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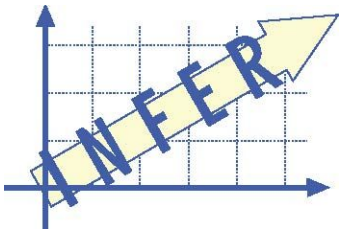

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The Impact of Exchange Rate Regimes on Production Structures across Countries: The European Case

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Abstract

This paper analyzes the impact of exchange rate variability on the economic specialization of European countries. Two theoretical approaches are used: the first one, advanced by Krugman (1991), underlines that the monetary integration is favouring the specialization of countries members of an integrated area while the second one, supported by Ricci (1997), considers that the exchange rate variability is the one that is enhancing countries specialization. In line with these two theoretical dimensions, we conduct empirical estimations on the EU countries (1993-2008) using two different measures of specialization. The results give a mixed picture: the link between specialization and exchange rate regimes is found to be significant but its sign differs according to the sectors desegregation. In order to conciliate these results with the two challenging theoretical settings, we propose an explanation based on the difference between inter-industry and intra-industry specialization.

Keywords*: exchange rate variability, economic specialization, monetary integration*
JEL Codes: *F3, F4, R3, R5*

1. Introduction

The European Union has continuously reinforced its enlargement and economic and monetary deepening. The impact of the latter on the production structures of the EU countries has been long under study. Within this framework, a specific issue can be emphasized, namely the effects of exchange rate variability on the European countries specialization as the switch from a flexible exchange rate regime to a fixed one is directly related to the monetary integration advances and EMU creation.

These issues can also be analyzed within a new economic geography (NEG) framework. The new economic geography suggests that integration deepening might induce higher specialization of economic structures (Krugman, 1991a,b). These theoretical predictions seem to be confirmed by the US experience (Krugman, 1993).

However this assertion might be reconsidered when monetary integration is at stake. One may advocate the opposite view, as the European commission did. Moreover, Ricci's (1997, 2006a, b) models give also a theoretical support to this view, as he argues that countries seem to be less specialized under fixed exchange rates than under flexible ones. These theoretical findings are confirmed by Frankel and Rose (1996 a, b).

In sum, we can assert that there are two logics that can mainly be associated to the economic specialization evolution with respect to monetary integration: Krugman's view and Ricci's approach.

In this paper we use and test elements of the two approaches as we investigate how the EU countries production structures have been affected by the exchange rates variability. Therefore, in this analysis, we suppose that the economic structure of EU countries can be endogenously influenced by the exchange rate regime changes.

The paper is structured as follows. First, we present a brief literature survey on the effects of exchange rate variability decrease - assimilated, for simplicity, to a monetary integration process - on specialization. Then, we turn to our empirical analysis: using two different measures of economic structure specialization, we estimate the influence that exchange rate regime or exchange rate variability indicators have upon. The results of the econometric estimations give a somewhat mixed picture that we conciliate with the two challenging

theoretical logics. Finally, the last section concludes.

2. Theoretical framework

The empirical application that we propose is based on the European case with a special concern for EMU. This approach can be related to the optimum currency areas (OCA) theory that outlines various criteria, as openness degree, labour mobility, production structure diversification and financial integration degree that can be used in order to assess countries capacity to form or join a currency union.

In this paper, the production structure criterion will be put forward in the spirit of Kenen (1966) who argues that "diversity in a nation product mix (… might) be more relevant than labour mobility". Thus, if an economy is diversified at the production structure level, a negative demand shock on a good or in a sector has a relatively modest effect (Kenen, 1966).

The originality of this work is related to the fact that instead of developing an analysis on the monetary union optimality, based on production diversity and shocks asymmetry related to a monetary union creation, we choose, to take the reverse approach and to evaluate the change in production structures induced by a monetary unification. Within this framework, our paper is connected to the issue of OCA criteria endogeneisation highlighted by Frankel and Rose (1997). This is to say that the monetary union reinforces the real integration, strengthens the symmetry of shocks and therefore establishes the conditions of its success.

