On the Economic Geography of the Euro.

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Abstract

Recent research has found that the introduction of the Euro has increased both trade as well as FDI flows for the member countries. We conduct an investigation of the economic geography of the euro by combining the inward FDI results with results obtained from regressions on exports, for the same countries and years, and examining direction patterns for "big" and "small" economies. The results indicate that potentialy large agglomeration forces appear due to the introduction fo the Euro. Moreover, in some cases FDI and exports follow the same direction pattern, which indicates an increase of vertical specialization in the sample.

1 Introduction

A question of great interest in recent years is the economic consequences of the European currency union on the member states, its future participants and its economic environment in general. Recent research shows that the introduction of the Euro has increased both trade as well as Foreign Direct Investment (FDI) flows for the member-states and their partners.[1] However, even if the effects of the Euro for the entire area seem to be positive, the issue of whether the gains of the indicated increase in economic activity are distributed equally among the member countries is still very open.

In the new trade literature the focus has been put on the geographic distribution of economic activity, where models display both forces of agglomeration as well as forces of dispersion. One key effect to agglomeration is the "market access effect". It states that firms tend to locate their production in the big market and export to small markets.[2] Even so, the relative strengths agglomeration and dispersion forces are determined by trade costs because free trade tends to make competion virtually non-localized. Mostly, these models

[1] See Bun and Klaasen (2002), Barr et al. (2003), Micco et al. (2003) and Flam and Nordström (2003) for trade effects and Petroulas (2004) for FDI effects.

[2] See Baldwin, Forslid, Martin, Ottaviano and Nicoud (2003).

show how lower trade costs may lead to increased agglomeration of economic production. However, agglomeration forces are, as a rule, hump shaped in their relation to trade costs and depending on the starting point dispersion forces may dominate when trade 'feeness' is increased.[3] The introduction of the euro has had a significantly positive effect on trade volumes and it can be seen as a step of reducing such trade costs. Yet, since we are not quite sure about our position on the hump prior to the euro we can not make any a priori assumptions about agglomeration effects.

Agglomeration tendencies, or lack thereof, are important as objects of policy consideration for both current as well as future EMU-members. Moreover, the direction of trade in conjunction with the direction of FDI might be able to reveal something of the character of FDI, that is if the directions correspond to the notion of vertical or horizontal FDI, and where we can keep in mind that a significant percentage of world trade, about 30 to 40 percent, is intrafirm trade.[4]

In this paper we will combine results obtained from reduced form regressions on Inward FDI and Exports in order to gauge potential agglomerations effects of the Euro introduction. Furthermore, this investigation may give us clues of whether FDI flows in the sample act as either a substitute of exports (*horizontal FDI*) or as a complement to exports (*vertical FDI*).

Increased exports usually indicates also a general increase in economic activity for the exporting country and in addition, most countries believe that, *inward FDI* is beneficial for local economies, It is considered positive for job opportunities, for tax income, technological development and the competitiveness of local firms and hence the general economic activity.[5]

2 Data and Empirical Specification

The introduction of the Euro can be viewed as a sharp change in the economic environment of the affected countries. This change makes it appropriate for us to use a difference-in-differences strategy. The idea behind this estimation strategy is to assess the effect of the introduction of the euro on inward FDI for the euro-countries, while keeping the effects for all other time-invariant variables, as well as common and country specific time-varying effects constant, whether these are observables or unobservables.[6] A general specification of this model can be expressed as:

$$FDI_{ij,t} = \alpha_{ij} + \beta_t + \beta_0 X_{ij,t} + \delta EMU_{ij,t} + \varepsilon_{ij,t} \quad (1)$$

$$eX_{ij,t} = \alpha_{ij} + \beta_t + \beta_0 X_{ij,t} + \delta EMU_{ij,t} + \varepsilon_{ij,t} \quad (2)$$

[3] See Baldwin et al. (2003).
[4] See, Markusen 2002, Ch.1 pp. 5-6.
[5] See Keller (2001).
[6] See Angrist and Krueger (1999).

where the dependent variable is $FDI_{ij,t}$ flows and exports. On the right hand side the explanatory variables include dummies to control for unobservable effects, specifically a country pair effect that is fixed over time (α_{ij}), in order to control for time-invariant unobservables, and a time effect that is common to all countries (β_t), in order to control for time-specific unobservables. The set of explanatory variables ($X_{ij,t}$) is comprised by a constant and a subset of variables that have been found, in one way or another, significant in explaining FDI flows or exports in prior empirical investigations.

