of first difference, of the profitability and the industrial production, the industrial prices, the raw material prices indexes and the interest rate. The variable exchange rate have been also differentiated, for to estimate the model in the same transformation as a whole. In this way, the different econometric models estimated respond to the following expression:

$$\Delta R = f\,(\Delta Q,\ \Delta P,\ \Delta M,\ \Delta I,\ \Delta E)$$

Moreover, there have not been appreciated symptoms in variance's trend: the sample is not so long, and the variance doesn't have enough time to demonstrate itself.

4. Methodology

Although the disposable information is referred to a short time period (1983-1996), the availability of data for two countries allows us to surpass the shortness of the sample. Thus, it has been considered a pool of data of 28 observations, which has allowed us to apply panel data techniques.

These techniques present the advantage of considering, in the econometric regressions, an individual specific component, by through it is possible to control the unobservable characteristics of each one of the analysed countries. Thus, every country can be treated in the conjunct according its own peculiarities (in this case, institutional and economical). The panel data techniques allow us to contrast some hypothesis of structural homogeneity between the different countries (samples), which integrate the global sample. This possibility is make concrete by the equality contrasts of the different estimated parameters of every country.

It has been proceed, therefore, to specify an initial model considering multiplicative dummies variables. Being i the number of countries ($i=1,...,m$, with $m=2$), j the number of exogenous variables ($j=1,...,J$, with $J=5$) and t the number of periods ($t=1,...,T$, with $T=14$), it is obtained that 12 [$m \times (J+1) = (2 \times (5+1) = 12$] is the initial number of parameters to estimate, being the total number of observations 28 [$m \times T = 2 \times 13 = 26$: the periods are 13, more specially as the variables have been expressed in differences and it has been lost an observation]. Thus, the initial model to specify is:

In where $\vartheta_{j\text{-}Q}$ is the parameter which measures the influence of the variable $-Q_t$ in the profitability of the country *i*, and so consecutively. Finally, D_i is a dummy variable, which is defined as follows:

$D_i = 1$ if the considered country is *i* $(i=j)$
$D_i = 0$ if the considered country isn't *i* $(i \neq j)$

The different models have been estimated by Generalised Least Squares (programme Econometric Views, version 3.0; PC, Pentium II, 300 MHz and memory, 128 Mb of RAM memory).

5. Description and results analysis

It has been estimated the Model 1 from the starting expression, considering that there is an independent term (constant) for Japan and Germany:

$$\Delta R_{it} = \sum_{j=1}^{2} \mu_j D_i + \sum_{j=1}^{2} \beta_i Q_{j\Delta t} D_i + \sum_{j=1}^{2} \beta_{j\Delta P} \Delta P_{jt} D_i + \sum_{j=1}^{2} \beta_{j\Delta M} \Delta M_{jt} D_i + \sum_{j=1}^{2} \beta_{j\Delta I} \Delta I_{jt} D_i + \sum_{j=1}^{2} \beta_{j\Delta E} \Delta E_{jt} D_i + U_{it}$$

Model 1

The results of this first estimation have been described in Table 1. As it can be observed, the value of Durbin-Watson statistic is not far from the value 2 (2.677877), which guarantees the consistence of the estimations (and also the non-existence of auto-correlation in the perturbations terms).

Observing the t-Student statistic values of industrial production prices of the two countries, there's no one of them significant; it could be suggested another model without this explanatory variable. Thus, it has been estimated the Model 2, according to the following expression:

$$\Delta R_{it} = \sum_{j=1}^{2} \mu_j D_i + \sum_{j=1}^{2} \beta_{j\Delta Q} \Delta Q_{jt} D_i + \sum_{j=1}^{2} \beta_{j\Delta M} \Delta M_{jt} D_i + \sum_{j=1}^{2} \beta_{j\Delta I} \Delta I_{jt} D_i + \sum_{j=1}^{2} \beta_{j\Delta E} \Delta E_{jt} D_i + U_{it}$$

Model 2

The results of the estimation of this second model are provided in Table 2. It is possible to establish a first hypothesis contrast to select the best of them, more specially as the descriptive statistics obtained of this second estimation (Model 2) are quite similar than the results supplied by the first estimation (Model 1).