The OCA criteria endogeneity can be opposed to Krugman's view. Taking the US experience as a case of economic and monetary integration and thus as a relevant example for the European integration, Krugman (1993) shows that the degree of production specialization in four European countries (Germany, France, Italy and the United Kingdom) is lower than in the US areas[1]. In Krugman's view, this means that the low specialization level of the European economies' is the result of a less advanced European integration. This will further imply that economic and monetary union, considered as a deeper integration phase, would lead to an increase of the European countries specialization. As a result, monetary union could induce an increased specialization and a rise of asymmetrical shocks.

In sum, whereas Krugman's approach suggests that within an integration framework, countries' specialization will go hand in hand with a greater probability of asymmetrical

shocks, Frankel and Rose (1996a, 1996b) stress that monetary integration could lead to a diversification of the productive structures.

These empirical findings can be related to two theoretical approaches. Krugman's view is supported by his new economic geography models while the approach proposed by Frankel and Rose (1997) can be linked to the model developed by Ricci (1997). All these models integrate elements belonging to open macroeconomics, trade and location theories and further propose new explanations to the effects of monetary unification on countries specialization and economic activities' agglomeration.

2.1. Specialization and exchange rate variability: Krugman (1991, 1993) versus Ricci (1997)

Krugman's (1991b) new economic geography model shows that increased integration will lead to greater geographical concentration of industries and thus to higher countries specialization. This model is built within a framework that supposes: two regions and two sectors (a traditional sector with constant returns and without transfer costs, characterized by perfect competition and an industry sector with increasing returns to scale, which produces differentiated goods, in monopolistic competition and whose sales are subject to transfer costs). This model studies the effects of integration on the increasing returns sectors' location in the presence of a mobile labour (the unique production factor of the model) which moves according to the wage differences. Within this framework, an integration deepening is expressed by lower transport costs and with this respect the lower the transport costs are, the more attractive the geographical concentration is for individual firms. The mechanism can be synthesised as follows: if countries are identical, firms will be indifferent to their location whatever the country; however if labour is allowed to move from one country to another, there are differences that appear among countries and as a consequence firms will want to locate their production in the largest markets in order to diminish all the costs related to selling from a distance. In the same time the market size of a country depends on the number of people living there and their income, which in turn depends on how many jobs are available in this country[2] (Baldwin *et al.*, 2003; Krugman, 1991b).

Labour and industrial firms' mobility, which is at the core of this mechanism, becomes

more significant if transaction costs are lower and this can be the case with the deepening of the integration process. Thus, the reduction of exchange rate uncertainty or the adoption of a single currency, since it diminishes or even eliminates the exchange risk, can be associated to a decrease in transaction costs between countries. On the whole, Krugman (1991b) shows, by insisting on the initial conditions, the value of different parameters (i.e. industry share in an economy, transport costs and scale economies or products differentiation degree) and the pecuniary externalities between firms and consumers, that a country is able to attract industry as integration progresses. Thus, an increase of countries' manufacturing specialization should go along with the process of monetary integration, translated by transfer costs reduction. In other words, the introduction of a single currency reduces the transaction costs and this decrease in the transaction costs is likely to release agglomeration forces especially in the sectors with scale economies as it is underlined in Krugman's new economic geography models. Nevertheless, the initial conditions (i.e. a low country specialization) as well as the borders effects that still exist in Europe (Disdier and Mayer, 2004) should moderate this influence.

The interaction between monetary issues, trade and location is differently analyzed by Ricci (1997, 2006b) who develops a simplified two-country two differentiated good monetary model with international trade elements. He shows that countries tend to be more specialized under flexible exchange rates than under fixed exchange rates. The explanation is the following: under flexible rates, firms have incentives to locate in the country which is relatively specialized in the goods they produce in order to face all the same variability of exchange rates while, under fixity, all firms face the same variability of their sales regardless of their location. The explanation can be developed along several lines of arguments with the assumption that firms want to avoid the consequences that uncertainty may have upon their ability to compete with other firms.

At first, an exchange rate adjustment mechanism may be invoked under the assumption that, in a two-good two-country model, each country exports the good produced by its largest production sector. In such a case, a shock affecting positively (negatively) the large exporting sector of a country is likely to lead to an appreciation (a depreciation) of the national currency; this will attenuate the positive (negative) effect of the initial shock on the exporting

sector and a negative (positive) impact will be put on the other sector. Hence, due to compensating exchange rate movements, the firms in the exporting sector, assumed to be the largest one in the country, are likely to experience a lower variability of their sales (Loisel, 2005).

