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REGIONALIZATION, CHANGES IN HOME BIAS, AND THE GROWTH OF WORLD TRADE

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ABSTRACT

In this paper we use numerical modeling methods to quantitatively assess the impacts of changes in home bias within regions on the growth of world trade among major blocs over the last three decades. Existing work focuses on the impacts of trade barrier, transport cost and income changes on trade growth, rather than preferences. Removing changes in home bias over the last three decades from our global general equilibrium model reduces world trade by 27% compared to actual world trade in 2004 in our central case scenario. These results support the view that world trade among major blocs has became more regionalized rather than internationalized which we suggest may be due to a proliferation of free trade agreements. We calibrate a simple global trade model of inter bloc trade to both 1975 and 2004 data and substitute different calibrated parameters from the two data sets between model parameterizations. Our results suggest that if changes over time in home bias involving different regionally sourced goods in a multi-region multi product model are removed, substantial effects follow for the growth of world trade in the last three decades. Home bias changes in developed and developing economies reduce world trade by 8% and 19% respectively, suggesting that regionalization is more pronounced in developing country trade. Our results also indicate that income growth, income convergence, and falling trade costs explain 76%, 4%, and 7% respectively of the growth of world trade over the last three decades.

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1. **Introduction**

In this paper we analyze the impacts of changing preferences for different regionally sourced goods over the last 3 decades in a global Armington model of trade and production involving major trading blocs which is calibrated to both 1975 and 2004 data. Contrary to the conventional view that globalization is fuelling world trade growth, we find a trend of international trade regionalization among blocs. Our results suggest that pro region product preference changes in the last three decades may have reduced world trade by 27% relative to 2004 levels (US$ 1.7 trillion), with separate preference changes in developed and developing economies reducing world trade by 8% and 19%, respectively. We interpret these results as indicating that regionalization, perhaps due to a growing role for regional trade agreements, is growing in importance in the global economy. Results also indicate that income growth (modeled by allowing regional endowments to grow at the same rate), income convergence, and falling trade costs explain 76%, 4%, and 7% of the growth of world trade in the last three decades, respectively.

We generate these results using a numerical general equilibrium model of the global economy. We use a pure exchange model to allow us to concentrate on demand side effects. In this model we group the world into 8 regions, the EU (25), developed North America (the U.S.

and Canada), Japan, developed Oceania (Australia and New Zealand), developing America, developing Africa, developing Asia and Oceania, other Europe and CIS. We use 3-level nested CES (constant elasticity of substitution) preferences to represent each region's preference structure. We then assess the impacts of various changes in preferences on the growth of world trade.

Classical trade theory typically focuses on the determinants of international trade in a variety of models; Ricardian, specific factors, Heckscher-Ohlin, and monopolistically competitive (market structure). World trade has increased by 10 times (in nominal terms) over the last three decades and a growing literature attempts to explain this rapid growth (Deardorff (1984), Leamer and Levinsohn (1995), Krugman (1995)). Trade liberalization (reduction of trade barriers), transportation cost reductions, income convergence and economic growth are the four most cited factors in this literature. (Helpman (1987), Hummels and Levinsohn (1995)) .More recently, Yi (2003), Feenstra (1998), Hummels, Rapoport and Yi (1998) have also stressed the role of outsourcing (vertical specialization, or disintegration of production) in surging international trade flows. Baier and Bergstrand (2001) decompose international trade growth in OECD countries using a gravity model. Their results show that income convergence explains little of the world trade growth, while income growth, reductions in tariffs and transportation costs explain 67%, 26%, and 8% respectively of the growth. These three factors

also collectively explain around 40% of the variation in trade growth leaving the remaining 60% unexplained.

As noted by Leamer and Levinsohn (1995) conventional trade models largely concentrate on production side sources of comparative advantage. Only a small number of studies, originating with Linder (1961) and reflected in recent applications of the gravity model, attempt to investigate the determinants of trade from the demand-side[1]. Armington (1969) type general equilibrium trade models assume that different country source goods are imperfect substitutes in demand and that this gives rise to trade between countries.

The paper is organized as follows. Section 2 presents the model that we use to explore the impacts of preference changes on world trade. The data we use in calibration of the numerical model to 1975 and 2004 benchmarks are also reported. In section 3 counterfactual experiment results assessing the impact of changing preferences on world trade growth are set out. Section 4 draws conclusions and briefly discusses further issues.