Finally, we have our variables of interest ($EMU_{ij,t}$), with the acompaning vector of estimates (δ) that capture the effect of the euro for the euro-countries. The ($EMU_{ij,t}$) are interacted dummies by membership and time, where the interaction term is zero in the absence of the intervention i.e. prior to the introduction of the euro in 1999 or in the case of non-membership. There are three such interacted dummy variables of primary interest here: one for inward FDI flows between euro countries (*EMU11*), one for inward FDI flows to euro countries from non-euro countries (*EMU12*) and one for inward FDI flows from euro countries to non-euro countries (*EMU21*) and where the point estimates of these variables represent the average effect of the euro introduction.[7]

The investigation in this paper entails a panel of 18 OECD countries, hence $(17 * 17) = 289$ country pairs, with yearly data spanning the period 1992-2001. Germany, France, Italy, Spain, Ireland, Portugal, Finland, Austria, Netherlands, Sweden, Norway, Denmark, Switzerland, Belgium-Luxembourg (BeLux), England, Japan and USA.

The regressions used here are: for *inward FDI*, regression (3) in *Table 3* and for *Exports*, regression (6) in *Table 4*, in Petroulas' (2004) and Flam's and Nordström's (2003) papers respectively. However a minor explanation of the variables used is in order.

The FDI regression has as dependent variable is $FDI_{ij,t}$ in millions of current US dollars. On the right hand side the explanatory variables include the set ($X_{ij,t}$) is comprised by a constant and a subset of variables that have been found, in one way or another, significant in explaining FDI flows in prior empirical investigations. These variables include measures of market size for each country Y_{it} and Y_{jt} that are represented by GDP in current millions of US dollars. The set includes a measure of capital- or financing ability for country j measured as country j's stockmarket value of listed companies, $Stock_{jt}$ and, in hope to capture potential forward looking elements, a measure of payoff for investing in country i that is measured as the percentage change in country i's stockmarket value of listed companies, $\Delta Stock_{it}$ is included. Moreover, since the dependent variable is "one-way" FDI, a real exchange rate index is needed for country

[7] A more precise description of the variables used in the regressions, sources and construction, can be found in Appendix II.

i and j, denoted REX_{it} and REX_{jt}. Our specification also includes dummy variables that capture the EU's common market effect are included as well, both for EU12 ($EU12in$, $EU12out$) as well as for Austria, Sweden and Finland ($ASFin$, $ASFout$). Where the EU12 dummy is zero in 1992 and one thereafter, while the ASF dummy takes the value one after 1995.

Explanatory variables such as tradecosts, investment risks, distance, and endowments, that are common in FDI settings, are rendered superfluous due to the aim of the paper as well as the sample and estimation technique used. To wit, since the sample consist of rich countries and includes fixed effects estimations the variables that explain crosscountry differences are made superflous. In addition, since we are not trying to explain more general characteristics of FDI, such as the almost exclusive concentration to rich countries, we do not constrict ourselfes in using structural form of regressions, but employ rather, more general reduced form regressions.[8] Hence the full FDI model to be estimated is:

$$\begin{aligned} FDI_{ij,t} &= \alpha_{ij} + \beta_t + \beta_1 Y_{i,t} + \beta_2 Y_{j,t} + \beta_3 Stock_{j,t} + \beta_4 \Delta Stock_{i,t} + \beta_5 REX_{i,t} + \\ &\quad \beta_5 REX_{j,t} + \beta_8 EMU11_{ij,t} + \beta_9 EMU12_{ij,t} + \beta_{10} EMU21_{ij,t} + \\ &\quad \beta_{11} EU12in_{ij,t} + \beta_{12} EU12out_{ij,t} + \beta_{13} ASFin_{ij,t} + \beta_{14} ASFout_{ij,t} + \varepsilon_{ij,t} \end{aligned}$$

Another issue with the FDI data is caused by the erratic nature of FDI flows between any country pair, where many flows can be, and are, negative due to disinvestment. The negative values in the dependent variable precludes a conversion of the data set into a logarithmic scale. However, it is still possible to obtain elasticities for the point estimates, since the predicted means are positive values, by using the chain rule. This enables us to obtain a clear picture of the magnitude of the effect due to the currency introduction. The main results will then contain two panels, with the first depicting the raw results and the second, below, depicting the elasticities of the predicted means.