Therefore if a firm wants to lower its sales variability, it has an incentive to be located in the country specialized in its own product. By consequence, in this context, firms location strategies generate a cumulative movement, leading to an agglomeration of one sector in the same country and consequently to countries specialization and to an increase of shocks asymmetry. As these incentives with respect to location do not exist when exchange rates are fixed, countries will be more specialized under flexible exchanges than under fixed exchanges.

Through another simplified model which combines trade theory and neo-keynesian literature, Ricci (2006a) suggests that under flexible exchanges, as compared to fixed exchanges, economic activities tend to be more concentrated and countries more specialized as exchange rate variability affects firms' location choices. Thus, on the one hand, on the demand side, if countries are different in size, as firms want to lower the exchange rate induced variability of their sales, they seek to locate in the larger market for their products. This is one of the obvious ways to minimize exchange effects on their sales. On the other hand, on the supply side, to keep in line with their competitors and avoid a variability of their price competitiveness induced by exchange rates, firms receive an incentive to locate in the country already specialized in their sector.

Hence, under flexible exchanges, an increase in the size of the market of a country reduces the variability of the sales of the located firms and reinforces the tendency of the firms to be established in this country. The volatility of the exchange rate in the presence of prices rigidities will lead firms to favour the country offering the lowest sales variability and which will be, besides, the country with the largest market. The firms' movement towards this country involve two opposite effects: on the one hand, it leads to an increase of the incentives given to other firms to establish in this country whose market size is increasing but, on the other hand, it also leads to a reduction of these incentives since firms will be in competition to attract the workers and, consequently, will have to offer increasingly higher wages. The fact

that the expected profits are identical for all firms implies that at equilibrium, each firm of the largest (smallest) countries will have a more (less) important production and will pay higher (lower) wages. Within this framework, if firms are mobile, but labour is not, the exchange rate variability involves a stronger concentration of firms in the largest markets – as it is the case in Europe - but this concentration is not infinite. If firms and workers are both mobile at the same time, there could be a circular agglomeration mechanism similar to the backward and forward linkages specific to the economic geography theory. These effects in terms of agglomeration emerge, as stated before, due to exchange rate variability and to the market size effect in the presence of short-term prices rigidity and firms' exchange rate risk aversion.

Thus, exchange rate variability acts as a centripetal force and, ceteris paribus, one should expect greater concentration of activities and specialization from countries under a flexible exchange rate regime. In other words, according to Ricci's view, the monetary union is likely to set up the conditions of its own success, because it removes the exchange rate uncertainty which is responsible for greater specialization.

2.2. Prices versus non-price competition

Krugman's and Ricci's views lead to quite different conclusions in terms of ex post optimality of a currency area. However these viewpoints are not totally incompatible. A closer look at the mechanisms underlying the impact of exchange rate on specialization in each model would suggest that these two analyses should be rather considered as complementary.

In Krugman's setting, exchange rate does not play an essential role in the location of productive activities. Exchange rate variability acts as a transaction cost. Its reduction will reinforce the centripetal forces within the general framework of production and market characteristics. This explains why a monetary union can lead to further specialization and agglomeration of activities, enhancing the divergences between member states' production structures.

In Ricci's work, exchange rates are at the heart of the analysis. Their variability has a direct effect on production choices that aim at avoiding uncontrolled consequences in terms of firms' competitiveness. This explains why greater exchange rate flexibility can lead to a

stronger specialization of countries, which means that, conversely, the diversification of activities between countries is easier to achieve in a monetary union.

Basically, whatever the model, the exchange rate influence is exerted through the price mechanisms. When the production process and the consumption of a good do not take place in the same currency area, changes in the exchange rates are likely to alter the relative positions of firms located in different countries and to create thus biases in terms of firms' competition. However these biases do not have the same importance under all circumstances. They depend upon the role played by prices in terms of market competition: if price competition is a fundamental determinant of specialization, exchange rate variability is likely to be a matter of great concern. But, in sectors where non price competition is prevalent, the exchange rate is not really an important determinant of specialization.