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[1] Using a gravity model and econometric methods Baier and Bergstrand (2005) also find that free trade agreements increase members' trade but the effects of FTAs on members' trade with nonmembers and trade among nonmembers is not analyzed.

2. A Global Numerical General Equilibrium Model, Data, and Model Calibration

Model Structure

We use a numerical pure exchange global general equilibrium model of 8 blocs (or regions) in which each region is endowed only with one good to explore the impact of preference changes on the growth of world trade. These are the EU (25), the US and Canada, Japan, Developed Oceania, Developing America, Developing Africa, Developing Asia Oceania, and other Europe and US. The use of a pure exchange model of this simplified form allows us to focus centrally on demand-side factors behind world trade growth. We incorporate 3 level nested CES preferences in all regions. In the model prices and trade flows are endogenously determined with regional endowments exogenously given.

Each region is assumed to have representative consumer who maximizes utility by first choosing among home and foreign goods as composites. Each region then chooses among two different composite foreign country goods at a 2nd level, from developed and developing economies. At the bottom level of the nesting structure, each region then chooses further among individual developed and developing economy goods. The additional nesting among developed and developing countries allows for a separate determination of home bias effects in those two groups of regions.

Top level CES preferences in the various regions *s* are given by

$$D_s = \sum_{i=1to2} [\alpha_{si} x_{si}^{\rho_s}]^{1/\rho_s} , \qquad (1)$$

where *s* is a typical region, and $i \in (s, s^*)$, where s^* represents foreign goods for all other regions than s represented as a single composite good. α_{si} is the first-stage Armington share parameter, x_{si} is region *s*'s consumption of goods supplied by region *i*; and $\sigma_s (=1/(1-\rho_s))$ is the elasticity of substitution between home and foreign goods in region s.

Each of the five regions faces a top level budget constraint involving home and foreign goods, written as

$$\sum_{i=1to2} p_{si} x_{si} = I_s = p_s \overline{X}_s , \qquad (2)$$

where $\overline{X}_s$ is the endowment of region s own good, p_s is the price of the region s own good, I_s is the income of region *s* (determined by the endowment of region specific goods, prices, and inter-regional transfers, if any); p_{ss^*} is the regional aggregate price index of foreign goods consumed by s, which in turn is given by a true cost of living price index constructed using the second and third level preferences for the region; and p_{ss} is the price of home goods.

First order conditions yield top level consumption of home and foreign goods in region s, once the price indices for composite goods are determined, as

$$x_{si} = \left(\frac{\alpha_{si}}{p_{si}} \right)^{\sigma_s} \frac{I_s}{\sum_{i'=i} \alpha_{si'}^{\sigma_s} p_{si'}^{1-\sigma_s}} \quad , \quad i = s, s* \tag{3}$$

Second level preferences involve two foreign country composite goods for each region s reflecting aggregation of the 8 regions in the model into developed and developing economies. These preferences are also assumed to be CES.. Demands can also be generated as above, i.e.

$$x_{ss*j} = \left(\frac{\alpha_{ss*j}}{p_{ss*j}} \right)^{\sigma_{ss*}} \frac{p_{ss*} x_{ss*}}{\sum_{j'=j} \alpha_{ss*j'}^{\sigma_{ss*}} p_{ss*j'}^{1-\sigma_{ss*}}}, \tag{4}$$

where $j \in (d,g)$ denotes (foreign developed economies for region *j*, foreign developing economies for region *j*) and x_{ss*j} is the demand for foreign country goods j in region *s*; p_{ss*j} and α_{ss*j} are corresponding price and share parameters; and σ_{ss*} is the elasticity of substitution between the two foreign composite goods in region *s*.