The export regression is takes the form of a standard gravity regression with a few ad hoc variables. The left hand side is the log of exports from country i to country j. On the right hand side, the set $(X_{ij,t})$ includes the log of GDP of exporting and the importing coungry $lnY_{i,t}$ and $lnY_{j,t}$ respectively, it includes the log of real exchange rate between exporting and importing country and the log of average real exchange rate between third countries and importing country, $lnrexr_{ij}$ and $lnrexr_{cj}$. The standard deviation of first differences of logs of monthly nominal exchange rates between exporting and importing country $nomexr$. There is also a host of dummy variables that capture entry to the EU[9]

[8] See Chakrabarti (2001) and Brainard (1997) for an overview and an EBA analysis on the FDI determinants. For structural form variables see Carr et al. (2001) and Bloningen et al. (2003).

[9] The dummy variables in question are six, for brevity however, we choose not to dwell on them.

($EUentries$) and a dummy variable that captures the Uruguay liberalization round (UR). Lastly as in the regression for FDI there are the three variables of interest *EMU11*, *EMU12* and *EMU21* that capture exports between euro countries, exports from euro to non-euro countrie and exports from non-euro to euro countries respectively. Hence the export regression to be estimated is:

$$\begin{aligned}\ln eX_{ij,t} &= \alpha_{ij} + \beta_t + \beta_1 \ln Y_{i,t} + \beta_2 \ln Y_{j,t} + \beta_3 \ln rexr_{ij,t} + \beta_4 \ln rexr_{cj,t} + \beta_5 nomexr_t + \\ &\quad + \beta_6 EMU11_{ij,t} + \beta_7 EMU12_{ij,t} + \beta_8 EMU21_{ij,t} + \beta_9 UR + \beta EUentries + \varepsilon_{ij,t}\end{aligned}$$

The results of the base equations are presented in Table 1 below

Table 1:

Dependent variable:	**Inward FDI**	**Inward FDI**		**log of Exports**
	millions US	$d(\ln y)/d(\ln x)$		
		$\hat{y}$ at the mean		
	(1)	(2)		
Y_i	0.005^{***}	4.92^{***}	$\ln Y_i$	1.20^{***}
	(4.17)	(4.43)		(14.5)
Y_j	-0.003^{**}	-2.58^{**}	$\ln Y_j$	1.00^{***}
	(2.19)	(2.29)		(13.1)
$Stock_j$	0.001^{***}	0.47^{***}	$\ln rexr_{ij}$	-0.88^{***}
	(2.61)	(2.66)		(14.6)
$\Delta Stock_i$	1.43	0.02	$\ln rexr_{cj}$	0.53^{***}
	(0.64)	(0.64)		(6.73)
REX_i	18.8	1.43	$nomexr$	-1.16^{**}
	(0.88)	(0.87)		(2.49)
REX_j	74.2^{**}	5.63^{**}		
	(2.23)	(2.37)		
EMU 11	1851.2^{***}	0.16^{***}		0.14^{***}
	(3.50)	(3.79)		(6.14)
EMU 12	1357.4^{*}	0.08^{**}		0.07^{***}
	(1.96)	(2.05)		(3.29)
EMU21	1728.8^{**}	0.11^{**}		0.08^{***}
	(2.49)	(2.57)		(3.63)
$EU12in$	-748.5^{**}	-0.08^{**}		
	(2.00)	(2.08)		
$EU12out$	-33.9	-0.003		
	(0.04)	(0.04)		
$ASFin$	-666.6^{**}	-0.02^{**}		
	(2.09)	(2.13)		
$ASFout$	-551.3^{***}	-0.05^{***}		
	(2.99)	(3.25)		
Obs.	2494	2494		2600
R^2	0.35			0.76

Notes: Robust |t-values| in parenthesis, Fixed and time effects not reported.
EU entry and UR variables not reported for the export regression
*,** ,*** denote significance at the 10-, 5- and 1 %-level respectively.

As we see the results for the emu dummies are positive and significant. These regressions have both been extendend robustness tests on both time as well as country dimensions.