In this study we suggest a reconciliation of Krugman's and Ricci's views. The former could be more relevant for the analysis of specialization in sectors where price competition is not of primary concern. The latter applies in sectors where price competition is a strong determinant of specialization. Since both price and non price competition are at work in countries economic structures, the combination of these two views leads to the conclusion that diminishing exchange rate variability in a process of monetary integration might be related to a decrease or an increase in specialization according to sectors dissagregation level. The empirical analysis that we propose in the next section settle the baseline interpretation of these two views and of their suggested combination.

3. Empirical analysis

The purpose of this analysis is to prove that a significant change in the specialization process of EU 27 countries can be spotted in relation to the monetary integration process.

3.1. Methodology

The theoretical models (Krugman, 1991; Ricci, 1997) that are used as reference for our empirical study are both static. Therefore one can expect that our econometric estimations should not be run in a dynamic framework (for which a wider sample would also be necessary).

In a first step, our estimates are run both with fixed effects and the random effects models. We further compute the Hausman test[3] for linear panel estimation (based on all countries). The Hausman test rejects the null hypothesis of random effects for all the estimated models and allows us to choose the within estimator.

Linear fixed effects are included in the regressions in order to account for time-invariant omitted variables. The model can be written as follows:

$$Inter_{it} = \beta_{1it} Exch_{it} + \sum_{k=1}^{K} \beta_k x_{itk} + \alpha_i + u_{it} \quad (1)$$

$$Intra_{it} = \breve{\beta}_{1it} Exch_{it} + \sum_{k=1}^{K} \breve{\beta}_k x_{itk} + \breve{\alpha}_i + \breve{u}_{it} \quad (2)$$

where $t=1,2,...T$ is the *time dimension*, $k=1,2,..K$ denote the *regressors* and $i=1,2...N$ denote the *individuals*. $Inter_{it}$ denotes the inter-specialization endogenous variable and $Intra_{it}$ is the intra-specialization endogenous variable. α_i translates the individual effects fixed over time and u_{it} is the disturbance term.

In both equations, $Exch_{it}$ reflects the exchange rate regime variables and x_{it} translates the control variables specific to country *i*. Control variables include trade openness, productivity, European integration dummy and country size (GDP).

With a fixed effect transformation, the unobserved effect, α_i, disappears. This will lead to unbiased and consistent results:

$$Inter_{it} - \bar{Inter}_i = \beta_{1it}(Exch_{it} - \bar{Exch}_i) + \sum_{k=1}^{K} \beta_k (x_{itk} - \bar{x}_{ik}) + (u_{it} - \bar{u}_i) \quad (3)$$

$$Intra_{it} - \bar{Intra}_i = \breve{\beta}_{1it}(Exch_{it} - \bar{Exch}_i) + \sum_{k=1}^{K} \breve{\beta}_k (x_{itk} - \bar{x}_{ik}) + (\breve{u}_{it} - \bar{\breve{u}}_i) \quad (4)$$

An implicit assumption in estimating our model is that the cross-sectional units are independent. To test this hypothesis, we use Pesaran's (2004) CD test. The CD test does not reject the null hypothesis of no cross-sectional dependence[4]. These results are confirmed by Frees' and Friedman's tests.

3.2. Data

The endogenous variables used in the analysis are related to specialization issues. Several

types of indicators can be used to describe the specialization of activities (see Aiginger *et al.*, 1999; Longhi *et al.*, 2005) as there are various ways of measuring specialization. For simplicity reasons, we have chosen to use only absolute indices in this paper.

We will construct specialization indexes using Eurostat sector GVA data for all 27 EU countries on a 16-year period (1993-2008). For each country i ($i = 1 \ldots nc$), we compute, on an annual basis, an absolute specialization index. The absolute measure of production activities specialization in a country i is given by the normalized Herfindahl-Hirschmann index (NHH_i):

$$NHH_i = \frac{(\sqrt{HH_i} - \sqrt{1/ns})}{(1 - \sqrt{1/ns})} \tag{5}$$

where $HH_i = \sum_{j=1}^{ns} \left(\frac{N_{ij}}{\sum_{j=1}^{ns} N_{ij}} \right)^2$ and N_{ij} = GVA of country's i in sector j

In the definition of this variable, the number of sectors or products (j) varies between 1 and ns ($j = 1 \ldots ns$).