The true cost of living price index for the top level generated from the second level is,

$$p_{ss*} = \left[\sum_{j'=j} \alpha_{ss*j'}^{\sigma_{ss*}} p_{ss*j'}^{1-\sigma_{ss*}} \right]^{\frac{1}{1-\sigma_{ss*}}} \quad . \tag{5}$$

Bottom level preferences in region *s* are also assumed to be CES and the demands are

$$x_{sl} = \left(\frac{\alpha_{sl}}{p_{sl}} \right)^{\sigma_{sj}} \frac{p_{ss*j} x_{ss*j}}{\sum_{l'=l} \alpha_{sl}^{\sigma_s} p_{sl}^{1-\sigma_{sj}}}, \tag{6}$$

where $j \in (d,g)$, and now *l* denotes the 4 developed economies if *j* is in *d,* while *l* denotes the 4

developing economies if *j* is in *g*. In both cases $l \neq s$. x_{sl} gives the demand for other region goods; while p_{sl} is the corresponding price, α_{sl} are share parameters, and σ_{sj} is the elasticity of substitution between either foreign developed or developing country goods depending on whether s is in d or g..

Bottom level preferences generate true cost of living price indexes for the second level as

$$p_{ss*j} = \left[\sum_{l'=l} \alpha_{sl}^{\sigma_{sj}} p_{sl}^{1-\sigma_{sj}} \right]^{\frac{1}{1-\sigma_{sl}}} \quad . \tag{7}$$

Equilibrium

For this pure exchange economy, a global equilibrium involves endogenously determined prices for region specific goods such that

$$\sum_{s} x_{ss} = \bar{x}_s \tag{8}$$

where $\bar{x}_s$ are the endowments of goods in region *s*.

In a trade costless world,

$$p_{ss'} = p_{s'} \tag{9}$$

and as only relative prices are of any consequence, we can set the price of the U.S. good to one as the numerare, ie.

$$p_u = 1 \quad . \tag{10}$$

If transportation costs and tariff revenue are included in the model, prices in each region are linked and

$$p_{ss'} = p_{s'}(1 + t_{ss'})(1 + \tau_{ss'}) \tag{11}$$

where $p_{s'}$ reflects the sellers price received by region s' and $p_{ss'}$ is the buying price of region s' good in region s for the representative consumer in g, and $t_{ss'}$ is the proportional transportation cost per unit from s' to s, and $\tau_{ss'}$ is the tariff rate in s on the good imported from s'.

Assuming the importing region fully bears transportation costs, the income of region s is given by

$$I_s = \sum_{s'} p_s x_{s's} - \sum_{s'} x_{ss'} p_{s'} t_{ss'} + \sum_{s'} p_{s'} x_{ss'} (1 + t_{ss'}) \tau_{ss'} \tag{12}$$

where the final term is tariff revenues assumed redistributed in lump sum form to the representative consumer in s. In equilibrium, in this case, if transportation costs are denominated in terms of the good transported, demands equal endowments less transportation costs, and government budgets in each region balance in terms of tariff revenues collected and redistributed.

Data and Model Calibrations

We have calibrated this model to both 1975 and 2004 benchmark data in which we group the world into the 8 regions listed above. Merchandise trade flows for each year are from the *Handbook of Statistics* (UNCTAD, 2006) and *International Trade Statistics* 2005 (WTO, 2006) and are valued on a F.O.B. basis. We have also included in the trade data international service trade flows which are also obtained from the *Handbook of Statistics* (Tables 5.1, UNCTAD, 2006). Intra-region trade (largely within the EU 25) is not included in international trade flows in the model data under this treatment. To calculate these, we decompose service trade flow data for the regions weighted by their export and import shares in regional exports and imports separately, and take the average of international trade flows in services. We use the shares in 1980 to represent the corresponding shares in 1975 since the data set starts from 1980. We treat the EU (25) as a single regional bloc even though the EU was smaller in earlier years.

Tariff and non-tariff data are from Whalley (1985) for 1975 and Anderson and van Wincoop (2004) for 2004. Transportation cost data reflect differences between import data of importing countries and export data of exporting regions as in the *Handbook of Statistics* (UNCTAD, 2006).

To calibrate share parameters in preferences for the model, we use the same elasticity parameters employed by Whalley and Xin (2006) in a recent modeling evaluation of Canada US home bias in a global model. We use an elasticity of substitution of 2.0 for the top level

sub-utility function in each region, 2.5 for the second level sub-utility functions between the foreign developed and developing country goods, and 3.0 for the bottom level preferences in each region.