3 Agglomeration Effects

Groups of countries will be excluded as receivers (country i) of FDI or investors (country j) and compared to their respective exports regression in order to check for any potential concentration of economic activityI. We can see that an increase for country (i) implies in this setting an icrease in economic activity and hence the estimations will give us an indication of whether the introduction of the euro has induced any agglomeration effects on economic activity.

The division of the sample into "big" and "small" economies is based on market size since it is considered a key effect of to agglomeratio. The "big" sample of euro countries contains Germany, France, Italy and Spain, while the remaining countries are found in the "small" sample. The baseline regressions for this exercise. The regressions are run by excluding the "big" or "small" group firstly as country i, i.e. as receivers of FDI and as Exporters *(Table 2.1)* and subsequently as country j, i.e. as investors and as receivers of exports *(Table 2.2)*. Moreover, since we only exclude countries as (i) in *Table 2.1*, we can disregard *EMU 21* for both FDI as well as exports. The same holds for *EMU 12* in *Table 2.2* where the exclusion is only countries as (j). The changes in *EMU 21* and *EMU 12* respectively will be due to changes in relative importance of the remaining data. They are quite cumbersome to interpret yet do not add anything to the analysis. The comparison of the obtained elasticities are in the case of exports straightforward, where we can compare the group elasticities with their full sample counterparts and be able to discern some pattern in the direction of trade. In the case of the FDI regressions it is not so straightforward, since the elasticities obtained are calculated using the chain rule and are applied to the predicted mean of the respective regression. This mean is represented in millions of dollars and varies when the sample is changed. In order to ease the understanding of the results the predicted means for each FDI regression ($\hat{y}$) are presented in the Tables 2.1 and 2.2.

Starting with the first three columns in *Table 2.1* it is not clear, at first glance, when comparing the estimates in regressions (1), (2) and (3) that "big" countries receive more FDI flows. Both subsamples experience a seemingly equiproportional increase in the *EMU 11* variable and the "small" sample seems to drive the results for *EMU 12* . However this is not entirely true. A comparison of the predicted average inward FDI, ($\hat{y}$), and the elasticities in regressions (1), (2) and (3) indicate that the "big" sample receives a larger share of the intra-EMU FDI than the "small" sample, after having controled for a host of factors including marketsize. Moreover, the results for the "small" sample are to a large extent driven by BeLux, which is a large receiver and sender of FDI. Separate figures for the two countries can be found for the year 2002 from Eurostat. These figures show that the share of Luxembourg, in the combined BeLux figures, is 89 percent of the inflows and 93 percent of the outflows from and to the EU15. A possible explanation for this occurence is that Luxembourg acts as a tax

haven for investment. Furthermore, if these figures for 2002 are representative for BeLux' FDI flows in earlier years we can conclude that BeLux is far from a 'typical' "small" economy and therefore exclude it from the sample. Regression (4) shows the results when BeLux is removed from the "small" sample. The results then become very clear insofar that inward FDI is highly concentrated in "big" countries. Even if "small" EMU countries experience a significant increase in intra-EMU FDI, the increase for the "big" economies is much larger and Wald tests confirm that the elasticities of *EMU 11* are significantly different between regressions (3) and (4).[10] Moreover, we can see that BeLux solely drives the results for *EMU 12*. Lastly, from regression (5), that includes only FDI between large countries, we see that the elasticity for EMU 11 is even larger than prior regressions. This indicates that a large part of the inward FDI increase due to the EMU is concentrated to a few large economies.

Table 2.1: EMU elasticities of inward FDI and Exports, country (i)