This index is constructed for two different decompositions of NACE (*Nomenclature Statistique des Activités Economiques*) sectors GVA data. The *first one* covers *all 16 NACE branches* ($ns = 16$)[5] while the *second one* is applied to *manufacturing industry*, using a desegregation of 14 manufacturing industry NACE data ($ns = 14$).

This normalized index varies between 0 (when economic activity is uniformly distributed between sectors) and 1 (meaning that the whole activity is concentrated in a single sector). It becomes higher as a reduced number of sectors get a large part of the total GVA (or of the manufacturing GVA) of the country; in other words, this index increases with the country's specialization in general (or with country's specialization in manufacturing, in particular).

All dependent variables have values between 0 and 1 while the independent variables of the model are real numbers. In this case, estimating the model with means of OLS would lead to biased results. Therefore, we rescaled the dependent variable through a logistic transformation in order to allow a variation between $-\infty$ and $+\infty$ and to make all variables comparable. Each endogenous variable (*EndoV*) is rescaled as follows:

$$EndoV^* = \log\left(\frac{EndoV}{1-EndoV}\right) \quad (6)$$

Our set of exogenous variables is represented by exchange rate variability indices and by variables that control for the other determinants of countries specialization.

Within the exchange rate framework, we aim at constructing an *exchange rate variability index*. Therefore we choose first the type of exchange rates (bilateral or effective, nominal or real) to be used in the analysis and then the appropriate measure of volatility. As our purpose is to study the impact of diminishing exchange volatility on production structures specialization, we will not work on bilateral exchange rates as they capture only the relation between two currencies. We will use effective exchange rates that are taken into account in nominal terms. Nominal series are usually used when analysing the relation between specialization (usually in trade) and exchange rate regimes as they are supposed to better capture the volatility driving the uncertainty faced by firms (Bini-Smaghi, 1991; Huchet-Bourdon and Korinek, 2011; Romagnoli, 2005).

As for the appropriate measures of the *exchange rates variability*, the most common ones relate to the variance measures. These measures are supposed to better reflect the ***de jure*** echange rate regime evolutions at countries level. The volatility variables can be constructed as the standard deviation of the exchange rate variable or as a moving standard deviation (Bahmani-Oskooee and Mitra, 2008; Bahmani Oskooee and Kovyryalova, 2008). We choose to construct annual standard deviation of the exchange rates as our database is annually set and all the other variables used in the analysis are constructed on a year-to-year basis. The ***NEER*** (nominal effective exchange rates) volatility represents the first set of exogenous variables related to exchange rate variability. This variable is constructed, at each country level, as the annual variance of monthly effective exchange rates (16 trading partners). The higher this index is, the stronger the variability of exchange rates will be.

In order to get ***de facto*** exchange rate regimes, we will employ the rankings provided by IMF and made available by Ilzeski et al. (2010). This set of indicators is used in order to illustrate the exchange rates environment and is given by the ***Fine*** codes. The annual ***Fine*** ranks provided by Ilzetzki et al. (2010) give the *de facto* exchange rate arrangements on the basis of their flexibility degree. For the ***Fine*** classification, the indicator moves from 1 under

perfect fixity to 15 under perfect flexibility. Introducing this index allows to take into account a certain continuity in the influence of exchange environment on specialization.

Alongside with the exchange rate variability indicators, standing for a reversed measure of monetary integration, some other controls have been included in the analysis in order to capture other integration aspects. Thus, **open** is the openness degree measured by a country's foreign trade (exports plus imports) as a percentage of its GDP. **Productivity** reflects the labour productivity at each country level. S**ize** is a measure of each country's economic size, given by its GDP. The **Eu** dummy captures each country integration into EU: it is set to 0 before a country's EU integration and equals 1 afterwards.

As suggested by Midelfart et al. (2000), we assume that the log-log model is superior to the linear model in terms of statistical properties. It allows for a heteroscedasticity correction and therefore the results obtained by using the logarithm are superior to those in value. Hence, all the variables used in our estimations are in log.