Using these elasticity parameters and the 1975 and 2004 benchmark data we calibrate model share parameters for all three levels of preferences using first order conditions for utility maximizing behaviour. One way to evaluate whether the preferences of each region exhibit home bias or not is to also calibrate share parameters using trade neutral data absent of trade effects for the same year. The procedures to be employed in doing this involve keeping each regions total imports constant but replacing actual bilateral trade flows by trade data which are proportional to income allowing for trade costs and recalibrating the model (see Whalley and Xin (2006)). The parameterizations generated both by using actual and synthetic trade neutral data for both 1975 and 2004 are reported in Tables 1 and 2.

These calibrated parameters not only suggest that preferences are not neutral within regions, but that there have been changes in preference structure in most regions in the last three decades. Comparing the differences between the share parameters calibrated to the observed data and neutral trade data suggests that in all regions except developed North America, developed Oceania, and developing America there is more bias in regional preferences for home goods in 2004 than in 1975. There is almost no change in home bias in developed

Oceania, while developed North America and developing America have become less home biased over the last three decades. These comparisons imply that international trade might have grown faster than otherwise if the 1975 preferences had persisted to 2004 and in this sense regionalization in the global economy has become more intense. We quantitatively assess the impacts of these changes in preferences on trade flows both jointly and separately in the next section. These preference changes thus underline the importance of examining the causes of growth of international trade from the demand side rather than the supply side only.

Table 1: Calibrated Share Parameters Using Actual 1975 Data and Synthetic Trade Neutral

Region	Top Level		Second Level		Bottom Level for Developed Economies				Bottom Level for Developing Economies			
	home	foreign	Developed countries	Developing countries	EU	US	JP	OD	AM	AF	AS	SU
Calibrated to 1975 Observed Data												
The EU(25)	0.537	0.463	0.347	0.653	--	0.457	0.313	0.230	0.192	0.218	0.285	0.304
The U.S. and Canada	0.621	0.379	0.409	0.591	0.425	--	0.376	0.199	0.287	0.254	0.284	0.175
Japan	0.537	0.463	0.451	0.549	0.293	0.425	--	0.282	0.189	0.200	0.403	0.208
Developed Oceania	0.553	0.447	0.677	0.323	0.407	0.320	0.273	--	0.165	0.155	0.518	0.163
Developing America	0.508	0.492	0.619	0.381	0.333	0.357	0.224	0.086	--	0.287	0.389	0.323
Developing Africa	0.432	0.568	0.722	0.278	0.383	0.257	0.271	0.089	0.319	--	0.467	0.214
Developing Asia and Oceania	0.439	0.561	0.733	0.267	0.334	0.278	0.249	0.138	0.277	0.257	--	0.466
Other Europe and CIS	0.525	0.475	0.521	0.479	0.353	0.279	0.228	0.140	0.275	0.225	0.500	--
Calibrated to1975 Synthetic Trade Neutral Data												
The EU(25)	0.195	0.805	0.434	0.566	--	0.478	0.323	0.199	0.259	0.194	0.260	0.287
The U.S. and Canada	0.189	0.811	0.437	0.563	0.484	--	0.319	0.197	0.259	0.194	0.260	0.287
Japan	0.105	0.895	0.479	0.521	0.419	0.410	--	0.171	0.259	0.194	0.260	0.287
Developed Oceania	0.051	0.949	0.504	0.496	0.379	0.371	0.250	--	0.259	0.194	0.260	0.287
Developing America	0.116	0.884	0.611	0.389	0.329	0.321	0.217	0.134	--	0.262	0.350	0.388
Developing Africa	0.075	0.925	0.588	0.412	0.329	0.321	0.217	0.134	0.322	--	0.322	0.356
Developing Asia and Oceania	0.116	0.884	0.611	0.389	0.329	0.321	0.217	0.134	0.350	0.262	--	0.388
Other Europe and CIS	0.136	0.864	0.622	0.378	0.329	0.321	0.217	0.134	0.364	0.272	0.364	--

Table 2: Calibrated Share Parameters using Actual 2004 Data and Synthetic Trade Neutral