Dependent variable: Inward FDI						
	Receivers of FDI					
	(1)	(2)	(3)	(4)	(5)	(6)
	All	$\text{Small}^{a}_{i-Euro}$	Big^{b}_{i-Euro}	$\text{Small}^{c}_{i-BeLux}$	Big^{d}_{i-All}	$\text{Big}^{e}_{j+BeLux}$
EMU 11	0.16^{***}	0.11^{***}	0.11^{***}	0.06^{**}	0.17^{**}	0.14^{***}
	(3.75)	(3.46)	(2.68)	(2.14)	(3.43)	(3.54)
EMU 12	0.09^{**}	0.07^{**}	0.05	0.01	0.08^{*}	0.11^{***}
	(2.13)	(2.03)	(1.17)	(0.56)	(1.66)	(2.36)
$\hat{y}$	1301.9	1310.4	1558.7	1216.4	2098.7	1987.4
Dependent variable: Exports,						
	Exporters					
	All	$\text{Small}^{a}_{i-Euro}$	Big^{c}_{i-Euro}	$\text{Small}^{b}_{i-BeLux}$	Big^{e}_{i-All}	
EMU 11	0.14^{***}	0.16^{***}	0.13^{***}	0.16^{***}	0.12^{***}	
	(6.14)	(5.50)	(4.97)	(4.51)	(3.59)	
EMU 12	0.07^{***}	0.06^{**}	0.09^{***}	0.06^{**}	0.07^{**}	
	(3.29)	(2.51)	(4.20)	(2.11)	(2.32)	

Notes: Robust $|t|$-values in parenthesis.*,** ,*** denote significance at the 10-, 5- and 1 %-level respectively.

[a] Excluding Germany, France, Italy and Spain

[b] Excluding Ireland, Portugal, Finland, Austria, Netherlands and BeLux

[c] Excluding Germany, France, Italy, Spain and BeLux

[d] Excluding Ireland, Portugal, Finland, Austria, BeLux, Netherlands, Sweden, Norway, Denmark and Switzerland

[e] Excluding Ireland, Portugal, Finland, Austria and Netherlands.

The results concerning exports in Table 1.1 differ markedly from their FDI counterparts. Firstly, we see that regressions (2) and (4) are virtually identical

[10] Wald tests reject the equality of point estimates at the 1%-level.

for exports, which implies that BeLux does not drive any results when exports are concerned. Secondly, for the intra- EMU area (*EMU 11*) the estimates inflate, compared to the base regression, when the "big" sample is dropped as exporter, but deflate when the "small" sample is dropped. Hence, the export increase is larger for the "small" countries. For *EMU 12* the opposite holds and the increase is dominated by the big countries exports to non-EMU members.

Table 2.2: EMU elasticities of inward FDI and Exports, country (j)
Dependent variable: Inward FDI

	Source of FDI					
	(1)	(2)	(3)	(4)	(5)	(6)
	All	$\text{Small}^{a}_{j-Euro}$	Big^{c}_{j-Euro}	$\text{Small}^{b}_{j-BeLux}$	Big^{d}_{j-All}	$\text{Big}^{e}_{j+BeLux}$
EMU 11	0.16***	0.11***	0.10***	0.04*	0.07*	0.15***
	(3.75)	(2.67)	(3.45)	(1.86)	(1.94)	(3.91)
EMU 21	0.11***	0.06	0.08**	0.01	0.04	0.12***
	(2.70)	(1.55)	(2.37)	(0.41)	(0.84)	(3.06)
$\hat{y}$	1301.9	1236.4	1444.7	1097.9	1981.3	1558.8

Dependent variable: Exports

	Receivers of Exports				
	All	$\text{Small}^{a}_{j-Euro}$	Big^{c}_{j-Euro}	$\text{Small}^{b}_{j-BeLux}$	Big^{e}_{j-All}
EMU 11	0.14***	0.11***	0.21***	0.09***	0.17***
	(6.14)	(3.89)	(8.97)	(3.07)	(5.13)
EMU 21	0.08***	0.04	0.13***	0.03	0.10***
	(3.63)	(1.62)	(5.85)	(0.91)	(3.07)

Notes: Robust |t-values| in parenthesis. *,** ,*** denote significance at the 10-, 5- and 1 %-level respectively.

[a] Excluding Germany, France, Italy and Spain

[b] Excluding Ireland, Portugal, Finland, Austria, Netherlands and BeLux

[c] Excluding Germany, France, Italy, Spain and BeLux

[d] Excluding Ireland, Portugal, Finland, Austria, BeLux, Netherlands, Sweden, Norway, Denmark and Switzerland

[e] Excluding Ireland, Portugal, Finland, Austria and Netherlands.