5.1. Test of neutrality of the industrial prices index

In this test it is considered in the null hypothesis (H_0) the nullity of the two parameters of the explicative variable industrial prices (Model 2). The alternative hypothesis (H_1) implies the non-acceptation of the null one (Model 1).

$$H_0 : \vartheta_{1\text{-}P} = \vartheta_{2\text{-}P} = 0 \rightarrow \text{Model 2}$$
$$H_1 : \text{No } H_0 \rightarrow \text{Model 1}$$

Being 26 the number of observations *(n*=26), *k* the number of parameters of the Model 1 *(k*=12) and *r* the number of restrictions *(r*=2), the statistic F^* stated is:

$$F^* = \frac{(SSR_0 - SSR_1)/r}{SSR_1/(n-k)} = \frac{(12.7484 - 11.8360)/2}{11.8360/(26-12)} = 0.5396$$

Expression in which SSR_0 denotes the Model 1 sum of quadrate errors (null hypothesis) and SSR_1 the same referred to the Model 2 (alternative hypothesis). Comparing the obtained value with an F (2,14), it can not be rejected the null hypothesis (it is *accepted* the null one, so the best model would be Model 2). The Wald test comparing Model 2 with Model 1 reinforces this decision: F-statistic=0.871633 (probability of 0.437211) and Chi-square=1.743266 (probability of 0.418268).

Analysing the results of this Model 2 it is also observed that there are no significant estimated parameters for the explicative variable exchange rate. It would be interesting to consider, in this way, if it is significant the influence of the exchange rate on the Japanese and German manufacturing profitabilities. Thus, it has been defined successively the Model 3, which supposes the non-relevance of the parameters linked to the exchange rate. The expression of this third model would be:

$$\Delta R_{it} = \sum_{j=1}^{2}\mu_j D_i + \sum_{j=1}^{2}\beta_{j\Delta Q}\Delta Q_{jt} D_i + \sum_{j=1}^{2}\beta_{j\Delta M}\Delta M_{jt} D_i + \sum_{j=1}^{2}\beta_{j\Delta I}\Delta I_{jt} D_i + U_{it}$$

Model 3

and its estimation results appear in Table 3. Being the descriptive statistics so similar, it can be stated a second test of hypothesis.

5.2. Test of neutrality of the exchange rate

In this second test it is considered in the null hypothesis (H_0) the nullity of all the parameters of the explicative variable exchange rate (Model 3). The alternative hypothesis (H_1) implies the non-acceptation of the null one (Model 2).

$$H_0 : \vartheta_{1\text{-}E} = \vartheta_{2\text{-}E} = 0 \rightarrow \text{Model 3}$$
$$H_1 : \text{No } H_0 \rightarrow \text{Model 2}$$

Being 26 the number of observations *(n*=26), *k* the number of parameters of the Model 2 *(k*=10) and *r* the number of restrictions *(r*=2), the statistic F* stated is:

$$F^* = \frac{(SSR_0 - SSR_1)/r}{SSR_1/(n-k)} = \frac{(14.3974 - 12.7484)/2}{12.7484/(26-10)} = 1.0348$$

This value has to be compared with an F (2,16) and the null hypothesis can not be rejected (it is *accepted* the null one, so the best model would be Model 3). The Wald test comparing Model 3 with Model 1 reinforces this decision: F-statistic=1.189115 (probability of 0.353198) and Chi-square=4.756458 (probability of 0.313211). So there is neutrality, no influence, of the exchange rate over the manufacturing profitability in Japan and Germany, and it is accepted the Model 3 as a better model than the Model 2.

In Model 3 it is observed that from the estimated parameters for the explicative variable interest rate there is only one (the German one) which is significant. Thus, it could be stated another test, considering a new model, Model 4, which eliminates the variable interest rate only for the Japanese manufacturing industry. The expression of this fourth model would be (country 1=Japan, country 2=Germany):

$$\Delta R_{it} = \sum_{j=1}^{2}\mu_j D_i + \sum_{j=1}^{2}\beta_{j\Delta Q}\Delta Q_{jt} D_i + \sum_{j=1}^{2}\beta_{j\Delta M}\Delta M_{jt} D_i + \beta_{2\Delta I}\Delta I_{2t} D_i + U_{it}$$

Model 4

and its estimation results appear in Table 4. Being the descriptive statistics so similar, it can be stated a third test of hypothesis.