Region	Top Level		Second Level		Bottom Level for Developed Economies				Bottom Level for Developing Economies			
	home	foreign	Developed countries	Developing countries	EU	US	JP	OD	AM	AF	AS	SU
Calibrated to 2004 Observed Data												
The EU(25)	0.594	0.406	0.360	0.640	--	0.469	0.344	0.187	0.181	0.198	0.330	0.290
The U.S. and Canada	0.575	0.425	0.402	0.598	0.485	--	0.356	0.159	0.294	0.182	0.363	0.162
Japan	0.613	0.387	0.451	0.549	0.366	0.395	--	0.239	0.160	0.171	0.491	0.178
Developed Oceania	0.542	0.458	0.537	0.463	0.389	0.333	0.278	--	0.126	0.154	0.509	0.211
Developing America	0.504	0.496	0.642	0.358	0.315	0.432	0.160	0.092	--	0.241	0.395	0.364
Developing Africa	0.495	0.505	0.591	0.409	0.414	0.265	0.187	0.134	0.257	--	0.491	0.253
Developing Asia and Oceania	0.504	0.496	0.713	0.287	0.305	0.265	0.264	0.166	0.309	0.313	--	0.378
Other Europe and CIS	0.579	0.421	0.592	0.408	0.491	0.242	0.171	0.096	0.242	0.284	0.474	--
Calibrated to 2004 Synthetic Trade Neutral Data												
The EU(25)	0.197	0.803	0.447	0.553	--	0.469	0.345	0.186	0.230	0.166	0.317	0.287
The U.S. and Canada	0.189	0.811	0.452	0.548	0.476	--	0.340	0.184	0.230	0.166	0.317	0.287
Japan	0.119	0.881	0.486	0.514	0.424	0.412	--	0.164	0.230	0.166	0.317	0.287
Developed Oceania	0.047	0.953	0.519	0.481	0.372	0.362	0.266	--	0.230	0.166	0.317	0.287
Developing America	0.092	0.908	0.611	0.389	0.326	0.316	0.233	0.126	--	0.215	0.412	0.373
Developing Africa	0.057	0.943	0.591	0.409	0.326	0.316	0.233	0.126	0.275	--	0.380	0.344
Developing Asia and Oceania	0.150	0.850	0.646	0.354	0.326	0.316	0.233	0.126	0.336	0.243	--	0.421
Other Europe and CIS	0.129	0.871	0.632	0.368	0.326	0.316	0.233	0.126	0.322	0.232	0.445	--

3. Using 1975 and 2004 Calibrated Models to Assess the Impacts of Preference Changes on World Trade

We have used our model calibrations for 1975 and 2004 to assess the impacts of preference changes on the growth of world trade. To do this, we use counterfactual analyses in which we jointly or separately substitute share parameters in preferences at different levels of the nesting structure in different regions between calibrations for the two years. We can substitute the parameters calibrated to 1975 data with parameters calibrated to 2004 data jointly or separately to obtain counterfactual trade flows in 1975. We can also substitute the parameters calibrated using 2004 data with parameters calibrated using 1975 data jointly or separately to obtain counterfactual trade flows in 2004. The differences between counterfactual and actual trade flows can then be attributed to changes in preferences.

Counterfactual experiment results on 2004 trade flows in Table 3 show the impacts of changes in preferences for different region source goods between 1975 and 2004. In these we substitute 1975 preference shares into the model parameterization for 2004 and recompute an equilibrium. We can do this for all or each level of nest separately, and / or for individual sub groups, or all regions. These results show that preferences changes within these blocs have had substantial negative effects on the growth of world trade over the period of evaluation. Results imply that preference changes in the last three decades have reduced world trade by 27% (US$

1.7 trillion). Changing preferences only in developed or developing economies reduces world trade by 8% and 19%, respectively. Further decomposition results indicate that preference changes in the EU and Developing Asia and Oceania reduce world trade by 12% (US$ 0.73 trillion) and 14% (US$ 0.910 trillion) of 2004 world trade, respectively. Preference changes in Japan reduce world trade by 5%, developing Asia 2%, other Europe and CIS 2%. In contrast, preference changes in developed America result in an increase of 8% (US$ 490 billion) in world trade in 2004, and in developing America of 1%.