3.3. Results and interpretation

The estimations obtained using a fixed effects model, give quite clear-cut results. These results presented in **Table 1**, show that the nominal effective exchange rate variability and the exchange rate regime have a significant effect on the specialization indexes. Before analyzing their effects, we briefly present the impact of controls on the dependent variable.

Table 1 shows that the variables used to control the effect of the economic integration process (Open and Eu) behave quite differently. The openness to trade (Open) and the European integration (Eu variable) seem to have no impact on the intraindustry manufacturing specialization. Nevertheless they affect positively the interindustry production specialization suggesting that the latter goes along with EU integration and in general, with countries insertion in the international trade. The openness to international trade and the elimination of barriers to trade and factor mobility with respect to European partners might encourage firms to locate on EU large markets and therefore to increase countries specialization.

Labour productivity (Productivity), when significant, can capture countries comparative advantages and has a positive impact on countries specialization in general. In other words, the stronger the comparative advantage of a country, the higher its specialization calculated at

all sectors level.

The economic size (Size) of a country has a significant impact on the production specialization. Thus, using the results available in **Table 1**, we can assert that the bigger the country, the lower its intra-sector specialization and the higher its inter-sector specialization. This latter finding is in line with Ricci's theoretical conclusions which emphasize that exchange rate variability in the presence of price rigidities increases firms concentration in large markets, which in our framework is synonym to higher production specialization at inter-sector level in large countries

Table 1. Specialization variables and exchange rate variability indices

	Dependent variable			
	Normalized Herfindahl index (NHH-all sectors)		**Normalized Herfindahl index (NHH-manufacturing)**	
lg(neer)	0.004** (0.002)		0.005 (0.004)	
lg(fine)		0.016* (0.009)		-0.123*** (0.025)
lg(open)	*0.206*** (0.064)*	*0.221*** (0.068)*	*0.151 (0.116)*	*-0.050 (0.177)*
lg(gdp)	*0.399*** (0.083)*	*0.350*** (0.071)*	*-0.192* (0.042)*	*-0.341*** (0.164)*
lg(productivity)	*0.013* (0.008)*	*0.013* (0.008)*	*-0.020 (0.019)*	*-0021 (0.020)*
eu	*0.055*** (0.012)*	*0.052*** (0.013)*	*-0.002 (0.029)*	*0.047 (0.032)*
const	*-2.891*** (0.415)*	*-2.658*** (0.357)*	*0.932*** (0.219)*	*0.733 (0.843)*
No. obs.	***261***	***261***	***234***	***234***
R-squared	***0.60***	***0.59***	***0.21***	***0.09***

Robust standard error in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

As for the exchange rate variables, the results are basically the same in each case: the coefficient estimating the effect of exchange rates variance on the inter-specialization index is negative and significant while the one related to the intra-specialization index is negative and significant.

The exchange rate variables do act in the same direction for each one of the production

structure indicators. Thus, on the one hand, when the specialization index is built on 16 NACE branches, the exchange variability indicators positively affect the production specialization. This means that a reduction in the variability of the exchange rate is associated with a lower production specialization. Such a finding matches the conclusions of Ricci's analysis. On the other hand, when the explained variable is a specialization index built on a disaggregated data for the manufacturing industry, the exchange rate variables have a significant negative coefficient (with the exception of nominal exchange rate variability with 16 partners that has no significant impact on intraindustry specialization).

A reduction in the variability of the exchange rate is related to an increase in the Herfindahl-Hirschmann specialization index. These results sustain Krugman's view according to which more fixity, as it means stronger integration, tends to favour specialization.

The marked difference between the two sets of results deserves attention. Our sample contains countries with different levels of income whose association to the integration process differs both in time length and form. Hence, one may think that various factors related to the general process of economic integration in the EU are at work behind the observed contrasted relations. Nevertheless the fixed effects introduced in the estimates capture these factors. Thus we can propose an interpretation of the results in line with the theoretical analyses developed in the first part of the paper.

The two sets of results can be distinguished according to the endogenous variable we use. In the first set, the Herfindahl-Hirschmann index refers to specialization between sectors defined at a relatively broad level. In the second set, the same index is defined at a more desegregated level since it concerns a specialization between 14 sub-sectors within the manufacturing industry.