5.3. Test of significance of the interest rate only for the German manufacturing

In the third test the null hypothesis (H_0) considers the nullity of the parameter for the explicative variable interest rate for the Japanese manufacturing (Model 4). The alternative hypothesis (H_1) is reserved for the opposite case (Model 3).

$$H_0 : \vartheta_{1\text{-}I} = 0 \rightarrow \text{Model 4}$$
$$H_1 : \text{No } H_0 \rightarrow \text{Model 3}$$

Being 26 the number of observations *(n*=26), *k* the number of parameters of the Model 2 *(k*=8) and *r* the number of restrictions *(r*=1), the statistic F* stated is:

$$F^* = \frac{(SSR_0 - SSR_1)/r}{SSR_1/(n-k)} = \frac{(14.3984 - 14.3974)/1}{14.3974/(26-8)} = 0.0012002$$

The null hypothesis can not be rejected (it is *accepted* the null one, so the best model would be Model 4; in this case, being a test in which there is only one parameter, for choosing the correct hypothesis it is enough with the information provided by the statistic t-Student). The Wald test comparing Model 4 with Model 1 reinforces this decision: F-statistic=0.951797 (probability of 0.475171) and Chi-square=4.758987 (probability of 0.445996). Thus, Model 4 is a better model.

Looking at the results provided by Model 4, it is possible to appreciate a positive relationship of the index of raw materials prices on the two manufacturing profitabilities (in Japan and Germany an increase of those prices would mean more profitability). Being these two significant estimated parameters so similar (0.052 and 0.049 for Japan and Germany respectively), it could be considered another hypothesis, in which those parameters would be the same for the two manufacturing industries. Thus, it can be formulated another model with the consideration of this possibility and the expression of this fifth model would be:

$$\Delta R_{it} = \sum_{j=1}^{2}\mu_j D_i + \sum_{j=1}^{2}\beta_{j\Delta Q}\Delta Q_{jt} D_i + \beta_{\Delta M}\Delta M_t D_i + \beta_{2\Delta I}\Delta I_{2t} D_i + U_{it}$$

Model 5

and its estimation results appear in Table 5. Being the descriptive statistics so similar, it can be stated a fourth test of hypothesis.

5.4. Test of homogeneity of the raw material prices index

In this fifth test the null hypothesis (H_0) implies the equality of the estimated parameters, referred to the raw material prices index (Model 5). The alternative hypothesis (H_1) supposes the acceptance of significant differences in the parameters mentioned before (Model 4).

$$H_0 : \vartheta_{1\text{-}M} = \vartheta_{2\text{-}M} = \vartheta_{-M} \rightarrow \text{Model 5}$$
$$H_{1:}\ \text{No } H_0 \rightarrow \text{Model 4}$$

Being 26 the number of observations *(n*=26), *k* the number of parameters of the Model 2 *(k*=7) and *r* the number of restrictions *(r*=1), the statistic F* stated is:

$$F^* = \frac{(SSR_0 - SSR_1)/r}{SSR_1/(n-k)} = \frac{(14.4143 - 14.3984)/1}{14.3984/(26-7)} = 0.02103$$

This value has to be compared with an F (1,19). The null hypothesis can not be rejected (it is *accepted* the null one, so the best model would be Model 5. The Wald test comparing Model 5 with Model 1 reinforces this decision: F-statistic=0.795798 (probability of 0.586785) and Chi-square=4.774786 (probability of 0.573006). Thus, Model 5 is a better model.