Results also show that preference changes only at the top level in all regions reduce world trade by 32% in 2004(US$ 2.04 trillion). For the developed economies the reduction is 12% (US$ 0.75 trillion) and for the developing economies 19% (US$ 1.19 trillion). Preference changes at the second level reduce world trade by a small amount (less than 1%) and at the bottom level, and in contrast, increase world trade by around 5% (US$ 0.32 trillion). These results imply that changes in preferences by level also have significant impacts on world trade.

These results thus show that if the 1975 preference structure had persisted into 2004, world trade in 2004 would have been 27% higher than actual world trade. If instead the 1975 preference structure had been replaced by that of 2004, parallel results (not reported in detail here) suggest that world trade in 1975 would be 18% lower than actual world trade (Table 4). These results thus support the position that in contrast to the conventional view of globalization of the world economy fuelling world trade growth, international trade among

major trade blocs has generally become more regionalized rather than globalized over the last three decades.

Table 3: Percentage Differences between Counterfactual and Actual Trade in 2009 both by region and globally (%)

	Percentage change in trade relative to Actual Trade in 2004by substituting calibrated 1975 shares into 2004 model parameterization				
Level / Region	All levels	Top level	Second level	Bottom level	
				Developed Economies	Developing Economies
All Economies	**27.3**	**32.2**	**0.6**	**-3.0**	**-2.1**
Developed Economies	**8.2**	**11.8**	**0.3**	**-1.1**	**-2.5**
Developing Economies	**18.6**	**18.8**	**0.3**	**-1.9**	**0.5**
The EU(25)	11.5	12.2	0.0	-0.3	-0.2
The U.S. and Canada	-7.7	-6.2	0.0	-0.8	-1.1
Japan	5.2	6.5	0.0	0.0	-0.9
Developed Oceania	0.0	-0.2	0.2	0.0	0.0
Developing America	-1.3	-0.3	-0.2	-0.8	-0.2
Developing Africa	2.4	1.9	0.5	-0.2	0.0
Developing Asia and Oceania	14.4	12.3	0.5	0.6	0.5
Other Europe and CIS	2.4	4.7	-0.6	-1.7	0.2

Note: Summation may not apply due to rounding and, counterfactual experiment design.

Our numerical model and calibrated parameters also allow us to assess the impacts of changes in income levels, income convergence, and trade costs on world trade growth in a multi region general equilibrium model in contrast to the gravity model used by Baier and Bergstrand (2001). Results are reported in Table 4. They suggest that income growth (modelled as growth in regional endowments) resulted in US$ 5.2 trillion world trade in 2004 and explains 76% of the growth of world trade in the last three decades. Income convergence explains a further 4% of the growth of world trade. Falling trade costs (tariffs, non-tariffs, and transportation costs) collectively contribute around 7% of the growth of world trade in the last three decades.

Table 4: Changing Preferences and the Growth of World Trade

Experiments	World Trade (10 billion,%)
1975 observed world trade	660
2004 observed world trade	6330
Percentage changes compared to 1975	860%
2004 World trade under other counterfactual Experiments	
Income growth (excluding income convergence)	4970
Share of world trade growth explained	76%
Setting 1975 regional endowments to 2004 regional endowments (i.e including income convergence)	5200
Share of world trade growth explained	80%
Setting 1975 trade costs to 2004 trade costs	1050
Share of world trade growth explained	7%

4. Concluding Remarks

Ignoring preference change can be misleading in any assessment of cause of global trade

growth. Here, we use a 3-level nested CES numerical model of a global pure exchange economy composed of 8 bloc regions; the EU(25), developed North America, Japan, developed Oceania, developing America, developing Africa, developing Asia and Oceania, other Europe and CIS and calibrate our model to data for 1975 and 2004. We are then able to replace preferences of one year by those of another allowing for an assessment of the contribution of preference change to world trade. Model results suggest that changes in preferences for different regionally sourced goods have had substantially negative effects on the growth of world trade among major blocs over the last three decades. Thus, in contrast to the conventional view of globalization of the world economy, we find a trend of international trade regionalization among major blocs.

In conclusion, we note that our analysis raises as well as resolves a number of issues. Why preferences within blocs for own goods have changed in this way is not analyzed, and may well reflect increased inter bloc trade from regional trade agreements (although this would not be the case in Japan). Also, we have not analyzed whether regionalization is also occurring within blocs due to the added detail involved in data. We leave these issues for further work.

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