It can be considered that the first set of variables gives indications relative to an inter-industry specialization while an intra-industry specialization plays a greater role in the second one. Besides, it can be argued that non-price competitiveness is more relevant at the intra-industry level while there is relatively more concern about prices in the inter-industry competition. That is why the role of exchange rate variability via its impact on price competitiveness is likely to be relatively less pre-eminent in intra-industry specialization than in inter-industry specialization. Comparatively, the ranking of its relative role in the two types

of specialization will be reversed when one considers its impact as an element of transfer costs. In other words, when inter-industry specialization is concerned, the exchange rate variability will operate rather as an element of price-competitiveness than as an element of transfer cost; conversely, with intra-industry specialization, its role as a transfer cost is relatively greater. Since Ricci's analysis emphasizes the role of exchange rate variability in the process of price competition while transfer costs are of primary concern in Krugman's view, a tentative interpretation of the difference between our two sets of results may be proposed, combining the two theoretical approaches. The reduction of exchange rate variability induces lower specialization between countries at the level of broadly defined sectors and, at the same time, increased specialization at a more desegregated level.

3.4. Robustness check

In order to check the robustness of our results, two types of tests are conducted: first, an alternative measure of *de jure* exchange rate regime is used, and then a new measure of the exchange rate variability is computed. Thus, we employ a new set of indicators in order to illustrate the exchange rates environment.

On the one hand, we use the ***Coarse*** codes that represent a second exchange rate arrangements' classifications provided by Ilzetzki et al. (2010). For this Coarse classification, the indicator varies from 1 under less flexible rates to 6 under most flexible rates. On the other hand, we construct the annual variance of monthly nominal effective exchange rate with 27 trading partners (neer27 variable). We run the previous regressions using these two control variables and reach almost the same findings: we should expect, under flexible exchange rates, more specialization in the inter-sector dimension and lower specialization in the intra-sector approach. The productivity has a negative impact on specialization, which might translate the fact that if productivity increases in all sectors, these might lead to redistribution of activities among sectors, and thus to a lower specialization in a particular sector, as manufacturing.

Table 2. Robustness check: specialization variables and exchange rate variability indices

	Inter sector specialization		**Intra sector specialization**	
lg(coarse)	*0.016**		*-0.233****	
	(0.023)		*(0.053)*	
lg(neer27)		*0.013****		*-.0076*
		(0.005)		*(0.021)*
lg(open)	*0.374****	*0.225****	*0.083*	*0.152*
	(0.047)	*(0.066)*	*(0.176)*	*(0.209)*
lg(gdp)	*0.108****	*0.401****	*-0.408****	*-0.237*
	(0.022)	*(0.082)*	*(0.175)*	*(0.196)*
lg(productivity)	*0.018****	*0.013**	*-0.032**	*-0.0294**
	(0.007)	*(0.008)*	*(0.020)*	*(0.021)*
eu	*0.071****	*0.057****	*0.012*	*0.007*
	(0.010)	*(0.012)*	*(0.030)*	*(0.034)*
const	*-1.439****	*-2.904****	*1.089*	*0.171*
	(0.119)	*(0.413)*	*(0.898)*	*(0.997)*
No. obs.	***261***	***261***	***234***	***234***
R-squared	***0.56***	***0.61***	***0.20***	***0.1***

Robust standard error in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Other robustness checks[6] have also been performed. For example, regressions have been run using, besides the independent variables already present, more controls (i.e. FDI) which appear to be non significant. However, in all the robustness regressions, our variables of interest (i.e. exchange rates regimes) keep their sign and significativity. Moreover, the controls of the integration process and the labour productivity are still significant. And these results hold also when lags are introduced into the analysis. Thus, conclusions are almost the same as in our previous estimates.

4. Conclusion

This paper analyzes two opposite views dealing with the effects of monetary integration (seen as a reduction of exchange rate variability) on the specialization of production structures in the European case. On the one hand, it is advanced that higher exchange rate variability,

thus flexible exchange rates, induce specialization compared to fixed exchange rates. On the other hand, it is assumed that more fixity in terms of exchange rates lead to higher specialization of countries.