Looking at the results provided by Model 5 it could be stated if it is significant the estimation of the intercept terms (until now they have been estimated by fixed effects). In this sense, it could be formulated a sixth model, in which is not considered the existence of the independent terms for to explain the Japanese and German manufacturing profitability. The expression of this sixth model would be:

$$\Delta R_{it} = \sum_{j=1}^{2} \beta_{j\Delta Q} \Delta Q_{jt} D_i + \beta_{\Delta M} \Delta M_t D_i + \beta_{2\Delta I} \Delta I_{2t} D_i + U_{it}$$

Model 6

and its estimation results appear in Table 6. Being the descriptive statistics so similar, it can be stated a fifth test of hypothesis.

5.5. Test of non existence of intercept terms

In this fifth test the null hypothesis (H_0) implies the nullity of the independent terms in the regressions (Model 6). The alternative hypothesis (H_1) supposes that it is significant to include these two terms in the regressions (Model 5).

$$H_0 : \mu_1 = 0 \; ; \mu_2 = 0 \rightarrow \text{Model 6}$$
$$H_1 : \mu_1 \neq 0 \; ; \mu_2 \neq 0 \rightarrow \text{Model 5}$$

Being 26 the number of observations *(n*=26), *k* the number of parameters of the Model 2 *(k*=6) and *r* the number of restrictions (*r*=2), the statistic F* stated is:

$$F^* = \frac{(SSR_0 - SSR_1)/r}{SSR_1/(n-k)} = \frac{(32.41401 - 14.41434)/2}{14.4143/(26-6)} = 12.4873$$

This value has to be compared with an F (2,20), which is smaller than the obtained F*. In this case it is rejected the null hypothesis. It can be said that Model 5 provides better estimations than Model 6. It is necessary to include the intercept terms in the equations that try to explain the two considered manufacturing profitabilities .

Thus, for to consider the intercept terms, it is possible to establish that these terms are equal for the two considered countries. It has been defined another model, Model 7, in which it is reflected this supposition. The expression of this seventh model would be:

$$\Delta R_{it} = \mu + \sum_{j=1}^{2} \beta_{j\Delta Q} \Delta Q_{jt} D_i + \beta_{\Delta M} \Delta M_t D_i + \beta_{2\Delta I} \Delta I_{2t} D_i + U_{it}$$

Model 7

and its estimation results appear in Table 7. Being the descriptive statistics so similar, it can be stated a sixth test of hypothesis.

5.6. Test of a common intercept for both manufacturing industries

In this sixth test the null hypothesis (H_0) implies the equality of the independent terms in the regressions (Model 7). The alternative hypothesis (H_1) is reserved for the opposite case (Model 6).

$$H_0 : \mu_1 = \mu_2 \rightarrow \text{Model } 7$$
$$H_1 : \mu_1 \neq \mu_2 \rightarrow \text{Model } 5$$

Being 26 the number of observations (*n*=26), *k* the number of parameters of the Model 2 (*k*=5) and *r* the number of restrictions (*r*=1), the statistic F* stated is:

$$F^* = \frac{(SSR_0 - SSR_1)/r}{SSR_1/(n-k)} = \frac{(15.39889 - 14.41434)/1}{14.4143/(26-5)} = 1.3661$$

This value has to be compared with an F (1,21). The null hypothesis can not be rejected (it is *accepted* the null one, so the best model would be Model 7. Thus, Model 7 is a better model and provides better results than Model 6.

Finally, it is observed that in the results provided by Model 7 the two estimated parameters for the explicative variable industrial production are significant, and could suggest the existence of a double impact on the profitability. Thus, the coefficient obtained for the German manufacturing is nearly the double than the Japanese one, in the sense that an increase of the industrial production would benefit more the German profitability than the Japanese one. Thus, it seems interesting to proceed testing this last hypothesis, and for this reason it has been proposed the estimation of another model. Model 8, therefore, reflects this double impact in the parameter of German industrial production. The expression of this last model would be:

$$\Delta R_{it} = \mu + 2\beta_{j\Delta Q}\Delta Q_{jt}D_i + \beta_{\Delta M}\Delta M_t D_i + \beta_{2\Delta I}\Delta I_{2t}D_i + U_{it}$$

Model 8

and its estimation results appear in Table 8. Being the descriptive statistics so similar, it can be stated a last test of hypothesis.