Turning our attention to the opposite side of this equation, namely where do the FDI come from and to whom do the countries export to, several patterns begin to emerge. In *Table 2.2* we see again the pivotal role of BeLux for the results of the "small" sample. When, BeLux is excluded from the "small" sample, regression (4), it is clear that the "big" economies are the ones that spawn most of the FDI, both within the EMU-area (*EMU 11*) as well as outside the same (*EMU 21*). The estimates of EMU 11 are again significantly different from each other in regressions (3) and (4) for inward FDI.[11] The regressions dealing with

[11] Wald tests reject the equality of point estimates at the 10% and 1%-level.

the export side of this experiment show an equal clear tendency where a clear increase occurs when "small" countries are dropped as receivers of exports, and conversely a clear decrease occurs when "big" countries are dropped. Hence the receivers of export are clearly dominated by "big" countries, both for *EMU 11* as well as *EMU 21*.

Overall, the results from *Tables 2.1* and *2.2* indicate that, excluding BeLux, FDI flows do indeed concentrate into the "big" economies. However, within the EMU area the FDI originate also mostly from the same countries. Exports on the other hand tend to increase more for "small" countries as a rule and are directed towards "big" countries, with an exception of EMU exports to non members, where the "big" members increase their exports more to "big" non members. Lastly we need investigate closer the the FDI flows that pass through Belgium-Luxembourg and their seemingly pivotal role. By dividing the groups into relevant subsamples it is obvious that most FDI flows both to and from BeLux are connected with the large economies of the sample. This enhances the suspicion that BeLux only acts as a "transit"-country for FDI flows due to tax-haven properties and that the flows mostly concern large economies. Hence regression (6) is added to the empirical results where the entity BeLux is added to the "Big" sample. These results clearly enhance the agglomeration forces of FDI that are present in the data.

Table 3: FDI flows from and to Belgium-Luxembourg. Million US $ 1999-2001.

	From BeLux			
	To			
	Small	*Switzerland .*	*Big non Euro*	*Big Euro*
Total 1999-2001.	56552	54820	107281	169392
average per year and country.	1571	13700	8940	10587
	To BeLux			
	From			
	Small	*Switzerland .*	*Big non Euro*	*Big Euro*
Total 1999-2001.	47444	3707	137703	117492
average per year and country.	1317	794	11475	7343

So, are there any general agglomeration tendencies apparent from this exercise? The answer to this is: only partially. Partially yes, since "big" economies attract a larger share of the total increase in inward FDI, after controling for a host of factors including market size. Hence we observe an increase in the concentration of production and the sample displays agglomeration tendencies. However, exports tend to increase slightly more for small countries, which may

indicate an increase in production and, in terms of economic geography, increased dispersion.

An interesting feature of the results is, in several cases, the similarity in direction of FDI and exports which is consistent with the notion of vertically integrated FDI. This creates the suspicion that perhaps intrafirm trade and vertical FDI increase in importance with the introduction of the euro. This suspicion is supported by findings from Flam and Nordström (2003) where they use regressions on one-digit SITC sector exports and find that export increases are concentrated on differentiated and processed input goods. Flam and Nordström note that the estimated increase for trade can be explained by increasing vertical specialization along the lines suggested by Yi (2003).

4 Conclusions

Recent research has found that the introduction of the Euro has increased both trade as well as FDI flows for the member countries. Here we conduct an investigation of the economic geography of the euro by combining the inward FDI results with results obtained from regressions on exports, for the same countries and years, and examining direction patterns for "big" and "small" economies. At a first glance the increase in FDI seems to be equally divided between "big" and "small" countries. When excluding BeLux though, indications of agglomeration forces appear in the results. Excluding BeLux an overwhelming majority of the increase in FDI is attracted to "big" economies. Moreover, in some cases FDI and exports follow the same direction pattern, which indicates an increase of vertical specialization in the sample.

The fact that the results show that the increase of FDI seem to locate, excluding BeLux, in the "big" economies in conjunction with the results indicating that export of input goods are increasingly directed from "small" to "big" economies raises several stepwise questions of relevance for future research. The first step is directed to the question of whether "small" economies are increasingly acting as suppliers of input goods to multinational enterprises that, in turn, are increasingly located in "big" economies? If this is the case, a second natural step is to investigate whether "small" economies are going to encounter a more volatile future in their production when exogenous shocks hit the EMU area due to this vertical specialization and the implied supplier status. Moreover, the question arises of whether such a development will impede further on the possibilities of "small" economies to pursue independent policies?

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