Our empirical results, while showing a significant relationship between various measures of exchange rate variability and specialization variables, suggest that these two views should not be opposed but rather combined.

A lower variability in the exchange rates appears to be associated with a weaker specialization at the inter-industry level and a stronger specialization at the intra-industry level. This may be combined with the two roles played by the exchange rate variability as an element of transfer cost and of price competitiveness respectively.

Such a finding and its suggested interpretation open some original perspectives in the debate about endogenous optimal currency areas and its implications, in the European Union, in terms of strategies for the euro adoption.

Notes

1. The idea that industrial production is much more specialized in the US than in the European countries but this will not prevent Europe from getting more specialized in time, due to the deepening of the European integration, is also present in Krugman (1991b). Moreover, numerous studies based on production data have confirmed the increase of the manufacturing specialization in Europe (Amiti 1999; Aiginger et al., 1999; Longhi et al., 2005; Midelfart-Knarvik et al., 2000).
2. A "cumulative causality" appears in the spirit of Myrdal (1957).
3. The Hausman test consists in testing the null hypothesis of no correlation between unobserved characteristics and some explanatory variables.
4. As our time span is relatively small we did not perform Panel-data Unit Root tests.
5. We had to exclude the 17th NACE branch (Extraterritorial activities) due to missing data.
6. All these regressions and results are available upon request.

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Appendix

Basic sample

Austria, Bulgaria, Belgium, Czech Republic, Cyprus, Denmark, Estonia, Finland, France Germany, Greece, Hungary, Italy, Irland, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Portugal, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, UK.

Table 3. Data and Sources

Variables	**Definition**	**Source**
Size	GDP at constant prices	Eurostat
Open	Openess degree (import plus exports as % of GDP)	Eurostat
NEER	Annual variance of monthly nominal effective exchange rate	Eurostat
Coarse	De jure exchange rate regimes classification (details in Table 3)	Ilzeski et al. (2008)
Fine	De jure exchange rate regimes classification (details in Table 4)	Ilzeski et al. (2008)
Eu	Dummy variable (=1 if a country joined the European Union , 0 otherwise)	Eurostat
Productivity	Labour producitivity (2005 = reference)	Eurostat

Table 4. Correlation matrix

	log (fine)	log (coarse)	log (neer16)	log (open)	eu	log (productivity)	log (size)
log(fine)	1.000						
log(coarse)	0.70	1.00					
log(neer16)	0.82	0.65	1.00				
log(open)	-0.08	-0.25	0.11	1.00			
eu	0.30	0.13	0.47	0.17	1.00		
log(productivity)	0.35	0.11	0.37	0.30	0.50	1.00	
log(size)	-0.17	0.13	-0.23	-0.42	0.45	-0.29	1.00

Table 5. Exchange Rate Regimes - Coarse Classification (Ilzeski et al., 2010)

1	No separate legal tender
1	Pre announced peg or currency board arrangement
1	Pre announced horizontal band that is narrower than or equal to +/-2%
1	De facto peg
2	Pre announced crawling peg
2	De factor crawling peg
3	Pre announced crawling band that is wider than or equal to +/-2%
3	De facto crawling band that is narrower than or equal to +/-5%
3	Moving band that is narrower than or equal to +/-2% (i.e., allows for both appreciation and depreciation over time)
3	Managed floating
4	Freely floating
5	Freely falling
6	Dual market in which parallel market data is missing

Table 6. Exchange Rate Regimes - Fine Classification (Ilzeski et al., 2010)

1	No separate legal tender
2	Pre announced peg or currency board arrangement
3	Pre announced horizontal band that is narrower than or equal to +/-2%
4	De facto peg
5	Pre announced crawling peg
6	Pre announced crawling band that is narrower than or equal to +/-2%
7	De factor crawling peg
8	De facto crawling band that is narrower than or equal to +/-2%
9	Pre announced crawling band that is wider than or equal to +/-2%
10	De facto crawling band that is narrower than or equal to +/-5%
11	Moving band that is narrower than or equal to +/-2% (i.e., allows for both appreciation and depreciation over time)
12	Managed floating
13	Freely floating
14	Freely falling
15	Dual market in which parallel market data is missing.