5.7. Test of double impact of the industrial production in the German manufacturing (than in the Japanese one)

In this seventh and last test, the null hypothesis (H_0) reflects that the German parameter of the explicative variable industrial production is exactly the double than the Japanese one (Model 8). The alternative hypothesis (H_1) is reserved for another values (Model 7).

$$H_0 : \vartheta_{2DQ} = 2\vartheta_{1DQ} \rightarrow \text{Model 8}$$
$$H_1 : \text{No } H_0 \rightarrow \text{Model 7}$$

Being 26 the number of observations *(n*=26), *k* the number of parameters of the Model 2 (*k*=5) and *r* the number of restrictions (*r*=1), the statistic F* stated is:

$$F^* = \frac{(SSR_0 - SSR_1)/r}{SSR_1/(n-k)} = \frac{(15.3881 - 15.39889)/1}{15.39889/(26-5)} = 0.0537$$

This value has to be compared with an F (1,21). The null hypothesis can not be rejected (it is *accepted* the null one). The Wald test comparing Model 8 with Model 1 reinforces this decision: F-statistic=0.699186 (probability of 0.672816) and Chi-square=4.894302 (probability of 0.672860). The best model would be Model 8, being the best of all stated models.

6. VALIDATION AND FINAL MODEL DIAGNOSTIC

Model 8 is globally explicative (F statistic = 27.14640 and its probability is 0.000000). Its predictive capacity is also quite good (R^2 = 0.787315). Individually, all the estimated parameters present statistics t-Student higher than 2 (taking values between 2.7 and 6.6). Moreover, Durbin-Watson statistic is 2.351604, closer to 2, so it seems that there's no auto-correlation between model's residues.

7. Conclusions

7.1. Neutrality of industrial prices and homogeneity of the raw materials prices for both manufacturing industries

In test 5.1 it has been proved the neutrality of the industrial prices over the respective manufacturing profitabilities. There is some recent experience and consens about this fact, in the sense that the benefits of enterprises, which have recovered quickly in the years 1994-96, have not generated inflation in the European countries (Trigo, 1995).

In test 5.4 it has been analised the homogeneity significance of the raw material prices obtained for Japanese and German manufacturing. The result interpretation means that when prices' index increases 1 point, both manufacturing profitability's accelerate 0.051 points. In the case of Germany, it is the unique European country that is self-sufficient, in terms of the raw materials that are used in the manufacturing industries (especially mineral materials). This would be the cause by the way an increase of those materials would affect (positively) the German's manufacturing profitability. Moreover, Japan is not a self-sufficient country as German is in terms of raw materials, but Japanese manufacturing multinationals control, in many manufacturing subsections, the whole production process (from extraction till selling and marketing). Thus, an increase of raw materials price doesn't damage their profit and loss accounts, as it happens in all the rest of the European manufacturing industries.

7.2. Neutrality of the exchange rate for both manufacturing industries

In test 5.2 it has been observed that estimated parameters for the explicative variable exchange rate are not significant for both manufacturing industries. It means that the evolution of the exchange rate doesn't affect Japanese and German profitability. It seems that both profitabilities are protected in front of an appreciation of the Yen or the Deutsche Mark. It is important to notice that, since 1945, Japanese and German currencies have been appreciating itselfs in front many other currencies, and both trade balances have been traditionally positive (with few exceptions). In front of the behaviour observed for other European manufacturing profitabilities, which are quite sensitive to appreciation or depreciation (the French one would be the most sensitive), the exchange rate is not a significant explicative variable for Japanese and German manufacturing profitabilities.

7.3. Unequal impact of monetary policy

In test 5.3 it has been described the significance of the interest rate only in the German manufacturing profitability. The interpretation of the estimated parameter of that variable implies that an increase of 1 point of German interest rate would disaccelerate German profitability in 0.6534 points. In this case, German manufacturing is less sensitive than other European manufacturing, in therms of presenting this negative relationship between interest rate and industries profitability (the French one would be again the most sensitive). In spite of this, German benefits haven't been so much affected in front of variations of the price of money: in the last thirty years, German competitiveness has been based in constant innovation, growth in productivity and continuos reductions in production's cost. Thus, German industry has been able to absorb quickly an increase of its interest rate, as it happened when Bundesbank raised it from 4.5% to 8.5% between 1990 and 1992 (for to finance German monetary and economic unification).

For Japanese manufacturing profitability it has been found no significance for the interest rate. In the considered period, the price of money in Japan has been decreasing considerably, as far as getting through the liquidity catch: for very low levels of interest rate, economic agents don't respond to its variations (monetary policy is not effective). In addition of this, what has been said for German manufacturing is also good for the Japanese one: Japanese competitiveness has been also based in innovation and productivity. Variations of interest rate (and exchange rate) have been successfully absorbed for both industries production systems.

7.4. Double impact of the industrial production in the German manufacturing (than in the Japanese one)

In test 5.7 it has been proved the significance of the two estimated parameters of the industrial production, having a positive relationship with both profitabilites. Model 8 results suggest that for every point of increase of the industrial production index, the acceleration of profitability would be of 0.161632 and 0.323264 points (in Japanese and German manufacturing, respectively). It is also interesting to consider the double impact observed for the German manufacturing: it means a higher dependence of German profitability to the German industrial production's evolution. Moreover, Japanese profitability appears with a lower sensibility, which implies a lower negative impact in case of output's recessions.

Table 1 - Model 1
Descriptive statistics and estimated parameters

SSR	R^2	D-W	F*
11.83600	0.850469	2.677877	8.847359
Dependent Variable: Profitability			
Explicative Variables	**Estimated parameters**	**Standard deviation**	**t of Student**
C Jap (Fixed effects)	-0.616171		
C Ger (Fixed effects	-1.551884		
Q Jap	0.140850	0.051288	2.746261
Q Ger	0.366911	0.085475	4.292619
P Jap	-0.284477	0.234059	-1.215409
P Ger	0.250104	0.484889	0.515797
M Jap	0.053630	0.014415	3.720355
M Ger	0.048936	0.025584	1.912755
I Jap	0.040581	0.240775	0.168544
I Ger	-0.937004	0.400358	-2.340414
E Jap	0.032166	0.016880	1.905602
E Ger	-0.139262	2.412916	-0.05771

Table 2 - Model 2
Descriptive statistics and estimated parameters

SSR	R^2	D-W	F*
12.74840	0.830323	2.639573	11.8527
Dependent Variable: Profitability Explicative			
Explicative Variables	**Estimated parameters**	**Standard deviation**	**t of Student**
C Jap (Fixed effects)	-0.661728		
C Ger (Fixed effects)	-1.160343		
Q Jap	0.139164	0.052776	2.636873
Q Ger	0.378628	0.078530	4.821428

M Jap	0.058801	0.014178	4.147388
M Ger	0.053119	0.023125	2.297049
I Jap	-0.080313	0.225714	-0.355818
I Ger	-0.810273	0.301250	-2.689702
E Jap	0.015515	0.010150	1.528496
E Ger	0.922640	1.199322	0.769301

Table 3 - Model 3
Descriptive statistics and estimated parameters

SSR	**R^2**	**D-W**	**F***
14.39746	0.798789	2.509481	14.39746
Dependent Variable: Profitability			
Explanatory Variables	**Estimated parameters**	**Standard deviation**	**t of Student**
C Jap (Fixed effects)	-0.776785 C		
Ger (Fixed effects)	-1.209711		
Q Jap	0.143670	0.056470	2.544160
Q Ger	0.373834	0.076487	4.887558
M Jap	0.052742	0.014588	3.615423
M Ger	0.049147	0.022024	2.231524
I Jap	0.010636	0.233335	0.045582
I Ger	-0.789564	0.293162	-2.693269

Table 4 - Model 4
Descriptive statistics and estimated parameters

SSR	**R^2**	**D-W**	**F***
14.39842	0.798766	2.511610	18.85431
Dependent Variable: Profitability			
Explanatory Variables	**Estimated parameters**	**Standard deviation**	**t of Student**
C Jap (Fixed effects)	-0.786968		
C Ger (Fixed effects)	-1.209711		
Q Jap	0.145587	0.036672	3.969957
Q Ger	0.373834	0.074447	5.021488
M Jap	0.052499	0.013224	3.969901
M Ger	0.049147	0.021427	2.292673
I Ger	-0.789564	0.285343	-2.767070

Table 5 - Model 5
Descriptive statistics and estimated parameters

SSR	**R^2**	**D-W**	**F***
14.41436	0.798580	2.491830	26.43171
Dependent Variable: Profitability			
Explanatory Variables	**Estimated parameters**	**Standard deviation**	**t of Student**
C Jap (Fixed effects)	-0.786515		
C Ger (Fixed effects)	-1.208255		
Q Jap	0.146027	0.035607	4.101037
Q Ger	0.373834	0.074447	5.021488
M	0.051576	0.010974	4.699786
I Ger	-0.779431	0.268215	-2.905999

Table 6 - Model 6
Descriptive statistics and estimated parameters

SSR	**R^2**	**D-W**	**F***
32.41401	0.537115	1.311812	8.509344
Dependent Variable: Profitability			
Explanatory Variables	**Estimated parameters**	**Standard deviation**	**t of Student**
Q Jap	0.078795	0.045883	1.717303
Q Ger	0.227553	0.081224	2.801561
M	0.051221	0.016042	3.193031
I Ger	-0.376752	0.338672	-1.112439

Table 7 - Model 7
Descriptive statistics and estimated parameters

SSR	**R^2**	**D-W**	**F***
15.34889	0.788191	2.355772	19.53644
Dependent Variable: Profitability			
Explanatory Variables	**Estimated parameters**	**Standard deviation**	**t of Student**
C	-0.891364	0.178270	-5.000070
Q Jap	0.154829	0.034112	4.538916
Q Ger	0.333994	0.062312	5.360028
M	0.051933	0.010916	4.757286
I Ger	-0.672032	0.250943	-2.678022

Table 8 - Model 8
Descriptive statistics and estimated parameters

SSR	R^2	D-W	F*
15.38814	0.787315	2.351604	27.14640
Dependent Variable: Profitability			
Explanatory Variables	**Estimated parameters**	**Standard deviation**	**t of Student**
C	-0.897449	0.173628	-5.168807
Q Jap	0.161632	0.024347	6.638765
Q Ger	0.323264	0.048694	6.638682
M	0.051756	0.010678	4.846777
I Ger	-0.653498	0.236960	-2.757838

APPENDIX 1

LABOUR UNITY COST =
= Staff Costs / Added Value

GROSS OPERATING MARGIN =
= (Added Value – Staff Costs) / Added Value =
= 1- Labour Unity Cost

PRODUCTIVITY OF CAPITAL = RETURN ON ASSETS =
= Added Value / Net Operating Assets

GROSS OPERATING PROFITABILITY / NET OPERATING ASSETS =
= Gross Margin x Return on Assets =
= (Gross Operating Margin / Added Value) x (Added Value / Net Operating Assets) =

= Gross Operating Margin / Net Operating Assets

**Net Operating Assets = Fixed Assets (Lands, Buildings, Machinery) + Stocks + Debtors – Cumulated Depreciation.*

<u>DEPRECIATION =</u>
= Depreciation / Net Operating Assets

<u>NET OPERATING ASSETS PROFITABILITY =</u>
= Gross Operating Profitability - Depreciation =
= (Gross Operating Margin / Net Operating Assets) -
- (Depreciation / Net Operating Assets) =

= Net Operating Margin / Net Operating Assets

Source: Genescà & Salas (1995).

Appendix 2

B.A.C.H. PROJECT: BALANCE SHEET.

A. Subscribed capital unpaid.

C. Fixed assets.

C.1. Intangible fixed assets.
C.1.1. Formation expenses.
C.1.5. Other intangible fixed assets.
C.2. Tangible fixed assets.
C.2.1. Land and buildings.
C.2.2. Plant and machinery.
C.2.3. Other fixtures.
C.2.4. Payments on account and assets in construction.
C.3. Financial fixed assets.
C.3.1. Shares and participating interests.
C.8. Other financial fixed assets.

D. Current assets.

D.1. Stocks.
D.1.1. Raw materials and consumables.
D.1.4. Payments on account.

D.1.5. Other stocks.

D.2. Debtors.

D.2.1. Trade debtors.

D.2.7. Other debtors.

D.3. Current investments.

D.4. Cash at bank and in hand.

E. Prepayments and accrued income.

A+C+D+E = ASSETS // LIABILITIES = F+I+J+K+L.

F. Creditors: amounts becoming due and payable within one year.

F.2. Amounts owed to credit institutions.

F.3. Payments on account of orders.

F.4. Trade creditors.

F.10. Other creditors.

F10.1. Other financial creditors.

F10.2. Other non financial creditors.

I. Creditors: amounts becoming due and payable after more than one year.

I.1. Debenture loans.

I.2. Amounts owed to credit institutions.

I.4. Trade creditors.

I.10. Other creditors.

I.10.1. Other financial creditors.

I.10.2. Other non financial creditors.

J. Provisions for liabilities and charges.

J.1. Provisions for pensions and similar obligations.

J.4. Other provisions.

K. Accruals and deferred income.

L. Capital and reserves.

L.1. Subscribed capital.

L.2. Share premium account.

L.3. Revaluation reserve.

L.4. Reserves.
L.5. Profit / loss brougth forward.
L.6. Profit / loss for the year.

B.A.C.H. PROJECT: PROFIT AND LOSS ACCOUNT.

1. Net turnover.
2. Variation in stocks of finished goods and work in progress.
3. Capitalised production.
4. Other operating income.

S. Total operating income = 1+2+3+4.

5. Costs of materials and consumables.
    5.a. Raw materials and consumables.
    5.b. Other external charges.
8. Other operating charges and taxes.

R. Total operating charges = 5+8. T. Added value BACH = S-5-8.

6. Staff costs.
    6.a. Wages and salaries.
    6.b. Social security costs.

U. Gross operating profit = T-6.

7. Value adjustements on non financial assets.
    7.a. Depreciation in intangible and tangible fixed assets.
    7.c. Other value adjustments and provisions.

V. Net operating profit = U-7.

9/11. Financial income.
12. Value adjustment on financial assets.
13. Interest and similar charges.
    13.a. Interest paid on financial debts.

13.b. Other financial charges.

W. Financial income net of charges = (9/11-12-13)

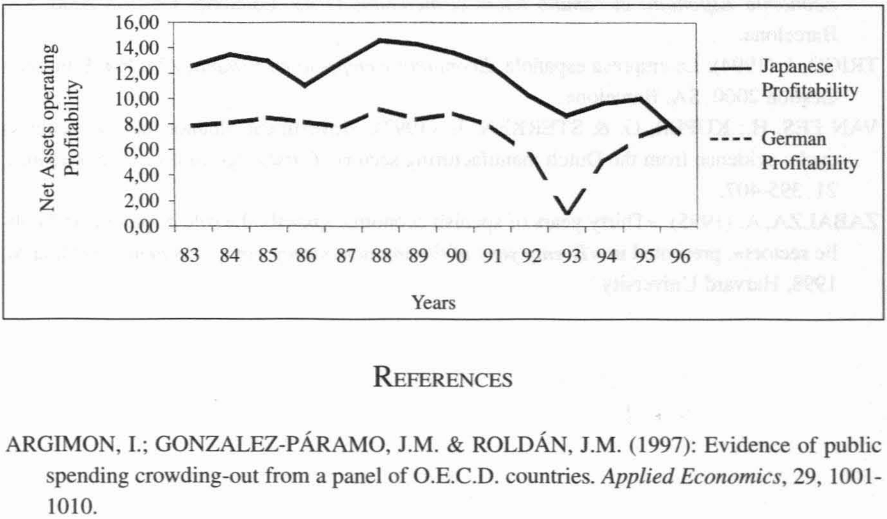
X. Profit on ordinary activities before taxes = V+W.

16. Extraordinary income.
17. Extraordinary charges.

Y. Taxes on profit.

1. Profit or loss for the financial year.

Graphic 1. Japanese and German Manufacturing Industry.



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